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User-Centered Value Specifications for Technologies Supporting Chronic Low-Back Pain Management

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Abstract

Low-back pain (LBP) is a leading cause of disability globally. It is complex and multifactorial, with a miriad of factors interwining and interacting to burden healthcare and individuals. Self-management support is central as part of best-practice to improve outcomes. In recent years, informatics has increasingly been considered to support care; however, due to its complex nature, several factors need to be unpacked in order to consider how technologies might support LBP. The present study utilised semi-structured interviews involving N=20 participants (n=10 practicing clinicains and n=10 indidivuals living with chronic LBP (cLBP)) to collect user-centered perceptions and considerations for key factors central to technology succeeding in supporting cLBP. Six themes were identified: tracking, alterts, user-experience, communication, feedback, and content. Findings lay groundwork for future research aimed at developing technologies that can encourage shared-decision making in supporting cLBP management in a particpatory health paradigm.

Keywords:

Low Back Pain; Informatics; Self-Management

Introduction

Low-back pain (LBP) continues to be listed as the leading cause of disability according to the Global Burden of Disease study by the World Health Organization (WHO) [1,2]. This can be observed via years lived with disability, ballooning costs, opioid analgesic abuse, increasing service demand, poorer quality of life, and inability to work [3,4,5]. Fear-avoidance of movement and poor adherence to self-management are major challenges at the heart of clinical patient management and individuals' self-management of chronic LBP (cLBP). This condition continues to plague health professionals and individuals within a participatory health and shared-decision making paradigm to achieve good outcomes, due to its complex and multifactorial etiology, with significant physical and psychosocial effects underpinning its presentation [4,6,7,8].

With greater self-management support for those living with cLBP, there is an increased likelihood that [9,10]: return to work outcomes will improve; overprescribing of opioids will decrease; unnecessary referrals to public chronic pain services from primary care will be reduced, thus unburdening the public healthcare system; better treatment options and health outcomes can be provided to individuals in rural and remote communities with difficulty accessing services; private health insurance claims may decrease, allowing opportunity for premiums to be reassessed.

Informatics technologies have been considered in its management. User-centered and participatory health enabling mobile health technologies have previously been reported to have a positive impact on motivation, behavior change, adherence to interventions, and pain outcomes in this context [11,12,13,14].

Clinicians, researchers, and informaticians continue to consider digital self-management support technologies for a variety of presentations of LBP; for example, this includes wearable monitoring device for movement and posture detection, and motivation and adherence tracking applications. These have the potential to transform current practices by improving health literacy, thus promoting greater self-management and improved outcomes [15,16,17,18].

However, before further developments in the digital monitoring and support space for cLBP can be achieved, more research is prudent to ascertain key evidence-based, user-centered considerations, in order to gather value specifications and user requirements for technology from both clinicians who treat cLBP and individuals living with cLBP. The present study forms part of a larger project, whose ultimate aim is to develop digital technology to support outcomes for LBP. The present study reports on data collected from individuals regarding perceptions concerning what underpins safe, effective and empowering mobile and/or digital monitoring technologies for this cohort. In other words, what will be required for participatory health enabling technologies for them to have a significant effect on cLBP management?

Methods

The present study recruited clinical health care professionals (HCP) with expertise in managing cLBP and individuals living with cLBP to participate in exploratory telephone-based semi-structured interviews (SSIs) to discuss the complex needs of living with and/or managing cLBP, as well as perceptions around the use and utility of informatics technologies to support care.

The University's Human Research Ethics Committee has approved this project (ID: 2018/135).

Recruitment

Participants were recruited through various avenues, inlcuding: word of mouth, study recruitment posters in clinical settings, and the study investigators' clinical networks spanning public primary health care settings, tertiary multidisciplinary pain services, and private primary care clinics

Once individuals registered interest in participating in the study, they were directed to an online form that included the study plain language statement and screening questions, which then directed them to the informed consent form. The questionnaire screened particpants against study inclusion criteria (which, for eligible participants from the cohort living with cLBP, included completing the Oswetry Disability Index to confirm a self-reported diagnosis of at least moderate LBP), and collected baseline demographics for descriptive statistical purposes (e.g. age range, gender, employment status, clinical speciality, years living with cLBP, etc.).

Data Collection

Data was collected and recorded using SSIs. Interviews took on average 22.7 minutes to complete.

The broader research project is methodologically sound and underpinned in informatics methodologies central to the robust and successful design and development of technologies for digital health interventions. This includes underpinning the research in the rigorous and academically validated roadmap for developing technology in health, the "Centre for eHealth Research Roadmap (CeHRES)", which has been used in a sample of chronic pain patients [19,20,21] http://www.ehealthresearchcenter.org/wiki/index.php/Main_Page . The present study is part of the 'value-specification' stage of CeHRES.

Furthermore, Greenhalgh et al. [22] recently published a robust review proposing a novel informatics model to ensure that future interventions in digital health do not fail the nonadoption, abandonment, scale-up, spread, and sustainability framework (NASSS). The framework consists of seven inter-related domains that should be considered when developing technology for health to support success.

Using NASSS as the methodological underpinning for data collection, the present research is the first (to the investigators' knowledge) to appropriate NASSS into a qualitative data collection instrument to conduct interviews as part of the value specification per CeHRES [20,22]. Hence, this study's data collection tool is a unique offering in itself to the informatics knowledgement management community as well.

Data Analysis

Once conducted, interviews were transcribed verbatim. Inductive thematic content analysis (TCA) was employed to identify themes latent within the data [23]. This was because the primary goal of the present study was to explore and examine user-centered consideration for technology that supportted management of LBP. Thematic analysis aims to identify themes in a set of qualitative data in an attempt to give meaning to the common voices of collective participants [23]. As described, basic descriptive statistics were also collected to quantify simple closed questions, such as demographics and condition-related data.

Three investigators (MM, CM, and AP) analysed the first interviews to be transcribed to create a preliminary coding schema and MM then used this framework to analyse the data.

Results

Recruitment and Participants

The present study successfully recruited and interviewed a total of N=20 participants. This included an even cohort of n=10 clinical health professionals with expertise in managing cLBP, and n=10 individuals living with cLBP. A full prospective cohort of N=27 were originally screened; however, after applying inclusion/exclusion criteria, five clinical health professionals were excluded due to lack of follow-up after pre-registering. Two prospective LBP patients were excluded for the reasons of lack of follow-up post registration of interest, and non-chronic LBP as per the Oswestry.

Participant demographics of those included can be seen in Table 1. As can be observed, health professionals came from a mixed background, were predominately male, between the ages of 30-39, with a wide range of clinical years of experience (3-25 years post-graduation), and skewed towards practicing in the hospital setting. Of participating patients living with cLBP, age range was also skewed towards 30-39, with an average Oswestry disability score of 39.1 (range = 31.1-51.1).

Table 1 - Participant Demographics

	HCP (n=10)	**Individuals with cLBP (n=10)**
Gender		
Male	8	5
Female	2	5
Age Range		
30-39	8	5
40-59	2	3
60-69	-	2
Level of Education		
High School or Less	-	4
College/University Completed	2	3
Post-Graduate Degree Completed	8	3

Thematic Content Analysis

A total of seven hours and 35 mintues of interview data was coded. Following the first round of coding, a total of n=52 codes were identified. This was broken down into n=31 individual codes from the health professional interview data, and n=21 codes from the cLBP cohort. This preliminary coding schema was conferred by the investigators and after a second round of coding, refined to group like codes into a resultant categorisation of n=6 themes common across both cohorts pertaining to digital technology for supporting cLBP. Of the n=6 resultant themes, these were broken down into sub-categories: N=19 identified by the clinical health professional cohort, and n=12 identified by people living with cLBP. Themes and sub-categories can be observed in Table 2.

Tracking

Participants from both cohorts idenitified the utility of any technological solutions to be able to track several metrics. For example, these may inlcude: activity tracking, other physiological metrics (i.e. inflammation, heart rate, etc.), posture, sleep, regimen adherence, and pain levels.

"I'd sort of think of something like that, where it feeds back and says oh, you're in this posture or you're in that posture, those sorts of things" (PRT05)

Alerts

Similarly, participants identified that a useful feature of digital technology to support cLBP would be to include alert/reminder features. This might include reminders to move or complete prescribed exercises, or further provide physical prompts and/or motivating prompts to breath, move, and reinforce good behaviours. Of note, as opposed to the health professional cohort, patients suggested haptic prompts, such as vibrations or prods, which might reinforce positive behaviours or postures.

"..almost like a, you know when the Apple watches, they give you a little buzz if you've been sitting down for too long, that kind of stuff I would be really, I'd find that really useful" (PRT04)

User-experience

User-experience of prospective digital solutions was also featured in the identified themes. This referred to both the platform of any physical platform (which was overwhelmingly suggested to be app and smartphone based), as well as reference to more aesthetic and subjective features. Feedback included suggestions for any technology to be small, portable, wireless, visually appealing, insightful, lightweight, and durable.

Communication

Clinicians were more vocal around their desire for digital solutions that support LBP management to include robust communication features. Whilst individuals living with LBP also indicated that SMS or text messaging features would be useful, clinical health professionals were more direct in their suggestions, recommending secure messaging features, email capabilities, and even social networking features for patients to connect with one another.

Feedback

Feedback was another theme commonly idenitfied. Quite similar to the 'alerts' theme, at the heart of providing feedback, participants indicated that they believed any digital technology designed for this context would be valuable and useful if it were intuitive to positively reinforce positive behaviours. This might include providing insights and reinforcement around good posture, regimen adherence, and gains/improvements.

"I can imagine if you had a wearable device that was, like, you've been standing for X number of minutes and we know that your tolerance is four minutes and you've been standing for three and a half, you need to go and sit down.." (PRT05)

Content

Finally, but perhaps the most strongly represented theme, several codes described key content or, functionality that the technology should include. For example, the most obvious inclusion according to both health professionals and individuals with cLBP, was the provision of education resources that educated individuals about cLBP, its causes, progress, and management. Furthermore, health professionals indicated certain complimentary features, such as, the inclusion of educative (or demonstrative) videos, the ability to prescribe and view exercises from within an app, gamification features to enhance motivation and/or adherence, mental health components (i.e. coping strategies, pacing and mindfulness training), as well as one suggestion to be able to collect pre-screening patient data before they arrive for an appointment. Patients on the other hand, also indicated that teleconsultation features, such as video-based consultation ability with their practitioner might be desirable.

"If there was some application component around what chronicity does to pain, and how that changes how pain is perceived in your brain..that woud be beneficial" (HCP02)

Table 2 - Thematic Analysis of Interviews

Theme	Sub Categories
Tracking	Activity
	Physiological Signals
	Posture
	Sleep
	Regimen Adherence/ Compliance
	Mood
	Pain
	Patient-Reported Outcome Measures
Alerts	Reminders
	Prompts
User-Experience	Platform
	Aesthetics
	Usability
Communication	
Feedback	
Content	Educational Resources
	Videos
	Exercise Prescription
	Gamification
	Mental Health Support
	Screening

Discussion

The data collected from the present study provides prelminary insights into the user-centered needs for informatics technologies that have the potential to support cLBP management. Findings indicate that both health professionals who manage cLBP, as well as individuals living with it, consider a range of factors when envisioning where and how informatics technologies might support management of the condition**, such as** being able to track progress, communicate, provide or receive feedback and reminders, and source educational content. Similar themes have been reported in a previous study [24]. The range of diverse themes identified (n=6) pertaining to techology to support cLBP further highlights the complexity of managing a condition like cLBP, with its mulifactorial nature [4**,**7**,**10].

Whilst both cohorts of participants (clinicians and individuals living with cLBP) provided data on the **six** themes, there was a slight difference in their individual perceptions or motivations underpinning these. For example, language pertaining to patient perceptions towards technologies surrounded their desire for technology to support active participation in self-management. Descriptive langauge used by participants pertaining to the sub-categories presented in Table 2 was quite 'active' in that it promoted active engagement in self-management (e.g. move, enter, log, reinforce, motivate, remind me). This supports literature in the participatory health domain, indicating that patients living with complex chronic conditions wish to be empowered shared-decision makers in their rehabilitative journey [14,16]. **Likewise, this** was also evident to some extent in comments from clinicians in describing their desire for technology to include robust communication features to enhance patient-practitioner communication, which has previously been reported to be beneficial [25]. Furthermore, patient comments commonly referenced their desire for technology that supports LBP management to focus on providing them motivation, feedback**,** and reinforcement to perform their exercises and rehabiltiation regimens. This was also broached by one clinician, who suggested gamification may be useful. These comments align to literature promoting best practice for LBP management, indicating that one of the primary factors in supporting the course of cLBP is to enhance motivation, decrease fear avoidance, and thus improve adherence in order to generate positive outcomes [11**,**12].

Conversely, descriptive language regarding the same **six** themes as described by health professionals, depicts language that is skewed towards data presentation and key indices of disease-specific progress (e.g. physical activity, measure, monitor, angles, habits, questionnaires, insight, and pre-screening), which has also been previously reported [24]. Whilst this is not suggestive of a disconnect, it does suggest that clinicians and patients do have differing needs and perceptions regarding the utilitiy of informatics in supporting outcomes. Hence, it is recommended that these subtle nuances are taken into consideration when considering technology to support care.

Study Limitations

As seen in the demographics of study participants, the insights generated in this study represent opinions from a range of clinical health professionals. **Eighty percent** of data represents a cohort aged between 30-39, which suggests that data is not to be generalised to a broader age range. This is similarly cautioned regarding the sample size, as well as themes generated not being an exhaustive list**; h**owever, several methodological approaches were included in study design to support and control for these biases. For example, a) the study's clinical cohort represented clincians working in a variety of settings, with a range of years of experience, working in several speciality areas (i.e. pain management, general medicine, physiothera**p**y, occupational therapy, psychology, etc). b) individuals living with cLBP were screened for inclusion using the widely used and validated Oswestry Disability Index, in order to be more confident participants lived with a moderate degree of LBP [26]. c) The entire scoping of this research project **was** guided and underpinned by the validated and published informatics roadmap for digital health development, the CeHRES Roadmap [20]. Finally, d) To the investigators' knowledge, this is one of the first studies to utilise, adapt**,** and appropriate the recently published rigorous informatics methodology published by Greenhalgh et al**.,** NASSS [22]. The authors believe that by considering the 7 domains of NASSS, the relevant insights obtained from the data are in depth and well considered.

Conclusions

This work adds to the informatics community in several ways. A) It provides unique insights into person-centered considerations for developing technology to support LBP, b) it offers a novel appropriation of the well-regarded NASSS framework, and c) suggests that multiple facets of informatics can come together under a single model to conduct research that has the potential to improve healthcare: i.e. user-centered design, evidence-based practice, patient-reported outcomes, and informatics research methods.

The present study provides preliminary evidence of what clinicians and patients perceive to be central considerations for developing digital technology to support LBP. Whilst the study cautions against wider generalizability outside of the present conditions, its findings are underpinned by well-regarded and validated informatics methodologies and offers a novel approach to considering technologies to improve patient-reported outcomes in a participatory health paradigm.

Future research is planned and will progress to a larger project aimed at designing and prototyping technology in this domain.

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