Hypertension Self-Management Success in 2 weeks

3 Pilot Studies

Simons, L.P.A.; Gerritsen, B.; Wielaard, B.; Neerincx, M.A.

DOI
10.18690/um.feri.6.2023

Publication date
2023

Document Version
Final published version

Published in
36th Bled eConference

Faculty of Organizational Sciences

36th Bled eConference Digital Economy and Society: The Balancing Act for Digital Innovation in Times of Instability

June 25 – 28, 2023, Bled, Slovenia

Conference Proceedings

Editors
Andreja Pucihar
Mirjana Kljajić Borštnar
Roger Bons
Guido Ongena
Marikka Heikkilä
Doroteja Vidmar

June 2023

HYPERTENSION SELF-MANAGEMENT SUCCESS IN 2 WEEKS; 3 PILOT STUDIES

LUUK PA SIMONS,[1] BAS WIELAARD,[2] MARK NEERINCX[1]

[1] Delft University of Technology, Faculty of Computer Science, Delft, Netherland
l.p.a.simons@tudelft.nl, M.A.Neerincx@tudelft.nl
[2] Health Coach Program, Hague, Netherland
Bas.Wielaard@healthcoachprogram.nl

Platform business models like Uber Ride or Airbnb Lodging enable innovative business models by operating digital platforms to connect providers and consumers of products and services in two-sided markets. A particular challenge with platform business models is designing an appropriate revenue model to capture value. This paper presents a taxonomy that classifies the different dimensions and characteristics of revenue models for platform business models. A proven taxonomy development method is used that includes a review of current literature related to platform business models. The taxonomy provides a comprehensive classification of platform revenue models and is applied to a real-life case. The results of this paper include a UML class model and a final taxonomy with 14 dimensions and 64 characteristics. The paper contributes to the design process of novel platform business models and expands the understanding of how digital platforms can generate revenues.

Keywords:
hypertension, self-management support, microlearning, social learning, eHealth, employee health

University of Maribor Press

DOI https://doi.org/10.18690/um.fov.4.2023.2
ISBN 978-961-286-751-5

1 Introduction

Hypertension is the main risk factor for death worldwide, according to Lancet publications from the largest health study ever (Lozano, 2012, Lim, 2012). Though it is preventable and reversible, most people get hypertension before they retire (Ostchega, 2020, Zhou, 2021, Carey & Whelton, 2020). So, we need healthier lifestyles. But how do we effectively learn the required competences?

Standard advice in health care hypertension is a bit simplistic when viewed from a competence building perspective. Plus, the feedback cycle takes too long. You might hear: "Try less salt and more sports, then come back in three months to check your blood pressure again." This approach contrasts strongly with the lessons from SMS (Self-Management Support) literature for the need of individualized learning support, regular monitoring and follow up coaching (Dineen-Griffin, 2019). If we add to this the microlearning lessons on competence building (Emerson & Berge, 2018, Simons, 2015, 2020b), we can hypothesize why many people experience unsatisfactory results. Standard care provides virtually no support for competence building.

In a previous study we reported on a preliminary pilot (Simons, 2022a) showing feasibility and perceived usefulness of daily hypertension feedback. Still, a question remained: how robust are effects across cases (external validity)? Next, on a more detailed level of design analysis: which elements in the support intervention are valued most; how does this depend on the intervention context? Where is the room for improvement? In this paper we conduct an analysis across three different cases. We compare the results and user evaluations from three hypertension Self-Management Support (SMS) pilots of 2 weeks each, across different employee groups, organisations, and intervention settings.

Our Research Question is:
How do the different support elements across the three cases relate to differences in health competences, -behaviors and blood pressure outcomes?

2 Theory and concepts

Four areas of expertise form the basis for the interventions and design analyses of this paper. They are: lifestyle medicine for hypertension, persuasive technology for health, Self-Management Support (SMS), and microlearning in a multichannel support mix. It was researched elsewhere how the challenges of ***persuasive technology*** (Fogg 2003, 2009) for health are not just located in the ICT (Information- & Communication Technology) design, but also in the design of the overall service scape, including health effectiveness and coaching performance (Starr 2008, Simons 2014b). It should generate positive, mutually reinforcing service experiences across communication channels, for effective health behaviours and -results. This is reflected in the following design evaluation framework for health improvement ICT solutions (Simons 2014), see Figure 1.

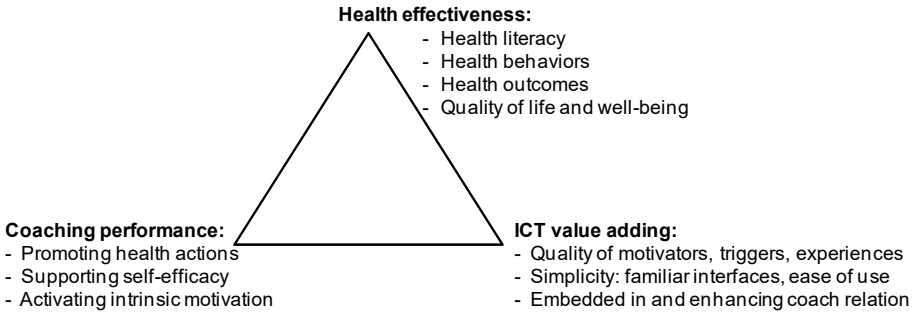

Figure 1: Design requirements for designing ICT-enabled healthy lifestyle support

Figure 1 addresses three domains to evaluate the impact of ICT-enabled health interventions: health effectiveness, coaching performance and ICT value adding. We use it as analysis framework for section 4, Results.

Lifestyle medicine for hypertension has a longstanding research tradition: overall (Roberts & Barnard, 2005) and regarding powerful short term effects on hypertension, inflammation and endothelial health of for example antioxidant foods (Franzini, 2012), flaxseed (Rodriguez-Leyva, 2013), beetroot and nitrates (Kapil, 2015), salt reduction (Dickinson, 2014) and healthy, low-fat food choices (Siervo, 2015), combined with exercise (Greger & Stone, 2016, Simons, 2022c) and stress

reduction (Pickering, 2001). We translated this research into lifestyle advice to generate short term, measurable improvements for hypertension.

As discussed in more detail elsewhere (Simons, 2022a), the field of health ***Self-Management Support (SMS)*** has support process components, besides support for specific health behaviours (exercise, diet, sleep, smoking etc) and for tailoring the action plan to a participant's own context and priorities (Demark-Wahnefried, 2007, Jonkman, 2016, Dineen-Griffin, 2019, Simons, 2013, 2017, 2020a, 2021). This set of SMS process components also forms the ***evaluation framework*** we used for user evaluation in section 4:

1. **Monitoring** of symptoms (regular, active self-monitoring)
2. **Information** transfer (throughout the learning process)
3. **Competence** building, including:
    a. ***Problem solving***/decision making
    b. ***Plan making***: self-treatment through use of an action plan
    c. ***Coping management***: skills for handling challenges, frustrations etc
    d. ***Resource utilization***: incl. social context or medication management

Finally, ***microlearning*** concepts are highly relevant to our objectives of increasing health behaviour competence levels of participants. Especially since our study took place in a (busy) work context, which creates a need for very efficient learning and rapid proof of effectiveness. "Business is about productivity, not learning. [..] *Inserting learning interventions into a busy employee's schedule is a real challenge*" (Emerson & Berge, 2018). Giurgiu (2017) states that microlearning should focus on only what you need to know. And that it should fulfil the human craving for instant gratification: satisfying short term goals that support long term goals. Gabrielli et al (2017) stress the "contextual" learning in a "conversation with the world and oneself". This conversation includes reflection, experimentation, and interpretation of results. Competence building is about *embedded learning*, where *doing* and *achieving results* are at least as important as learning (Emerson & Berge, 2018, Simons, 2010).

Multiple studies show how self-management tools and ICT (Information and Communication Technology) are useful, in a multichannel service-scape, for: goal setting based on personal preferences, ICT supported tracking and progress feedback (Kari, 2017, Lehto, 2013, Lopez, 2011, Ricciardi, 2013, Wickramasinghe, 2010). Elements like individual coaching, eTools like microlearning for health,

Quantified Self (QS, Swan, 2012, 2013) progress tracking, WhatsApp groups and peer coaching in virtual support teams have all been shown to aid motivation and success (Simons, 2015, 2016, 2020b, 2022b). So does the power of group-based social learning (Bandura, 1971)

3 Methods and Materials

In a design research approach, we follow the design cycle methodology of Vaishnavi & Kuechler, (2004) which goes from problem awareness and solution suggestion to development, evaluation and conclusion. After reporting our multiple-case study results in section 4, we discuss design lessons in section 5.

The ***hybrid lifestyle intervention with twice-daily biofeedback*** consisted of:

- Telephone intake & instructions for BP home measurements
- Start- and final group sessions (2 weeks apart, face-to-face)
- Daily MS Teams eCoaching in week 1
- (Case A: individual and group; Case B: group; Case C: only email tips)
- Twice-daily BP measurements and logging email (Case A & B)
- Feedback on group progress after 1st week (Case A & B)
- Healthy recipe suggestions
- Content (portal and/or email) on health, BP, and behaviour strategies

From Nov 2021 to Feb 2023, a ***multiple-case study with three employee groups*** was conducted to evaluate real world impacts of the healthy lifestyle intervention for hypertension Self-Management in Dutch work settings. They were small scale pilots (n=8 to n=4), for three reasons. First, because we saw previously (Simons, 2022a) how robust the BP effects were across users, which enables small group sizes. Second, because we follow the design approach of multiple small tests to collect and test multiple improvement options, instead of conducting one big test (Cennamo, 2019). Third, we depended on employer organisations for volunteers. In total, n=20 volunteers participated.

Table 1: Case description and start situation

Aspects	Case A (n=8)[1]	Case B (n=6) [2]	Case C (n=4)
Case start	Nov '21	Nov '22	Jan '23
Participants	4 men, 4 women	3 men, 3 women	4 men
Avg. start blood pressure (mmHg)	145/92	161/112	155/95
Intervention duration	11 days	11 days	17 days
Final user evaluation	10 weeks after start	5 weeks after start	5 weeks after start
Support format specifics	Extra App for healthy menus	In week 1: longer daily e-Sessions, with more content & group interaction	*Light-weight*: * no coaching * no daily BP log-mail * info via mail instead of portal

Cases A and B were conducted with mixed groups of university groups (mostly support staff, with some academics) and Case C with ICT professionals. Their SES (Socio-Economic Status) and education levels were on the Dutch average or above. They all had hypertensive BP at start and volunteered for these 2-week in-company BP interventions. There were some cross-case differences: in the intervention service mix, group make-up, and organisational context, which enabled some interesting cross-case observations, see next section.

4 Results & Cross-Case Comparisons

A first question for our findings is: were there meaningful ***BP improvements*** across these cases? The short answer is: yes.

[1] One of the participants had a user evaluation outlier pattern, see Table 3.
[2] One of the participants had a user evaluation outlier pattern, see Table 3.

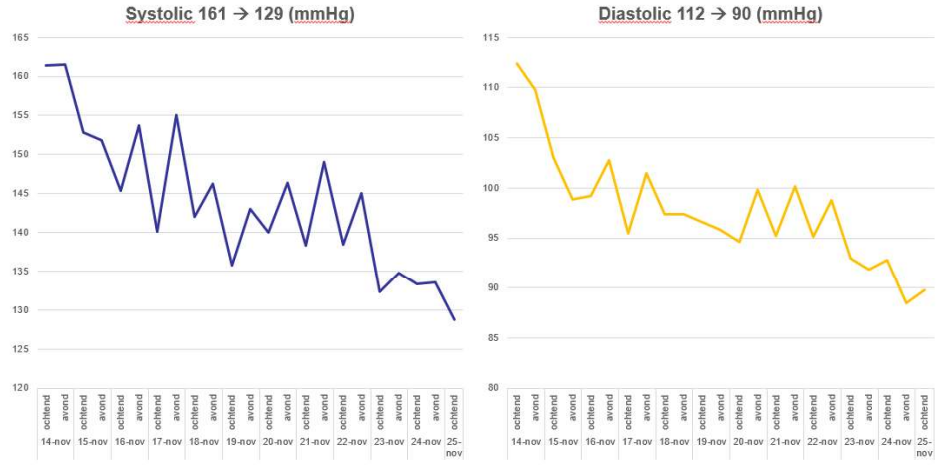

Figure 2: Average blood pressure drop in Case B (n=6)

Previously, we reported on the large BP improvements of case A (Simons, 2022a): from 145/92 down to 126/86 mmHg in 11 days (from Monday morning at start, to Friday morning in the second week). Case C also showed BP improvements, see Table 2, from 155/95 to 139/85 mmHg. The largest improvements occurred in Case B, see the BP trend line in Figure 2. Since participants measure their BP every morning and evening, an 11-day (average) 'spiky' trend line was created per pilot. The line is 'spiky' since evening BP tends to be higher than morning BP. Based on our user evaluations, we can say that participants generally find it very motivation to see their individual and collective trends: "I was positively and strongly surprised how large the impacts of our behaviour changes were." In case B, hypertension dropped from 161/112 down to 129/90 mmHg in 11 days.

A second finding is that the intended outcome of this intervention on BP occurs quite ***robustly across individuals***. (Which, on a methodological level, also enables us to work with small pilot groups and still observe robust effects per group.) The extend of BP effect robustness across individuals is indicated in Table 2, with the 'High BP Responder' percentage per case. We defined a 'High BP Responder' as a participant who had an average or above average BP improvement. This leads to a third finding: Case A and B have more 'High Responders' than Case C. Although this could be a coincidence, we propose that this is caused by the lesser degree of competence support given in Case C. This proposition is supported by our

qualitative user- and case evaluations below, plus it is explored further in section 5, discussion.

Table 2: Cross-Case findings and authors' design evaluation, on design requirements from Figure 1 (authors' opinions, 5-point scale from - - to ++)

Findings	Case A (n=8)	Case B (n=6)	Case C (n=4)
Final Blood Pressure (BP, Avg. mmHg)	126/86	129/90	139/85
BP drop, mmHg	-19/-6	-32/-22	-16/-10
% of High BP Responders[3]	63%	66%	25%
Health behaviours	+ Healthier diet + Avg. 10.000 steps/day	++ Largest diet improvements ++ Highest physical activity	- No changes in intensive exercise - Most are still searching how to implement in daily patterns
Coaching performance	+ Raise efficacy + Adoption (except by some: time constraints)	++ Largest information transfer & impact from assignments ++ Largest social learning	+ Relevance of content was valued - Progress depends on user him/herself, without daily coaching
ICT value add	+ BP log mails daily; impact + Daily coaching (indiv & group) + Info in portal	+ BP log mails daily; impact + Daily digital 'day-start' sessions + Info in portal	- Portal and daily logging not used + Daily mail tips were appreciated

Table 2 shows a ***design evaluation*** across cases, based on the theory framework: health behaviours, coaching performance and ICT value add. First, regarding health, all cases showed improvements in BP and health behaviours. Case B showed the largest improvements and Case C the smallest. In our observation, this was a consequence of the second aspect: coaching. The coach assignments for behaviour

[3] This the % of participants in a case that had average or above average BP improvments. This is an indicator of robustness of BP results across participants.

improvement were more explicit in case B than A (e.g. "no cheese or meat for two weeks and at least 800 grams per day of fruits or vegetables") and there was extensive daily group coaching and content on everyday challenges. Case C had no coaching, just a start workshop to explain people what to do, plus daily content mails until the final workshop. Thus, the extent of behaviour progress largely depended on a person's self-management. The third design evaluation aspect, ICT value add, was higher in Case A and B, than in C: twice-daily BP logging mails, portal information on health and BP, healthy recipes, daily e-coaching in week 1 (in Case A more on the individual, in Case B more on group level learning, content, exchange of experiments and follow-up assignments) and feedback on group level BP progress after week 1. In Case C this was replaced with daily emails tips on hypertension, health, and behaviour change tactics.

From the ***user evaluations***, we discuss the perceived usefulness of the various intervention components across cases, see Table 3. Scores were given on a 7-point Likert scale, ranging from 'totally disagree' to 'totally agree', in answer to the question: 'Which components stimulated you to adopt healthier behaviours?' The components are clustered in the SMS process framework, even though some components support more than one SMS process.

Table 3: Components that stimulated healthier behaviours (7-point (dis)agree, Avg)

Monitoring:	**Case A[4]**	**Case B[5]**	**Case C[6]**
1. Mail triggers for blood pressure logging	4.9	6.2	n.a.
2. Daily management	5.4	5.6	6.0
3. Gaining more blood pressure control	6.3	6.4	6.5
Information transfer:			
4. Start workshop	6.4	6.4	6.8
5. Healthy menu suggestions (App/portal)	4.4	4.8	n.a.
6. Health and blood pressure information in portal/mails	5.4	5.2	6.3
7. More understanding of blood pressure & health	6.1	6.2	6.0
Competence building:			
8. Follow-up workshops	6.3	6.2	7.0
9. Individual tips and answers to my questions from the coaches	6.6	6.2	6.8
10. Doing this as a group	6.4	5.8	5.5
11. Tips in dealing with challenges	6.0	6.2	6.0

In Table 3 we see that the main perceived benefit from *Monitoring* was the blood pressure control participants gained (3.). For the second SMS process element, *Information transfer*, we see that the start workshop (4.) and increased understanding of blood pressure and health (7.) were valued most. These two intervention components (4. & 7.) were not just about information transfer, but also about increasing competences for: effective plan making and prioritizing efforts on those lifestyle choices that have the best combination of short-term effectiveness and long-term perceived attractiveness/ feasibility for a participant. The element, *Competence building*, is key for training sustainable self-management skills and coping strategies. All four components (8. to 11.) receive relatively high scores, and for case B the perceived value of doing this as a group (10.), was explicitly stressed by participants

[4] One of the participants had an outlier pattern of scoring (since she could not be present at several of the group coach sessions, due to illness plus family logistics). Table 3 displays the average scores of the other 7. (Score 4=neutral) Her scores were resp.: 6; 6; 6/3; 3; 4; 5/3; 6; 3; 3.

[5] One of the participants had an outlier pattern of scoring (she had hereditary hypertension since 18 years old and her BP values did not change, despite her best efforts). Table 3 displays the average scores of the other 5. (Score 4=neutral) Her scores were resp.: 4; 4; 4/4; 4; 4; 5/4; 4; 6; 5.

[6] n.a. = not applicable

in the joint group evaluation after 5 weeks. So, support for competence building was generally valued by the participants.

Previously, a more detailed presentation of the healthy behaviour challenges was given, as well as what helped participants to improve those behaviours (Simons, 2022a). In answer to our Research Question (How do the support elements relate to differences in health competences, -behaviours and blood pressure outcomes), several ***elements for promoting health improvements*** found previously, were confirmed in our cross-case analysis:

a. Rapid feedback: twice-daily measurement of progress
b. Achieving results and enhancing self-efficacy
c. 'Quick results'-tips & education: which large steps for large benefits
d. Practical tips for every-day choices and practicing new behaviour patterns
e. High quality coaches and coach sessions to increase health competence
f. Doing this in a group and teaching each other
g. Coaching on coping strategies

Next, we highlight findings from the main ***cross-case differences***. After Case A, we made three adaptions to the support components, based on user feedback. First, we had rented a (commercial) mobile App for the users, with many easy and adaptable 'hypertension-friendly' menu options, including a 'home-delivery' function. However, this was hardly used and thus discarded. Besides, we relied quite a bit on individual coaching. But given the large benefits we saw from group learning in case A, we changed two other things for Case B: (1) we replaced individual coaching with longer, information-intensive daily digital group workshops as day-starters in week 1, and (2) we gave more explicit daily assignments: what experiments and behaviours to practice today. We subsequently observed larger improvements in healthy eating and exercise in Case B, see Table 2, which we propose is a consequence of these changes that were made. In Case C support was lightweight, see also Table 2, given the different organisation context and participants' preferences for a more light-weight (and less time-intensive) approach. So, there was no coaching in between the start and final workshop, of two hours each. Besides, daily logging and portal access were not used (even though the participants did monitor their blood pressure themselves during the two weeks). Instead, they received daily email tips on health behaviours, self-management, and blood pressure.

The main finding from case C is that health behaviour changes were smaller and that only one participant achieved above-average BP improvements.

Cross-case differences confirm that most individuals find it hard to make large changes in their health choices solely based on information. Cases A and B (versus C) illustrate that ***for most participants daily support with coaching and group learning processes appear to be required to generate sufficient behaviour- and Blood Pressure (BP) improvements***, and even daily support is not enough for every participant in Cases A and B. Next, one element stands out from the user feedback which was very similar across all three cases: ***the quality of information/tips was highly valued by participants, because it was effective for generating rapid BP improvements.*** In all three cases, the information was deemed important ("these really helped") and valued ("most useful information in years").

5 Discussion

This cross-case design analysis has several ***limitations***. Firstly, due to its small scale (in total n=20 participants across 3 cases) our research question is qualitatively answered, not quantitatively. Secondly, the BP trends are based on self-reported measures. Still, they practiced these measurements during a wash-in period of three days before the start, which helps create robustness. Thirdly, we qualitatively assessed health competence growth, changes in lifestyle behaviours, and learning strategies. In future research, we would like to use more formal and validated surveys to generate health competence improvement scores for example. However, this is not straightforward, for two reasons: (1) BP related competence is not the same as general health competence and (2) health competence was already above average in these participants at the start. Fourthly, each intervention/case tested multiple intervention components together, without control group. So, cross-case intervention differences provide some insights, but interpretations are qualitative and (inter-)subjective.

Based on the cross-case analysis, we propose ***four design lessons***.

- First, since many individuals indicate that they find it hard to make large health behaviour changes based solely on information, as stated in the

findings, extra support is needed: ***daily group coaching speeds up social learning processes*** and stimulates participants to do new health experiments or try new tactics to cope with difficult situations.

- Second, ***light-weight*** support (like in Case C) only works ***if self-management competences of participants are high***. Besides, participants struggle more with establishing longer term health patterns.
- Third, the ***quality of information*** and tips must be high: it is valued (and applied) if participants recognize it as effective ***for generating rapid BP improvements***. This in turn requires daily 'proof' from BP improvements.
- Fourthly, the ***power of the 'Challenge Regime'*** was mentioned in many evaluations. The two main elements: (1) making a commitment for large health changes and experiments, (2) knowing that it is for only two weeks. This combination enhances temporary attention, motivation, effort, and willingness to experiment. The result is: more improvement, more learning, a positive experience, plus a desire to continue using some of the lessons learned in the longer run.

As a lesson on ***practical implications***, we should not forget the important added ***value of technology*** in this intervention: daily home monitoring is now feasible thanks to affordable and reliable blood pressure consumer electronics; our mail/web-based coaching portal enables real-time progress tracking by participants and coaches alike; daily MS Teams meetings enabled high quality group and individual coaching without travel- or time constraints; our portal content database supports participants with multiple lessons on blood pressure and healthy lifestyle; the healthy menu App offered even included a button to directly order/deliver the ingredients to participants' homes (even though this latter option was not used by the participants). In short, the intervention was highly dependent on these technologies and tools.

By contrast, ***microlearning*** is sometimes framed as 'a tool' or technology. But we saw that it is much more. Its value ***as an embedded learning strategy*** to create daily, relevant, and 'rich' learning instances was key in our case implementations: creating multiple, daily competence-building microlearning opportunities, also face-to-face and in group discussions.

In ***conclusion***, this intervention was attractive and feasible for the participants. It was effective for achieving blood pressure improvements in two weeks. The value was confirmed of the Self-Management Support (SMS) and microlearning

approaches for competence building. Besides, our study illustrates the added value of: (a) group coaching/social learning; (b) a 'Challenge Regime' with high commitments for a short time; (c) self-efficacy growth for users from large health results within days; (d) multiple (technology-enabled) health competence building lessons each day. These options hold promise for future health Self-Management Support innovations.

Acknowledgements

This research was (partly) funded by the https://www.hybrid-intelligence-centre.nl/ a 10-year programme funded the Dutch Ministry of Education, Culture and Science through the Netherlands Organisation for Scientific Research, grant number 024.004.022 and by EU H2020 ICT48 project ``Humane AI Net'' under contract $\# $ 952026.

References

Bandura, A. (1971). Social learning theory (Vol. 1). Prentice Hall, Englewood cliffs.

Carey, R. M., & Whelton, P. K. (2020). Evidence for the universal blood pressure goal of< 130/80 mm Hg is strong: controversies in hypertension-pro side of the argument. Hypertension, 76(5), 1384-1390.

Cennamo, K., & Kalk, D. (2019). Real world instructional design: An iterative approach to designing learning experiences. Routledge, Oxfordshire, UK.

Demark-Wahnefried, W., Clipp, E., Lipkus, I., Lobach, D. et al. (2007). Main Outcomes of the FRESH START Trial: A Sequentially Tailored, Diet and Exercise Mailed Print Intervention Among Breast and Prostate Cancer Survivors. J Clin Oncol, 25(19), pp. 2709-2718.

Dickinson, K. M., Clifton, P. M., Burrell, L. M., Barrett, P. H. R., & Keogh, J. B. (2014). Postprandial effects of a high salt meal on serum sodium, arterial stiffness, markers of nitric oxide production and markers of endothelial function. Atherosclerosis, 232(1), 211-216.

Dineen-Griffin, S., Garcia-Cardenas, V., Williams, K., & Benrimoj, S. I. (2019). Helping patients help themselves: a systematic review of self-management support strategies in primary health care practice. PloS one, 14(8), e0220116.

Emerson, L. C., & Berge, Z. L. (2018). Microlearning: Knowledge management applications and competency-based training in the workplace. Knowledge Management & E-Learning, 10 (2), pp.125-132.

Fogg, B. J., & Fogg, G. E. (2003). Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufmann, San Francisco.

Fogg, B. J. (2009). A behavior model for persuasive design. Proceedings of the 4th international conference on persuasive technology. ACM, 2009.

Franzini, L., Ardigo, D., Valtuena, S., Pellegrini, N., Del Rio, D., Bianchi, M. A., ... & Zavaroni, I. (2012). Food selection based on high total antioxidant capacity improves endothelial function in a low cardiovascular risk population. Nutrition, Metabolism and Cardiovascular Diseases, 22(1), 50-57.

Gabrielli, S., Kimani, S., & Catarci, T. (2017). The design of microlearning experiences: A research agenda (on microlearning).

Giurgiu, L. (2017). Microlearning an evolving elearning trend. Scientific Bulletin, 22(1), 18-23.

Greger, M., & Stone, G. (2016). How not to die: discover the foods scientifically proven to prevent and reverse disease. Pan Macmillan, New York City.

Jonkman, N. H., Schuurmans, M. J., Jaarsma, T., Shortridge-Baggett, L. M., Hoes, A. W., & Trappenburg, J. C. (2016). Self-management interventions: proposal and validation of a new operational definition. Journal of clinical epidemiology, 80 (December 2016), 34-42. DOI: https://doi.org/10.1016/j.jclinepi.2016.08.001

Kapil, V., Khambata, R. S., Robertson, A., Caulfield, M. J., & Ahluwalia, A. (2015). Dietary nitrate provides sustained blood pressure lowering in hypertensive patients: a randomized, phase 2, double-blind, placebo-controlled study. Hypertension, 65(2), 320-327.

Kari, T., Koivunen, S., Frank, L., Makkonen, M., & Moilanen, P. (2017). The expected and perceived well-being effects of short-term self-tracking technology use. International Journal of Networking and Virtual Organisations, 17(4), 354-370.

Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., ... & Remuzzi, G. (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. The lancet, 380(9859), 2095-2128.

Lim, S. S., Vos, T., Flaxman, A. D., Danaei, G., Shibuya, K., Adair-Rohani, H., ... & Pelizzari, P. M. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. The lancet, 380(9859), 2224-2260.

Lehto, T., Oinas-Kukkonen, H., Pätiälä, T., & Saarelma, O. (2013). Virtual health coaching for consumers: a persuasive systems design perspective. International Journal of Networking and Virtual Organisations 4, 13(1), 24-41.

Lopez, G., Shuzo, M., & Yamada, I. (2011). New healthcare society supported by wearable sensors and information mapping-based services. International Journal of Networking and Virtual Organisations, 9(3), 233-247.

Ostchega, Y., Fryar, C. D., Nwankwo, T., & Nguyen, D. T. (2020). Hypertension prevalence among adults aged 18 and over: United States, 2017–2018, NCHS, National Health and Nutrition Examination Survey, 2017–2018: https://stacks.cdc.gov/view/cdc/87559.

Pickering, T. G. (2001). Mental stress as a causal factor in the development of hypertension and cardiovascular disease. Current hypertension reports, 3(3), 249-254.

Ricciardi, F., Rossignoli, C., & De Marco, M. (2013). Participatory networks for place safety and livability: organisational success factors. International Journal of Networking and Virtual Organisations 4, 13 (1), 42-65.

Roberts, C. K., & Barnard, R. J. (2005). Effects of exercise and diet on chronic disease. Journal of applied physiology, 98(1), 3-30.

Rodriguez-Leyva, D., Weighell, W., Edel, A. L., LaVallee, R., Dibrov, E., Pinneker, R., ... & Pierce, G. N. (2013). Potent antihypertensive action of dietary flaxseed in hypertensive patients. Hypertension, 62(6), 1081-1089.

Siervo, M., Lara, J., Chowdhury, S., Ashor, A., Oggioni, C., & Mathers, J. C. (2015). Effects of the Dietary Approach to Stop Hypertension (DASH) diet on cardiovascular risk factors: a systematic review and meta-analysis. British Journal of Nutrition, 113(1), 1-15.

Simons, L. P. A., & Hampe, J. F. (2010). Service Experience Design for Healthy Living Support; Comparing an In-House with an eHealth Solution. The 23rd Bled eConference, pp. 423-440. Accessed 2010 from www.bledconference.org

Simons LPA, Hampe JF, Guldemond NA. (2013). Designing Healthy Living Support: Mobile applications added to hybrid (e)Coach Solution. Health and Technology. 3 (1) pp.85-95. DOI 10.1007/s12553-013-0052-9

Simons LPA, Hampe JF, Guldemond NA. (2014). ICT supported healthy lifestyle interventions: Design Lessons. Electronic Markets. 24 pp. 179-192. DOI 10.1007/s12525-014-0157-7.

Simons LPA, Foerster F., Bruck PA, Motiwalla L & Jonker CM. (2014b). Microlearning mApp to Improve Long Term Health Behaviours: Design and Test of Multi-Channel Service Mix. Paper presented at the 27th Bled eConference. Bled, Slovenia, Proceedings. Retrieval from www.bledconference.org and http://aisel.aisnet.org/bled2014/4

Simons LPA, Foerster F., Bruck PA, Motiwalla L & Jonker CM. (2015). Microlearning mApp Raises Health Competence: Hybrid Service Design. Health and Technology, 5 pp 35-43.

Simons, L. P., Pijl, H., Verhoef, J., Lamb, H. J. et al (2016). Intensive Lifestyle (e) Support to Reverse Diabetes-2. In Bled eConference (p. 24), accessed Dec 20, 2016 www.bledconference.org.

Simons LPA, Hafkamp MPJ, Bodegom D, Dumaij A, Jonker CM. (2017). Improving Employee Health; Lessons from an RCT. Int. J. Networking and Virtual Organisations, Vol. 17, No. 4, pp.341–353. DOI https://doi.org/10.1504/IJNVO.2017.088485

Simons, LPA, Heuvel, AC van den, Jonker CM. (2018). eHealth WhatsApp Group for Social Support; Preliminary Results, pp. 225-237, presented at the 31st Bled eConference. Bled, Slovenia, Proceedings retrieval from www.bledconference.org. ISBN-13: 978-961-286-170-4, DOI: https://doi.org/10.18690/978-961-286-170-4

Simons, LPA., van den Heuvel, W. A., & Jonker, C. M. (2019). WhatsApp Peer Coaching Lessons for eHealth. In Handbook of Research on Optimizing Healthcare Management Techniques (pp. 16-32). IGI Global, ISBN 9781799813712.

Simons, LPA, (2020a). Health 2050: Bioinformatics for Rapid Self-Repair; A Design Analysis for Future Quantified Self, pp. 247-261, 33rd Bled eConference. June 28-29, Bled, Slovenia, Proceedings retrieval from www.bledconference.org. ISBN-13: 978-961-286-362-3, DOI: https://doi.org/10.18690/978-961-286-362-3.17.

Simons, LPA, Heuvel, AC van den, Jonker CM. (2020b). eHealth WhatsApp for social support: design lessons. International Journal of Networking and Virtual Organisations, 23(2), 112-127. DOI https://doi.org/10.1504/IJNVO.2020.108857.

Simons, LPA, Neerincx MA, Jonker CM (2021). Health Literature Hybrid AI for Health Improvement; A Design Analysis for Diabetes & Hypertension, pp. 184-197, 34th Bled eConference. June 27-30, Bled, Slovenia, Proceedings retrieval from www.bledconference.org. ISBN-13: 978-961-286-385-9, DOI: https://doi.org/10.18690/978-961-286-385-9 .

Simons, LPA, Gerritsen, B, Wielaard, B, Neerincx MA (2022a). Health Self-Management Support with Microlearning to Improve Hypertension, pp. 511-524, 35th Bled eConference. June 26-29, Bled, Slovenia, Proceedings retrieval from www.bledconference.org. ISBN-13: 978-961-286-616-7, DOI: 10.18690/um/fov.4.2022

Simons, LPA, Pijl M, Verhoef J, Lamb HJ, van Ommen B, Gerritsen B, Bizino MB, Snel M, Feenstra R, Jonker CM. (2022b). e-Health Diabetes; 50 Weeks Evaluation. Int. J. Biomedical Engineering and Technology, 38(1), 81-98.

Simons, LPA, Neerincx MA, Jonker CM (2022c). Is Google Making us Smart? Health Self-Management for High Performance Employees & Organisations, International Journal of Networking and Virtual Organisations, Vol 27, No 3, pp.200-216. DOI: 10.1504/IJNVO.2022.10053605

Starr, J. (2008). The coaching manual: the definitive guide to the process, principles and skills of personal coaching. Prentice Hall, New York.

Swan, M. (2012). Health 2050: The realization of personalized medicine through crowdsourcing, the quantified self, and the participatory biocitizen. Journal of personalized medicine, 2(3), 93-118.

Swan, M. (2013). The quantified self: Fundamental disruption in big data science and biological discovery. Big data, 1(2), 85-99.

Vaishnavi, V and Kuechler, W. 2004. Design Research in Information Systems. Last updated August 16, 2009 from http://desrist.org/design-research-in-information-systems

Wickramasinghe, N., & Goldberg, S. (2010). Transforming online communities into support environments for chronic disease management through cell phones and social networks. International journal of networking and virtual organisations, 7(6), 581-591.

Zhou, B., Perel, P., Mensah, G. A., & Ezzati, M. (2021). Global epidemiology, health burden and effective interventions for elevated blood pressure and hypertension. Nature Reviews Cardiology, 18(11), 785-802.