

Using Design Science Research to Develop a Secure Social Platform for Complementary and Alternative Medicine

Miloslava Plachkinova, Ph.D.

Coles College of Business
Kennesaw State University
mplachki@kennesaw.edu

Guillaume Faddoul, Ph.D.

Lam Family College of Business
San Francisco State University
gfaddoul@sfsu.edu

Abstract

Complementary and alternative medicine (CAM) practices are being used by a growing number of individuals. However, many patients do not disclose this information to their physicians, which can lead to ineffective or even harmful treatment. Social platforms and mobile applications are an efficient approach to bridge this communication gap between patients, CAM practitioners, and western medicine physicians. We utilize a design science approach to design, build, and evaluate a secure CAM social platform. We demonstrate the utility and value of the tool using a Systems Usability Scale and data from Google Analytics. The current study identifies gaps in patient-physician communication related to CAM disclosure and provides an empirically validated and secure tool to improve the process. Further, it demonstrates how a social platform can organize more efficiently the efforts related to successful CAM communication. The study also identifies best practices in designing and developing mechanisms for patient engagement and empowerment.

1. Introduction

Complementary and alternative medicine (CAM) practices and products are not part of conventional medicine due to insufficient proof of their safety and effectiveness [1]. Yet, their use in the US in the last couple of decades has been constantly growing [2-4]. However, many patients still do not disclose to their physicians when they use such therapy. Adler and Fosket [5] suggest this can be due to physician disinterest, anticipation of negative physician response, belief the physician is unable or unwilling to contribute useful information, and perception that CAM disclosure is not relevant. Rausch et al. [6] discovered that on average approximately 45% of patients do not disclose their CAM use to healthcare providers. Further, it should be noted that discussions of biomedical treatment are much more frequent with

CAM practitioners and that CAM practices are poorly integrated into the medical encounter with physicians.

Such a misbalance represents a serious challenge for medical communication [7] and can potentially lead to harmful treatment. There are numerous calls for medical practitioners to acknowledge the concerns and beliefs of patients in making their health care decisions and to work with patients so that the use of CAM is acknowledged and the patients' needs, beliefs and concerns are respected [8-10]. Yet, accomplishing such a major shift in physicians' perception is still difficult to achieve.

Information security issues and concerns are another reason of hesitation when it comes to CAM communication. Healthcare data breaches have been on the rise since 2005 [11] and this negative trend only adds more concerns for those who do want to use a social media platform to exchange health information. Thus, any new approach we propose to address this problem, has to be grounded in security and not just consider it as an afterthought. Demonstrating a commitment to offer a safe and secure online environment can help increase participation and establish trust in the platform.

The current study aims to improve patient-physician communication by building trust among them and developing a secure social platform where both patients and physicians can benefit from each other's experiences with CAM. The project helps to raise awareness among physicians of the breadth of CAM usage among their patients and encourage them to carefully integrate alternative practices in the conventional care they offer. We utilize a Design Science Research (DSR) framework to conceptualize our work and guide the design, build, and evaluation aspects of the study. We follow best practices in DSR [12, 13] to create a secure social platform for improving the communication between patients and physicians regarding CAM.

2. BACKGROUND

2.1 Complementary and Alternative Medicine

There has been an abundance of publications on CAM in the last two decades and yet the subject is still hard to define because CAM has a different meaning to different people. A large number of therapies, more than 100, fall under the umbrella term. Further, [14] developed an operational definition of complementary and alternative medicine for the Cochrane Library that encompasses the various types of CAM therapies and provides a comprehensive classification list of all treatments. Some well-known examples of CAM include Ayurvedic medicine, Yoga, Homeopathy, Naturopathy, Acupuncture, Reiki therapy etc.

2.2 Patient-Physician Communication

Physicians provide a great variety of responses when discussing CAM with their patients [15, 16]. Some of the most common arguments used by CAM opponents are: alternative practitioners do not have the extensive knowledge that is required to diagnose an illness properly [17]; there is a lack of evidence of the efficacy of CAM [18, 19]; and CAM is potentially harmful, either directly due to its adverse effects, or indirectly through the failure of patients to seek appropriate medical care [18, 20]. There are also others who have become strong supporters of CAM, regardless of whether or not there is scientific evidence of efficacy [21, 22].

Such variance in the physician opinions can potentially create confusion and distrust and can lead to the problem of disclosing CAM information. The lack of facilitated communication channels also contributes to the insufficient integration of CAM therapy in conventional care. Having a comprehensive platform for the community of patients, physicians, and practitioners to communicate can improve their interaction, reduce risk from negative treatment interactions, and can lead to better outcomes of the healing process.

2.3 Mobile Technology

Mobile health (mHealth) information and sensing technologies can have a positive effect on improving health outcomes and research while at the same time reducing the costs of healthcare. Although there are a number of CAM mobile applications available in the Apple and Android App Stores, such as “Herbs & Home Remedies,” “Chinese Medicine” and “Homeopathy 1000+ Treatments,” scientific research

has been seriously lacking in this domain. Examples from prior literature demonstrate that patient-physician communication can and should be improved in order to provide better integration between CAM and conventional healthcare. Utilizing mobile applications to build a social platform is a potential solution to the lack of CAM disclosure among patients and can provide a more effective and easier to access communication channel. Development of such a platform is necessary but it also needs to be rigorously evaluated to make sure it provides value to users, it is secure, easy to navigate, and intuitive to use.

Developing a secure social platform may help physicians to be more aware of their patients’ CAM use. The solution we are proposing can bring together patients, physicians, and CAM practitioners to discuss CAM treatment in a safe and secure environment. Such an approach can be effective in evidence building on CAM, which has been pointed out as one of the reasons for physicians’ distrust in alternative healing methods [21, 22]. Another positive outcome of the CAM social platform is building trust between patients and physicians. As a result of using the proposed tool, physicians can provide patients with information on the risks and benefits of CAM use and refer patients to other services that may address unmet needs. However, this approach often requires a shift in the physician’s mindset and another challenge may be the additional time physicians need to spend interacting online or via the social platform with their patients and reading articles on the latest CAM research.

2.3 Security Challenges

Information security has been a growing concern for virtually any industry these days, but the impact of security breaches in the healthcare industry is much larger due to the consequences of such attacks. Some recent security incidents involved organizations such as Anthem [23] and Quest Diagnostics [24] and have exposed hundreds of millions of healthcare records. According to a recent study [11], from 2005 to 2019, the total number of individuals affected by healthcare data breaches was over 249 million and the healthcare industry has been consistently facing the highest number of breaches among all industries. These numbers support the pressing need to consider security in the early stages of the development process and integrate security best practices throughout the entire process. In order for our platform to promote trust and engage users, we have to establish a strong security posture. To do that, we use recommendations from [25] and [26]. Incorporating a risk management approach can reduce project risk [27] and can lead to

overall project success. Such a proactive strategy can help alleviate any concerns that the users may have about the security and privacy of their data.

One major concern of using a social media platform for healthcare is how users' proprietary health information (PHI) is being used, stored, and processed. There are various regulations to protect PHI like the Health Insurance Portability and Accountability Act (HIPAA) in the US and the General Data Protection Regulation (GDPR) in Europe. Such regulations need to be taken into consideration when developing the mHealth application to gain users' trust and promote a safe environment to share CAM information. One way to ensure that is by carefully vetting third parties and verify that they are compliant with such regulations.

3. DESIGN SCIENCE APPROACH

3.1 Design Science Research

The research approach we utilize for this study is based on design science principles [12]. Theories on CAM, mobile applications, security, privacy, and healthcare communication are used to inform the design and respectively provide the initial design. Further, qualitative and quantitative techniques are used to gather data. The requirements elicited from the environment in the relevance cycle and the theories identified in the rigor cycle are then used as inputs to the design cycle. A prototype of the secure social platform was developed for conducting experimental testing before releasing the application on the Internet. The prototype was then made available to the public and an evaluation was performed with a limited

number of participants. Based on the feedback obtained from users, multiple iterations were performed. The stable version of the application was released online to provide the general community with access to the platform.

The following diagram (Figure 1) presents the iterative design we used following DSR principles. We made changes at each of the development phases to account for the needs of the end users and the environment. For instance, we included new CAM sections on the discussion board and videos suggested by the users on topics such as yoga, vitamins, and exercising. We also added buttons to improve the navigation and the text fields of the social platform. This feedback was provided to us by the participants in the study in various forms: interviews, direct messages, and emails. Overall, the subjects were satisfied when we were able to accommodate their requests and were eager to provide us feedback for improvement in the design and evaluation process. Our goal was to build a prototype of the secure social media platform for patients and providers to engage in an open discussion.

3.2 CAM Secure Social Platform Design

To better design and implement the proposed tool, we elicited the requirements for the CAM secure social platform based on best practices established in prior literature and observations on other applications for healthcare, well-being, and health promotion (e.g., Patients Like Me and WebMD). We also consulted with two experts on CAM and, as a result, we developed a list of requirements, which went into several iterations. We adopted agile concepts [28] for an iterative design process.

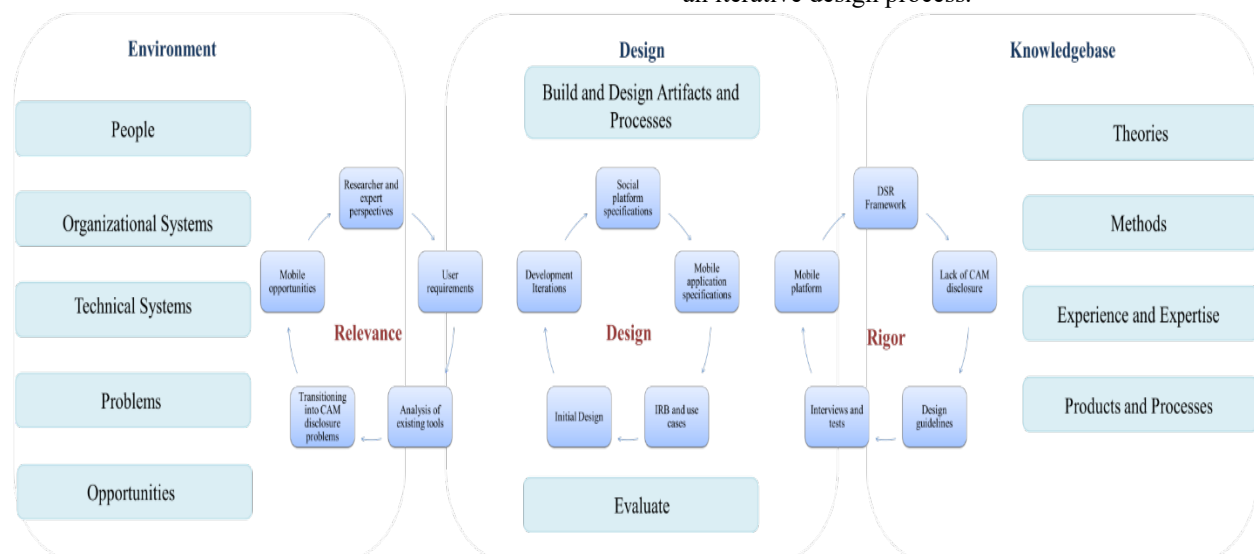


Figure 1. Iterative Design of the Secure Social Platform – Adopted from Hevner and Chatterjee, 2010

The social platform can be used by a variety of CAM providers. In the registration form, we provide users with the option to select their category – patient, physician, or CAM practitioner and then there is a text box where the individuals can input information about their CAM interests, skills, knowledge, and experiences. There is no specific format for this field, so the platform can encompass any type of CAM simple URL that they only have to click on. The tool was designed using WordPress and was hosted using a third-party provider platform. The open architecture concept was selected because it offers more flexibility and more options for customizing the application without necessarily requiring sophisticated programming skills or purchasing expensive software or hardware to build and maintain the application. Further, we installed a number of plugins to support the necessary features of the platform outlined in the requirements engineering process and to ensure that best security practices were followed.

To further strengthen the security of the platform, we have also integrated a Secure Systems Development Lifecycle (Secure SDLC) approach [29]. That allows security best principles to be embedded in the project since the beginning. We started with a risk analysis during the requirements gathering phase. Next, threat modeling and design review were performed during the design phase. During the development, we did static analysis, and the testing was expanded to include security testing and code review. Since we used a third-party provider to develop the social media platform, some of these functions were outsourced and performed by it. Finally, during the deployment phase we performed a security assessment to ensure the configuration we built is safe and secure. Following the established Secure SDLC methodology helped improve the overall security of the proposed tool and we will continue to perform these tasks on a regular basis to keep up to date with the latest security threats.

We conducted initial tests with eight subjects (graduate students with technical skills) who evaluated the usability of the platform and provided feedback on the features and functionality of the tool. We used their input to make the necessary changes and improve the quality and usability of the platform. The following screenshots (Figures 2-6) reveal some of the social platform features as suggested by prior literature and the test subjects. Those include but are not limited to user profiles with specific CAM information, relevant videos on various CAM topics, discussion board where users can provide advice and share information with each other, activity wall where each user can see his or her activity on the app, post statuses, images, and other types of information, and a rating system that

provider or therapies that may appear in the future. Providing this information allows the users to get to know each other better and to learn more about new therapies and approaches to CAM.

The CAM social platform is designed as a mobile-responsive website and, thus, it is accessible by any device and any browser. We provided users with a

allows each user to get star ratings based on the quality of their posts. Thus, the tool can increase deep trust [30] and help build social capital [31] related to CAM.

Figure 2. User Profile Information

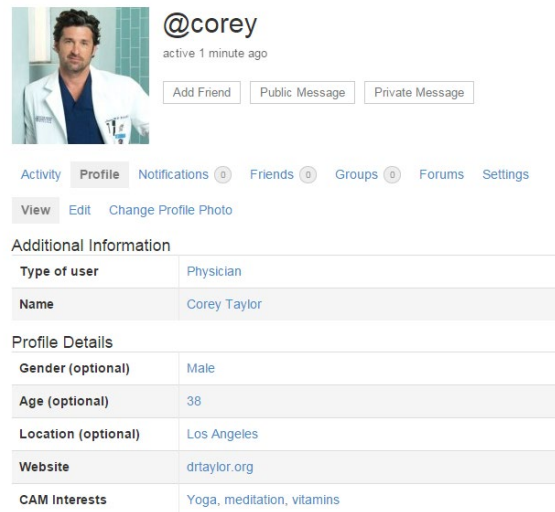


Figure 3. Social Platform Features – Videos on Exercising, Yoga, and Vitamins

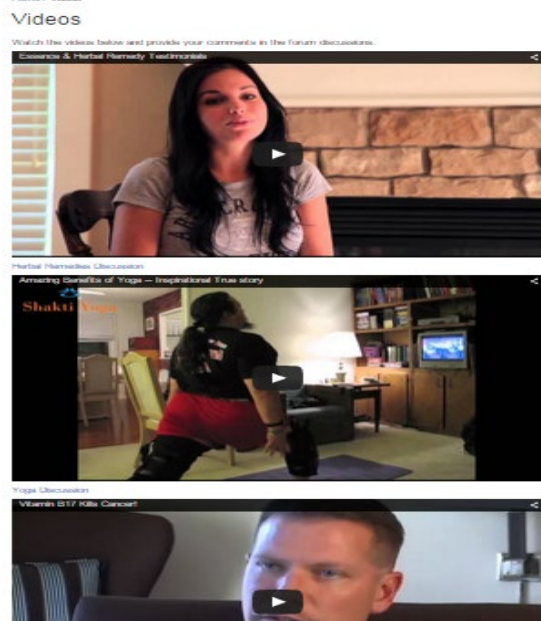


Figure 4. Social Platform Features – Discussion Board

Forum	Topics	Posts	Freshness
My Story Share your stories and inspire others	4	17	1 day, 21 hours ago Katalin Lanczi
Acupuncture Have you used acupuncture before? Did it help you and how?	4	9	1 day, 20 hours ago Katalin Lanczi
Ayurveda Ayurveda, is an ancient healing system based in Indian philosophy that means "the science of life." Has anyone tried an Ayurvedic lifestyle plan?	2	10	2 days ago Mia Plachkino
Biofield therapies Has anyone used Reiki or therapeutic touch? Although Wikipedia calls these practices, "pseudoscience", in fact there is a systematic review of 66 studies that have been done on biofield therapies showing evidence for their effectiveness.	1	2	1 day, 21 hours ago Katalin Lanczi
Chiropractic Have you used a chiropractor before? What was your experience and would you recommend any specialists?	3	8	1 day, 20 hours ago Katalin Lanczi
Herbal Remedies What herbal remedies have you used? Share your experience and advise others.	2	7	1 day, 23 hours ago Katalin Lanczi
Relaxation How do you relax? Share inspirational music and videos and describe your experience.	2	3	1 week, 1 day ago Mia Plachkino
Vitamins What kind of vitamins do you use? Share your experience with them to help others.	2	8	1 day, 21 hours ago Katalin Lanczi
Yoga What kinds of yoga do you practice? Recommend exercises and provide feedback to others.	3	8	1 day, 23 hours ago Katalin Lanczi
Other For all other types of complementary and alternative medicine	2	6	1 day, 18 hours ago Mia Plachkino

Figure 5. Social Platform Features – Activity Wall

Home > Site-Wide Activity

What's new, Mia?

All Members (12) My Friends (5) My Groups (3) Mentions

RSS Show: — Everything —

Mia Plachkino posted an update right now
How is everyone's week going so far?
Comment Favorite Delete 0

Diana Wood became a registered member 3 hours, 34 minutes ago
Comment Favorite Delete
Mia Plachkino replied 17 seconds ago @dianawood
Diana, welcome to Social Healing! Thank you for registering and I hope you can share some interesting stories and experiences with us!
Reply Delete

R | Kettering DC became a registered member 4 hours, 28 minutes ago
Comment Favorite Delete
Mia Plachkino replied 58 seconds ago @rkett
Welcome to Social Healing! Thank you for registering and I hope you can share some interesting stories and experiences with us!
Reply Delete

Mia Plachkino posted an update 1 week, 1 day ago
Greetings from Dublin! I was quite surprised to see so many alternative medicine practices in the city center. I guess such therapies are quite popular here 🍀
Comment Favorite Delete

Launey changed their profile picture 1 week, 1 day ago
Comment Favorite Delete

Launey became a registered member 1 week, 1 day ago

Figure 6. Social Platform Features – mCAM Rating System

I practice yoga every day and it keeps me happy and healthy.
Post ★★★★★ (1 Vote)

Jessica
Participant
Type of user : CAM Practitioner

April 12, 2015 at 6:01 pm REPLY #121

Can you recommend me some yoga studios or groups to practice with?
Post ★★★★★ (1 Vote)

Mia
Keymaster
Type of user : General user

4.5 out of 5
Excellent (1)
Good (1)
Average (0)
Poor (0)
Awful (0)

April 12, 2015 at 6:12 pm REPLY #122

I recommend posted here is some remarkable results. The video
Post ★★★★★ (2 Votes)

Corey Taylor
Participant
Type of user : Physician

4.2 Software Usability Data

After the 30-minute interviews and interactions with the system and its functions, the eight participants were sent a link to an online survey, which asked them to evaluate the usability of the presented tool. We used the System Usability Scale (SUS) [32] and we followed the instructions provided for interpreting the SUS scores. Each participant had to state to what extent they agree with the presented statements, using the scale from 1 to 5, where 1 was “Strongly Disagree” and 5 was “Strongly Agree.” The scores of the eight participants for each question were converted to a new number, added together, and then multiplied by 2.5 to convert the original scores of 0-40 to 0-100. Though the scores are 0-100, these are not percentages and should be considered only in terms of their percentile ranking [31].

Based on prior research [32], an SUS score above 68 would be considered above average and anything below 68 is below average. The average SUS score of our proposed tool is 73.125, which is above average and demonstrates the utility and usability of the social platform for CAM. It meets the needs of the users and provides them with an easy to use and intuitive interface. The converted scores vary from 55 to 82.5 with a standard deviation of 11.32. According to the instructions for interpreting the SUS, the results of these usability tests indicate that the social platform meets all user criteria and can successfully be deployed on the Internet for a wide audience to access it. Table 1 presents the recalculated scores for each participant based on the recommendations for interpreting the SUS [33].

Item No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
SUS Scale	I think that I would like to	I found the system	I thought the system was	I think that I would need the support of a technical person	I found the various functions in this system were well	I thought there was too much	I would imagine that most people would learn to use	I found the system very	I felt very confident using the	I needed to learn a lot of things before I could get	Total Score	Converted SUS Score
Part #1	3	2	2	3	1	2	3	1	2	3	22	55
Part #2	3	4	3	4	2	3	4	3	4	4	34	85
Part #3	3	4	4	4	3	3	4	2	2	3	32	80
Part #4	1	3	3	3	1	1	4	3	2	4	25	62.5
Part #5	1	3	3	3	1	1	4	3	2	4	25	62.5
Part #6	3	2	3	4	3	3	4	2	4	4	32	80
Part #7	2	4	3	3	3	4	3	4	3	4	33	82.5
Part #8	3	3	3	4	3	3	2	3	3	4	31	77.5

Table 1. Recalculated Software Usability Scores

5. IMPLICATIONS

The current study demonstrated an approach to design, develop, and evaluate a social platform where patients and CAM practitioners can interact with each other and benefit from each other's experiences using various types of treatment. A number of online discussions were generated and even started by the end users of the tool indicating that a certain level of trust among them was established, which was among the main goals of the project. Many of the involved individuals admitted the platform raised their awareness regarding CAM disclosure issues and had a positive impact on their health communication with other patients, practitioners, and physicians. The platform also encouraged many of the participants to consider an integrative healing approach and to engage both physicians and CAM practitioners to get better health outcomes and improved quality of care.

Overall, the subjects were pleased with the security mechanisms in place to protect their data. Our platform does not collect any PHI or other sensitive information. Furthermore, our platform's purpose is to generate discussions and to exchange information. We made it very clear that this is not a place to seek professional advice on medical conditions and advised the users to call 911 for medical emergencies. While we implemented best practices regarding data privacy and security, we emphasized that we are not collecting any information, thus minimizing potential liability for all parties.

Another implication of the study is related to the devices participants used to access the platform. During the initial analysis of the gathered requirements, it turned out that a mobile responsive website would be preferable since it could be opened not only on mobile devices but also on desktops. This expectation was confirmed during the analysis when it turned out over 90% of all visitors used a PC to browse the application. During the interview process only one person indicated they preferred a mobile application rather than a mobile responsive website. This person also believed that the application should have less text and be more interactive, as they did not see that much value in the online discussion board. The rest of the participants supported the option to access the application on their desktops, as it made it much easier for them to type responses and actively participate in the discussions. Future iterations of the tool can include a mobile only version, but this may impact the main functions of the platform such as sharing experiences and giving advice.

As part of the evaluation process, we also explored the changes in attitude of participants

regarding CAM disclosure after their experience with the mobile application. This was an inherently difficult task for several reasons. First, as we discussed earlier, the CAM healing process is very comprehensive and consists of many components such as involving champions for the cause, properly marketing and targeting the efforts, discovering, verifying, and sharing the information, etc. Although the current study was specifically focused on integration of the CAM practices in western medicine, for the mobile application to be successful, it requires a lot of input from multiple agents involved in the process such as patients, physicians, CAM providers, insurance companies, family members, and marketing and communication experts. One example of the challenges we faced was helping people discover the platform and popularizing it due to the cognitive overload everyone is experiencing as a result of constant exposure to various technologies and finding successful strategies to win their trust of the platform. Another problem we encountered was related to generating data and the lack of a CAM champion to support the discussion board. This was pointed out by several participants as the main reason the application did not have a positive influence on their CAM disclosure issues. However, we are confident that with the proper resources and support, such a tool can be successfully utilized for bridging the gap between CAM and western medicine. The goal of the current paper was to provide a proof of concept by outlining the best practices in designing the platform. We encourage our colleagues to build upon our efforts and expand the tool by also engaging industry professionals and well-known CAM champions.

6. LIMITATIONS AND FUTURE RESEARCH

The current study presents a first attempt to solve such a serious problem as patient-physician disclosure of using complementary and alternative medical practices. This issue has been of growing importance to the medical community in the last fifteen years and due to the specific nature of the domain, it may take a while for the social platform to be picked up by a significant number of users. The goal of the project is to demonstrate that modern technology has a lot to offer in the CAM domain and can be more efficiently utilized in the future.

Generalizability and small sample size are two of the major limitations of the current study. Due to the specifics of the targeted population and the nature of the research, we used a convenience sample. However, prior research [34] has discovered that 3-5 participants is a sufficient sample to test the usability of a system.

In addition, collecting longitudinal data can be used to better understand the long-term effects of the application on the targeted audience. Further, we expect some of the tests to be replicated when the application is officially marketed and a much larger number of individuals will become aware of it.

In the future, our goals include expanding the mCAM platform evaluation and incorporating further data points for analysis. For instance, we can follow the contextual inquiry method to obtain information from real users and observe how they interact with the platform on their own. This methodology has been very effective when designing new systems [35] and has the potential to positively transform how individuals interact with the proposed social media tool.

7. CONTRIBUTIONS

The current study makes several important contributions to science and practice. First, it identifies gaps in patient-physician communication related to CAM disclosure and provides a solution to improve the process. We took into consideration recommendations from prior literature, comments from different end-users, and we strived to find a secure technical solution to meet the current needs of all targeted groups. Ours is among the first studies to establish a CAM communication channel with security and privacy in mind.

Second, we designed and developed a social platform to stimulate the CAM communication between patients, physicians, and CAM practitioners. Currently, there is no such tool in the marketplace and the fact that our solution has been grounded in theory and demonstrates excellent utility and usability makes it a possible option for bridging the gap between the various stakeholders in the healing process involving CAM and Western biomedical practices.

Third, the process of designing and developing the mobile applications can be used to create a set of guidelines for effective social platforms workflow and identify recommendations for improving the CAM communication process between patients and physicians. By considering best practices in human-computer interaction (HCI) and usability testing, we proposed a more successful strategy for building and managing a CAM social platform with a user-centered design.

Fourth, we also added knowledge to the mCAM domain, which is still a relatively unexplored area. We transferred successful models and practices from mobile healthcare (mHealth) to mobile complementary and alternative medicine (mCAM), established a solid ground for future research, and

motivated application developers to take a more rigorous approach when creating mobile and social applications for CAM.

Fifth, CAM has been widely investigated but mainly from the perspective of understanding its benefits and providing evidence on successful healing methods. Mobile communication, on the other hand, has been considered mostly for its application in healthcare. Exploring how CAM can benefit from utilizing Web 5.0 and providing new communication channels to connect patients, CAM practitioners, and conventional physicians has not been fully understood yet. Patients' unwillingness to disclose CAM information to their physicians may lead to harmful treatments with negative outcomes [18, 20]. Thus, the proposed artifact can be successfully utilized to bridge the gap and restore trust among patients and physicians by including CAM practitioners in the conversation.

8. CONCLUSION

The current study provides a proof of concept that a secure social media platform can successfully mediate the communication between patients, physicians, and CAM providers. We integrated best practices from theory and application development to design, build, and evaluate our artifact and to showcase its value. We recognize the need for security and privacy and we incorporate it in the initial stages of the process to reduce the risk of data breaches. Such an approach can bridge the existing communication gap and provide a platform for openly sharing information on CAM best practices.

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