If You Build It, Will They Come? A Mixed-Methods Study of Knowledge Translation Strategies to Support Bipolar Disorder Self-Management

Erin E Michalak, Emma Morton, Steven J Barnes, Rachelle Hole, CREST.BD, Greg Murray

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Abstract

Background: Self-management is increasingly recognised as an important method through which individuals with bipolar disorder (BD) may cope with symptoms and improve quality of life (QoL). Digital health technologies have strong potential as a method to support application of evidence-informed self-management strategies in BD. Little is known, however, about how to most effectively maximise user engagement with digital platforms.

Objective: The aims of the present study were to a) create an innovative online Bipolar Wellness Centre, and b) to conduct a mixed-methods (i.e., quantitative and qualitative) evaluation to assess the impact of different sorts of engagement (i.e., 'knowledge translation' [KT]) for self-management strategies for BD.

Methods: The project was implemented in two phases. In phase one, Community Based Participatory Research and user-centered design methods were used to develop a website (Bipolar Wellness Centre) housing evidence-informed tools and strategies for self-management in BD. In phase two, a mixed-methods evaluation was conducted on the impact of and engagement with four KT strategies (online webinars, online videos, online one-to-one 'Living Library' peer support, and in-person workshops,). Quantitative assessments occurred at two time points: pre-intervention and three weeks post-intervention. Purposive sampling was used to recruit a sub-sample of participants for the qualitative interviews, ensuring each KT modality was represented, and interviews occurred approximately three weeks post-intervention.

Results: Ninety-four participants were included in the quantitative analysis. Responses to evaluative questions about engagement were broadly positive. When averaged across the four KT strategies, significant improvements were observed on the Bipolar Recovery Questionnaire (p = .018) and QoL.BD (p = .005). Non-significant improvements in positive affect and negative affect were also observed. The sole difference that emerged between KT strategies related to the Chronic Disease Self-Efficacy measure, which decreased after participation in the webinar and video arms, but increased after the Living Library and workshop arms. A sub-sample of 43 participants were included in the qualitative analyses, with the majority of participants describing positive experiences with the four KT strategies; peer contact was emphasised as a benefit across all strategies. Infrequent negative experiences were reported in relation to the webinar and video strategies, and included technical difficulties, the academic tone of webinars, and feeling unable to relate to the actor in the videos.

Conclusions: The present study adds to a growing literature that suggests digital health technologies can provide effective support for self-management for people with BD. The finding that KT strategies could differentially impact chronic disease self-efficacy (hypothesised as being a product of differences in degree of peer contact) warrants further exploration. Implications of the findings for the development of evidence-informed apps for BD are discussed.

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ORIGINAL PAPER

A Mixed-Methods Study of Knowledge Translation Strategies to Support Bipolar Disorder Self-Management

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*CREST.BD is a Canadian government (Canadian Institutes of Health Research) funded multidisciplinary network dedicated to advancing bipolar disorders research and knowledge exchange, particularly embracing Community Based Participatory Research.

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Abstract

Background: Self-management is increasingly recognised as an important method through which individuals with bipolar disorder (BD) may cope with symptoms and improve quality of life (QoL). Digital health technologies have strong potential as a method to support application of evidence-informed self-management strategies in BD. Little is known, however, about how to most effectively maximise user engagement with digital platforms.

Objective: The aims of the present study were to a) create an innovative online Bipolar Wellness Centre, b) to conduct a mixed-methods (i.e., quantitative and qualitative) evaluation to assess the impact of different sorts of engagement (i.e., 'knowledge translation' [KT]), and (c) to support engagement with the self-management information in the Bipolar Wellness Centre.

Methods: The project was implemented in two phases. In phase one, Community Based Participatory Research and user-centered design methods were used to develop a website (Bipolar Wellness Centre) housing evidence-informed tools and strategies for self-management in BD. In phase two, a mixed-methods evaluation was conducted on to explore the potential impact of four KT strategies (online webinars, online videos, online one-to-one 'Living Library' peer support, and in-person workshops). Quantitative assessments occurred at two time points: pre-intervention and three weeks post-intervention. Purposive sampling was used to recruit a sub-sample of participants for the qualitative interviews, ensuring each KT modality was represented, and interviews occurred approximately three weeks post-intervention.

Results: Ninety-four participants were included in the quantitative analysis. Responses to evaluative questions about engagement were broadly positive. When averaged across the four KT strategies, significant improvements were observed on the Bipolar Recovery Questionnaire, $F(1,77) = 5.887$ (p = .018) and QoL.BD, $F(1,77) = 8.212$ (p = .005). Non-significant improvements in positive affect and negative affect were also observed. The sole difference that emerged between KT strategies related to the Chronic Disease Self-Efficacy measure, which decreased after participation in the webinar and video arms, but increased after the Living Library and workshop arms. A sub-sample of 43 participants were included in the qualitative analyses, with the majority of participants describing positive experiences with the four KT strategies; peer contact was emphasised as a benefit across all strategies. Infrequent negative experiences were reported in relation to the webinar and video strategies, and included technical difficulties, the academic tone of webinars, and feeling unable to relate to the actor in the videos.

Conclusions: The present study adds incremental evidence to a growing literature that suggests digital health technologies can provide effective support for self-management for people with BD. The finding that KT strategies could differentially impact chronic disease self-efficacy (hypothesised as being a product of differences in degree of peer contact) warrants further exploration. Implications of the findings for the development of evidence-informed apps for BD are discussed.

Key words: bipolar disorder; eHealth; self-management; knowledge translation; qualitative; Community Based Participatory Research.

Introduction

The tremendous impact of mental disorders - for the people who live with them, their families, and society - is well established. Mental health conditions account for 14% of the global burden of disease worldwide and 37% of all healthy life years lost from chronic disease [1]. Millions of people worldwide are suffering and losing quality of life (QoL) due to mental disorders, and many will lose their lives. Bipolar disorder (BD) - a mood disorder characterized by pronounced variability in mood, activity, and energy levels [2] - contributes significantly to this global burden of disease. Robust epidemiological studies indicate a 1-2% lifetime prevalence for BD [3] and it is estimated that 6-10% with the condition will die by suicide [4]. However, these "misery statistics" [5] do not tell the whole story; people with BD can and do experience good health and QoL [6-8].

Effective support for self-management - "the plans and/or routines that a person with BD uses to promote health and QoL" [9] - are viewed as one important route to optimising outcomes in BD. Our Collaborative Research Team to study psychosocial issues in Bipolar Disorder (CREST.BD) has spent the past decade incrementally advancing the literature on self-management and BD. Outputs have included: qualitative explorations of self-management application in BD [7, 8, 10], a Delphi Consensus Consultation project [9], and a review of eHealth/mHealth applications for self-management of the condition [11]. These findings complement a solid international literature speaking to the importance of self-management in terms of impacting health and QoL in people with BD and recommendations for supported self-management in international BD clinical treatment guidelines (e.g.,[12]). However, as recently noted, "means to support these self-management interventions... are critically needed" [13].

Digital health technologies offer clear potential as one route to support application of evidence-informed self-management strategies in BD, and there is no doubt that people with the condition are seeking health information online. An international survey of 1222 people with a diagnosis of BD from 17 countries reported that 81% of respondents described themselves as Internet users; 78% of this sample sought information related to their diagnosis online [14, 15]. The most commonly cited reasons for Internet searching were to seek more information on the symptoms of BD, prescription drug information, the general course of illness, coping strategies, and medication side effects. Notably, 67% of respondents said that information seeking online helped them to cope with their BD 'sometimes or frequently.' Respondents were more likely to report a positive impact of online information on their ability to cope if they were 'always able to find what they were

looking for' [14]. Our own research into online information seeking in youth with BD has indicated that what youth 'are looking for' online is credible, safe, and stigma-free information about their condition [16]. However, there are prevailing concerns about the quality and accuracy of online health information [17, 18].

Taken together, the key messages from emerging research in the BD digital technology arena are two-fold. First, it is clear that people with BD are looking online for information and support in order to optimally manage their condition. Accordingly, BD research and clinical communities need to rise to the challenge of providing high-quality, evidence-informed online information and resources to meet this need. Second, we need to advance our understanding of how to best maximise user engagement with the online tools we produce. The present mixed-methods study was designed to address these needs by assessing the impact of a range of digital and face-to-face engagement (i.e., 'knowledge translation' [KT] [23]) strategies on user engagement and health-related outcomes in Canadians with BD developed for an online Bipolar Wellness Centre.

The current study

The aim of the current project was to advance understanding of KT strategies in BD. To this end, we investigate four distinct strategies for encouraging engagement with an online BD resource. The strategies were all face-valid methods for engaging people with lived experience with health information, but differed in terms of resource intensiveness and accessibility. The four strategies were online webinars, online videos, online one-to-one 'Living Library' peer support and in-person workshops. The online resource to which these KT strategies related (the Bipolar Wellness Centre) was a newly developed website structured around our group's approach to the domains of QoL in BD. Funding from the Canadian government in the form of a 2-year Canadian Institutes of Health Research (CIHR) 'Knowledge to Action' grant supported the development of the central website and the accompanying mixed methods investigation of how different KT strategies impacted engagement with the online content held within it. The research project is positioned as the initial phase of a longer-term developmental program of research to advance understanding of the potential utility of digital health technologies for supporting self-management in people with BD.

Methods

Overview

The project was conducted under the auspices of the Collaborative RESearch Team to study psychosocial issues in Bipolar Disorder (CREST.BD, [19]), a Canadian-based network dedicated to

collaborative research and KT in BD. CREST.BD specialises in Community Based Participatory Research (CBPR), where researchers and knowledge users (in this case, people with BD, and BD healthcare providers) work in hand-in-hand [20]. Informed by a decade of research and integrated KT, CREST.BD has developed a specific model of CBPR for BD [21] and dedicated web and social media platforms [22].

The project was implemented across two study phases over a two-year period. In the first phase, we applied the principles of integrated KT, CBPR, and user-centred design to develop a website (the Bipolar Wellness Centre, described below) to house evidence and tools on self-management strategies for BD. In the second phase, we conducted a mixed-methods (quantitative and qualitative) evaluation of the impact of four bespoke (online or in-person) KT strategies designed to foster engagement with the content housed within the Bipolar Wellness Centre. The primary aims of the quantitative study component were to assess whether the four KT strategies: 1. represented effective engagement strategies, and; 2. impacted health-related outcomes in study participants with BD. The aims of the qualitative study component were to explore whether the four KT strategies represented effective engagement strategies. Participants in the study self-selected one of the four KT strategies in which to participate.
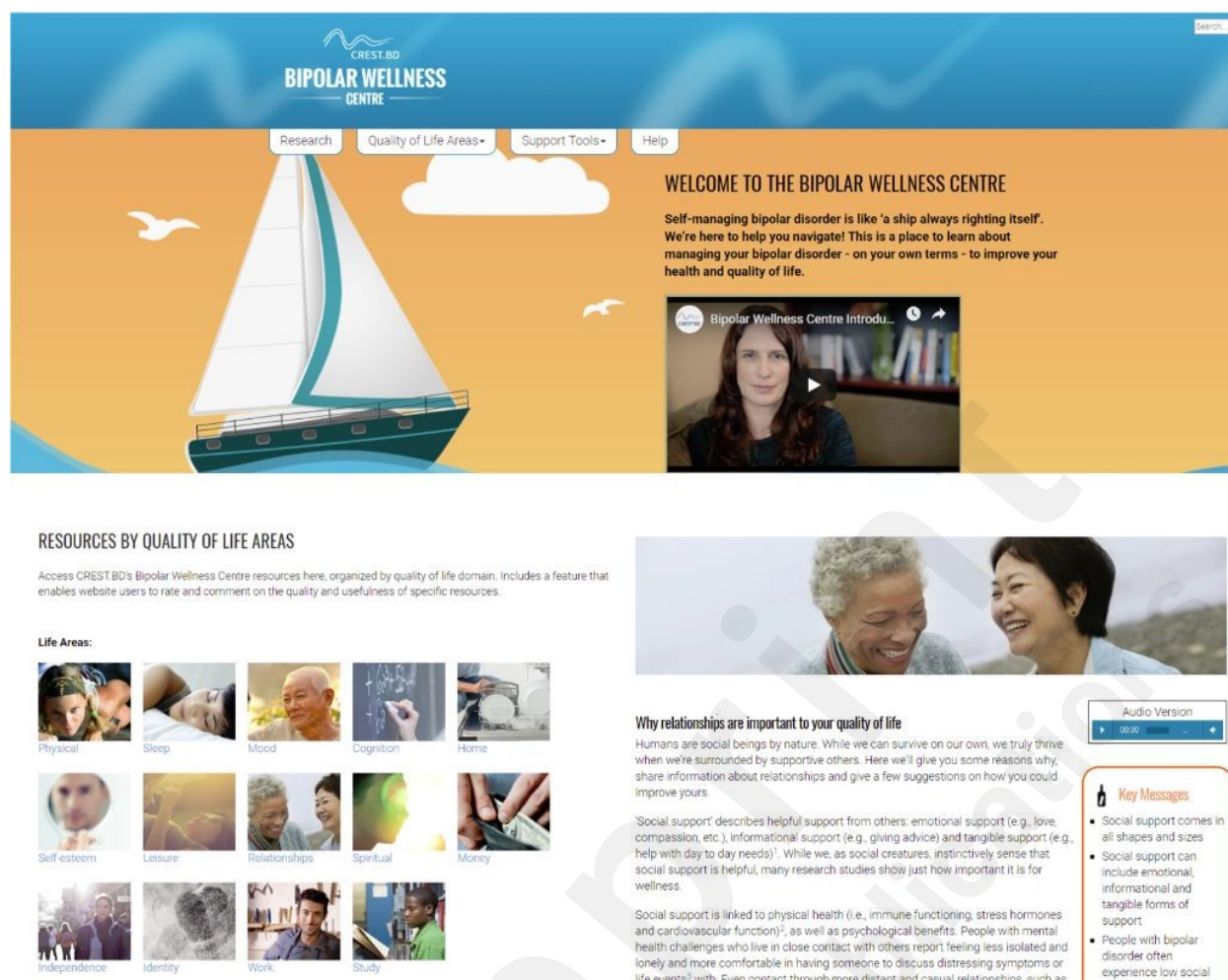
Development of the Bipolar Wellness Centre

During the first phase the study, we developed, within an integrated KT and CBPR framework, our signature website, the CREST.BD 'Bipolar Wellness Centre' [23]. The primary goal of the Bipolar Wellness Centre is to support self-management in people with BD, and empower them to manage and improve their health and QoL. Structurally, the website's design emulates our theoretical understanding of QoL in BD, developed on the basis of our longstanding program of research exploring the QoL construct in BD (e.g., [6, 24]). Self-management categories were presented according to the 14 domains of QoL measured by our Quality of Life in BD (QoL.BD) scale [25] and its online counterpart, the QoL Tool [26], which assesses the cardinal life areas impacted by BD (e.g., mood, sleep, physical health, cognition), more concrete life areas (e.g., finances, home, work, education, leisure), and some which are more psychosocially-orientated (relationships, self-esteem, spirituality, identity, independence).

In keeping with the principles of CBPR, we fused the expertise of academic researchers, people with BD and healthcare providers to co-create the content in the Bipolar Wellness Centre. First, we conducted three consultation events in partnership with the Mood Disorders Association of Ontario

(MDAO) in the Canadian cites of Toronto, Bowmanville, and Guelph, in order to develop the 'look and feel' of the website. These consultations with people with BD resulted in the selection of an overarching nautical metaphor (effective self-management of BD has been likened to "to a ship that's always righting itself" [7]). Identification of the research evidence and tools for the Bipolar Wellness Centre was a thoroughgoing process. In order to determine the content for each of the 14 self-management areas, we first appointed a CREST.BD lead and then conducted academic and grey literature reviews. Draft section content was created, revised by a plain language writer and then reviewed by the CREST.BD Community Advisory Group. Our early design consultations also prioritized accessibility of website content for people with BD who were struggling with symptoms or cognition problems. The research evidence was therefore presented in succinct text form and audio version, and augmented by brief 'key messages' and ways to 'take action'. Also provided are key scientific references and carefully curated (and annually updated) area-specific resources and tools (e.g., evidence-informed tools to support application of self-management strategies for sleep). The official launch of the Bipolar Wellness Centre (see Figure 1) occurred on World Bipolar Day (March 31st 2015). The project to evaluate the impact of the four KT strategies (i.e., webinars, videos, Living Library, workshops, described in full below) was conducted throughout 2015. After the evaluation of the KT strategies was complete, the webinars and the videos (but not the Living Library nor workshop strategies) were made publically available through the website (funding parameters did not permit implementation or longer-term sustainability of the Living Library or workshop strategies).

Figure 1. Bipolar Wellness Centre.

Development of and evaluation methods for the Bipolar Wellness Centre KT strategies

During the second phase of the study, we developed (again within an integrated KT and CBPR framework) and evaluated four bespoke Bipolar Wellness Centre KT strategies (see Figure 2).

Figure 2. Overview of KT strategies.

1. Online webinars: 14 webinars [27] (see Figure 3) were produced, one corresponding to each self-

management area; each webinar was delivered by a CREST.BD member with internationally recognised expertise in the focal self-management area. Twelve of the webinar presenters were academics (one of whom, co-author SJB, also lives with BD) and two presenters provided lived experience of BD. Webinars were 15-20 minutes in length (not including Q&A) and each followed a structured delivery format, covering: 1. Education about the specific self-management area (e.g., the importance of sleep as a self-management strategy and it's relation to QoL, as summarised in the text section relating to sleep and BD on the Bipolar Wellness Centre); 2. Some key messages from current research evidence in that area (e.g., as provided in the text and literature on the Bipolar Wellness Centre); and, 3. How to take action (e.g., recommendations for tools to support self-management strategies for sleep, as housed on the Bipolar Wellness Centre). The webinars (split screen of video of presenter and PowerPoint slides) were pre-recorded to ensure audio quality and delivery fidelity. The actual webinars were, however, delivered 'live' (i.e., the pre-recorded webinar with a live Q&A with the presenter) to research participants. Following evaluation, a recording of the webinar and Q&A was made publically available through the website.

Figure 3. Webinars.

2. Online videos: 6 videos [28] (see Figure 4) were developed in collaboration (with the production

company *As You Like It*) in the areas of: mood, sleep, relationships, physical health, finances and home life. Videos were 2-4 minutes in length and all featured CREST.BD member Victoria Maxwell, an actor and mental health educator who lives well with BD. Video content (development of which was informed by the self-management area content on the Bipolar Wellness Centre) was similarly structured across the 6 videos, with the actor/narrator introducing the key self-management area, followed by pragmatic examples of self-management behaviours in everyday life (e.g., how to apply the principles of good sleep hygiene).

Figure 4. Videos.

3. Online Living Library: The Living Library KT strategy (Figure 5) consisted of a single 45-minute session between the research participant and a Living Library 'expert' (i.e., one of five experienced patients living well with BD who had undergone thorough training in Bipolar Wellness Centre content and navigation) via a secure online telehealth system (©Medeo). Sessions were relatively unstructured, but the Living Library experts were instructed to explore the research participant's priorities for self-management focus, and to navigate the participant through the germane content areas and tools in the Bipolar Wellness Centre (with the exception of the videos and webinars,

which were not, at that time, made available via the website).

Figure 5. Living Library
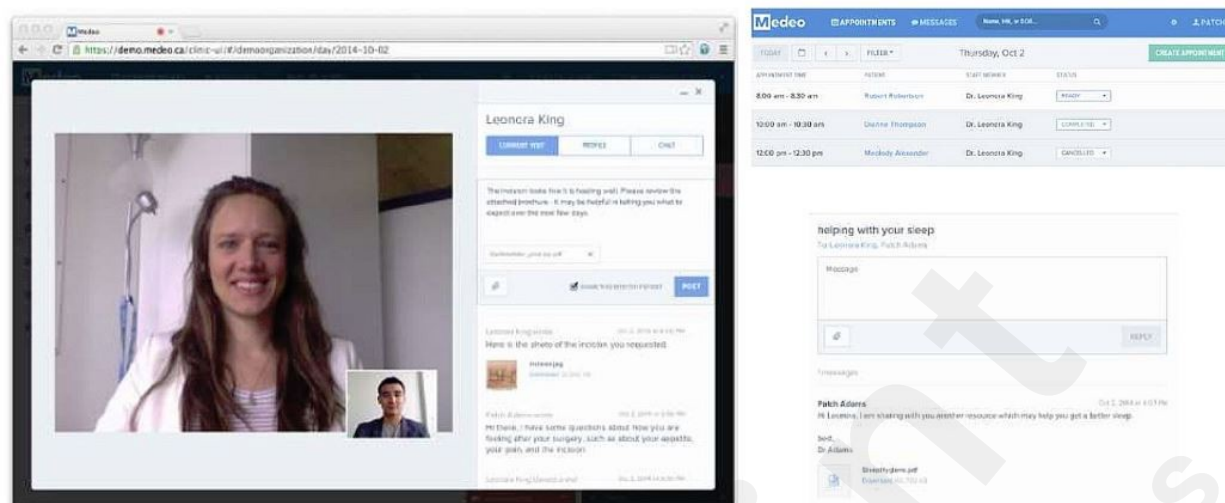
4. **In-person workshops:** A structured 2.5 hour in-person group workshop (Figure 6) was developed focused on two self-management domains (mood and sleep, cardinal BD self-management areas). Workshops were co-delivered by three CREST.BD team members (co-authors EEM and GM and Victoria Maxwell) and provided structured delivery of didactic, role-play and small group work. They were delivered three times in the Canadian cites of Ottawa, Kingston and Toronto (sample size at each workshop was 6, 10 and 16, respectively) in partnership with the Mood Disorders Association of Ontario (MDAO).

Figure 6. Workshops

Recruitment

To be eligible, participants were required to be: i) age 19 years or above, ii) able to communicate in English, iii) able to provide informed consent, iv) a resident of Canada, and v) have a self-reported diagnosis of BD (Type I, II or NOS). Participants were recruited via diverse methods including CREST.BD face-to-face (e.g., outreach at community events and conferences), web-based (e.g., news releases on the CREST.BD website and blog), and social media communications (e.g. CREST.BD Facebook and Twitter accounts), and notices were sent to those individuals with BD who had been recruited for previous studies for whom we had ethical permission to contact. Participants were free to self-select which of the four KT strategies they wanted to engage with. Participants were remunerated with a $10 gift certificate to recognise their time in the webinar or video (quantitative) arms, $20 for participation in the workshop or Living Library (quantitative) arms, and an additional $20 for participation in the qualitative arm.

Quantitative Methods, Statistical Analysis and Assessment Scales

Ethics approval for the study was granted by the University of British Columbia's Behaviour Research Ethics Board. All participants received written information on the study and gave written informed

consent. Participants consenting to the quantitative arm of the study were given the option of consenting to be re-contacted for a qualitative interview.

Quantitative assessments of the experience and impact of the KT strategies was conducted in two ways. First, we investigated the subjective experience of participating in the KT strategy immediately upon completion of contact ('immediate post-test'). Participants rated each of four statements related to a particular KT strategy (i.e., 'learned something new', 'applicable to me', 'met my expectations', 'would recommend to others with BD') on a Likert scale from Strongly Agree (1) to Strongly Disagree (5). Second, we investigated the short- term impact of the KT strategy by comparing 3-week follow-up ratings (Time 2) with baseline scores (pre-intervention, in the week prior to engagement with the KT strategy [Time 1]). Only a 3-week assessment timeframe was feasible for this exploratory project. Quantitative assessment of the impact of the KT strategies on health outcomes utilized four scales, assessing: QoL (via the 56-item Quality of Life in BD or QoL.BD, a condition-specific QoL scale which is sensitive to change in clinical state over 7-10 days [25]), recovery (via the 36-item Bipolar Recovery Questionnaire or BRQ [29]), mood (via the Positive and Negative Affect Schedule or PANAS, a self-report questionnaire that consists of two 10-item scales to measure both positive and negative affect [30]), and chronic disease self-efficacy (SECD, via the 5-item 'Manage Disease in General' sub-scale of Stanford's Chronic Disease Self-Efficacy Scales [31, 32]). Quantitative data were analyzed using SPSS version 24.

By necessity, data collection approach differed slightly by KT arm. In the webinar arm, research participants self-selected a single webinar to participate in based on their own interests; webinars were scheduled at a rate of approximately three per week April through May 2015. A week before the webinar, research participants were sent a unique link to the Time 1 assessments. After participating in the webinar and Q&A they were sent a link to the immediate post-test questions, and three weeks after that, another link to the Time 2 assessments. In the video arm, the videos were embedded directly into the Qualtrics system; participants conducted the Time 1 assessments, viewed the video, immediately conducted the immediate post-test questions and were sent a link to the Time 3 assessments 3 weeks later. In the Living Library arm, participants were sent a link to the Time 1 a week before their scheduled Living Library session, sent a link to the immediate post-test questions on completion of the session and then a link to the Time 2 assessments 3 weeks later. Finally, for the workshops, delivered in May-June 2015, the Time 1 and 2 assessments were administered via Qualtrics but the immediate post-test questions were completed by paper and

pencil at the end of the workshop.

Qualitative Methods and Data Analysis

Purposeful criterion sampling [33] was used to ensure the breadth of KT modalities were represented. Consenting participants were contacted via email approximately two weeks after participating in the KT strategy to schedule a telephone interview; interviews occurred approximately three to four weeks following participation in the KT strategy. A total of 43 interviews were conducted by co-author EM. Interviews ranged from 20 to 70 minutes in length (M = 39.4, SD = 11.2). A semi-structured interview schedule was developed with three main sets of open-ended questions. The first set of questions asked participants about their engagement with the information shared in the KT session. The second set of questions explored any attempts to implement self-management strategies. Finally, participants were asked about their QoL, including any changes to their QoL following exposure. Probes and reflective listening were used to elicit depth in participant responses. The interviews were digitally recorded and transcribed verbatim by EM (n = 24, 55.8%) or research assistants (checked by EM for accuracy; n = 19, 44.2%).

Thematic analysis [34] of participants' perceptions and responses to the content and delivery of the self-management information in the KT strategy occurred. Themes describing participants' experiences of engaging with a KT strategy are discussed in detail elsewhere [10]. For the purposes of this paper, a secondary analysis was conducted that focused on information that would add to or clarify understanding of the quantitative study results. Step 3 of Braun and Clarke's (2006) [34] analytic process informed the analysis producing *descriptive, literal categories* of the data. Examples of positive and negative experiences relating to the KT modalities were identified. Data were assigned brief descriptive codes in the qualitative data management software NVivo [35]. Codes were examined and overarching categories identified. The content of categories was reviewed for coherency, and transcripts were revisited as the themes were developed to ensure all relevant data were adequately described. The essence of the most important categories in relation to understanding quantitative data were then described in a report with illustrative transcript extracts. To reduce the risk of bias and to address analytic validity, authors EEM and RH reviewed both the descriptive accounts of themes and transcripts for coherency and validity of interpretation, with disagreements resolved via consensus.

Results

Participants

A total of 94 participants were included in the quantitative analyses, with an age range was 45-54 years and the majority (n = 53, 60.2%) identifying as female. The most frequently reported diagnosis was BD Type I (n = 46, 55.4%), followed by BD-II (n = 31, 37.3%). In the 43 participants in the qualitative analyses, age range was 45-54 years and n = 30 (69.8%) were female, with n = 24; (55.8%) reporting BD Type I and n = 16 (37.2%) BD Type II.

Quantitative results

We firstly analyzed the immediate post-intervention data to explore participants' perceptions of the different types of KT strategies. Data were analysed using a one-sample t-test comparing the difference between the mean response and the neutral rating of 3. As shown in Table 1, participants were very positive about all KT strategies with modal response of Agree or Strongly Agree in each case, and responses significantly better than neutral for 15 of the 16 cells.

Table 1. Ratings of satisfaction with four KT strategies (1 = Strongly Agree, 5 = Strongly Disagree). Date in the table are mean (mode) responses. Asterisks refer to significance of one-sample t-test comparing mean with neutral response (i.e., rating of 3).

Strategy	Something new	Applicable	Expectations	Recommend to others with BD
Webinar (*n* = 22)	2.41 (2)**	1.77 (1)***	2.55 (1)	1.77 (1)***
Video (*n* = 26)	2.35 (2)**	1.85 (2)***	2.50 (2)*	1.65 (2)***
Workshop (*n* = 32)	1.78 (2)***	1.34(2)***	1.81 (2)***	1.56 (2)***
Living library (*n* = 14)	1.93 (2)***	1.86 (1)***	2.21 (1)*	1.43 (1)***
Combined (*n* = 94)	2.11 (2)***	1.66 (1)***	2.23 (2)***	1.62 (1)***

* *p* < .05
** *p* < .005
*** *p* = .000 (survives Bonferroni adjustment for 16 comparisons)

To understand the impact of participation in the four KT strategies over time, we firstly conducted a multivariate repeated-measures (pretest to follow-up on each of BRQ, QoL.BD, PA, NA and SECD) analysis of variance with KT strategy (i.e., webinar, video, Living Library, and workshop) as the between-subjects variable. The analysis revealed a main effect of Time: when averaged across the

four strategies, participation led to improvements across the five outcomes (upper 5 rows of Table 2). Post-hoc analyses found non-significant improvements in PA, and NA, and significant improvement as measured on the BRQ (p = .018) and QoL.BD (p = .005). Chronic Disease Self-Efficacy as measured by SECD was the outlier, with a small (non-significant) decrease when averaged across the four strategies.

Secondly, we looked at the five outcome variables separately, via a Time X Strategy interaction (bottom 5 rows of Table 2). For BRQ, QoL, PA and NA there was no difference between KT strategy in terms of their ability to improve outcomes (i.e., there was no significant Time X Strategy effect for these four variables). Interestingly, the data showed that for SECD there was a significant Time X Strategy effect (p = .016) (the sole outcome that showed a negative average impact across strategies). Figure 1 shows that SECD declined in the two conditions that were more technology-dependent (webinar and video), but actually improved in the two conditions that had more peer or interpersonal contact (Living Library and workshop).

Table 2. Results of repeated measures MANOVA, testing change in five outcome measures between pre-test and follow-up (upper 5 rows are main effect of Time, lower 5 rows are the interaction between Time and KT strategy).

Analysis	Measure	df	Mean Square	F	Significance
Time	BRQ	1	205.053	5.887	.018
	QoL.BD	1	1.252	8.212	.005
	PA	1	.457	1.889	.173
	NA	1	1.236	3.059	.084
	SECD	1	.490	.283	.597
Time X Strategy	BRQ	3	23.241	.667	.575
	QoL.BD	3	.302	1.982	.124
	PA	3	.091	.376	.771
	NA	3	.404	.999	.398
	SECD	3	6.339	3.652	.016

Figure 7: Pre-test to follow-up change in SECD by strategy (difference in slopes p = .016)
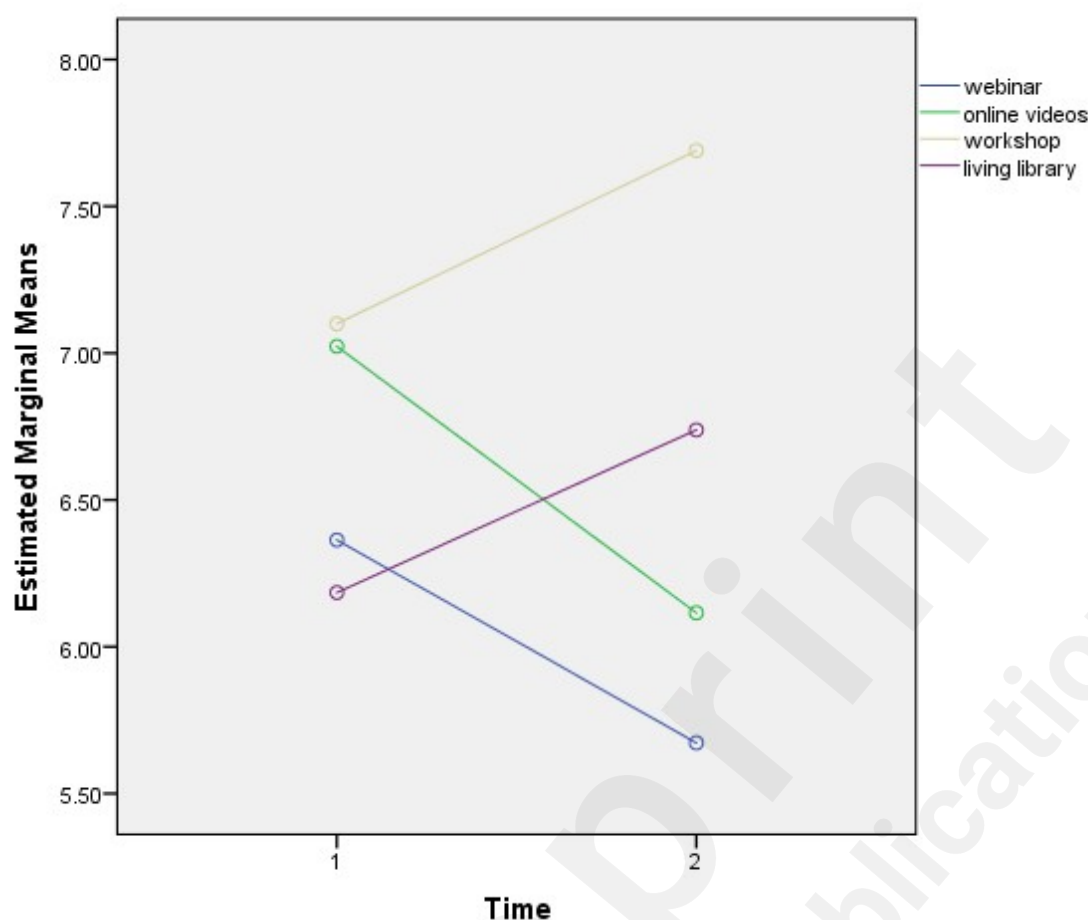
Qualitative results

Participant descriptions of both positive and negative experiences specifically associated with the webinar, video, Living Library and workshop arms are summarised in Tables 3-6, respectively. Positive aspects of the various KT strategies emphasised by participants included: the interactive nature of the webinars and the depth of information provided, and the brevity and visual accessibility of the videos. Across the KT modalities, peer contact was consistently emphasised as a helpful or appreciated aspect, but descriptions of how peer contact was experienced varied by modality. Participants in the workshop arm emphasised appreciating the opportunity to learn from others managing the same condition and reducing self-stigma though normalisation of shared experiences. The Living Library was described as a helpful place to share experiences with an expert who could understand and relate to them, and some participants described being inspired by having access to somebody who lived well with BD. Participants in the video arm often felt able to relate to the actor/narrator, which helped them better understand their own experiences as well as identify the personal relevance of strategies.

Reports of negative experiences of KT modalities were infrequent, particularly in participant

descriptions of the workshop and Living Library arms (two participants across both these arms described unique negative experiences). As such, description of negative experiences in this section focuses on the webinar and video arms, where a small number of participants described feeling disengaged or discouraged by the interventions. Four participants in the webinar arm described the academic style of information delivery in the webinar as off-putting and one reported technical difficulties. Some participants found it difficult to relate to the depiction of a woman living well with BD in the videos, resulting in a sense of discouragement or frustration. Although the length of the videos was described by some participants as a positive, there were others who found their brevity limited the amount of useful information conveyed. Finally, of note, a preference for in-person services was described by some participants across both the webinar and video arms.

Table 3. Qualitative findings: Positive and negative experiences of webinars

Category description		Quote
Positive experiences	Interactive (n=7)	"I also really liked that they had a question and answer period at the end." [F, BD-II, 25-34]
	Depth of information (n=5)	"I find them very informative, and I personally like webinars." [F, BD-I, 55-64]
	Peer presence as normalising/providing community (n=3)	"I saw the people on the right, the people who had signed in, and the comments. So it just said, 'Well, you're in good company, and you can do this, and you're doing things right', kind of." [F, BD-I, 55-64]
Negative experiences	Overly academic/clinical (n=4)	What kind of triggered me at the beginning was a lot of what I call MBA type language... I find that really, really frustrating, because the emphasis on quality indicators and efficacy and all this kind of stuff, really is never about the person. [M, BD-NOS, 45-54]
	Technical difficulties (n=1)	"Well for one thing I entered the webinar rather late because I was having some system problems, so I had to contact the webinar organisers and get everything sorted out. So I might not have learned as much as I could have." [F, BD-I, 55-64]

Table 4. Qualitative findings: Positive and negative experiences of videos

Category description		Quote
Positive experiences	Succinct (n=3)	"It's not overwhelming, it's not like reading a thousand page book, the videos are short and sweet and I think that's good." [M, BD-I, 55-64]
	Visualizing self-management (n=3)	"Watching somebody do things... that's how I learn, and I found the video is really helpful in that... It gave me a sort of visual concept of what

it's about." [F, BD-I, 55-64]

	Relatability of the narrator (n=5)	"Just seeing how that video was, like first of all, how her life was with her depression or how she was feeling, her mood, how things were cluttering her world, I recognize that that's what happens to me, but to know it, to actually see it was helpful." [F, BD-II, 45-54]
Negative experiences	Difficulty identifying with a person living well with BD (n=4)	"I didn't' connect with the video as much as I would have liked to, because I felt like a bit of a personal failure because it wasn't that easy for me, it was so much harder." [F, BD-II, 45-54}
	Amount of information (n=2)	"I found that the videos were very short and not very, from a user's point of view, not that informative." [M, BD-I, 35-44]

Table 5. Qualitative findings: Positive and negative experiences of Living Library

Category description		*Quote*
Positive Experiences	Living Library expert understands my experiences (n=2)	"One of strongest points of our talk was finding out that [the Living Library expert] was also bipolar. And that's what I've been searching for, is to talk to others that live it, and not just read about it in a book, because even then, when I read some of the books, it doesn't quite fit what I've experienced and maybe I'm looking for others like me" [F, BD-I, 45-54]
	Being inspired by Living Library expert (n=4)	"Knowing that people go through the same stuff and probably manage the condition better. So just knowing that helped." [M, BD-I, 25-34]
Negative Experiences	Lack of information provided by Living Library expert (n=1)	"I learned absolutely nothing...She didn't understand the program herself, she couldn't help me get into some of the stuff." [F, BD-I, 55-64]

Table 6. Qualitative findings: Positive and negative experiences of workshops

Category description		*Quote*
Positive experiences	Learning what works for others with BD (n=5)	"I found that was also helpful, sharing with other people, you know suggestions about things that have helped them and so on." [M, BD-II,35-44]
	Normalising difficulties (n=4)	"I felt when I was there that I didn't stand out. It was just kinda like everybody was there and everybody has their own little struggles." [F, BD-I, 35-44]
Negative experiences	Scheduling (n=1)	"I would have preferred if the workshops had been a bit earlier, especially because we

ended up going later. I found that hard, you know, we're talking about sleep - we're talking about going to bed at the regular, you know, for setting up the pattern. And I ended up going to bed late that night. So that was, that was a bit frustrating, to be talking about setting up a regular sleep time and then, set back, from doing that, rolling my sleep schedule off." [F, BD-I, 35-44]

Discussion

Overview

The potential for digital technologies to produce transformative impact in the mental health arena is profound. Research is burgeoning in this space, driven in part by recognition of the remarkable rate at which society is adopting technology into their everyday lives, the pressures on healthcare systems for services to be delivered flexibly in a patient-centred manner, and acknowledgement of the empowerment that digital technologies can bring to patients by enabling them to make choices about when and how they access care [36]. Technology-supported self-management holds significant potential to improve the health and QoL of people facing mental health challenges, and represents one avenue to reduce the substantial healthcare costs associated with chronic illnesses [37]. However, the production of evidence-based self-management support technologies is time and resource intensive, and requires sustained maintenance; the identification of effective approaches to optimize user engagement with them is therefore paramount. This mixed-methods study explored the impact of four KT strategies on user engagement and health-related outcomes in people with BD.

Principal Findings

Quantitatively, at a broad level, participants evaluated all four KT strategies positively. When the KT strategies were examined collectively, we observed a non-significant trend towards increased positive affect and decreased negative affect following exposure to the KT strategies and significant improvements in perceived recovery and QoL. A modest non-significant decrease in perceived self-efficacy to manage chronic illness was observed post-exposure. Exploration of the impact of the KT strategies individually indicated that all four KT strategies positively impacted perceived recovery, QoL, and both positive and negative affect. Chronic disease self-efficacy was observed to significantly decline in the more technology-dependent conditions (webinar and video), but improve

in the two conditions with more peer and interpersonal contact (workshop and Living Library).

This study adds one piece of incremental evidence to a growing literature suggesting that online technologies can represent an effective conduit for, or complement to, care for people with BD. In a recent systematic review of web-based and app-based applications for self-management in BD, for example, we identified 15 studies, several of which demonstrated positive impacts of digital interventions on QoL [11]. The most commonly supported self-management strategy categories delivered by online interventions identified in the review were "ongoing monitoring," "maintaining hope," "education," and "planning for and taking action"; the least commonly supported categories were "relaxation" and "maintaining a healthy lifestyle."

Qualitatively, user experiences of the four KT strategies tested were also largely positive. Most dominant was an appreciation of the opportunity for peer contact. Negative descriptions of experiences tended to focus on the webinar and video strategies, citing issues such as disliking the academic tone of the webinars, or an inability to identify with the woman living well with BD depicted in the videos. Broadly speaking, our qualitative findings suggested that there was no 'one size fits all' approach for determining the right type of KT strategy for BD self-management information. Other qualitative analyses of this qualitative dataset have been published, with a focus on participants' experiences of self-management more broadly as well as perception of their QoL [10, 38]. While the present analysis focused on perceptions of the KT strategies embedded in the overall self-management intervention, an evaluation of experiences of engaging with the self-management intervention more broadly as well as attempts to enact self-management strategies was conducted [38]. Feelings of empowerment and responsibility to self-manage BD were discussed, while a minority of participants felt that self-management strategies lacked power to control BD symptoms. The relationship of self-management to the healthcare system was also discussed, with opportunities to develop a sense of partnership between clinicians and patients via attention to self-management identified. A more in-depth discussion of the links of such experiences to self-efficacy, recovery, and therapeutic alliance is presented therein. In addition, a qualitative analysis focusing on individuals' subjective experiences of their QoL was conducted [10]. The relativity of subjective QoL quality of life judgements to self, others, and possible futures was explored, and the possible implications of the flexibility of reference point usage for future therapeutic interventions discussed.

Our observation that chronic disease self-efficacy may be differentially impacted by mode of KT

strategy (i.e., ones containing more versus less peer interaction) is intriguing. On the one hand, existing literature clearly points to the potential benefits of online peer support in terms of increasing feelings of social connectedness, group belonging and serving as an avenue to share self-care strategies [39]. Online peer support for people with mental health problems can occur in diverse ways, including via general support forums (e.g., [40]), advanced interactive forums dedicated to sharing illness experiences such as PatientsLikeMe [41], discussion forums that are embedded within formal online treatment interventions (as being evaluated, for example, in the BD MoodSwings 2.0 [42, 43] and ORBIT [44] trials) or through social media platforms such as Twitter, Facebook and Reddit [39, 45] , blogging [46] or video-based platforms [47, 48]. Regardless of the conduit, it appears that engagement rates with online applications that foster social connections may be higher [49].

Online engagement should not be viewed, however, as entirely without risk; Naslund and colleagues [39] note that online interactions can result in exposure to unreliable information, hostile or derogatory comments, or can result in feelings of uncertainty or anxiety about one's mental health condition. Our finding, albeit from a modest dataset, that chronic disease self-efficacy may be negatively impacted by KT strategies with less peer support may be one example of how digital interventions might also have unintended negative consequences. In a recent study, Williams and colleagues [47] qualitatively explored users' experiences of lived experience videos on an interactive of recovery-oriented website (the Self-Management and Recovery Technology or 'SMART' program) designed for people with psychosis. Although the delivery and focus of the videos in the SMART program differed from those of the present study (SMART program videos were focused on recovery-principles rather than on self-management strategies, and were designed to be viewed either with a mental health worker or independently), results from that study are germane to the present project. In particular, participants' experiences of the videos were clearly situated for many in the context of their personal recovery journey, as the authors' state: "responses to the videos appeared to be influenced by the participants' existing ways of coping with life and managing their recovery, as well as by how they used technology. Participants who did not relate to the peers as role models perceived that their ways of coping were too different, or they were at a point in their recovery journey where they did not want to identify with peers".

In sum, our quantitative (i.e., decreased chronic disease self-efficacy scores in the video and webinar arms) and qualitative (i.e., some participants reporting difficulties identifying with the actor

living well with BD in the videos) findings suggest two things. First, participants' experiences of KT strategies appear to be influenced by their understandings of their position in their own recovery journey. Second, there appears to be benefit of KT strategies which incorporate peer support. Future research is needed to more fully explore the precise relationship between peer support and engagement with, or enactment of, concrete self-management strategies.

Limitations

A number of limitations to the present study should be noted. First, participants self-reported their diagnosis of BD; although confirmation of diagnosis by structured psychiatric interview would have been preferable, there is some evidence that people who self-identify as living with BD typically do meet diagnostic criteria [50]. Second, this study was positioned as an exploratory phase in a longer-term program of research to advance understanding of the utility of digital health technologies for supporting self-management in people with BD. Participants were volunteers who were paid a modest honorarium for their participation and were free to self-select which KT modality they wanted to engage with, likely biasing towards an engagement method they were intrinsically attracted to, which in turn may have impacted the range of positive and negative experiences reported and limits the generalizability of the results to routine health service delivery settings. Third, the assessment timeframe for the examination of quantitative outcomes was short, i.e., 3-weeks. Many digital health intervention studies apply assessment periods of 4-8 weeks (e.g., [51]). Further, changes in the outcomes of interest in this study, such as QoL, are anticipated to emerge relatively slowly in BD compared to changes in symptoms (e.g., [52]) and changes in self-management behaviours are fully expected to take time to incorporate into everyday life. Longer assessment timeframes in future work are called for in order to fully capture expected trajectories of change in QoL outcomes. Unlike QoL, a sense of personal recovery as measured on the BRQ might be expected to shift quite quickly as people adopt new attitudes towards their role in managing BD. Responses to BRQ items such as, "I have the resources to manage my health", and "The activities I do make a difference to others" could shift solely via insights gained from interactions in the intervention. Fourth, as there was no control group of participants who did not partake in any strategy, non-specific causes (such as attention, time, demand characteristics, or the honorarium paid for participation) cannot be ruled out as an explanation for the observed quantitative outcomes.

Implications and Future Directions

Despite the aforementioned limitations, the present study provides a useful mixed-methods evaluation of the potential impact of a range of knowledge translation strategies on health-related outcomes in people with BD. The study was conducted between 2014-2016, our CREST.BD program of research has been focused since then on meeting emerging opportunities and needs of the digital mental health landscape. Moving forward, we are seeking funding for work to incorporate the evidence and tools held in the Bipolar Wellness Centre, our web-based QoL Tool [26], and the findings from the present study to inform the development of a new mHealth app: 'Bipolar Bridges". In doing so, we are carefully addressing some of the key challenges currently being faced by the in the digital technology space, which relate prominently to issues of information credibility, safety and privacy.

More than 10,000 mental health apps are available for immediate download today; worryingly, most mental health apps in commercial marketplaces are not evidence-based nor conform to clinical guidelines [53]. A 2015 systematic review found the majority of apps for BD (82/571 available apps were reviewed) were not aligned with clinical guidelines or established self-management principles and did not cite sources of evidence [54]. Some may even offer dangerous recommendations (e.g., one app recommends that people experiencing BD mania drink alcohol at bedtime to assist with sleep [54]). Further, many available apps do not respect the privacy of personal health information [53-55]. Thus, there are significant barriers for people facing mental health challenges in identifying safe, evidence-informed apps [56, 57]. Data from adults with BD [58] reports 'wish list features' for new apps inclusive of 'social interaction capability' and 'between-app integration' and receptiveness to digitally supported self-management [59]. Data from youth with BD reports prioritization of ease-of-use, scientific quality, customization, and data privacy [16, 58]. At a broad level, the BD field needs to advance in terms of creating technology-supported spaces which are inclusive of diverse people, regardless of their gender, sexual-orientation, SES, digital literacy, geography and ethnicity. Finally, the results of the present study indicate that more work is needed to inform how to best advance social connectivity via apps. Looking ahead, our Bipolar Bridges project aims to address some of these key challenges via the creation of a new app designed to enable diverse users with BD to optimise their QoL via supported self-management, resting on an innovative and secure blockchain-based platform. The results of the present study will be applied to hone a comprehensive mixed-methods (quantitative, qualitative and machine

learning) investigation of the feasibility, engagement, adoption, impact, and mechanisms of change associated with use of the app.

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Conflicts of Interest

None declared

Abbreviation	Explanation
BD	Bipolar Disorder
BRQ	Bipolar Recovery Questionnaire
CBPR	Community-based Participatory Research
CIHR	Canadian Institutes of Health Research
CREST.BD	The Collaborative RESearch Team to study psychosocial issues in Bipolar Disorder
KT	Knowledge Translation
NA	Negative Affect (a measure from the Positive and Negative Affect Schedule scale)
NOS	Not Otherwise Specified (clinical diagnostic descriptor)
PA	Positive Affect (a measure from the Positive and Negative Affect Schedule scale)
PANAS	Positive and Negative Affect Schedule (scale)
SES	Socioeconomic status
SPSS	Statistical Package for the Social Science (software)
QoL	Quality of Life
QoL.BD	Quality of Life in Bipolar Disorder (scale)

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