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SELF-EFFICACY IMPROVES UTAUT TO DESCRIBE ADOPTION OF HEALTH-ENHANCING PHYSICAL ACTIVITY PROGRAMS

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Abstract There is consensus in health studies that regular physical activities of sufficient intensity and duration contribute to better health both in the short and long term. In an ongoing research program, we focus on getting young elderly, the 60-75 years age group, to adopt and include physical activities as part of their everyday routines. Regular health-enhancing physical activities can serve as preventive health care, which will improve and sustain quality of life and build up savings in health-care macro costs for an ageing population. We have learned that digital service tools can be instrumental for the adoption and use of activity programs, and that the Unified Theory of Acceptance and Use of Technology (UTAUT) is instrumental for the acceptance and use of digital tools and services. We will argue that the UTAUT is not sufficient as such but can be enhanced to describe the adoption and use of health-enhancing physical activity programs.

Keywords:
physical activities,
young elderly,
digital service tools,
UTAUT,
self-efficacy,
HEPA.

1 Introduction

We work out a theory framework for the adoption and use of HEPA programs among young elderly with the guidance and support of digital tools for logging physical activity. HEPA is an acronym for *health enhancing physical activity*, which translates to physical activity (PA) of enough intensity and duration to give short- and long-term health effects. A HEPA program consists of one or several physical activities that will give health effects when carried out over some period (typically, weekly programs adopted and used for several months); the combinations of PAs to programs work out individual PA characteristics and how well they combine (PAs may be conflicting or supportive); well-balanced, effective, and enjoyable combinations of PAs form the basis for HEPA programs.

Health recommendations agree on that regular PA at moderate intensity for at least 150 minutes per week will have positive health effects (cf. [34]). The European HEPA network offered some guidelines (in 2000): “health-enhancing physical activity is any form of physical activity that benefits health and functional capacity without undue harm or risk”. The guidelines state that “physical activity does not need to be strenuous to be effective. Thirty minutes a day of moderate-intensity activity is enough to benefit health”. These guidelines may be too general and not effective enough for HEPA programs (cf. [19], [24]).

Our context is the young elderly – the age group 60-75 years – which public policy more or less has ignored – “*we are too healthy, to active, with too good social networks to need any intervention or support from public resources*”; and “*we are too many*”, a sarcastic interpretation of prevailing political opinions. Nevertheless, young elderly should be given some priority - HEPA programs would offer long-term effects in cumulative health and social care costs; even a few percentage points in cumulative savings will be significant in actual numbers – in Finland, the young elderly group is 1.3 million and the annual health care costs for this group was 3.7 B€ in 2019 according to the Finnish Institute for Health and Welfare.

A renowned physician, himself part of the young elderly age group, has found that – if you adopt and continue with systematic HEPA programs when you turn 60, then you get 10 more good senior years. This insight gains support from a large number of research programs (for example, [4], [34]). Nevertheless, the insight has

not turned into action programs; the ATH 2010-2017 study in Finland (ATH, 2019 [13], [14]) shows that in the age group 55-74 years only 15% spent several hours per week in PA-programs; in the 75+ age group we are down to 7%.

The pensioners organizations are aware of the problem and the challenges; they develop and run PA programs among and for their members. We learned that most offered PA programs, (i) are not intensive enough, (ii) are not running for enough time, and (iii) are not regular and interesting enough to become sustainable habits for young elderly. The policy is that the programs should “fit every-body”, which requires that they be adapted to the participants that have spent least time with physical activity and exercise. The complaints get young elderly to drop out of the organized activities. Thus, we should find some better way to get them to adopt and sustain physical activities and exercise.

The “better way” is the *DigitalWells* (short for *Digital Wellness Services for Young Elderly*) research program 2019-22 that recruited more than 800 participants from the pensioners organizations (and 200 more participants from other organizations). We developed digital service tools to support the participants with building and monitoring weekly programs. The tools also collect daily data on actual PA exercises, which is combined with data from follow-up surveys (collected with other digital service tools in 6-month intervals) on perceptions of how effective participants believe their exercises are. Data is collected in cloud-supported databases for analysis - both cross-sectional and longitudinal - to answer research questions in series of studies (cf. [18], [20], [23], [32]); here we will summarize some of the results and further develop a couple of research questions.

In *DigitalWells* we want to find drivers that could get young elderly (i) to adopt and use HEPA programs (RQ1) when aided by digital service tools, and (ii) to sustain the adoption of HEPA programs (RQ2).

In Information Systems research the first choice for a theory framework would be the UTAUT (cf. [36]), as we assume that the HEPA adoption and use can be aided by digital service tools. The UTAUT describes the acceptance and intention to use digital service tools, but it is doubtful if it can describe the adoption and use of HEPA programs. Venkatesh [37] refers to his framework as the UTAUT paradigm for acceptance and use of technology; a paradigm (cf. [10]) is normative, rigid and

guides research to get valid and verifiable results; Venkatesh [37] is not paradigmatically restrictive but recommends adding constructs to the UTAUT as needed. Then our agenda is to find out if we can improve on the UTAUT to find answers to RQ1 and RQ2.

Section 2 is a short introduction to the methodology used, in section 3 we summarize some results from studies carried out in *DigitalWells* with the UTAUT framework and compare them with several similar studies collected by Venkatesh et al [37]. Section 4 introduces Self-efficacy for Exercise as an alternative framework, which is tested with an empirical study that is summarized in section 5. Section 6 offers an outline of how self-efficacy combined with ELM (the Elaboration Likelihood Model) can improve on UTAUT to describe the adoption, use and sustained adoption of HEPA programs. Section 7 is a short summary, conclusions, and an outline of the next steps in the research process.

2 Methodology

The *DigitalWells* research and development program has been running 2019-22. It was initiated in cooperation with three pensioners organizations with 350 000 members that helped recruit volunteers for the program; *DigitalWells* collected 30 groups (with 25-25 members per group) and more than 200 participants from other organizations. Most participants spent 18-30 months with the program. The research design adapted to the objective of being a development program that that would attract and support participants to get active with PA exercise, to combine exercises to (weekly) PA programs and gradually develop the activities to (weekly) HEPA programs. No attempt was made to make random selections of the participants for the groups nor to build control groups that would not use the *DigitalWells* technology and support; the aim was to get as many young elderly participants as possible active with PA and then to sample the groups for the research program.

DigitalWells developed a PA logger application for smart mobile phones (Android, iOS) that was integrated to a (cloud-based) database infrastructure and later also synchronized with (Android, iOS) sport watches. The PA logger supported the participants with registering PA exercises, the intensity and duration of the exercises, built up a PA history for the participants and offered them (weekly, monthly, 6

monthly, yearly) reports on their PA programs with both numerical and graphical follow-ups.

The participants had a selection of 35 PA exercises (later expanded to 48 exercises) to choose from; each PA exercise was graded in terms of CPA-MET (cf. [40]) as *light*, *moderate*, *vigorous* and the effort spent in MET-min. A standard requirement for HEPA exercise is to reach 675 MET-min/week (cf. [14]) but there are some variations from this requirement for gender, age-group, PA history, etc. Follow-up studies showed that 96% of the participants reached HEPA levels after 3-4 months in the program. A large majority of the participants were active with 5-6 common PA exercises; the participants logged 294 140 PA exercise events over the program, which built a large database of actual PA efforts. All participants were registered with 8-number pseudonyms and had given written consent to having the data collected with the PA logger registered in the database (the local ethical committee deemed that no separate approval was required for the conducted studies).

Postdoc researchers worked with the participating groups as field researchers to initialize PA programs, to set up and support the use of the PA logger, the smartphone platform, the synchronization with the cloud-supported database and smartwatches, and to carry out follow-up studies. The field researchers worked first locally with the groups but after the covid-19 restrictions were applied all activities went digital. This offered some challenges for the participants, but follow-up studies showed that 91% of them could carry out all parts of the program.

Follow-up studies were carried out after 4, 6, 12, 18 and 24 months in the program with *LimeSurvey* using the participants' smartphones; this turned out to be an efficient and smoothly running setup. The surveys work with theory frameworks from UTAUT, IPAQ(E) and Self-efficacy for Exercise, the questionnaires built on self-reported assessments of how effective PA exercises are and of the factors that form the drivers in the theory frameworks. The judgments of the effectiveness of the PA exercises are followed up with the actual PAs for each participant (as registered with the MET-min/week (month, 6 months)); these were first self-reported and manually inserted in the PA logger, later they were also registered with cardio load from sport watches that were synchronized with the PA logger. The samples built up for the follow-up studies were sufficiently large and the data was analyzed with a selection

of standard models using SPSS 26 software: partial least square structural equations, multifactor analysis of variance, Wilcoxon signed-rank test, Mood's median test, etc.

The overall goal was to test the UTAUT conceptual framework with supporting, synergistic concepts to add analytical capabilities to the UTAUT. This approach has been used by Brown et al. [6] and Lallmahomed et al. [21], and we will try it out.

3 Results and Insight with the UTAUT Framework

The young elderly in the *DigitalWells* research program participated in a number of studies that have been published; here we will collect only a few results that are part of our storyline for answering RQ1 and RQ2. Makkonen et al. [23] noticed that there are rather few studies of digital wellness technologies among the young elderly, which makes it difficult to compare and cross-validate more general research results. They focused on PA logger applications, mobile phone applications that allow users to log, keep track of and get updates on their PA exercises. The study builds on a sample of 115 young elderly who used a PA logger to follow up on their weekly PA exercises; daily activity data was analyzed with partial least square structural equation modelling (PLS-SEM) using UTAUT2 as the research model (cf. [36]). Makkonen [23] found five of seven UTAUT constructs to be relevant (all participants had the same resource requirement, got the same training and support (no difference in facilitating conditions) and the application was free (no price value)) (cf. [36]). *Performance expectancy*, *hedonic motivation*, and *habit* were found to have positive and statistically significant effects on behavioral intention to adopt and use the PA logger; *habit* proved to be the primary construct. The results differ from previous studies (e.g., Yuan et al. [39]; Macedo [22]; Duarte and Pinho [11]) which typically bring out performance expectancy as primary construct. Talukder et al. [33] show a similar result, that habit is the strongest driver on use intention for wearable fitness devices. The study [23] follows a standard approach for studies based on the UTAUT framework (cf. [37]) and finds similarities and support among previous studies.

In two other studies [24], [25] Makkonen et al. focus on the adoption and use of digital wellness technologies and how the use evolves after an initial acceptance. This type of longitudinal study is important as it captures "lapses" in the intention to use and shows that the UTAUT constructs are not constant over time but change and

evolve (cf. Epstein et al. [12]). The studies collected PA logger data in three subsequent surveys, after about four months (T1), 12 months (T2) and 18 months (T3) of using a digital PA logger; a final sample of 91 participants was used as they responded to the survey at all three time points. The study used UTAUT2 (cf. [36], [37]) as the theoretical framework and two constructs - *hedonic motivation* and *habit* - had positive and statistically significant effects on the acceptance and use of the logger; *performance expectancy* had a positive and statistically significant effect at T1 and T3, but not at T2; *effort expectancy* had a positive and statistically significant effect at T2, but not at T1 and T3. The proportion of explained variance (R²) in behavioral intention was 73.2 % at T1, 77.0 % at T2 and 83.0 % at T3, which shows that the constructs capture behavioral intention quite well.

The results are interesting. First, the construct scores stabilized over time. Second, the scores declined quite strongly between T1 and T2, but less so between T2 and T3. A likely explanation is the novelty effect, where the PA logger first is perceived favorably but then more realistically with continued use; the longer the PA logger was used, the more effortful and less fun it was found; this shows in the scores for habit that declined strongly also between T2 and T3.

It appears that the UTAUT2 constructs for which there are statistical support – habit, hedonic motivation, performance expectancy and effort expectancy – explain intention to use a PA logger but not necessarily to adopt and use HEPA programs. It is of course plausible that once a PA logger is accepted with an intention to use it, the user starts PA exercises and may adopt HEPA programs. This type of cross-context influences is found as UTAUT extensions (cf. [37], Table 2 for a list of 37 studies).

Venkatesh et al [37] list several key hypotheses for extensions of the UTAUT framework (cf. [37], Appendix D); they also list hypotheses on factors that will not have a significant influence on behavioral intention: facilitating conditions, computer self-efficacy, computer anxiety and attitude toward using technology. Computer self-efficacy - the confidence a user has in his/her ability/competence to use a computer - is getting a minor role in the 2020's as smart mobile phone technology becomes a dominant platform – also among young elderly.

Nevertheless, *self-efficacy* is an interesting theory framework for drivers that could offer answers to RQ1 and RQ2. Self-efficacy is also attractive because there is some experience in combining it with the UTAUT framework (cf. [37]).

4 Self-efficacy and HEPA Programs

We will next explore self-efficacy and the possibilities it can offer as a conceptual framework for the work on HEPA programs. Bandura [3] shows that self-efficacy beliefs affect the quality of human functioning through cognitive, motivational, affective, and decisional processes. He further finds that self-efficacy beliefs influence how well people motivate themselves and win over difficulties through the goals they set for themselves, their outcome expectations, and causal attributions for successes and failures. This fits quite well an intuitive understanding of what is needed to start, continue, and then sustain the use of HEPA programs.

Bandura (cf. [1], [2], [3], [28]) introduced self-efficacy as “belief in one’s capabilities to organize and execute the courses of action required to produce given attainments” [2], or shorter “the belief that one can achieve what one sets out to do” [1]. The sources of self-efficacy are developed in four ways [3], through (i) *mastery experiences* (if people have only easy successes, they come to expect quick results and are easily discouraged by setbacks and failures; resilience is built by learning how to manage failure); (ii) *social modelling* (seeing people similar to oneself succeed by perseverant effort raises aspirations and beliefs in own capabilities); (iii) *social persuasion* (people who are persuaded to believe in themselves are more perseverant; individuals are encouraged to measure success by self-improvement); (iv) people rely on their *physical and emotional states* in judging their self-efficacy. There are several variations of the influences of self-efficacy (cf. [28]) since the first version was introduced in 1977.

Kari et al [20] studied how effective a digital PA application is in promoting self-efficacy for physical activity in several groups of young elderly that had been 12 months or more with the *DigitalWells* program. The study traced changes in self-efficacy, at T0, T1(+4 months) and T2 (+12 months) with online surveys and the Self-Efficacy for Exercise (SEE) Scale [52], a self-report instrument that has been tested also with older adults [31]. A participant assesses his/her ability to exercise for 20 minutes three times per week and reports his/her personal confidence on a [0, 10] scale relative to nine statements on obstacles; overall self-efficacy (TS [0, 90])

is the sum of the nine statement measures. The statistical significance of the changes was analyzed with the Wilcoxon signed-rank test [70]; the changes in self-efficacy were measured at both item and construct level.

As Kari et al [20] carried out the study 264 participants formed the initial group; 165 participants responded to all three self-efficacy questionnaires and formed the sample. At the construct level, the total score (TS) showed a statistically significant change both T0-T1 and T0-T2; the mean total score had increased from 56.0 (T0) to 62.0 (T1) and 61.5 (T2). The changes in self-efficacy were positive after 4 months and sustained at after 12 months. At the item level, three (of 9) items showed statistically significant changes both T0-T1 and T0-T2; four items statistically significant changes T0-T1 but not T0-T2 (all changes were positive, the mean score had improved). *Mastery experience* (cf. [2]) was the main explanation for increased self-efficacy. The PA application enables and supports self-tracking of PA exercises and offers graphical reports of collected PA data to allow users to verify that they have mastered chosen and started PA exercises.

In [20] Kari et al found that the total score (TS) for self-efficacy first increased and was sustained after 12 months. The increase is important for sustained PA (e.g., [26], [27], [38]) and for sustained HEPA when that is reached. The results are in line with earlier studies (e.g., [9], [15]).

Sustained self-efficacy improvement supports sustained adoption of PA exercise, which contributes to health benefits; when HEPA levels are reached it is reasonable that sustained improvement secures long-term health effects (needs to be verified in future research). Self-efficacy may not increase indefinitely, mastering PA exercises and a PA application will typically be accomplished in 1-2 months (cf. [24], [25]) and the increase in self-efficacy will wear off, but self-efficacy is a possible driver for sustained adoption of HEPA programs among young elderly.

Bandura [3] states ([3], p. 15) that “efficacy scales are unipolar, ranging from zero to a maximum strength of belief; a statement of intention should not be included in a self-efficacy scale”. This contrasts with the UTAUT which ends with “behavioral intention” (cf. [36]) but could be useful for the extension (cf. [37]) which ends with the actual use. Testing for self-efficacy should be done with controlled experimentation and self-efficacy should be raised or lowered by non-performance

means (cf. [2]); the stronger the self-efficacy among test subjects, the more demanding goals they set for themselves, the more effort they spend and the better performance they manage. Self-efficacy is positively related to subsequent performance after controlling for past performance, a positive contribution of self-efficacy to subsequent performance not only increases over time but is a stronger predictor than past performance at each of the time points (cf. [2]).

5 Empirical Tests of Self-efficacy and PA Exercise

Bandura (cf. [1], p 207) states that “the intensity and persistence of effort, and hence level of performance, should be higher with strong than with weak self-efficacy”. Thus, high self-efficacy should match high levels of PA exercise, increases in self-efficacy should match increases in PA exercise; thus, by building high levels of self-efficacy for exercise among young elderly we could build a basis for high and sustained levels of HEPA exercise.

With the group of 264 participants in [20] we carried out a first screening of how well the participants reached 675 MET-min/week, which is a simple HEPA standard. The initial check was at T0, follow-up 1 at T1 (+4 months), follow-up 2 at T2 (+12 months) and follow-up 3 at T3 (+18 months); not all participants answered the questionnaire at the later follow-ups.

675 MET-min/week	Initial	Follow-up 1	Follow-up 2	Follow-up 3
N	238	192	181	147
Percentage	91.9	97.5	97.8	96.7

The PA exercise efforts decline at the third follow-up. We checked the changes in self-efficacy T0-T1 and T1-T2 (data for the self-efficacy check at T3 is not yet ready) to find out if there are matches with the changes in PA exercise T0-T1 and T1-T2.

The 165 participants who responded to the self-efficacy study at T0, T1 and T2 formed the sample for the present study. Following Bandura (cf. [3]) we used the following control variables (simplified from the original sample to build larger groups): (i) agegroup (≤ 69 years; ≥ 70 years); (ii) gender (male; female); (iii) education (4 levels); (iv) used apps (< 3 years; 3-5 years; 6-10 years; > 10 years); (v) BMI (normal; overweight; obese); (vi) residential environment (5 categories).

A multifactor analysis of variance was used to find effects of the control variables on the difference variables (main effect model: MET0-MET1, MET1-MET2 and SE0-SE1, SE1-SE2). The MET_i is the total MET-min per week summed at T0, T1 and T2; the SE_i is the self-efficacy total score summed at T0, T1 and T2. Changes in self-efficacy and actual MET-minutes were calculated as difference variables T0-T1, and T1-T2. Bonferroni adjustments for multiple comparisons were used for pairwise comparisons. The statistical test is significant if the p-value is ≤ 0.05 . The analysis was carried out with the SPSS 26 software.

For MET0-MET1 there were three statistically significant factors: education ($p = 0.009$), BMI ($p = 0.018$) and residential environment ($p = 0.027$); the increase T0-T1 is larger in the university education group compared to the vocational education group; the increase T0-T1 is smaller in the obese group compared to the normal weight ($P = 0.30$) and the overweight ($p = 0.021$) groups; the increase T0-T1 is larger in the big city group compared to the small or medium-sized city ($p = 0.020$) and the countryside ($p = 0.042$) groups; for MET1-MET2 there were no statistically significant factors.

For SE0-SE1 there were no statistically significant factors; for SE1-SE2 gender is a statistically significant factor – the increase T1-T2 is larger in the male than in the female group. Kari et al [20] found that the self-efficacy total score had stabilized by T2 for the whole group, which means that there probably is a decline in the female group. The experience of using applications on smartphones (used apps (< 3 years; 3-5 years; 6-10 years; > 10 years)) was not a statistically significant factor for changes in neither self-efficacy nor PA exercise; the users' experience with both smartphones and applications are often mentioned as problems for the use of digital PA loggers (cf. [11], [15], [22]).

The present research design did not show the expected relation between positive changes in self-efficacy and PA exercise, which could have formed a basis for a more detailed analysis of the joint drivers.

6 Self-efficacy and ELM as UTAUT Extensions

The UTAUT2 served as a framework in several of the empirical studies summarized in section 3; the UTAUT2 is a relevant framework for study of acceptance of digital services like the PA logger (cf. also Yuan et al. [39]). We expressed some doubt that drivers that motivate young elderly users to accept and use the PA logger also make them adopt and use HEPA programs; here we found use for the Elaboration Likelihood Model (ELM).

The ELM was constructed by Petty et al. [29], (i) to work out influence processes and their impact on human perceptions and behavior, and (ii) to explain why a given influence process may have varying outcomes across different users in each context. Influence processes can contribute to either *intrinsic* or *extrinsic* motivations and help build inherent satisfaction or instrumental outcomes that could motivate HEPA programs. The key part would be how an influence process is used to motivate young elderly. It appears that with a larger group we need a series of influence processes (one process never fits all). The task would be to tailor influence processes for young elderly to get them interested in and to adopt HEPA programs; then to get them to move to sustained use of the programs.

The ELM has been used as a theory framework to describe and explain intention to use information technology (IT) (cf. [5]). The ELM logic appears to have some common ground with the UTAUT, and we have sketched out a joint conceptual framework. The ELM part includes self-efficacy as a driver and works out how PA (program) users (here, young elderly) adopt and accept sustained use of HEPA programs. The UTAUT part works out drivers for intention and then actual use (cf. [37]) of the PA logger to facilitate PA exercises and use of HEPA programs.

In ELM attitude is the key influence (cf. [5]) with moderating factors that include perceived usefulness, source credibility and argument quality (a function of source credibility); self-efficacy (job relevance in ELM for IT) and user PA history (user experience in ELM for IT) are added as moderating factors. In fig.1 perceived usefulness is now a driver for both the PA logger and the sustained use of HEPA programs and will (i) support logging of PA exercises, (ii) evaluate PA exercises with HEPA criteria, (iii) help organize PAs in PA programs, (iv) support goal setting for PA programs and (v) guide and support the choice of PAs for HEPA programs.

In terms of the ELM (cf. fig.1), perceived usefulness and attitudes to HEPA programs are intrinsic motivations for sustained use of the programs; more perceived usefulness strengthens attitudes (and vice versa). One of the early studies (cf. [23]) showed that performance expectancy, hedonic motivation and habit have statistically significant effects on behavioral intention to use a PA logger. These UTAUT constructs (cf. [37]) have some kinship with the ELM constructs for HEPA programs: performance expectancy (~ perceived usefulness), hedonic motivation (~ attitudes), habit (~ sustained use). In [16] demographic backgrounds do not decide the effectiveness of the PA logger, but previous PA experience can be more decisive (~ user PA history). In [17] participants fall in three categories – low, moderate, and high-level PA activists (~ user PA history) – who have different attitudes to PA exercise (and hence to HEPA programs). Self-efficacy – and sustained self-efficacy improvement – is a function of mastery experiences, social modelling, social persuasion, and physical and emotional states (cf. [3]); self-efficacy contributes to attitudes to HEPA programs and help form the sustained use of HEPA programs; the self-efficacy drivers are not included among the UTAUT drivers.

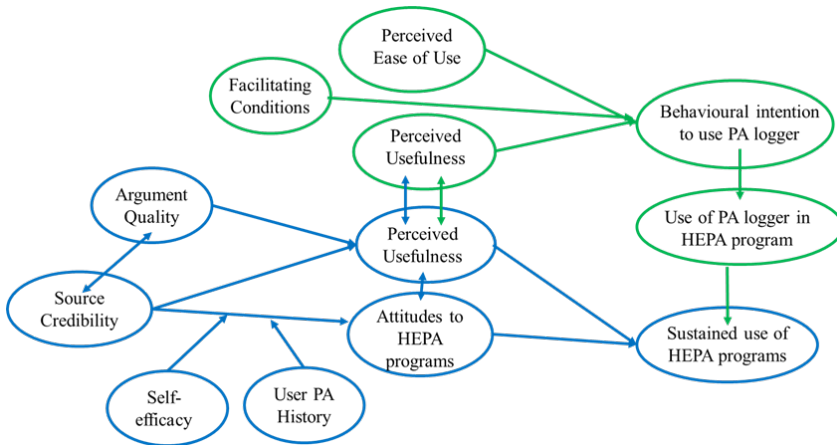


Figure 1: The ELM (blue) + UTAUT (green) framework applied to the sustained use of HEPA programs

The attitudes to HEPA programs build on getting better and sustained health effects; “to get more good years”. Argument quality and source quality build on verifiable medical research results to show that HEPA gives health effects, both in the short- and long term.

The users recruited for the *DigitalWells* program represent three main categories, which are expansions on user PA history, (i.1) regular PA users, who have been active for multiple years (even decades), (i.2) sporadic PA users who are active in an on-off mode, and (i.3) inactive PA users with on-off intentions to get active. The three categories show different attitudes to involvement with HEPA programs that require sustained and more demanding efforts. Self-efficacy brings out reasons to build mastery of HEPA programs, deciding on goals, (ii.1) to lose weight and get in (much) better shape, (ii.2) to stay in sufficiently good shape to be able to carry out daily tasks, but also (ii.3) to enjoy life and (social) pleasures without HEPA pressures, or (ii.4) to relax in retirement with no HEPA demands; the mastery could obviously cover both being active with and staying out of HEPA programs.

We propose that the PA logger will contribute to a sustained use of HEPA programs; for this we need only three of the UTAUT drivers for behavioral intention, (ELM will cover the rest of the drivers): (i) perceived usefulness (\approx performance expectancy); (ii) perceived ease of use (\approx effort expectancy) and (iii) facilitating conditions. The facilitating conditions are determined by the context and include (cf. [37]) digital experience, trust, and technology readiness.

Fig.1 now sketches out how the conceptual frameworks of ELM and UTAUT could combine to give a meaningful description of how our focus group adopts, uses and sustains the use of PA programs, with an intention to make progress towards HEPA programs, through the adoption and use of the digital PA logger, that could be part of a system of digital services {DS} that offer (for instance) coaching, gaming, evaluation of PA exercises with HEPA criteria, peer group interactions, (friendly) competition, etc. The extended {DS} system with the PA logger supports the adoption and use of PA programs, will support the progress to and sustain the use of HEPA programs for extended periods of time; details will be worked out in some next steps.

In the ELM framework we work out the usefulness of HEPA programs from attitudes to sustained HEPA, and the self-efficacy and history of individual HEPA/PA for a user. In the UTAUT framework we work out what digital services will be useful and if and how they are easy to use for sustained use of HEPA programs. This approach, to use synergistic combinations of conceptual frameworks was used by Brown et al. [6] and Lallmahomed et al. [21], and offers possibilities to

work out innovative, new models for description and explanation that are not available and verifiable with the original conceptual frameworks.

7 Summary and Conclusions

Physical wellness comes from physical exercise to build stamina, muscle strength and balance, and to ward off age-related serious illness; sustained physical exercise helps to meet everyday requirements. Studies show (cf. Wallén et al [34]) that systematic PA contributes to good quality of life in senior years. The understanding of why physical exercise matters comes from the young elderly themselves (cf. [7], [8]): “*it is nicer to get old if you are in good shape*” or a more sober version: “*to get good remaining years*”. These insights also capture a strong motivation to get in better physical shape.

We found it doubtful that drivers that get young elderly to accept and use digital tools also make them adopt HEPA programs, i.e., UTAUT is not sufficient as a theory framework. We propose to use a combination of Self-efficacy for Exercise, ELM and UTAUT to better describe adoption and use of HEPA programs and to propose that the use will be sustained with support from digital services. Using synergistic combinations of theory frameworks shows that the UTAUT can be improved with this approach, which then will have implications for enhanced use of the UTAUT framework in new, and so far, untried applications (following Venkatesh [37]). We further propose that the drivers we are searching for point to explanatory theories (in the sense of Popper [30]) that explain the sustained adoption and use of HEPA programs when the UTAUT framework identifies and describes useful digital service support.

The answers to RQ1 and RQ2 are already apparent in the text but will be summarized as follows:

- RQ1. What drivers could get young elderly users to adopt and use HEPA programs when aided by digital service tools? *Intrinsic motivations supported by extrinsic motivations, i.e. - expected inherent satisfaction supported by performance accomplishment, health goals and objectives* [“more good years”]
- RQ2. What drivers could sustain the adoption of HEPA programs? *Intrinsic motivations supported with progress in self-efficacy, i.e. - perceived usefulness, attitudes to HEPA programs supported with (progress in) self-efficacy (mastery experiences) with*

HEPA combined with ease of use, perceived usefulness of, and facilitation from digital service support.

Forthcoming research will explore what drivers are necessary and/or sufficient to get sustained adoption and use of HEPA programs with different types of user groups (male/female, age group, PA history, HEPA relevance, HEPA goals and HEPA programs) and in various contexts (HEPA individually, HEPA with friends, HEPA in organized groups, HEPA with personal/group coaching, HEPA with digital coaching, public (standard) HEPA programs, etc.).

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