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Is Google making us smart? Health self-management for high performance employees and organisations

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Abstract: Globally, the burden of disease is rising. High performance employees and organisations need to improve their health self-management options and skills. Unfortunately, there are an overwhelming number (>500,000) of new health publications every year. We aim to design a health AI on top of Scholar Google, to support rapid employee do-it-yourself (DIY) health improvement. Thus, we analysed user requirements, based on design analyses for two cases: hypertension and type-2 diabetes (T2D), two major diseases of affluence in our society, which are reversible with healthy living. We show how a hybrid AI may empower employees instead of medicalising them. To conclude, we propose a next level of quantified self for worker health self-management.

Keywords: health; employee performance; self-management; AI; quantified self; service design; personal medicine.

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1 Introduction

In the famous article 'Is Google making us stupid?' (Carr, 2008) browsing for information was deemed suboptimal for reading and acquiring deeper levels of knowledge. Still, in this paper we want to investigate some opportunities that Google and more specifically Scholar Google may offer to make us smart, instead of stupid. We aim for a future use of Scholar Google, in combination with a hybrid AI for the academic health literature, for finding and using state-of-the-art science on improving health and performance, which high performance organisations and employees may use to better themselves.[1]

High performance organisations (de Waal and de Bono, 2020; Coulson-Thomas, 2012; Mannion et al., 2005) and high performance employees (Gallardo-Gallardo et al., 2013) share a common goal. Which is: optimal self-management of health, recovery and performance in order to increase productivity, resilience, and agility in teams and organisations (Schwartz and McCarthy, 2007; Loehr and Schwarz, 2001). Still, organisations also face a second challenge: in affluent countries roughly half of the employees older than 45 years are suffering from diseases of affluence and related health problems (Greger and Stone, 2016) which hamper their productivity and flexibility in dealing with new opportunities and demands in their working life. Generally, these health problems increase with an increasing average age of the work force.

Still, not all employees older than 45 years are in the same dire situation regarding health and performance. On the other end of the spectrum, many business leaders are 50+ years of age, as well as other 'strong shouldered' employees who carry various responsibilities to help their organisation forward. Increasingly, their less healthy peers are noticing the differences and are being nudged to get healthier and more resilient. This introduces questions of health self-management and reversibility of health problems. In this paper we focus on the two conditions of *hypertension* [prevalent in 1 in 3 adults (Fryar et al., 2017)] and *type 2 diabetes* (T2D) [prevalent in 1 in 10 employees before retirement (American Diabetes Association, 2018)], since there is increasing awareness in employees that these conditions are reversible with health self-management.

Besides individual motivations to improve, there is also an urgent financial need in our corporates and our society to use the reversibility of the diseases of affluence. Already in 2009 Safeway CEO and the corporate Coalition to Advance Healthcare Reform have calculated that 74% of health costs come from only four conditions (cardiovascular disease, T2D, obesity and cancer) which are largely preventable or reversible (Burd, 2009). The Lancet EAT committee reiterated this urgency to use options for prevention and reversal of disease more effectively: we cannot afford our current approach, not in health nor in ecology (Willett et al., 2019).

Of course, not all employees are aiming for health self-management and disease reversal. However, we focus on front runner employees (generally above average in terms of education level and self-management aptitude) who want to use state-of-the-art science for rapid lifestyle-based cure of diseases of affluence. The reason we focus on this high-performance employee group is two-fold. First, we need people who will be leading the way. Already there is a 'health divide' emerging, with on the one hand the positive examples of healthy living, leading to more resilience and positive life choices. On the other hand, there are quite a few people who state they 'have tried everything, all to no avail'. For too many people 'health' is about failed attempts to solve health

problems and about behaviours of self-disciplining which border on self-negation. Thus, we need more people in the first group: showing that 'health' can be a positive thing, enhancing life instead of beating you down. A second reason to focus on high-performance employees is that, while trying to create a positive movement, it is helpful to find a logical group of 'early adopters' who have the motivation, self-management skills and positive perceived cost/benefit ratio which are suitable for this role (Ricciardi et al., 2013).

Still, high-performance employees aiming for do-it-yourself (DIY) health improvements may have difficulties in deciding on their priorities of action. The amount of yearly new science on health is so large that the field can be overwhelming. For example, even when limiting the search to only the year 2019, Scholar Google finds >500,000 studies on 'health', of which >60,000 are on 'healthy lifestyle'. Furthermore, 2019 has >150,000 studies on 'obesity' and >180,000 studies on 'cardiovascular health'. In short, every working day of the year there are >2,000 new studies on health! And as an employee, you likely have tasks which preclude reading many hours of literature every day. Alongside their own efforts, many employees may discuss their plans with their healthcare providers who also are not up to speed in this rapidly evolving field or at least only know a small subset of the relevant science. For example, even in multiple academic journals misconceptions about obesity (a major causal factor for T2D and hypertension) are still propagated (Casazza et al., 2013). On average, new findings take about two decades before they enter standard (para)clinical protocols (Balas and Boren, 2000). Hence, employees and their healthcare providers need additional support in navigating and using new findings.

In order to help health DIY employees and their healthcare practitioners navigate this massive amount of science and help them capture, assess and use the best and most recent available evidence on lifestyle interventions for disease reversal, we aim to develop a health literature AI. Thus, the main *research question* is:

> "What are user requirements for a health literature AI in order to support successful DIY healthy lifestyle choices for health self-repair?"

2 Concepts

In this section we introduce two concepts, or maybe even paradigms, that guide the design analyses in this paper. Firstly, in order to aim for design progress beyond current barriers, we will briefly explain our 'optimism by design' approach. Secondly, extending the traditions of health self-management (Lehto et al., 2013; Lopez et al., 2011; Wickramasinghe and Goldberg, 2010; Wickramasinghe et al., 2009), biological self-repair science (Greger and Stone, 2016; Li, 2019) and quantified self (QS) (Swan, 2012, 2013) we explain how we want the use the concept of 'rapid self-repair feedback cycles' to increase the self-efficacy and results that DIY employees can achieve.

As a first concept, for our design purposes, we introduce a '2030' view from the future, using 'optimism by design'. This can be viewed as a consciously 'utopian' version of extreme design, focused on non-average and relatively extreme use case scenario's (Roaf et al., 2019; Simons and Verhagen, 2008) Thus, we will assume maximum use of the dynamic nature of our biology for self-repair and we temporarily ignore current healthcare barriers. Our aim is to promote cure via rapid health self-repair feedback

cycles. From a bio-engineering perspective, some of the most promising recent health discoveries use our innate mechanisms for rapid bodily self-repair (Li, 2019). We want to help people experience and measure improved health, possibly within days, with rapid feedback of progress from health measurements. This needs an approach with personal iteration cycles, see Figure 1 (Cross, 1994; Simons, 2020), using goals analysis (problem space), intervention planning (solution space) and measurement portfolio (evaluation space).

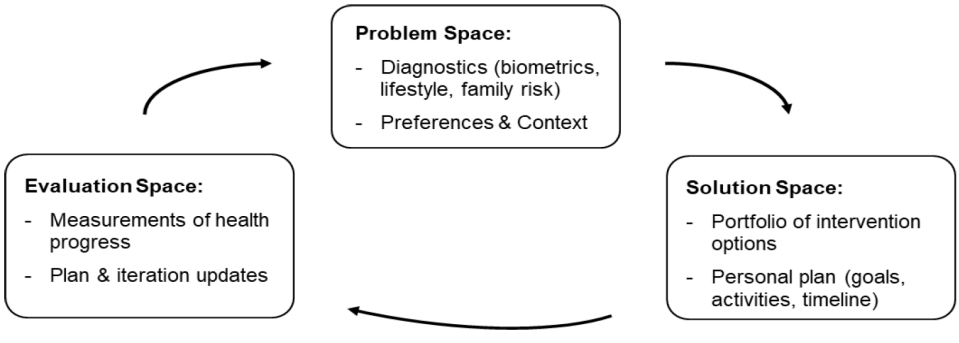
Empowering people with health iteration cycle competences is the field of self-management support (SMS) (Dineen-Griffin et al., 2019; Jonkman et al., 2016) and microlearning-based competence building (Simons et al., 2022b). We can translate this need for competence building into DIY health questions for the hypertension and T2D cases of this paper. DIY health questions for an employee (or a care provider guiding him/her) may become:

1 What is the underlying biology of the condition (causes, outlook, risk factors)? (= problem space)

2 What are the most effective lifestyle interventions (and their attractiveness)? (= solution space)

3 What are suitable health tracking options (behaviours, symptoms, and biometrics)? (= evaluation space)

Figure 1 Personal iteration cycles for rapid health self-repair



Notes: Besides biology opportunities of self-repair, overall health iteration success depends on the full picture of choosing personal goals and behaviours that are best suited for one's preferences and context.

Source: See Simons and Hampe (2010) and Simons et al. (2013, 2014) for information on intervention planning

Regarding the hybrid AI system we aim to design, this requires a new form of intermediation. The 'old' way of intermediation, with your healthcare provider as 'sole source of advice', is partly removed. It is important to remain aware of the speed at which know-how becomes outdated and overspecialised, ignorant of important new findings from other academic disciplines for the patient and lifestyle choices at hand. In other words: most healthcare providers are only aware of a limited part of the relevant health literature. On a meta-level we need to integrate new health know-how and then encode it in the AI system. For system and health-advice-level encoding of the know-how, a

meta-level intermediation is needed. What we mean is that at the moment, the various (academic) experts live in different 'bubbles', for example molecular biology, surgery, exercise science, behavioural psychology, pharmacology, or endocrinology with different experts being rather different in focus and advice. Thus a 'public health expert' has different goals and advice than a specialist on intensive lifestyle interventions. Not only are their perspectives different, also their subsets of scientific questions and papers are quite different. AI-supported mining of various subsets of science should facilitate the opening up and mutual use of those fields of expertise to others. This does require meta-level knowledge integration from a subset of experts who are willing and capable to act as 'bridge-builders' and help encode the conclusions into the AI systems know-how representations and health advice practices. More on this 'hybrid' part of the hybrid AI system follows in the discussion section.

A final foundational concept to empower people into SMS is that of 'rapid self-repair feedback cycles' (Simons, 2020), using health self-management, QS approaches and biological self-repair science (Greger and Stone, 2016; Li, 2019). Various studies illustrate health self-management approaches using: goal setting based on personal preferences, ICT support and progress feedback (Kari et al., 2017; Lehto et al., 2013; Lopez et al., 2011; Wickramasinghe and Goldberg, 2010; Wickramasinghe et al., 2009). Elements like individual coaching, eTools like microlearning for health, QS (Swan, 2012, 2013) progress tracking and peer coaching have all been shown to aid motivation and success (Simons et al., 2015, 2016, 2020). Generally, it is important that employees can create their own plans and priorities, while also using practitioner support (Simons et al., 2014).

From a biological sciences perspective, research increasingly shows that often health self-repair is more effective than current 'best available' medical treatments (largely because self-repair is biologically more plausible and more advanced, thanks to millions of years of evolution (Greger and Stone, 2016; Li, 2019). The number of well conducted randomised controlled trials (RCT's) showing rapid health improvements within a matter of hours, days or weeks is rapidly growing, largely in the domains of cardio and metabolic conditions, plus increasingly so in the onco and neurology domains: depression and even dementia (Greger and Stone, 2016; Bredesen, 2017; Bredesen et al., 2018; Ornish and Ornish, 2019; Willett et al., 2019; Simons, 2020, 2021; Simons et al., 2022a). For participants, the benefits of rapid progress feedback are significant: for motivation, results and much faster learning loops: whereas initially the cause-and-effect of their health condition is largely theoretical, within several instances of daily progress feedback it becomes very clear what is effective health behaviour and what is not (Simons et al., 2022a; HCP, 2021).

Below, we describe how we use a cross-case analysis to find user requirements that must be fulfilled in order for the health literature AI system to aid DIY health intervention choices.

3 Method

Our research question is a design analysis question. The analysis is an example of design research rather than design science (Vaishnavi and Kuechler, 2004), since design research aims at generating (domain specific) knowledge for solving a given problem. Our analysis will follow design cycle phases 1 and 2 of (Verschuren and Hartog, 2005):

1 first hunch

2 assumptions and requirements.

Our first hunch is that we need to explicate the gaps in common sources of information for educated DIY employees (healthcare lifestyle guidelines and Google Scholar[2]). In other words: which needs or gaps should be filled with the health literature AI to aid DIY health intervention choices? Second, can we formulate 'voice of the user' user requirements? We use the first step from quality function deployment (QFD) for software design. This means we explicate 'the voice of the user', using words that users might use themselves (Simons and Verhagen, 2008; Schockert and Herzwurm, 2018), to indicate their needs when using the AI system (next, outside the scope of this paper, come steps to validate this with user testing and to form a QFD matrix translating user requirements to technology attributes).

Supporting the search for a domain-independent structure of the AI health literature support system, we use two different health domains for our DIY case analyses: hypertension and T2D. We see them as suitable cases, since they are relevant (with these conditions impacting respectively 50% and 30% of people in affluent countries), different (managed and researched by different specialists) and obviously lifestyle related. We analyse the Dutch situation: What are some of the main healthcare lifestyle sites and guidelines that employees encounter? What do we observe if we compare that to leading edge lifestyle interventions?

Our approach is similar to action research in the sense that we have a high level of 'access' to the current practices and employees struggling with these issues,[3] while at the same time trying to help them in navigating the information diversity they encounter. Many 'front runner DIY employees' are not average. Although they are higher educated on average, we see their struggles on a daily basis in trying to digest and use the available health science for their DIY health choices. Simultaneously, we see potential for AI to help them. The user analysis in this paper is meant as a first iteration for 'user requirements' that would support their search and decision needs. A fruitful way to start, is to evaluate the current routes/tools they use and analyse the user needs that become apparent from that process.

In the analysis section below, we will take the following steps for our case and user needs analysis (for T2D and hypertension), in the first two paragraphs:

1a Case analysis *healthcare advise*: What are some of the main healthcare lifestyle sites and guidelines that employees encounter for their condition?

1b Evaluation from the design goal perspective: What *omissions* do we see if we compare results from step 1a to *leading lifestyle intervention science*?

2a Case analysis *science*, via Google Scholar: What is the content and applicability of the information found?

2b Evaluation from the design goal perspective: Given the need for evaluating disease causes, health intervention options and progress measurement instruments, what *limitations* do the Google Scholar search results have?

In the third paragraph of the analysis section below, we will make a first tentative *translation to 'voice of the user' requirements*: how could an AI system provide improved support for my needs and decisions (as a health DIY employee or practitioner)?

The method for this is to first identify the 'customer journey' or 'user process' and to explicate the key support needs during this process, in the non-technical voice of the user him/herself (Schockert and Herzwurm, 2018). Moreover, we focus in this paper is on the first DIY information phase: what are my options, what can I do and what suits me? So for our 'voice of the user' analysis, long-term health self-management is out of scope. The 'voice of the user' analysis starts with a high level user process explication and is usually further detailed in the next design phases, which are outside the scope of this paper. Those 'next phase' support needs and sub-scenarios of health SMS success (Dineen-Griffin et al., 2019) for hypertension are discussed elsewhere (Simons et al., 2022b). One can think of: prioritising and plan making, preparing for difficult situations (like unhealthy parties), learning skills (for physical activity or for healthy cooking), coping with difficulties, researching new options, etc. This paper however, focuses on explicating the 'phase 1' design questions: DIY user needs for this DIY employee group; the gaps in current support; the high level user process and main user questions which the hybrid AI system should support.

4 Analysis, cases T2D and hypertension

4.1 Healthcare lifestyle guidelines vs. DIY health decisions

As an exemplary search route for a DIY employee with *T2D* in the Netherlands, we started with a Google search (in Dutch) with: "I have diabetes, what can I do?" This led to a top 3 of respectable online sources: http://www.thuisarts.nl (most visited NL site for family doctor questions), http://www.diabetesfonds.nl (NL diabetes research and funding) and http://www.dvn.nl ('Diabetes Vereniging NL' patient association).

Apart from the similarities across the top 3 sources per condition as summarised in Table 1, it is interesting to see that there are differences. For example, http://www.thuisarts.nl is more directed towards medication and three-monthly checks for complications. Whereas the other two sources explain the causal roles of health behaviours and insulin sensitivity better.

A similar search for *hypertension* gave as top 3 sources: http://www.thuisarts.nl again, http://www.hartstichting.nl (cardiac research funding and patient education) and http://www.zorgkaartnederland.nl (patient association to compare care providers). Of these, http://www.hartstichting.nl gives most lifestyle support, but not anywhere close to lifestyle medicine scientific state-of-the-art.

Three aspects are fascinating about these sources:

1 the extent of their omissions: the evidence-based *health facts they do not give*, see 'omitted' in Table 1

2 tendencies to medicalise instead of empower people

3 the *contradictions and biases that persist* from Dutch food culture.

As two examples of bias, all three T2D sources are clear that saturated fats make things worse. Which they give as one of the reasons that meats should be avoided. Still, Figure 2 shows what the very first picture is on the http://www.dvn.nl healthy foods page: a meat-based dish. And we all know that 1 picture speaks louder than 1,000 words … A second example of Dutch food bias is cheese. Despite its high saturated fat content, all

three T2D sites say that cheese is perfectly healthy for T2D patients, without providing any justification. The cheese advice is biologically implausible (given its high saturated fats content) and it contrasts with large empirical studies (Guasch-Ferré et al., 2017; Drouin-Chartier et al., 2019) showing clear T2D risk reductions when replacing cheese and butter with less harmful foods.[4]

Table 1 Case analyses: what is advised vs. omitted on traditional healthcare sites?

	Type 2 diabetes (T2D)	*Hypertension*
Advised (a)	• Lower your blood sugar by eating well (fruits, veggies, nuts, yogurt, and no sugary drinks) brisk walk 30 min/day or 60 min/day if overweight. • If that does not work: pills. • Management via three-monthly medical checks.	• Stop smoking, eat well (fruits, veggies, wholegrain, fibres, and less saturated fat), less salt, brisk walk 2.5 hrs/week, less stress. • Other factors: weight, alcohol, fatty foods (and some meds). • If cardiac risks: pills. • Discuss checkups with doctor.
Omitted (b)*	• -T2D is >90% avoidable with healthy lifestyle. • -Interventions exist that remove >75% of meds in four weeks. • -Causes: insulin resistance, lipotoxicity, inflammation: 1 week reset interventions very effective.	• Hypertension >90% avoidable with healthy lifestyle. • Interventions exist that remove >50% of meds in four weeks. • Causes: endothelial function and inflammation: food has more and faster effect than medication.

Source: *from longstanding research lines: overall (Roberts and Barnard, 2005), in T2D (Hu et al., 2001; Fuhrman and Sorensen, 2012; Simons et al., 2016, 2022a) in hypertension, endothelial health and inflammation (Niskanen et al., 2004; Franzini et al., 2012; Rodriguez-Leyva et al., 2013; Dickinson et al., 2014; Kapil et al., 2015; Siervo et al., 2015; Greger and Stone, 2016)

4.2 Scientific studies vs. DIY health decisions

As illustrated in Subsection 4.1, healthy lifestyle advice on main support sites is watered down and prone to cultural and historical biases. In other words: outdated and not suited for employees or practitioners that prefer high impact interventions. Hence, the question is: what if we go directly to the scientific state-of-the-art, how easily will we find clear and actionable answers? Though one could argue that scientific studies are not useful since they are not written for DIY health questions, one could also argue the opposite: when looking for the latest findings and evidence, what better place to look than science? The AI for DIY health we aim for, is meant to bridge both sides of this equation.

One sees when using Google Scholar, see Figure 3, that the body of scientific studies is not only large, but also highly diverse, with many different subdisciplines in science having their own language and focus. For example, the search results for measuring insulin sensitivity (or resistance) are way too diverse and technical for helping an employee with his/her daily or weekly progress tracking question. A simple “ask your doctor to measure it via an oral glucose tolerance test (OGTT)” would be more helpful. In

Table 2 we summarise our main Scholar search findings with regard to Section 2 employee questions: causes, interventions and measurements.

Figure 2 Food page of http://www.dvn.nl directly contradicts http://www.dvn.nl advise (see online version for colours)

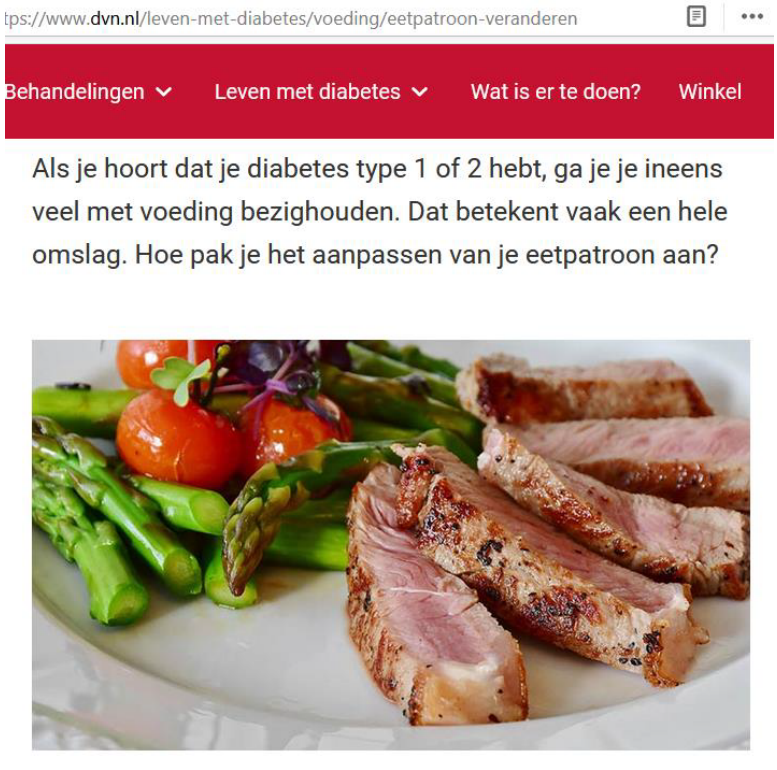
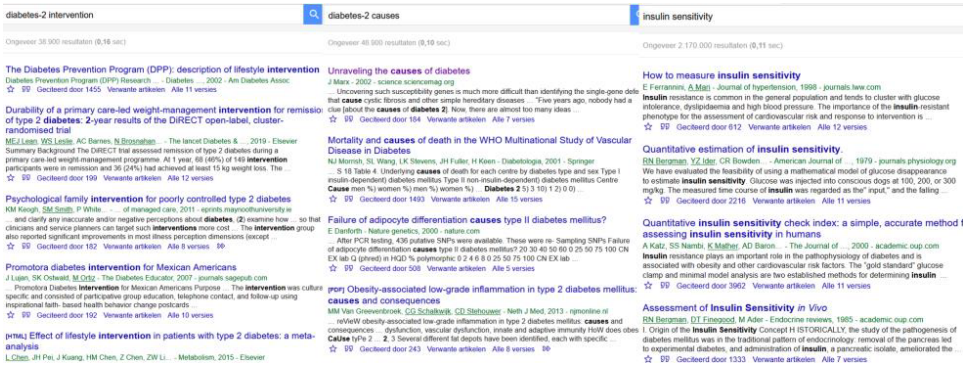


Figure 3 Illustration of study diversity when searching for DIY health answers (see online version for colours)



Another finding is that Google Scholar search results aid in exploring the field, but they are not qualified overviews, see also Figure 3. Overviews exist in the various academic

subdisciplines, like literature reviews or meta-analyses, but they often match poorly to the more action-focused 'voice of the user' questions we hear on a daily basis.

Table 2 Use cases science: study overview and contents evaluation

	Type 2 diabetes (T2D)	*Hypertension*
Study search content	• *Causes:* Diverse papers, many with a genetics, cell or pharma focus, or on complications (cardiac, renal, retina, etc). Different results per population. Psycho-socio-cultural factors. • *Interventions:* Widely varying results and difficult to assess why. Reviews = 'average' results, not highest impact. • *Measuring:* Either 'medi-tech' details or quarterly checks and sugar management or 'modest' QS for walking, weight loss etc.	• *Causes:* Many forms (resistant, pulmonary, non-dipping, secondary) correlates and co-morbidities of hypertension. • *Interventions:* Apart from many drugs intervention also a long lifestyle interventions tradition. Hard to find and compare dose-response for components: salt, meat, smoke, sports, stress, alcohol, fruits, veggies, fibre, etc. • *Measuring:* Many on 24-h ambulatory monitoring. 'Management' is checkups (and often drugs).

4.3 Support needs, following a 'voice of the user' perspective

The action-focused 'voice of the user' questions are quite different from scientific questions or argumentations (even though 'voice of the user' questions and answers can very well be extracted from those scientific studies, but this requires a re-interpretation of those results toward a 'voice of the user' requirements perspective). These are questions on, e.g., feasibility, attractiveness and ease of implementation of interventions, on effectiveness and what is most useful to do, questions on how to deal with dilemma's or tradeoffs, plus, last but not least: questions on how to reliably (and easily) measure progress.

Table 3 'Voice of the user' questions as user requirements for the AI system

1	What are the main causal lifestyle factors that I can potentially influence?
1.1	How large are the effects per causal factor?
1.2	What is the quality of evidence to support this?
2	What are the most effective lifestyle interventions?
2.1	Which are relatively easy and/or attractive for me?
2.2	Which offer rapid, noticeable health results?
3	How can I rapidly measure my health progress?
3.1	Which measurements are low cost and practical for DIY?
3.2	Which are reliable health progress indicators (= have good external validity)?
4	Which attributes above (from user questions 1 to 3) need trade-off decisions?
	• For example, how to combine effectiveness with attractiveness?
	• Or: how to combine all the main causal factors into feasible daily lifestyle patterns?
	• Or: which daily measurements are low cost and practical, as well as reliable?

In *answer to our research question* and including the concerns above, we propose as draft *'voice of the user' requirements* for the AI system: a set of sub-questions linked to the main topics of concern for health DIY employees: causes, intervention options and progress measurements, see Table 3.

The questions from Table 3 as user requirements list are at this point still assumptions (phase 2 of the design approach from Section 3), inspired on the one hand by the details of the causes, interventions and measurements encountered in our cross-case study, see also Tables 1 and 2. On the other hand they are grounded in our understanding of DIY health improvement questions from employees that we hear on a daily basis in our coaching, see note 3. Of course, these assumptions are just a first version designer's set, requiring further testing, as discussed in Section 5.

As a final conclusion from our cross-case analysis, if we now look at for example questions 2.1 (intervention ease and attractiveness) or 2.2 (rapid results), we find that most academic overviews are not outlined along these lines, see also the results displayed in Figure 3 and Table 2. The AI system will need to provide functionality to fill that void and help answer these questions for front runner DIY employees and practitioners.

5 Discussion: AI for next level QS for worker health self-management

An important limitation to our two-health-conditions case study is firstly that our results still need validation via user testing. Preferably via a Wizard of Oz type of study, with questions like: what would you like to know? Which searches would you use? How would result XYZ help you? What type of results display would you need? Secondly, in terms of design process, the next QFD step has to be taken: translation of the user requirements to technical attributes which fulfil those requirements for the AI system. Thirdly, a limitation is that we only studied two health conditions. On the one hand, the other lifestyle medicine publications we cited throughout this paper also support the finding that DIY health self-management is generally ill-supported in medicine, for multiple lifestyle related diseases (Greger and Stone, 2016) when compared to the knowledge available in scientific literature. So our case findings do appear to have external validity. On the other hand, it is still too early to answer the design question whether DIY support for other health conditions could follow the same 'domain-independent' overall design approach and AI tool structure (while of course using domain-specific content within the AI tool structure).

A more fundamental limitation for the design goal of this paper is that in health self-management the risks for self-deception need to be mitigated. Self-deception risks exist on at least two levels. First on the individual health self-management level: when employees, or even their healthcare providers, use research findings from areas they are not experts in: what is the quality and risk level of what they do? The idea is to reduce these risks using the hybrid approach: the meta-level intermediation from Section 2. This meta-level intermediation does need quality management processes and constraints, in order to avoid self-deception on this second level. This is an important topic, outside the scope of this paper, for further research. It would need to include elements like:

a incorporating and weighing the historical body of evidence, especially against new and 'revolutionary' claims, without ignoring promising new venues

b involving existing experts and expert organisations, especially for 'building meta-level knowledge bridges' as mentioned in Section 2

c excluding industry biases and conflicts of interest, which is an especially large problem in food, medical and health sciences and their expert boards (Mialon et al., 2022).

Apart from the limitations of this study, there are two main findings following from our case analyses. The first finding is that the default lifestyle guidelines of our healthcare system for the two health conditions we studied are rather meagre for DIY purposes (Subsection 4.1). The second finding is that the scientific information is, due to it is wide scope and diversity, quite difficult to assess for lay people or general healthcare providers. The Google Scholar searches show many different 'bubbles' within the scientific community whose discussions are highly specialised and disjunct (Subsection 4.2). This means that there is quite some room for improvement in supporting DIY employees (and their practitioners).

In order to help individuals with their health self-management, the QS concept of building an 'exoself' is quite interesting. Swan (2013, 2014) provides the examples of stress monitoring and step counters to include sensor data into an extended self-image for health self-management. Recently we proposed to move this one step further: towards a QS 'endoself' which teaches us about the quality of our internal repair systems (like endothelial function for example), that may initially be relatively new to us, but have a large impact on our health and performance. The AI system we want to develop for support DIY health should increasingly be able to educate people on their main endoself opportunities, driven by practical, understandable insights for our state-of-the-art biology sciences.

When designing such an AI support system, there are three reasons for currently aiming for a *hybrid* AI system (which includes expert mediated interpretations) rather than stand-alone AI. Firstly, human interpretation of research design and study validity are needed to counter 'fabricated pseudo-science' lifestyle studies which are often industry-sponsored (Campbell and Campbell, 2016; Greger and Stone, 2016; Simons, 2020). Secondly, expert opinions from experience scientists in this domain must be taken into consideration in order to avoid 'newness bias'. For example the Physicians Committee for Responsible Medicine (PCRM) show how 'serious scientists' have abandoned studying cholesterol effects of eggs decades ago, since the results were so clear about their detrimental effects, leaving the field open to biased egg industry studies (of very small scale, with n = 12 to n = 20 participants) with conclusions like 'recent studies show no significant effects' (Barnard et al., 2019). Thirdly, due to all kinds of confounding factors, lifestyle intervention successes can be difficult to achieve, thus cluttering the scientific field with mediocre results. If 90% of attempts for a certain intervention were less successful, how do we interpret and present the 10% that were very successful? Although this 10% may not form a majority, they often do lead the way forward for new lifestyle successes.

Given the previous discussion points and limitations, we see several next steps for research. First, user testing to further elicits user support processes and requirements. Second, designing the quality management processes to ensure that interpretations and guidance provided by the hybrid AI system are free from industry conflicts of interest (Mialon et al., 2022) and embedded in the academic state-of-the-art (Willett et al., 2019).

Third, feasibility testing in one specific domain (e.g., hypertension or T2D) where a first proof of concept version of such a hybrid AI is built and tested, in order to see if some of the promises in this wealth of health advancement science, can bear fruit for health SMS.

6 Conclusions and QS outlook for a more effective '2030' healthcare

Front runner employees and practitioners aiming for rapid DIY health improvements and using QS could pioneer the frontiers of a more sustainable and effective '2030' healthcare. Self-efficacy in health self-management has a lot of potential for healthier and happier aging (Greger and Stone, 2016; Bredesen, 2017; Bredesen et al., 2018; Ornish and Ornish, 2019; Willett et al., 2019; Simons, 2020, 2021; Simons et al., 2022a). Moreover, many people value being empowered to increase their self-control, especially when faced with potentially debilitating health conditions (Simons et al., 2014, 2017, 2022a).

We hypothesise that this will become more powerful when these front runner individuals can receive clear state-of-the-art health literature advise thanks to the hybrid AI system we aim to develop. Besides employees themselves, having limitations in time, effort or health background education, such a hybrid AI system could be useful for any health practitioners, nurses, physician assistants, dieticians, physiotherapy and exercise professionals which have a keen interest in health self-management and disease reversal, but currently lack the tooling or scientific overview to confidentially and reliably provide state-of-the-art DIY health advise.

Both case studies (hypertension and T2D) illustrated that the default lifestyle advice given is generally insufficient for achieving large health improvements. For diseases of affluence, if 'health is what happens between doctors' visits', the AI support system proposed here may offer us a cheaper, more effective channel to deliver future healthcare.

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Notes

1 As a coincidental side note to this 'smart' use of Scholar Google, recent findings also indicate that 'heart health promotes brain health', including better performance on learning and problem solving skills (Attuquayefio et al., 2017; Bredesen, 2017; Bredesen et al., 2018; Li, 2019). Hence, DIY health self-management individuals may turn out to become smarter on an individual level too.

2 We take Scholar Google as a reference point for exploring recent studies, since it is so widely used.

3 By providing six months of healthy lifestyle coaching (Simons et al., 2010, 2017) for literally thousands of participants and caregivers in these domains, over the course of the past ten years.

4 Outside our scope, there are ample discussions (Campbell and Campbell, 2016; Fuhrman and Sorensen, 2012; Greger and Stone, 2016; Greger, 2019) of how our health institutions are living in bubbles of 'not rocking the boat', leading to culturally biased and watered down advice. Which is quite different from the high impact interventions that leading edge DIY employees and practitioners are looking for.