SLOWBot (chatbot) Lifestyle Assistant

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ABSTRACT
SLOWbot is a research project conducted via a collaboration between iaso health and FBK (Fondazione Bruno Kessler). There are now thousands of available healthy aging apps, but most don't deliver on their promise to support a healthy aging process in people that need it the most. The neediest include the over-fifties age group, particularly those wanting to prevent the diseases of aging or whom already have a chronic disease. Even the motivated "quantified selfers" discard their health apps after only a few months. Our research aims to identify new ways to ensure adherence to a healthy lifestyle program tailored for an over fifties audience which is delivered by a chatbot. The research covers the participant onboarding process and examines barriers and issues with gathering predictive data that might inform future improved uptake and adherence as well as an increase in health literacy by the participants. The healthy lifestyle program will ultimately be delivered by our "SLOWbot" which guides the participant to make informed and enhanced health decision making, specifically around food choices (a "longevity eating plan").

Author Keywords
Health promotion; Human-centred design; Health eating coaching. Health literacy.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
There are hundreds of thousands of consumer-oriented automated "healthy diet" coaching apps and very few seem to be working. Some of the most popular and supposedly advanced apps deal with weight loss, but still the evidence shows that the average overweight primary care patient is unlikely have a significant weight change through using an app [1]. This is in spite of an extensive body of knowledge about what does actually work in real life; there is still a vast gap between an understanding of that knowledge and it being effectively embedded in technologies. The reality is that most health apps (particularly weight-related apps) don't have sufficient coverage of successful strategies for them to work [2][3]. Also most of the apps appeal to the so called "quantified selfers" and are not being adopted by the cohort of people that are arguably the most needy; the over-fifties who are in imminent danger of experiencing one or more of the diseases of aging or those with one or more chronic diseases [4]. Also they don't typically personalize the interventions to match the individual's life situation, nor their specific goals as it typically takes an ongoing conversation between a coach and client to tease out the goals that will work for that individual.

Regardless of the failure of many apps to-date, the research shows that there is still the potential for health apps with appropriate and extensive coaching strategies to make a difference [5]. The use of dietary interventions by health professionals as a means to positively address concerns with the aging process as well as to prevent disease, are the most popular as they are the most accessible and can be used at home and don't necessarily need third parties involved in order to implement.

A healthy diet is also recognised as one of the cornerstones of any successful management of disease prevention and the aging process in general [6]. Even though the use of a dietary intervention is the most accessible, it is arguably the most challenging to implement given that people's eating habits have been ingrained from birth. By default, individuals are plugged into a social/family situation where the implementation of the desired change of eating behavior is often in a context where they are surrounded by people who aren't necessarily vested in supporting this. Also the kind of diet that is deemed healthy by family members and social networks might be considered so vastly different that the kinds of foods that are required might not be readily available.

For the individual to significantly change their eating behavior, there needs to be a considered investment into the preparation and support process and the person has to be ready and willing to change their behavior. There are many and varied obstacles related to the interplay between the behavioral, environmental, and physiological mechanisms that impact the individual's decision making [7]. They will be required to learn new skills when it comes to identifying the correct kinds of foods as well as be able to embed them into their day to day activities. Low health literacy is linked to poor health outcomes [8]. We believe that even if the individual is ready to make the requisite changes, they will also need to participate in a robust educational process (to lift their health literacy) to become fully aware of the

implications of their good and bad food choices and then successfully implement long-term changes. They need to increase their level of literacy about the medicinal benefits in the components in foods as well as be able to link the important medicinal qualities of their foods to their desired health benefits and then in the longer term to their targeted health and longevity goals. The chatbot will deliver targeted and personalized educational messages on the specifics of the food's phytonutrients and how these support specific areas of disease prevention such as healthy eyes, skin, gut, bones and the like.

The SLOWbot solution is a specialized healthy lifestyle messaging bot (chatbot) that enables the delivery of supportive and educational messages about the medicinal qualities of certain "longevity" foods. We are conducting a pilot with fifty female participants in the age group 45 - 70. These women are interested in learning how to implement a healthy longevity diet into their lives. The bot will guide the women on a 14-day "healthy longevity" diet and they will be supported with education about the nutrients in the foods as well as what happens if they do or don't eat certain foods. If the participant wants to change foods suggested by the chatbot, then the chatbot will educate them as to the implications.

Through this process we aim to lift health literacy as well as improve eating plan "stickiness" beyond the scope of the diet.

We will involve the participants in an extensive initial workup ("onboarding") in order to gather baseline data so we can identify currently unknown links between the adoption of sustainable new and healthy habits and personal traits and aspirations.

The onboarding process will enable us to segment our participants by aspiration and initial level of health literacy. At the end we can also look at links between health literacy and ability to adhere to the diet etc.

The onboarding question sets will cover the following broad areas: nutritional status, activity levels, readiness to change, perception of wellness, motivational factors and risk profile.

SECOND GENERATION GUIDANCE

The market for diet and meal planning applications is massive. The first generation apps are struggling though and aren't adapted for our audience; women 45 - 70 who require "healthy longevity planning". They are also largely operating outside health systems and aren't necessarily seen as evidence-based in their approach and so haven't successfully gained referral traffic from the medical profession. The focus of these apps are diverse and their application areas range from chronic disease management (e.g. type 2 diabetes), to weight loss, to specific disease management (e.g. celiac disease), food preferences (e.g. vegan eating), food intolerances (e.g. gluten free), education on food labels etc.

There are also many and varied coaching apps/systems aimed at helping people change and develop new and sustainable healthy habits. More often than not though, the subscribers go back to old habits not really having learnt new healthy habits or indeed why they needed to change their eating habits [9]. They focus on what to do rather than why. They don't necessarily anchor the desired change to the mechanism they are trying to modulate or the enjoyable health benefit they could achieve. Any diet at the best of time is seen as punitive and most apps haven't built in mechanisms to make the change process enjoyable and sustainable and something to joyfully embrace.

THE SOLUTION

SLOWbot is an innovative chatbot and app that enables a user to follow a 14-day "healthy longevity" meal plan (part of the SLOWaging longevity program). The diet has recipes containing "longevity foods" and we provide support and resources via a closed Facebook group. The chatbot focuses on increasing the participants' health literacy through the use of motivational and educational messages during the 14-day period. It will also reinforce the users' reasons for undergoing the dietary change by sending positive messages that are linked to specific personal health benefits as articulated by the user during their onboarding process.

If the user wants to change the ingredients or foods outlined in the eating plan, then the chatbot will educate on the implications of that change and in light of their desire to achieve healthy longevity. Each user will have a different reason to pursue healthy longevity and indeed will have different key motivating factors and desired benefits. In order to identify these before we start the diet delivery and education process, we've developed a comprehensive onboarding process which sees the user complete a range of questionnaires.

The app uses the Horus.ai [10] (persuasive knowledge-based application) to deliver the SLOW aging longevity eating plan and associated education about better food choices and better behavior to increase longevity. The SLOWbot is part of a suite of tools that are being developed in order to help women undergo a personalized strategic planning and implementation process targeting healthy longevity.

THE MEAL PLAN

The 14-day longevity meal plan is modified version of the Mediterranean Diet. The guiding principles for the selection of foods are based on the evidence around how certain nutrients impact the underlying dynamics of aging. We also consider how the food is cooked (certain cooking processes can accelerate the aging process), how it is grown (certain foods are so polluted by toxins they can be damaging in large quantities), how they are manufactured and other elements that impact food quality.

Foods contained in the 14-day meal plan include above-ground vegetables, fish, meat and poultry, eggs, low

glycemic/high nutritionally dense fruits (such as berries), nuts and seeds, fresh and dried spices and herbs and "good" fats such as olive oil and avocados. No dairy or grains are included in the diet.

We promote cooking methods that enhance or help maintain the nutritional value of the food and the recipes are constructed without overcooking or overheating the food (hence preventing the generation of advanced glycation end products which detrimentally impact health).

EDUCATION ON HEALTHY LONGEVITY

Snippets of educational information about the eating plan components and associated healthy habits are continually delivered by the chatbot.

For example, when avocados are included in a meal then SLOWbot will suggest they buy organic because they are in the USDA's list of "Dirty 51" foods. If a user consumes a strawberry, then the message will be even stronger; according to the research unless they are organic, they are one of the dirtiest foods available.

Using the same ontology, when a user consumes tomato or tomato products SLOWbot will teach them that these foods are high in the phytonutrient lycopene and are heart and prostate protective.

When SLOWbot asks the user "have they have fasted for 12 hours or more last night", it will then educate them why this is important in the context of their desire for healthy longevity [11].

We believe that by using targeted and personalized messages that link educational messages about the components within the eating plan to desired benefits, then the user will be more likely to adopt the new eating habit beyond the 14 days.

THE HORUS.AI ONTOLOGY DRIVING THE CHATBOT

SLOWbot uses a novel combination of persuasion technologies, natural language generation techniques, and deep knowledge representation tools a context-aware system for inducing the user to adopt healthier lifestyles.

The system relies on persuasion and motivational techniques to generate effective suggestions and recommendations that take into account the users' will to change.

In our view, personalized and tailored messages generated according to certain user characteristics are extremely useful to increase the effectiveness of persuasion efforts in terms of user acceptance of the proposed behaviors.

EVALUATION PLAN

For this initial pilot, we aim to work with approximately 50 users. The target market is women over the age of 45. The pilot will cover the onboarding process and identify key barriers and opportunities related to the successful implementation of the 14-day meal plan.

During this initial research phase, we will use email and phone to engage with the participants as well as a Facebook group where doctors, health coaches and nurses will act as supporters and moderators.

We will use a series of surveys and questionnaires aimed at understanding the drivers and motivating factors of our users. Amongst other things, we will identify to what degree they are currently taking care of their health, how ready they are to implement new changes in their life, their general state of nutrition, activity level and their perception of wellbeing.

They will complete an exit survey after the 14-day meal plan so we better understand their experience, what the pain points were and whether they have increased their health literacy. We will use a specialized analytics tool to mine the data from the Facebook group.

Further on, we will also survey participants to establish whether they've sustained their desired changes.

EXPECTED RESULTS

The aim of this first pilot is to understand barriers to the adoption of a longevity diet and to identify data linkages so we can develop an approach that supports a more personalized approach to "selling" the requisite changes involved in adopting "healthy longevity" lifestyle interventions.

We also want to probe the link between detailed education on the nutrients and how they impact the key drivers of aging and the means to prevent specific (and in particular chronic) diseases, and improved health literacy. Also whether by linking education in this way, the participants will be more likely to stick to the necessary new eating habits.

The initial results will be around the onboarding and the planned chatbot educational outputs. What are their main health concerns? What are the triggers for signing up? How open are they to building and sharing their data sets if they can get a healthy longevity benefit? How long are they willing to have a conversation with a chatbot? Is this related to the extent to which they're ready to make changes in their life? To what extent is the support group important to them? There are many questions we plan to ask as part of this onboarding process which will become apparent as we embark on the actual pilot foreseen to start in May 2018.

FUTURE WORK

In the long term, SLOWbot will be part of a strategic longevity planning platform, where recommendations on what to eat will ultimately be very personal and will be

delivered according to the users' specific desirable benefits and need for disease prevention.

Suggestions will take into consideration their medical family history and personal health concerns and symptoms and will "prescribe" a personalized longevity eating plan.

The aim is to engage with users regularly and comprehensively enough and to extract sufficient data so we can build a self-learning system that is tailored to the individuals' requirements.

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