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HEALTH SELF-MANAGEMENT SUPPORT WITH MICROLEARNING TO IMPROVE HYPERTENSION

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Abstract High blood pressure is a leading cause of premature death. Healthy lifestyle choices (of diet, exercise, sleep and stress) could offer significant results. However, health literacy and -competence are lacking in most people, compared to best practice health choices, so there is room for improvement in creating hypertension self-management results. We tested an intensive two-week Self-Management Support (SMS) pilot, using daily feedback and microlearning cycles. Participants (n=8) reduced their blood pressure from 145/92 to 126/86 mmHg on average. User evaluation on effectiveness of the health support elements highlighted the importance of key SMS components like: information transfer, daily monitoring, enhancing problem solving/decision making, self-treatment using a tailored action plan, coping skills and ongoing follow-up with skilled coaches. Moreover, several aspects from microlearning, peer coaching, results-achievement and feeling better (=intrinsic motivation) were useful and hold promise for future intervention updates.

Keywords: self-management support, microlearning, peer coaching, eHealth, hypertension.

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1 Introduction

We all know that health plans and healthy New Year's resolutions are usually pushed to the background relatively fast. The book 'Will power' elegantly describes how other priorities in 'the rest of our lives' soon draw most of our time and attention away from our new health plans (Baumeister & Tierney, 2012). So how to create healthy behaviors then? One solution is to aim for health literacy and intrinsic motivation (e.g. feeling better when in healthy patterns than in unhealthy patterns) to create healthy patterns that are self-sustaining or even self-growing. For example: if someone really enjoys tennis games and joins a club to play regularly, this fosters both intrinsic motivation (=fun of playing) and competence growth (increasing skills, stamina etc via practicing and wanting to continue tennis).

By contrast, health advice in standard care for a person with hypertension is often somewhat simplistic when viewed from a learning/teaching perspective and it is slow in its feedback cycle: e.g. "Try exercising more and reducing salt, then come back in three months to check your blood pressure again." This contrasts strongly with the lessons from SMS (Self-Management Support) literature for the need of individualized learning support, plus regular monitoring and follow up coaching (Dineen-Griffin, 2019). Thus it may be not surprising that many people experience unsatisfactory and/or slow results, leading them and their doctors to conclude that healthy lifestyle doesn't help them enough.

Hence we developed an intervention to combine two opportunities: Firstly, multiple studies show that rapid and significant blood pressure improvements are possible with healthy lifestyle. So we aim to achieve rapid improvements with our participants, see hypothesis 1 below. Secondly, even 'experienced patients' often lack the health literacy and -skills to create the most effective and sustained health habits. This means there is a lot of room for improvement. So in order to foster rapid improvements in health self-management skills, our intervention aimed to combine high impact health behaviors with twice-daily blood pressure monitoring and daily learning/training cycles.

We describe the results and user evaluations from a feasibility pilot of a 2-weeks high impact SMS lifestyle intervention, using a daily learning- and results feedback cycle. Apart from testing feasibility, attractiveness and robustness of the intervention with

n=8 participants, we also wanted to qualitatively evaluate results on two underlying research hypotheses for our intervention design:

Hypothesis 1: Significant blood pressure improvements can be achieved within two weeks, which are meaningful enough for participants in order to support health competence training and daily microlearning.

Hypothesis 2: Using high frequency microlearning in a multicomponent SMS intervention format with daily coaching and feedback can foster health literacy, health competence and habit formation, besides supporting motivation and self-efficacy.

2 Theory and concepts

Regarding the ***biology and effectiveness*** of healthy lifestyle interventions for tackling hypertension, longstanding research lines exist: 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). We translated these research findings into explicit advise/lifestyle options for our participants to ***generate short term, measurable improvements*** for their endothelial health and blood pressure. This aimed to help jumpstart their positive feedback and learning cycles.

Central to the findings in the field of health ***Self-Management Support (SMS)*** is the need to have ongoing, tailored training/teaching cycles with individuals in order to build up their competences for health self-management (Jonkman, 2016, Dineen-Griffin, 2019). On the one hand there are several elements for the overall setup and quality of support: an activated participant / patient, skilled health professionals /coaches, face-to-face and multicomponent interventions in order for participants to have rapport with the health professional(s) and build up commitment for multiple self-management and self-education efforts, as well as having multiple options to tailor the action plan to their own context and priorities (Simons, 2020a, 2021).

On the other hand, several general ***support process*** components (besides support for specific health behaviors: e.g. exercise, diet, sleep, smoking etc) have been identified which are conducive to competence building of participants (Jonkman, 2016, Dineen-Griffin, 2019). This set of SMS process components also forms the ***evaluation framework*** we used for evaluating this feasibility pilot:

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

Next, several ***microlearning*** insights and concepts are relevant to our objectives of increasing health behavior competence levels of participants. Especially since our study took place in a work context, with most participants having quite busy work lives, 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, 2018). Hence, supplying concise single-learning topics to fit in between tasks or when employees can spare 5 – 15 minutes helps. Giurgiu (2017) states that microlearning should focus on only what you need to know. And that it should fulfill the human craving for instant gratification: satisfying short term goals that support long term goals. Gabrielli et al (2017) stress the "contextual, lifelong learning process [where microlearning must] enable 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, 2018). Finally, few things support motivation and competence building as much as achieving results (Simons, 2010, 2014, 2015, Greger & Stone, 2016) In sections 4 and 5, user evaluation results and discussion, we will reflect on the added value of the various eHealth intervention components for microlearning competence building.

3 Method

This study is an example of ***design research*** for health SMS (different from design science), since design research is aimed at creating knowledge for solving domain specific problems. In designing our intervention we followed the design cycle phases of Verschuren & Hartog (2005) and in this paper we focus on phases '6. evaluation' and '1. first hunch'. Our 'first hunch' is expressed in the two research hypotheses in the introduction (in short: that rapid blood pressure improvements and high-frequency microlearning support health competence development). Regarding phase 6 'evaluation', there are two aspects in this ***feasibility*** pilot. On the one hand we evaluate the attractiveness, feasibility and robustness of the intervention. This includes answering research hypothesis 1 regarding the effectiveness and added value of aiming for short term blood pressure improvements. On the other hand, we conduct a ***user based design evaluation*** on the perceived usefulness of the various elements in our multicomponent intervention, for qualitative answers on research hypothesis 2.

The health SMS ***intervention*** format is an updated version of the format used in the first two weeks of the high intensity T2D (Type 2 Diabetes) intervention described elsewhere (Simons, 2016, 2022). The updates regard blood pressure specific updates, a healthy menu App, a two-week-focus for training health competence skills and a much lower time investment: this to increase efficiency and improved fit with busy work schedules of employees. Core components of the ***eHealth intervention*** are: low threshold *mail triggers twice a day* for *blood pressure monitoring*, individualized *feedback and daily coaching*, *group coaching* and education, daily *peer coaching*, a *menu support App*, a *portal* with personalised *progress*, *online content* and *eTools* for health, lifestyle and blood pressure, plus *specific blood pressure lifestyle quick wins* that participants could use to kickstart their improvements. Apart from the tools and contact instances used, an important contribution for the ***microlearning*** field is the explicit strategy throughout the intervention to create multiple moments daily for learning, experimentation and reflection, in order to stimulate daily competence building cycles. There were on-site group sessions on Monday, Wednesday and Friday of week 1 (and digital group sessions on Tuesday and Thursday), plus on Friday of week 2, besides brief individual coach sessions per participant when needed, as a form of stepped care. Two coaches supported the group. For reasons of practicality, the intervention (and official blood pressure progress monitoring)

started on Monday morning of week 1 and finished at Friday morning of week 2, both moments combined with a group coaching and education session.

Study ***participants*** were university employees who volunteered for participating in the intervention, starting half-way November 2021 (n=8). All of them provided written consent for inclusion in these (anonimized) study results. Most of them (n=7) had participated in a more general employee health support program (Simons, 2017) somewhere in the 11 years before this intervention. Inclusion criteria for participation in this 2-weeks intensive blood pressure intervention were: commitment to making lifestyle changes and participating in the various coaching and support formats, plus having hypertension stage 1 or 2, hence systolic pressure between 130 – 179 or diastolic pressure between 80 – 119. Participants were asked to start measuring their blood pressure twice a day, three or four days before start of the intervention, logging the results in their dashboard via our email prompts. It turned out that one of the participants had slightly lower blood pressure at start than he thought, having 'heightened' levels in 5 of the 8 and 'hypertensive' levels in 3 of the 8 measurement moments before start, according to AHA norms (Whelton & Carey, 2017). The other participants consistently had hypertensive values before intervention start. After 2 weeks and 10 weeks group session user evaluations took place to collect feedback. Since the intention was to create health competences during the two weeks that would also have longer lasting value, survey-based individual feedback on intervention attractiveness and perceived usefulness of the intervention's components was collected at 10 weeks follow up, the results of which are reported below.

4 Results

There are two types of results confirming ***Hypothesis 1*** ('Significant blood pressure improvements can be achieved within two weeks, which are meaningful enough for participants in order to support health competence training and daily microlearning'). Firstly, Figure 1 illustrates that average blood pressure improved from 145/92 mmHg at start to 126/86 mmHg on Friday morning, eleven days later. Thus, diastolic pressure improved 7% and systolic pressure improved 13%, on top of the fact that one participant discontinued medication after week 1, following consultation with her physician. The overall improvement trend was visible across all participants, even the one participant who was not consistently hypertensive at

start, making the results relatively robust. Overall (though this cannot be statistically verified due to small sample size) the general research finding that larger lifestyle improvements lead to larger health improvements (Greger & Stone, 2016) was also visible as a trend in this group.

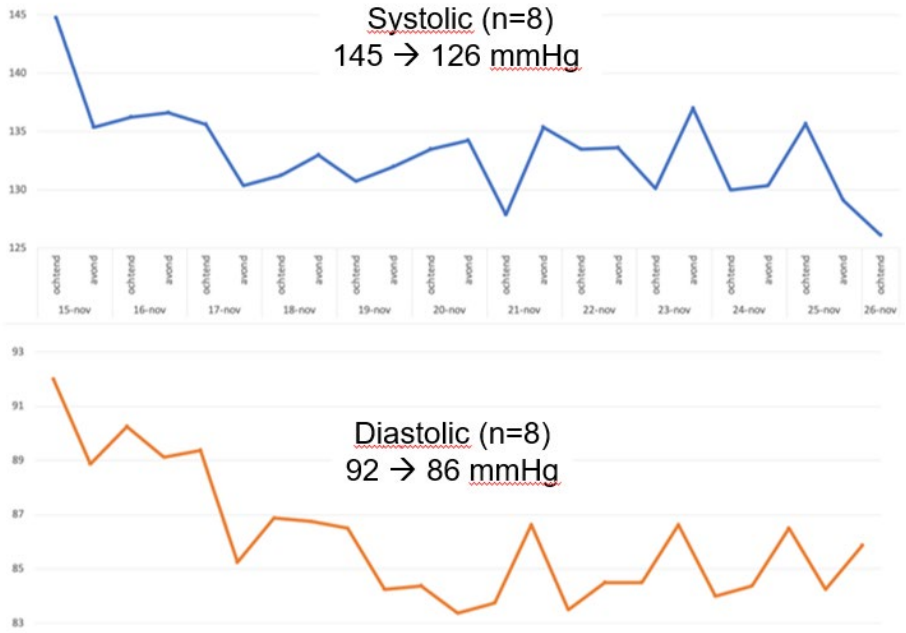

Figure 1: Average blood pressure improvement (n=8)

Secondly, most participants made explicit remarks during the group sessions on the direct effects they noticed between their health behaviors and their blood pressure. For example: working late, poor sleep, various dietary choices, exercise benefits, explicit relaxing vs. continued work day stress. Thus there was a double effect regarding meaningful feedback from blood pressure monitoring: individual lessons learned, but also sharing experiences in the group, which helped educate and motivate participants, even on days that they themselves did not have improved measurements.

Next, user evaluations showed qualitative confirmation for ***Hypothesis 2*** ('Using a microlearning approach in a multicomponent SMS intervention format with daily coaching and feedback can foster health literacy, health competence and habit formation, besides supporting motivation and self-efficacy'). We discuss two forms of user feedback. Firstly, Table 1 shows user evaluations on the perceived usefulness of the intervention components for supporting healthier behaviors. To guide interpretation, we clustered the components according to the SMS process framework, even though some components support more than one SMS process, as we will describe below Table 1. 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 behaviors?'

Table 1: Components that stimulated healthier behaviors (7-point (dis)agree, n=7/8[1])

Monitoring:	**Avg Score**
1. Mail triggers for blood pressure logging	4.9
2. Daily management	5.4
3. Gaining more blood pressure control	6.3
Information transfer:	
4. Start workshop	6.4
5. Healthy menu suggestions in the food App	4.4
6. Health and blood pressure information in portal	5.4
7. More understanding of blood pressure & health	6.1
Competence building:	
8. Follow-up workshops	6.3
9. Individual tips and answers to my questions from the coaches	6.6
10. Doing this as a group	6.4
11. Tips in dealing with challenges	6.0

In Table 1 we can see that the main perceived benefit from *Monitoring* was the amount of blood pressure control participants gained (3.), which is confirmed by the user explanations from Table 3 below. Regarding the second SMS process element, *Information transfer*, Table 1 indicates that the start workshop (4.) and increased understanding of blood pressure and health (7.) were valued most. These two

[1] 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 1 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. For n=8, the avg scores were resp.: 5.0; 5.5; 6.3/6.0; 4.3; 5.3; 6.0/5.9; 6.5; 6.0; 5.6.

intervention components (4. & 7.) were not just about information transfer, but also about increasing competences regarding: 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 third SMS process element, *Competence building*, is key for training sustainable self-management skills and behaviors, especially since daily life provides several challenges to healthy behavior, as also listed in Table 2. All four components (8. to 11.) scored at least 6 out of 7 on average, so support for competence building was generally valued by the participants.

Table 2: Challenges to adopting healthy behaviors (participant group inputs)

Challenges:
1. Dealing with social events (and pressures towards unhealthy foods/drinks).
2. Involving family members, who are often attached to old patterns. Family dinner food dilemma's/choices which they may not follow.
3. How to stay on course? (What helped us: tips & tricks, peer support group, putting things in perspective.)
4. The first week's effects are easy; achieving the same degree of progress (and thus motivation) the second week is harder.

Table 2 lists some of the main challenges of participants in adopting healthier behavior patterns. These inputs were given during in response to the question: 'Which things did you find challenging in adopting healthy behaviors?' In Table 3 we list participant group inputs (by the end of week 2 and week 10) on the question: 'What helped you to achieve healthy behaviors?'

In short, participant feedback highlighted the importance of not only monitoring and information, but also the diversity and complexity in developing and practicing the wide range of competences involved in making multiple daily 'blood-pressure-healthy' behavior choices. Participants gave various examples of the forms of competence support also present in the SMS framework: decisions/problems solving, plan making, coping management and resource utilization. As elaborated in the discussion section below, the daily competence building moments strongly depended on the full breadth of the eHealth intervention mix.

Table 3: What helped to achieve healthy behaviors (participant group inputs)

What helped:
1. **Rapid feedback** from twice daily monitoring: see direct effects from behaviors.
2. Achieving **results** and enhancing **self-efficacy**: confirming you are on the right track. And the belief you can do this. Week 10: The power of experiencing that it really works. And confirmation that you can do this.
3. **'Quick results'-tips** (like using flax seed, beet juice and daily physical activity): to kick-start rapid results fast.
4. **Education**: which behaviors give the **largest results**.
5. **Practical tips for every-day choices and practicing new behavior patterns** (diet, exercise, sleep, alcohol, stress etc), including clever strategies and products in the supermarket. Week 10: All those practical tips to make things easier: for example healthy pizza base and toppings we can find in the supermarket.
6. **High quality coaches and coach sessions** (individual and group) **to increase mastery and health competences**: for questions, practical tips, deeper knowledge, reducing noise/confusion.
7. Helps to be in a **group with peer support**: for inspiration, peer coaching, practical tips and commitment/motivation, stimulating and teaching each other.
8. Education & peer coaching on **coping**: how to deal with various challenges (involving/coping with family and social context; low-salt or low-cheese; fast & healthy meals; time and tips for exercise and moderate level physical activity.)
9. Week 10: Building **healthy** '**new normal' patterns**: Easily replaced breakfast and lunch with healthier options. Or: Many 'heart-healthy' foods are now standard stock in our cooking. Or: Gotten used to new tastes (e.g. no cravings for sugar or salt). Or: Step counter as a tool for triggering regular activity. Or: Seeing the effects of stress on hypertension: impetus for better stress management habits.
10. Week 10: Power of **repetition and follow up**: some 'familiar health advice and resources' much more intensively internalized and used, in the past 10 weeks.

At the end of week 10 we asked three satisfaction questions (range 1 to 10), looking back at: the support received (score: 8.6), their health behavior progress after 2 weeks (score: 7.7) and evaluating their remaining health behaviors after 10 weeks (score 7.4)[2]. ***Two elements stand out in their feedback***, which extend beyond standard SMS literature. Firstly, the ***large added value of the group process***: not just for motivational reasons, but also for daily peer coaching, inspiration and practical tips.

[2] For n=7 participants. If we include the 8th participant who missed part of the sessions, see footnote 1, the scores were 8.4, 7.6 and 7.2 respectively.

Secondly, ***how baffling and inspiring it is to see how much blood pressure improvement can be achieved within 11 days:*** "By experiencing how well this works, I built up a strong belief in what else I could achieve after those first two weeks."

5 Discussion and contribution

This feasibility study has several ***limitations***. Firstly, due to its small scale (n=8) our two hypotheses are only qualitatively confirmed, not quantitatively. Secondly, our group of participants was not homogenous, nor was their use of all our support components. (On the upside, robustness of the intervention is thus tentatively confirmed, given that all participant blood pressures trended towards improvement, despite the heterogeneity.) Thirdly, the study tested multiple intervention components together, without control group, so interpretations of effectiveness and added value are of an (inter-)subjective nature.

Still, given the extensive qualitative inputs from this feasibility study, we tentatively propose some ***contributions to theory***. Firstly, whereas Self-Management Support theory mostly aims at managing diseases, symptoms, medication and on preventing disease progression towards worsening situations, we propose that focusing on *disease reversal* and on rapid, positive health results creates added value: not just for motivation and feeling better, but also for health literacy and -competence building. As one participant said: *"I now understand better how blood pressure improvement also represents healthier arteries and health overall."* Secondly, the difference between learning and competence building became quite apparent in this study: *doing and experimenting* rather than (cognitive) learning. One of the big challenges in the busy lives of the participants was to create enough time and focus for this. Three participants indicated that they had not been able to implement/attempt all the lessons they learned, even thought the concise, high-frequency microlearning approach in two weeks helped their learning focus. Some longer, 'deep dive' training formats were suggested: *"It is hard to implement all the useful tips. For example a supermarket safari for showing healthy choices would help my shopping choices further."* Thirdly, SMS and microlearning theory mostly focus on managing an individual's learning process. However, the power of *group support* we observed goes beyond motivational, affective or supportive (Simons, 2018, 2019, 2020b) aspects. Building on *Social Cognitive Learning* theory: competence building is enhanced by seeing, discussing and reflecting

on results of others and their experiments. In their words: *"By doing this together, I get much further. I learn a lot from the others' examples, suggestions and discussions."*

It may be easy to overlook the role of technology in this intervention, but ***technology was integral*** to many of its components, even beyond the eHealth/mHealth opportunity outlook given a decade ago (Simons & Hampe, 2010): 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; MS Teams meetings enabled daily 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). All in all, the multiple competence building lessons each day, which were the backbone of this intervention, were largely dependent on these technologies and tools.

To conclude, this intervention was attractive and feasible for the participants, as well as effective for achieving blood pressure improvements within 11 days, most notably an average drop in systolic pressure from 145 to 126 mmHg. The intervention offered many options for tailored information transfer, monitoring, coaching and competence building in the Self-Management Support (SMS) framework. On top of that, it illustrated the added value of: (a) group/peer coaching; (b) self-efficacy boosts by using 'quick-win options' and achieving relatively large health results within several days; (c) multiple (technology-enabled) health competence building lessons each day. These options hold promise for future health Self-Management Support innovations.

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