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Prospective acceptance of distinct mobile mental health features in psychiatric patients and mental health professionals

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ABSTRACT

Background: Despite numerous mobile health (mHealth) applications available, current impact on mental healthcare is low. Users face overwhelming variety of applications and sensors. Evidence for distinct features' effectiveness is largely lacking. Along with technical feasibility and data security issues, readiness and preferences of patients predetermine engagement and impact of mHealth in psychiatry.
Objective: We aimed to assess the prospective attitudes of psychiatric patients and mental health professionals (MHP) towards mHealth applications in general and with regard to distinct features.
Methods: We conducted a survey entailing 486 subjects (297 MHP and 189 patients).
Results: Professionals and patients indicate both, considerable acceptance and rejection for most features. Marked concerns across groups relate to data security in general. Actimetry and geotracking were considered particularly skeptical. Importantly, most patients prefer to be prompted timely about health status changes.
Conclusion: Altogether, evidence indicates substantial support for mHealth features in mental healthcare despite considerable rejection of distinct features. We conclude that tighter collaboration between researchers, developers and clinicians must address matching mHealth-apps to patients' needs. Improved information on potential risks and possibilities associated with mHealth features is strongly indicated in MHP and psychiatric patients in order to reach an appropriately informed decision on individual involvement.

1. Introduction

It seems no question that eHealth will play a role in modern mental healthcare, just the extent will remain an ongoing debate (Torous and Baker, 2016; Torous and Firth, 2018). Knowledge and acceptance among specialists and the general population grow along with technical feasibility (Torous and Baker, 2016; Torous and Firth, 2018). This demands recurring examination of promises, pitfalls, and their perception by the involved groups, e.g. patients and healthcare providers.

The term eHealth (electronic health) entails application of a wide range of electronic tools in healthcare in order to make use of opportunities, modern information- and communication technology offers. Mobile mental health (mHealth) as a slightly more confined term, tags involvement of mobile devices such as smartphones, tablets and wearables. Despite numerous approaches available (McKay et al., 2018; Nicholas et al., 2015; Shen et al., 2015), no significant impact on regular care as delivered within the framework of public or private health insurance has yet been achieved (Hollis et al., 2015). Associated applications and limitations are spanned between maximizing accuracy by handling uttermost detailed data, and to focus features and collected data to a minimum owing to privacy concerns potentially reducing engagement.

Central technical preconditions which determine the further analysis options include subjective and objective measures, like self-reports of mood, sleep or events as well as biosignals (e.g. heart rate, breathing, body temperature, skin impedance, voice analysis), actimetry (e.g. accelerometry, pedometry), geodata (location, ways), ambient data (light, noise), consumer behaviour or social interaction patterns (frequency of phone calls, messaging, internet social media, …). In particular, very sensitive information e.g. involving geotagging, analyses of voice, frequency of phone contacts and messages, bears critical security and privacy issues which require proper technical solutions (Ben-Zeev et al.,

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2015a, 2015b; Cornet and Holden, 2018; Nicholas et al., 2015, 2017). Within the framework of considering experience sampling (van Os et al., 2017) or ecological momentary assessment (EMA), these measures support various methods targeting behaviour change. Examples range from mere self-informative monitoring to synchronous communication involving rapid feedback and EMA-dependent triggers (Ben-Zeev et al., 2015a; Bos et al., 2015; Klein et al., 2016; Probst et al., 2016).

Technical feasibility and user-friendliness along with high rates of engagement critically determine obtaining adequate data and sustained impact with lasting effects on user behaviour (Rahman et al., 2017; Rehman et al., 2017; Scherer et al., 2017; Torous and Firth, 2018; Torous et al., 2017). For successful implementation of mHealth tools, patients' immediate acceptance of distinct features and mental health professionals' (MHP) readiness to support the respective features are crucial (Berry et al., 2016; Proudfoot et al., 2010; Sinclair et al., 2013).

Previous studies found MHPs to be rather uniformed about technical devices for use in mental health despite expecting benefits, particularly for younger patients (Surmann et al., 2017). Regarding the actual engagement in mobile phone intervention, data are heterogeneous and high engagement has been reported for older age groups. The same study demonstrated the general capability to engage in mHealth applications over several months, even in severe mental illness (Ben-Zeev et al., 2016).

In this study, we aimed to conduct a survey addressing prospective acceptance of distinct eHealth features involving different types of data assessment in psychiatric patients and MHPs. Furthermore, the effect of preoccupation regarding data security and commercialization on patients' engagement is assessed.

These topics bear crucial relevance in order to synchronize development and rollout of e-mental-health tools, tailored to patients' needs and reduce mutual misconceptions.

2. Material and methods

2.1. Participants

Between October 2017 and April 2018, we asked MHP and psychiatric patients to participate anonymously. For this article, MHP refers to psychiatrists and residents in psychiatry (comprised as physicians) as well as to licensed psychological psychotherapists and psychologists training (comprised as psychologists). The study complies with the Declaration of Helsinki and was approved by the local ethics committee. An online link to the questionnaire (http://maq-online.de) was sent to 15 psychiatric hospitals in Germany (university hospitals: LMU and TU Munich, Heidelberg, Regensburg, Tübingen, Aachen, Charité Berlin, Jena and Frankfurt; county hospitals: KBO Agatharied, KBO Wasserburg, KBO Haar, Darmstadt, LVR Langenfeld, and APZ Königslutter). Patients from the Department of Psychiatry and Psychotherapy, University Hospital, LMU Munich, were asked to complete a paper-based survey. Furthermore, we asked psychiatrists' and psychotherapists' in 105 practices around Munich to participate and distribute the questionnaire.

2.2. Questionnaire

The questionnaire was structured into three parts. Items and questions were developed by the authors according to relevancy for the research question. Initially, a short introduction explained the intention of the survey and the term “eHealth” to provide the interviewee with sufficient information about the topic. The first section of the survey asked for personal frequency of electronic device usage (smartphone, tablet, computer) in a 5-item ordinal scale from “never” to “hourly”. The second part assessed in dichotomous format (yes-no), whether patients would participate in distinct eHealth features and if MHPs would support their implementation. Distinct features addressed were: daily assessment of mental condition, biosignals, wrist actigraphy (“fitness bracelet”), confirmation of medication-intake and video-communication. The third part addressed attitudes towards rather general issues of eHealth on a 5-point-likert-scale (ease of clinical daily routine, risks of data abuse and commercialization; cp. supplement for questionnaire details).

2.3. Data analysis

Data were analyzed using RStudio (https://www.rstudio.com, Version 3.4.3). Responses of the three groups to scaled question formats (device usage, general acceptance of eHealth) were tested for significance of group differences by nonparametric analysis of variance (Kruskal-Wallis-Test) with post-hoc Dunn's test. Dichotomous answers (distinct features) were assessed via Pearson's chi-squared test with post-hoc chi-squared test of independence (physicians vs psychologists and MHP vs patients). The significance level was set to $p < .05$, corrected for multiple comparisons (Bonferroni). For questions only addressing MHP-groups (Fig. 2D and E) Mann-Whitney-U-test for two-group comparison was calculated. Furthermore, we performed correlation analyses (Spearman) between demographic and behavioral sample characteristics, scaled questions regarding general acceptance of eHealth and the sum of supported features (SSF); p-values were computed using algorithm AS 89 (Best and Roberts, 1975).

3. Results

3.1. Study sample

Altogether, 486 subjects anonymously self-completed the questionnaire. Online links sent to hospitals were answered by 169 physicians, 128 psychologists, and 189 patients. From outpatient units/practices 25 psychiatrists and 29 psychologists participated. Please refer to Table 1 and Fig. S1 for details.

3.2. Attitudes towards distinct eHealth features

Concerning distinct eHealth features, daily reports of mental state were supported by psychologists with balanced acceptance and rejection in physicians and patients (physicians/psychologists/patients: acceptance: 82/46/87, rejection: 86/81/101; group differences not significant ($\chi^2 = 5.03$, $p = .08$; Fig. 1 A)). Wrist-actigraphy was opposed by a relatively small majority in patients and physicians in contrast to supportive psychologists (acceptance: 70/75/72, rejection: 94/52/113; $\chi^2 = 12.61$, $p = .002$; Fig. 1 B). There was a significant difference in acceptance of geodata (acceptance: 32/10/41, rejection: 134/118/146, $\chi^2 = 11.33$, $p = .01$) with most psychologists rejecting ($\chi^2_{(\text{physicians vs psychologists})} = 15.87$, $p = .001$, Fig. 1 C). Video-consultation was supported by a majority of physicians, whereas psychologists were balanced in acceptance and rejection, similar to patients (acceptance: 98/69/93, rejection: 68/59/93, $\chi^2 = 2.89$, $p = .24$; Fig. 1 D). Transmission of biosignals like heart rate and blood pressure was endorsed by slightly larger proportions of physicians and patients than psychologists (acceptance: 79/50/98, rejection: 88/78/89, $\chi^2 = 5.44$, $p = .07$; Fig. 1 E). The response pattern roughly matched advocacy of monitored drug taking (acceptance: 89/43/111, rejection: 78/83/75, $\chi^2 = 20.29$, $p < .001$; Fig. 1F). Most patients would prefer their MHP to contact them when potential worsening of their mental health status were indicated, and most physicians would do so, whereas less psychologists consented (acceptance: 106/56/139, rejection: 59/69/48, $\chi^2 = 28.20$, $p < .001$; post-hoc: $\chi^2_{(\text{physicians vs psychologists})} = 15.87$, $p = .001$; Fig. 1 G). This preference strongly correlated with the SSF (rho = 0.59, $p < .001$), not with concerns about data security (rho = 0.009, $p = .9$).

Table 1
Sociodemographic and clinical details of the study sample.

	Psychiatrists (n=169)	Psychologists (n=128)	Patients (n=189)	Kruskal-Wallis/ Chi-square
Age *Hospital* *Private Practice*	40.95 (10.36) *39.43 (9.63)* *49.27 (9.74)*	37.01 (10.43) *36.52 (10.35)* *39.90 (10.96)*	42.64 (15.69) *42.76.93 (15.99)* *41.61 (14.21)*	H= 14; p= <.01
Sex (m/f) *Hospital* *Private practice*	86/77 *80/63* *11/14*	22/102 *20/73* *2/25*	75/90 *70/72* *5/18*	X^2= 2.8; p= .43
Clinical position/ Diagnoses				
In training Attending/Consultant	84 52/32	56 PT: 60	F2x F3x F4x F6x 32 86 14 10	

Displayed are mean values and standard deviation of demographics of the two professional groups examined and patients. In total, 84 of the physicians (50%) were still in residency, 52 board certified/attending physicians (31%), 32 consultants (19%). 81 worked in a university-affiliated hospital (48%, university-hospital or teaching hospital), 54 at a county hospital (32%), 25 in outpatient units/private practices (15%). Among psychologists, 56 (44%) were still in training, 60 were licensed psychotherapists (47%), 19 in outpatient units (15%). The questionnaire was returned by 189 patients. ICD-10-diagnoses as self-reported by patients were mainly affective and psychotic disorders (F3x: 57%, of which 87% unipolar and 13% bipolar; F2x: 25%, F4x: 7%).
Group differences were assessed for significance via Kruskal-Wallis (age) and chi-square test (sex). Patient subgroups are specified as follows: inpatients and outpatients of the Department of Psychiatry and Psychotherapy of the LMU Munich, outpatients of certified mental health professionals; abbreviations: SD = standard deviation, PT = licensed psychological psychotherapist; Diagnoses are referred to ICD 10 codes: F2x = psychotic; F3x = affective; F4x = anxiety and adaptive disorders; F6x = personality disorders.

3.3. Use of technical devices

Device usage significantly differed between groups for smartphones ($H = 6.54$; $p = .038$; Fig. 2 A), computers ($H = 56.54$, $p < .001$; Fig. 2 B) and tablets ($H = 19.331$, $p < .001$; Fig. 2 C). Post hoc tests indicated that tablets and computers were used more often by psychologists ($Z = 3.37$, $p = .002$ and $Z = 4.49$, $p < .001$, respectively) and physicians ($Z = 4.04$ $p < .001$; $Z = 7.39$, $p < .001$), with a trend towards significance for more frequent smartphone usage by physicians ($Z = 2.35$ $p = .056$, Fig. 2 A), compared to patients.

3.4. Attitudes towards general issues with eHealth and its prospective application

Most Patients considered eHealth to be an important topic and enrichment for medicine in general (Fig. 2H and I). Answers were mixed regarding individual relevance for patients' health (Fig. 2 G). Attributions of importance were strongly correlated with the SSF (Table 2 C). Overall worriedness about risks of data protection was indicated and most pronounced in patients (Fig. 2 F). However, group differences were not significant ($H = 3.12$, $p = .210$) and negative correlation with SSF was low, yet significant for MHP (driven by psychologists), not for patients (Table 2 A, B). Moderate negative and positive correlation with SSF was found for age in MHP and device usage in patients, respectively (Table 2 B).

Furthermore, gained ease of clinical processes in MHP correlated negatively with age ($rho = 0.17$, $p = .004$, Table 2 A) and strongly correlated with the SSF ($rho = 0.53$, $p < .001$, Table 2 B). On the contrary, the perceived risk of commercialization was age-correlated for psychologists ($rho = 0.28$, $p = .002$, Fig. 2 E; Table 2 A). Group differences were not significant ($W = 11600$, $p = .23$; Fig. 2 D).

4. Discussion

The current survey was undertaken to assess the prospective acceptance of eHealth tools in patients and MHPs in general as well as to differentiate between distinct eHealth features. More specifically, questions addressed regular use of electronic devices and attitude towards general impact and risks of eHealth applications. Additionally, we investigated the acceptance of distinct features: daily reports of mental health status, wrist actigraphy, geotracking, feedback upon signaled status worsening, monitoring of biosignals, and intake of medication.

Overall, general and feature-specific acceptance did not differ to a great extent between MHP and patients. Answers indicate mixed perspectives across all groups. In all three groups, slight majorities encourage daily reports of mental state. Higher degree of acceptance by psychotherapists compared to physicians is likely to reflect greater subjective relevance in daily practice. The same relevance could be assumed regarding monitored drug taking that seems to be valued to a higher extent by physicians and patients than in psychotherapists.

Changed setting of conventional techniques like shifting from direct face-to-face communication to video conversation was opposed only by a minority of MHP. Despite mixed positions of patients, further development and integration into regular care is demanded with adequate attention to concerns as discussed further below. Our results are well in line with recent studies demonstrating feasibility, acceptance and effectiveness, although evidence is limited (Barnes et al., 2011; Ben-Zeev et al., 2018; Murray et al., 2015).

4.1. Particularly critical features

Actigraphy was overall regarded more skeptically across groups and, even more so, was geotracking. The particular relevance for estimating health states of these features needs to be evaluated further, however, some results indicate their added value (Ben-Zeev et al., 2015b; Osipov et al., 2015; Shin et al., 2016). Hence, it seems justified to consider them for adequate EMA as an essential part of mHealth, potentially boosting quick recognition of state changes (Ben-Zeev et al., 2015b; Lüttke et al., 2018). Therefore, more information of MHP and patients appears necessary in order to obtain an adequately informed decision in the light of individual preferences of prognostic accuracy and feedback on the mental status changes (cp. below).

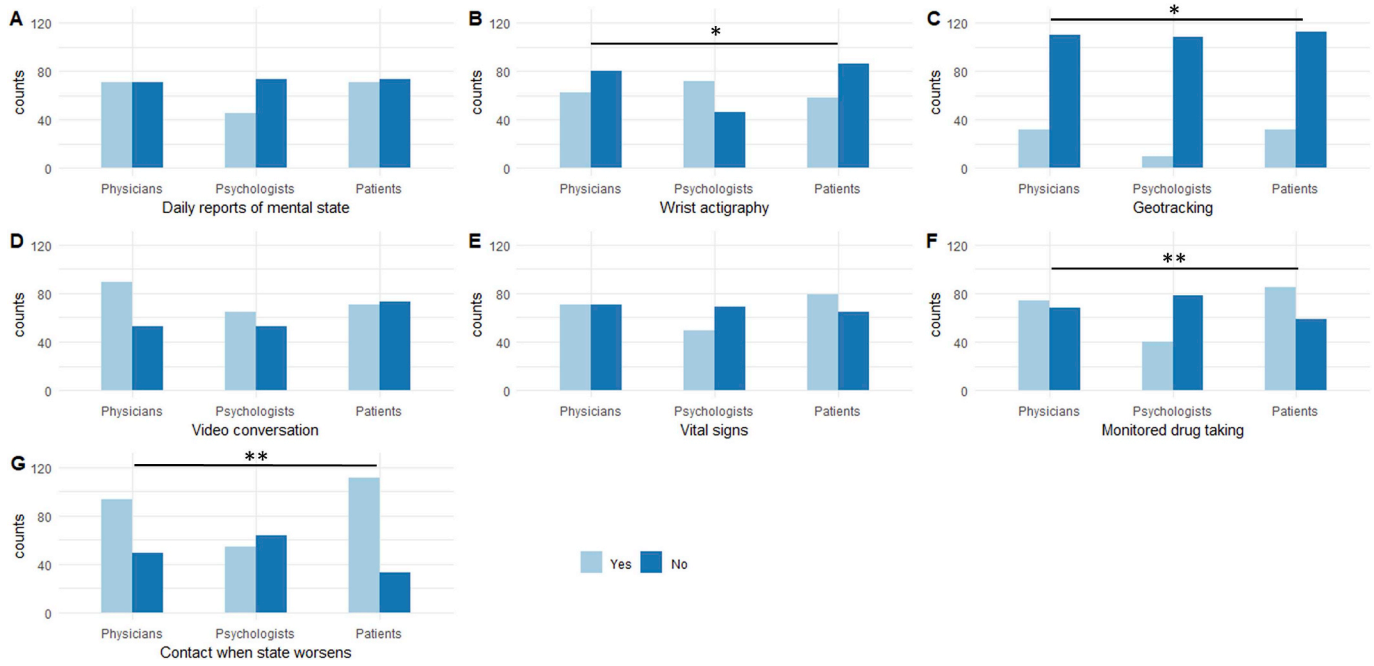

Fig. 1. Support of distinct eHealth features. Mental health professionals (MHP) and patients were asked, which features they endorse and employ, respectively. Group differences were assessed via Pearson's chi-squared and post-hoc chi-squared test of independence, p-values were Bonferroni-corrected for multiple testing. Bars specify significant group differences, * and ** indicate p-values $< .05$ and $< .001$, respectively (post-hoc tests not graphically displayed). A) $\chi^2 = 5.03$; $p = .08$; B) $\chi^2 = 12.61$; $p = .002$; C) $\chi^2 = 11.33$; $p < .01$; D) $\chi^2 = 2.89$; $p = .24$; E) $\chi^2 = 5.44$; $p = .07$; F) $\chi^2 = 20.29$; $p < .001$; G) $\chi^2 = 28.20$; $p < .001$; post-hoc$_{(\text{MHP vs patients})}$: B) $\chi^2 = 4.84$; $p = .03$, C) $\chi^2 = 4.15$; $p = .003$, F) $\chi^2 = 9.16$; $p = .002$, G) $\chi^2 = 15.87$; $p < .001$.

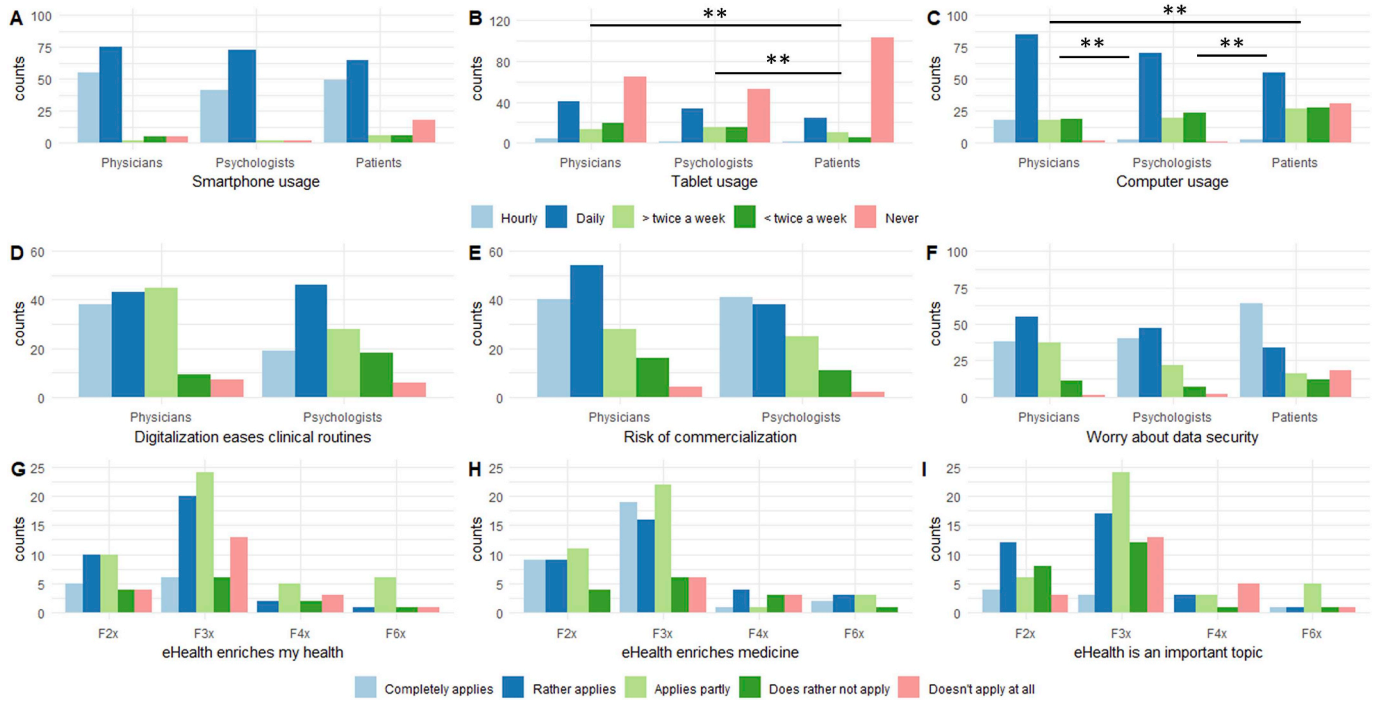

Fig. 2. Device usage and general perspectives on eHealth-use. The first row (A–C) displays frequency of device usage in mental health professionals (MHP) and patients Second and third row show the groups' perspective on critical issues of the implementation of eHealth tools. Bars specify groups for significant differences, * and ** indicate p-values $< .05$ and $< .001$, respectively. Group differences were assessed for significance via Kruskal-Wallis (in case of three Groups (H), with post-hoc Dunn's (Z)) and Mann-Whitney-U test (in case of two groups; W); post-hoc tests are displayed when $p < .1$: **A)** $H = 6.54$, $p = .038$, ($Z_{(\text{physicians vs patients})} = 2.35$; $p = .06$); **B)** $H = 19.33$, $p < .001$ ($Z_{(\text{physicians vs patients})} = 4.04$, $p < .001$; $Z_{(\text{psychologists vs patients})} = 3.37$, $p < .001$); **C)** $H = 56.54$, $p < .001$, ($Z_{(\text{physicians vs patients})} = 7.40$, $p < .001$; $Z_{(\text{psychologists vs patients})} = 4.49$, $p < .001$; $Z_{(\text{physicians vs psychologists})} = 2.31$, $p < .001$); D) $W = 11600$, $p = .23$; E) $W = 9825$, $p = .19$; F) $H = 3.12$, $p = .21$, G) $H = 5.78$, $p = .12$; H) $H = 7.09$, $p = .07$; I) $H = 4.89$, $p = .18$. Abbreviations: ICD 10 codes: F2x = psychotic; F3x = affective; F4x = anxiety and adaptive disorders; F6x = personality disorders.

Table 2
Correlation between general perspectives on eHealth, demographic and behavioral sample characteristics.

A	Fear of data abuse						Risk of commercialization						Easier daily processes					
	Age			Device usage			Age			Device usage			Age			Device usage		
	S	p	Rho	S	p	Rho	S	p	rho	S	p	rho	S	p	Rho	S	p	Rho
MHP	37	.18	.08	38	.97	-.002	34	.003	.17	39	.65	-.03	48	.004	-.17	35	.16	.08
Psychologists	31	.25	.10	38	.10	-.14	25	.002	.28	31	.50	.06	39	.14	-.13	31	.50	.07
Physicians	62	.13	.12	58	.12	.12	6	.11	.13	71	.31	-.08	89	.001	-.24	60	.30	.08
Patients	8	.62	-.04	9	.50	-.05												

B	Correlation of sum of supported features with:														
	Age			Device usage			Data security			Risk of commerce			Ease of processes		
	S	p	Rho	S	p	Rho	S	p	Rho	S	p	Rho	S	p	Rho
MHP	51	< .001	-.25	34	.06	.11	52	< .001	-.21	51	.002	-.18	20	< .001	.53
Psychologists	45	.002	-.28	31	.41	.07	43	< .001	-.24	42	.03	-.20	18	< .001	.49
Physicians	94	< .001	-.33	59	.15	.11	92	.03	-.16	90	.07	-.14	35	< .001	.55
Patients	86	.26	-.09	66	.004	.21	12	.19	-.10						

C	Patients														
	eHealth is important …									Fear of …					
	as a topic			for my own health			for modern medicine			Data security			MHP having less time		
	S	p	Rho	S	p	Rho	S	p	Rho	S	p	Rho	S	p	Rho
Device use	53	< .001	.33	7	.07	.14	7	.10	.13	9	.50	-.05	8	.74	.03
Age	8	.5	-.04	7	.22	.10	7	.10	.13	8	.62	-.04	8	.24	-.09
SSF	64	< .001	.41	38	< .001	.64	48	< .001	.56	12	.19	-.10	12	.20	-.10

Spearman's rank order correlation was assessed between device usage frequency, age, the sum of supported eHealth features (SSF) and general perspectives on eHealth. A) Displays MHPs' concern about commercialization of patients' data, their experience of eHealth tools easing clinical routines, and both groups' fear about data abuse correlated with age and device usage. B) Displays the correlation of each group's SSF with age, device usage, fear of data abuse, risk of commercialization and ease of clinical processes; C) displays patients' attitudes towards eHealth as an important topic in general and its current influence on their own health, relevance for medicine in general and whether there is a concern about data abuse or MHPs investing less time in treatment due to eHealth applications. Abbreviations: SSF = sum of supported features (cp. Fig. 2), S = sum of all ranked square differences ($x10^5$), all p-values corrected for multiple comparisons (Bonferroni), rho = Spearman's rank correlation coefficient.

4.2. General perspectives on eHealth and sociodemographics impact overall acceptance of features

We found large correlative effect sizes between the attributed importance to eHealth and the SSF in patients, whereas preoccupation about data security only significantly impacted the SSF in MHP, not in patients. This may point towards a gap between patients daring to take risks from the background of individual needs and caution within the professionals' context. Only few previous studies considered participants' perspectives and sample sizes were low (Cornet and Holden, 2018). Altogether, widespread worries about data security need to be addressed thoroughly and the precise concerns should be evaluated for an effect of specific education. Age seems to be more relevant in MHP in the context of SSF, perceived risks and benefits in daily processes, whereas it impacts patients' perspectives less. This is well in line with behavioral data from previous studies, showing that older healthy subjects (Seifert et al., 2017) and patients diagnosed with schizophrenia were able to engage in a mobile phone intervention (Ben-Zeev et al., 2016). On the contrary, patients' SSF correlated with device usage, which should be evaluated further to distinguish, whether increased usage or expertise determine acceptance of distinct features.

4.3. Patients wish feedback on mental state changes

Importantly, the vast majority of patients responded that they would like to be informed by their MHP in case of signs for health status worsening, which correlated with the SSF. Interest in early identification and feedback on status changes could be expected to be accompanied by a positive perspective on the majority of distinct eHealth features, which is well in line with these results. However, the relatively high proportion of critical positions towards distinct features seems to be conflicting and needs to be discussed considering perceived risks in more detail. This imbalance may be interpreted to reflect a gap between the need for adequate status evaluation and prediction of mental state changes on the one side, with uncertainty about technical tools and data collection on the other side. In a previous report from a small sample, inpatients with schizophrenia were particularly concerned about their privacy as opposed to outpatients (Ben-Zeev et al., 2015). Future studies with adequate sample sizes are required to disentangle the precise interrelations between consent, information level, diagnoses, symptom severity and life circumstances.

4.4. Perceived and predicted impact of eHealth on medicine

Broadly, most (and particularly younger) MHP already experience ease of clinical routines through eHealth tools and most patients see an enrichment for medicine in general (despite not considering eHealth an important topic). The influence eHealth can obtain with more widely available tools critically depends on feasibility and evidence of effectiveness along with implementation into regular care (Firth et al., 2017a,b; Firth et al., 2017; Nicholas et al., 2015, 2017). However, results underline the promising potential value and acceptance. Despite patients' worry about time taken from the personal interaction with their MHP, research points towards beneficial use of blended face-to-face and eHealth-contacts (Erbe et al., 2017; van der Vaart et al., 2014; Wentzel et al., 2016). This further underlines the need for education on the potential range of applications and nuanced individual feedback.

4.5. Limitations

The sample of patients was mainly collected from a tertiary care hospital and its outpatient department (Dept. of Psychiatry and Psychotherapy of the University of Munich). The illness severity was not assessed and acceptance patterns among patients may differ in other samples. Furthermore, this survey was intended to minimize barriers to engage in the study and time demands. Thus, the items were held relatively coarse and future specifications, considering more detailed subitems, are required. Moreover, the number of patients is relatively small to consider subgroup-analyses to reflect a definite statement, particularly concerning diagnoses. Additionally, the sample includes a relatively high proportion of patients with diagnoses in the spectrum of psychotic disorders (F2x) and few patients with anxiety (F4x), particularly in comparison to the distribution of diagnoses in outpatient units/private practices (Jacobi et al., 2014a, 2014b; Mack et al., 2014). The returning rate of questionnaires from this sector was very low, thus we cannot assume generalizability of our results, e.g. across care sectors and reproduction is warranted. The same applies for cultural aspects and data from other countries are aspired, also considering more demographic and disease-specific details. Finally, most data assessed were from subjects living in urban areas. Generally, the results reflect a prospective assumption on likely behaviour. Despite prior evidence from behavioral data pointing into the same direction (Ben-Zeev et al., 2015, 2016), it remains to be evaluated, if the anticipated behaviour, needs and goals match actual behaviour when the methods become available. Regarding the relatively long duration of the survey, the interrelation between changes in the technical and legal environment and acceptance of mHealth tools remains to be assessed alongside evaluation of longitudinally changing individual positions e.g. in relation to technical expertise and information on the topic, especially as subjects receive more information.

4.6. Conclusion and future directions

We provide evidence indicating substantial support for many features of mHealth in mental healthcare despite considerable rejection of particular features (geotracking, actimetry). Mixed answers should be specified by future qualitative studies assessing the underlying subjective circumstances.

Currently, data are insufficient to reliably estimate the prognostic relevance of individual features (Firth et al., 2017a,b; Firth et al., 2017). The precise interrelation between diagnoses, monitored symptoms, the preferred mode and the (individual) intensity of contact remain to be assessed further in more detail. Importantly, the relevance of detailed data acquisition on the accuracy of estimated status and prognosis needs to be specified in order to justify data security implications. Moreover, it should be examined if subjects change their perspective after obtaining adequate information, e.g. about details regarding technical issues, their diagnosis and treatment. It has been shown previously, that the level of details in information influences the decision to consent (Moser et al., 2002, 2005). In addition, information also needs to reach MHP so the gap in knowledge and experience with deploying eHealth tools (Surmann et al., 2017) can be closed. Finally, software development and implementation should match patients' needs, respecting privacy by efficiently collecting relevant data.

Declarations of interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2018.11.025.

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