Using Information Tools to Leverage Our Strengths as We Age

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Aging is a journey that we are all engaged in. Though some abilities may decline with time (e.g., manual dexterity, memory, and perhaps cognition), we also learn new things, increasing our abilities to perform various activities, and have a greater body of knowledge to draw upon.

As we age, we may acquire 'untapped strengths', such as more free time to work with digital resources, increased tendency to fact-check, improved emotion regulation, and greater propensity to be civically active and to volunteer (Moore & Hancock, 2020). In this paper, we reflect upon on how information tools may assist us on the journey of life and aging, and how we might improve these tools.

It may be helpful to reflect on how one might conceptualize "successful aging." In this context, we plan to focus on personal development of successful strategies for pursuing health and wellbeing. Important facets of wellbeing include: feeling connected to nature and to others; feeling capable of dealing with life's challenges; seeing meaning in daily activities; and feeling calm, at peace, and balanced (Lambert et al., 2020).

However, life can present us with many challenges, including threats to our health and wellbeing. These threats may be long-term, including complex and multiple chronic conditions, fibromyalgia, chronic fatigue syndrome, frailty, and most recently, Long COVID. Successful health management of chronic conditions can involve substantial "invisible work," including a variety of information activities and tools, such as memorization, keeping personal or electronic records, and using patient portals (Ancker, Witteman, Hafeez, Provencher, Graaf, et al., 2015). Despite the difficulties that health challenges may pose, addressing them can also result in growth and self-actualization.

Previous research concerning older adults' perceptions of keys to successful aging including: psychological and social components; resilience and coping mechanisms; and reliable social support systems (Tkatch et al., 2017). In this paper, we explore how information management tools currently, and might additionally, play a role in enriching our experience of life as we age. Our multidisciplinary team draws upon on our own research and that of others, particularly in the fields of information science, biomedical informatics, and nursing.

Learning the Language of the Body to Facilitate 'Body Listening'

"Body listening" involves "subprocesses of physical self-assessment and applying a personal filter through which to interpret that information" (Ehrlich et al., 2010, p. 265). As we get to know our bodies, we 'learn its language' (Chen et al., 2017). For example, those who experience migraines may be able to differentiate types, and thereby apply appropriate management strategies to address

them. Those who experience food sensitivities may perform an elimination diet to identify what these are and seek to avoid them (Chen, 2016).

Our bodies are complex, and they may send us a variety of signals. The process of attending to 'competing voices' in our bodies can be stressful (Chen et al., 2017). Information tools may help us in the tasks of 'body listening' and sense-making about one's body. A previous study reported that 62.8% (428/682) of older adults tracked health-related measures (Jaana & Paré, 2020), but most did so manually (Jaana & Paré, 2020), despite older adults recognizing the potential value of activity trackers (Puri et al., 2017).

The use of paper, electronic records, and apps for tracking may provide information to help us problem solve about health problems we encounter. Aside from devices which may provide quantitative data, we can also consider leveraging automated textual analysis methods using simple methods such as a keyword search, or more sophisticated natural language processing methods, to identify concepts in free text journaling. But increased cognitive load and stress that can result from too much information. It is also important to recognize the emotionally charged nature of one's own health data (Ancker, Witteman, Hafeez, Provencher, Van de Graaf, et al., 2015), and it is important to consider these issues in the incorporation of tools to assist in 'body listening.'

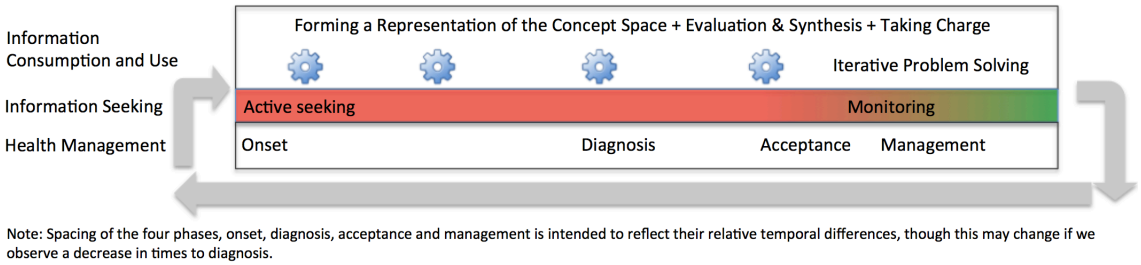
Previous literature has observed older adult users may want to track information related to restful activities, social interactions, and stress relief activities, and this is not currently well supported in existing applications (Davidson & Jensen, 2013). Developing applications that facilitate tracking of these activities could enhance the usefulness of these tools to support other purposes that may emerge over the life course. While these activities might simply be tracked in a journaling, calendaring, or physical exercise application, one might also imagine integrating cognitive-behavioral techniques, coupled with analytics, to provide "intelligent" feedback based on behavior: "You have been sitting all afternoon. Maybe you could reach out to Jane to see if she wants to take a walk?"

Supporting Concept Space Formulation and Information Synthesis over Time

Many health issues may require extensive information searching and problem solving. For example, in the case of fibromyalgia, a syndrome in which those affected experience chronic widespread pain and often other symptoms such as fatigue, migraines, mood disturbances, and food sensitivities (Goldenberg, 2009), coming to understand the signals of one's body can be invaluable in dealing with health challenges (Chen, 2016).

Unfortunately, this process is easier said than done, and people with chronic health conditions may need to seek information and experiment through trial-and-error, or other approaches, in addition to consulting with health care providers, before developing workable solutions (Chen, 2016). Persons with fibromyalgia, for instance, obtain information from diverse sources, including organizations, general media, online discussion forums, support groups, and informal sources including friends and family members (Bennett et al., 2007). Mobile apps might also be a part of this personal toolkit (Chen, 2016).

The search for information often continues until a successful management strategy is found or formulated, or the person comes to accept their new state (Chen, 2016). Once this happens, people may stop searching for new information (Figure 1).



Note: Spacing of the four phases, onset, diagnosis, acceptance and management is intended to reflect their relative temporal differences, though this may change if we observe a decrease in times to diagnosis.

Figure 1. The relationship of information behavior and health management over time in the context of fibromyalgia (excerpted from Chen, 2016).

The idea that information behaviors and search strategies evolve as one learns more about their condition is not new. For example, previous research has reported that searches on medical concerns evolve over time (White & Horvitz, 2012). However, it is important for us to consider how to support changes in information and search behaviors, in conjunction with our evolving health state.

Early on when we are adapting to changes that we experience, our representation of the concept space relating to our novel health state may not be clear. At this stage, it can be helpful to have more general articles, particularly explaining terminology, as one faced with an emergent symptom may not be aware that the health experience that they have has a name. Reading about people's experiences in online environments and interacting with others may also be helpful.

After becoming acclimated to our situation, we may continue to receive newsfeeds and engage in passive monitoring, but not make much effort. Enhanced customizability and personalization of newsfeeds to our information needs can be helpful, but customizing these newsfeeds can also be a burden (and design challenge to be addressed).

As our mental models change, the information that we want to track over time may also evolve. Developing systems that augment our search and information management strategies, particularly over the long-term, may be critical.

Connecting and Sharing Information

Social connectivity can be an important aspect of wellbeing. We consider two ways in which people might connect with and share health-related information with others: mobile and wearable technologies and online discursive spaces.

Mobile and wearable technologies are increasingly ubiquitous, and they can be invaluable for helping us to get to know our bodies. However, they may also be a way for us to achieve more fulfilling lives in other ways – by connecting with those around us through the sharing of health information. Previous research on the use of mobile devices for physical activity tracking observed that, though tracking activity and motivating oneself to remain healthy were the primary reasons

for tracking, just over 20% of the sample performed tracking to exchange data on physical activity and health with friends (Seifert et al., 2017).

Online communities can help people connect and share information about health and wellbeing that they can then apply to their own lives. It is perhaps important to recognize that these communities may serve multiple purposes, including increased knowledge of information resources, decreased social isolation, and a sense of meaning. Recent history has revealed that online communities may also play important roles in facilitating connectedness due to potentially narrowing offline networks (Fischl et al., 2020) and social isolation due to decreased mobility and COVID-19.

Online discursive spaces can help us to expand our knowledge, but how these spaces are shaped can influence this interaction. There can be exchanges that affect whether we continue to engage with the community, such as the ability of the community to produce novel information for the reader. As people interact with online communities over time, the lack of new information can be discouraging (Chen, 2016). Lack of engagement from others can also deter subsequent engagement (Gerritzen et al., 2022). In our experience developing Virtual Online Community for Aging Life Experiences (VOCALE), an online group-based problem-solving intervention, we noted that concerns about platform privacy and blurred lines between online and offline interactions discouraged some people from sharing information in earlier rounds, and that this affected others' propensity to contribute (Teng et al., 2019).

To address these issues, supports to increase rapport among community members and help people find information of direct relevance to them may be particularly important. VOCALE utilized different techniques, including "icebreakers," or prompts to allow people to get to know each other, and information resources. Ways to connect people to others with similar experiences and concerns may be important, and there may be a need to better understand what the relevant dimensions may be, so that they can be incorporated into information retrieval systems.

The issue of community size also deserves consideration. On the one hand, anonymity can be an appealing characteristic of online communities (Blank & Adams-Blodnieks, 2007). Based on personal research of the first author, large communities might facilitate anonymity, but can also perhaps give rise to difficulty in appreciating the sense of one's contribution, and of novel information being drowned in a sea of redundancy. In our experience with VOCALE, which involved online groups of older adults, either addressing the challenges of frailty and caregiving, online communities of 10 – 20, appear to serve as a safe environment to share related experiences and know-how, and struck a balance between nurturing common ground and preserving anonymity.

Design Considerations

Key categories of aging barriers in the design of applications for older adults include cognition, motivation, physical ability and perception (Wildenbos et al., 2018). Models of engagement with digital health can draw our attention to design attributes and considerations, including usability, interactivity, novelty, delivery mode, etc. (Perski et al., 2017; Ritterband et al., 2009; Short et al., 2015). However, the ways in which technologies are constructed must be context driven, meaning there is no prescription for an engaging technology.

At these times, it may be helpful to consider the nature of physiological change. Even though one expects that memory will decline with age, these abilities do not degrade uniformly. Even though issues with explicit recall of names and events is common, one's memory for automatic actions tends to be better preserved (Lewis & Neider, 2017). Developing intuitive features or cues could perhaps enhance the usability of information tools that we choose to incorporate in our lives.

For example, In our experience with VOCALE, we observed difficulties in participants' use of the platform, including forgetting to press the enter key when posting and difficulties posting due to mobility and fine motor issues (Chen et al., 2021). To address these challenges, we added additional training sessions and instructional materials, but we might also integrate voice-assisted technologies. Though additional features can be beneficial, they may also come with potential issues, and it is important to consider the tradeoff between potential benefits and costs.

To enhance people's abilities to access and recall information, in the design of information systems we might also consider integrating features such as auto-completion, and leveraging databases, ontologies, or other knowledge resources to suggest tags. However, unintended consequences can also arise, such as frustration resulting from the auto-complete options being different from what users would want to say.

As we age, we may accrue resources such as time, as well as pressures, such as a need to adapt to health challenges we experience. In the first author's research experience, individuals who experience tremendous adversity in terms of health-related challenges will often unearth every stone, and pursue any conceivable avenue, to improve their health situation. This drive can overcome great obstacles to solve problems, and can be leveraged synergistically with information tools including but not limited to recommender systems, discussion forums, and wearable technologies to help people realize greater health and wellbeing over the long-term.

Discussion

Each of us comes to know the world and life in different ways, and we are constantly shaped by our life experience. In this paper, we drew upon our research experiences to explore how information tools may help us to meet life head-on as we age. In particular, we elucidated three considerations which could facilitate how information tools could help us to realize our potential: getting to know and work with our bodies as we age; supporting understanding, information synthesis, and information management; and connecting and sharing information; we then discuss design considerations. Aside from considering physical processes, one particularly important area of need is to consider alternate ways of knowing ourselves and realizing human potential, on the road to successful aging.

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