RESEARCH-ARTICLE

Changing Health Goals with Personal Informatics

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Abstract

People's health goals change as their contexts, needs, and values evolve. Personal informatics (PI) literature recognizes the importance of supporting goal change; however, little is known about how these tools can best support the changes people go through with their goals. To understand how PI are currently involved in goal change, we conducted a survey (N=80) and interview (N=10) study with people who had recently changed their health goals. Overall, we found that PI gave limited support to people during goal changes. Changes were driven by four actors (i.e., who and what influences the goal change): internal motivations, contexts, PI, and social surroundings. We further highlight five factors related to goal change (i.e., the ways in which the actors affect goal change): challenge, self-efficacy, changing priorities, learning, and enjoyment. We discuss how PI could better support people in goal change by considering different implementations and interactions of actors and factors.

CCS Concepts

• **Human computer interaction (HCI)**; • **Interaction design**; • **Health informatics**;

Keywords

Goal Setting, Behavior change, Health, Wellbeing, Personal Informatics, Personal Data/Tracking, Qualitative Methods

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1 Introduction

Goal setting helps people manage their health and well-being [5, 34, 82]. The goals people set are shaped by their motivation, self-efficacy, the ability to overcome perceived barriers, and action planning [82]. In personal informatics (PI), goal setting is one of the most widely used strategies for health management [31]. Accordingly, setting goals enhances performance by providing clear direction, energizing effort, sustaining persistence, and fostering discovery and learning [58].

Meanwhile, many commercially available PI tools have been developed to support individuals in pursuing various health goals, including improving physical activity [3], supporting mental health [1, 48], managing menstruation and fertility [27, 35], and adopting a more holistic approach to health management [20, 49]. People often begin using PI tools with specific goals in mind [33]. However, as people engage in tracking and managing their health, their goals evolve and are adapted in response to changing values and challenges [41, 78, 79]. These changes stem from various motivations sources, such as changes in circumstances (e.g., new routines), feelings (e.g., boredom), capabilities (e.g., successfully achieving a goal), or major life transitions (e.g., becoming a parent) [79, 81].

While prior literature has highlighted the dynamic nature of goals, and frequent changes and adjustments made, PI literature has given limited focus on how to design for goal change. Significant work has argued for the benefit of tools that adapt and evolve as people's health goals change [17, 29, 31, 33]. However, much of the existing research has primarily focused on people's initial goal setting experiences, particularly helping them think about and establish goals when they start tracking [80], or on their experiences with a single goal connected to broader qualitative goals and eudaimonic needs [65]. In practice, people often work toward and navigate between multiple goals that span different aspects of their

health [1, 83]. This can involve adding new goals to an existing goal (e.g., incorporating new exercises into a training routine while still tracking other exercises), disengaging from one goal while still self-tracking a related goal, and revising goal priorities while pursuing concurrent goals (e.g., prioritizing sleep tracking over exercise tracking).

Our work expands prior work by positioning "goal change" as the "navigation of goals to fit different wants, needs, and experiences". Goal change can be as influenced in multiple ways, leading goals to evolve and adapt accordingly. By approaching goal change this way, we aim to address misalignments between goals that people have and PI goals which are used to manage health. Often, people are presented with goals when using PI tools that do not match their personal interests or goals [40] and are not suited well for situations where people manage different types of health goals [13, 31], which may shift in priority at different times [83]. Such misalignments can undermine people's confidence and motivation to pursue goals [11, 40], and lead to the lapse or abandonment of PI tools [17, 32, 33]. Conversely, when PI goals are aligned with people's personal goals, they can support long-term engagement with PI tools [40].

To develop PI that support people during goal change, a practical understanding of what affects people to goal change decisions is needed. Therefore, in this paper, we study the influences on goal change and the role that PI play. Through a survey study, we first investigate the effect and support PI tools play in people's goal change experiences. We then broaden and deepen our understanding of goal change through an interview study.

Our work will specifically address the following research questions: **(RQ1) What makes people change their health goals? (RQ2) How do personal informatics tools influence and support making decisions to change goals?** By tackling these research questions, we contribute to PI literature by providing insights into the *actors* (i.e., the who or what influenced people's goal change decisions) and *factors* (i.e., the ways in which the actors influenced goal change). Through analyzing our results in this way, we distinguish what makes people change their goals, where they find support for these changes, and look to the future at how PI should adapt to better support people through goal change. Our findings suggest that PI tools often play a supportive role, where they facilitate the pursuit of goal change rather than directly causing goal change. We focus on how these tools better accommodate fluctuations of goal pursuit and support confidence during goal change. Additionally, we reflect on the relationships between these *actors* – centrally through PI tools - and *factors*, and how they can more effectively support individuals. Specifically, we discuss how PI tools can integrate social circles into goal change.

2 Related work

2.1 Theoretical Reflections on Triggers of Goal Change

Goal change is a complex and multifaceted process, which requires numerous decisions that go along with contextual considerations (e.g., work schedule) and people's aspirations (e.g., completing a triathlon). According to Goal Setting Theory [58], people's goal commitment is closely linked to the importance they place on

goals, as well as their sense of self-efficacy and confidence towards goal completion. However, as values, needs, and circumstance shift, the importance of a goal may change [53], which results in people's reassessment of their commitment towards their goal. Therefore, shifts in goal importance, people's motivations, and their self-efficacy are key indicators that goals may need to be changed.

Goal importance relates directly to how much an individual values its achievement [58]. This value can stem not only from attaining the goal but also from the pursuit itself and the journey of the goal (e.g., enjoying the "feeling" of doing the activity [88]). As individuals age, their values evolve, which leads to shifts in their goals to cope with the new stages of their lives [78]. Consequently, goals are continuously reconstructed and changed when people face new challenges and personal development, like transitioning to parenthood [79]. Life transitions, whether voluntary or involuntary, can force people to modify their goals especially when they lack sufficient information about the process or alternatives [36]. This can be due to contextual changes requiring goals to change, such as moving to a new location, where people have different access to doing activities and changing routines often leading to need to switch everyday patterns [29, 92]. In addition, going through retirement changes people's routines, activities, and requires support in guiding a new set of goals and patterns in people's lives [90]. Moreover, challenges can change perspectives towards goals, such as being diagnosed with cancer changing goals to be viewed a more short-term, temporal way [41]. During such transitional periods, individuals may experience stress and uncertainty, requiring external support to cope and manage these transitions, which can affect their motivations and ability to maintain or adjust their goals as they navigate new circumstances [79]. Thus, changes in motivations are key aspects in determining how people adjust their goals in response to life's challenges.

Psychology literature is rich in explaining the role of motivation in goal pursuit and achievement. For instance, Goal Setting Theory describes **motivations** towards goals as the key determinant of goals pursued [58]. Accordingly, motivations can be either explicit, where individuals are consciously aware of their objectives (e.g., sharing weight loss goal with friends) or implicit, where goals are subconsciously influenced by external factors (e.g., as seeing a friend achieve their weight loss goal can affect ones eating habits) [58, 59, 84]. As people are often juggling multiple goals, the goals can support, conflict, or remain neutral to each other [54]. For example, the goal of reducing stress through running, may conflict with a goal to spend more time with family if they are not involved in the activity. This dynamic can lead to shifts in goal importance and prioritization dependent on other goals.

Goal change is closely tied to an individual's motivation, particularly intrinsic motivation, which is driven by personal satisfaction and interest. People are more likely to pursue and stay committed to goals that they find meaningful and enjoyable; and in contrast, external factors like monetary rewards or competition can undermine intrinsic motivation [75]. If the motivation is more extrinsic, (e.g., exercising for external validation), it may be more easily abandoned when conflicts arise [75]. Therefore, for goal change to be effective and sustainable, they should align with intrinsic motivation, ensuring that people continue to find their goals personally relevant and fulfilling [23]

As people's abilities change, so too do their needs and goals. For instance, physical limitations due to an injury may necessitate a change in fitness goals or a new diagnosis may lead to development of different health objectives. Such changes in goals are a moment when people may try something new and different. Through these changes in abilities and what goals people would like to pursue, people's **self-efficacy** should be supported. Goals are more likely to be achieved when people believe they can accomplish them [58]. Relatedly, feelings of **competence** are important for maintaining intrinsic motivation as people need to feel capable of achieving new, modified goals [75].

Self-efficacy plays a significant role in different phases of goal pursuit: in the beginning to imagine and believe in goal achievement, during goal pursuit to cope with challenges, and being able to be optimistic to try again after goal failure [5, 39, 82]. Self-efficacy affects people's motivations and their willingness to put effort towards their goals [6]. People can have negative feelings when changing goals caused from not knowing their capabilities and how to pursue a goal successfully [8]. Challenging goals can be viewed as threatening, which people can feel helpless to cope with [5, 26]. The way forward is to support self-efficacy which can be achieved through personal experience to accomplishing goals [7]. For example, knowing one has pursued and achieved a similar goal in the past, can help them feel confident to pursue the new changed goal. Self-efficacy can also be enhanced through support from other people and by modeling behaviors from others [7, 60]. Therefore, personal informatics goals need to be aligned and adapted to people's needs, aspirations, and motivations as well as supporting feelings of self-efficacy as their personal goals evolve.

2.2 Personal Informatics and Goal Change

Goal change is not an unexplored topic in personal informatics literature. Several models of personal informatics have shown that people engage in self-tracking with a wide range of motivations and often change their goals and practices as they find different benefits from their tracking tools [33, 65]. These models focus on how people go through changes in tracking habits and use of PI tools [33, 57], and how to support long-term goal setting adapt to people's personal needs [1]. People may change their PI tool and goals when their goals are achieved, due to contextual events, or to switch to another goal [81]. This line of work has mostly considered changes made to a single goal during people's tracking experiences. For example, the Goal Evolution Model shows how people narrow their data collection once a goal evolves from an abstract need (e.g. wanting to be healthy) to something that is actionable and quantifiable (e.g. wanting to walk 10,000 steps per day) [65]. Similarly, the Lived Model of Personal Informatics highlights people's lapses and changes in the PI tools they use a goal is achieved, or as they switch to another goal [33].

The Longitudinal Goal Setting Model describes how people go through identifying multiple goals, simplifying, and adjusting goals in the mental health context [1]. They highlighted that people often pursue multiple goals while tracking, calling for further research to understand how people change their goals and how PI tools can be designed to support integration between goals and long-term goal support [1]. People's multiple goals can be supported or hindered by PI tools [83], through being independent, complementary, or in conflict with one another [54]. Moreover, people often make complex decisions regarding their health goals and switch between health goals to make decisions [18]. For example, deciding when to pursue a physical activity can be affected by the social activities throughout the week. It is essential to consider the multiple goals people may be juggling between at one time, whether they are explicitly aware of them or are in their subconscious. Personal informatics also need to be framed to help people consider more contextual factors, such as friends and family's impact, when setting goals [29].

Personal informatics research has supported goal change by adapting goals to people's context [21], aligning goals to people's interests and identities [2, 66], and adjusting goals to personal abilities [50, 63]. For instance, the work of Alqahtani et al. [3] explored how reflection on self-efficacy supports goal adjustments to changing personal contexts. To further support self-efficacy in changing priorities, Munson et al. has explored the idea of secondary goals, where people have two different goals to aim for, one that is more challenging and one that is easier if the individual has other priorities that affect their ability to achieve their weekly goal [64]. The work of Jung et al. also introduced margins for goal achievement, so that people can still be considered achieving a goal if they were "good enough" or close enough to achieving [42]. Self-experimentation can be used to help people understand their current skills and formulate what goals to set in the future [56]. In this way, goals can be changed to better fit people's contexts and abilities. Recent literature has also used creative and social approaches, such as storytelling and peer modelling, to helped people increase their understanding of how to pursue a new goal [76]. In these ways, the goals are changed to adapt to people's current contexts, however long-term understanding on goal change is still an open-ended question.

In short, multiple studies have championed goal change as an essential topic for supporting long-term use and pursuit of personal wellbeing with PI tools [1, 17, 29, 40]. However, despite the evidence from psychology studies about the importance of various factors that affect goal change (see section 2.1), PI literature on goal setting has focused primarily on how these tools can support people in setting and achieving goals, rather than supporting changes to goals. Most personal informatics studies are done over short periods of time (between less than 1 month to 3 months [29, 31, 92]), making it challenging to look at how goals change over a long-term period.

3 METHOD

We used a survey and interview study to understand how individuals identify and express change in their goals while using personal informatics tools. First, an online survey was devised that aimed to understand the range of health goals that people pursued, if and how these goals had recently changed, and what role personal informatics played in these changes. Interviews helped us gain deeper insights into the results obtained through the survey, allowing us to explore why people decided to change their goals, and how their personal informatics and surrounding environment influenced these changes. We obtained ethical approval from our university before recruiting participants.

Table 1: Survey Questions Pertaining to Goal Change Experience

Question	Type of Question	Aimed at Understanding
PI tools used to track health	Open text	PI tools used
Reason for using PI tool	Open text	Motivations for using a PI tool
Current health goals (up to 3)	Open text	Current health goals pursuing
Personal informatics used for corresponding health goals	Open text	Which health goals are used for which PI tools?
If the provided goals are new or changed	Single choice for each goal	What are their changed health goals?
(Optional: If "No" to above) Provide a new or changed health goal	Open text	What are their changed health goals?
Reason for changing goal	Open text	What triggered the goal change?
Health goal before changing	Open text	What was their previous health goal?
If PI tool played a role changing health goal (if yes, reason)	Single choice + Open text	What role do PI tools play in changing health goals?
If PI tool caused challenges when changing health goals (if yes, reason)	Single choice + Open text box	What challenges were involved when changing goals with PI?
If use of PI tool changed after changing goals (if yes, reason)	Single choice + Open text box	How did the new goal affect use of the PI tools?

3.1 Study Procedure

3.1.1 Survey Study. We developed a survey to understand the breadth of health goals that people were pursuing, changes made to these goals, and how personal informatics tools factored into supporting and changing these goals. All authors iteratively designed and reviewed the survey questions for their relevance for answering the study's research questions. We included a mix of open and close-ended questions and distributed the survey via Qualtrics (the list of used questions can be found in Table 1). At the end of the survey, participants were able to share their email addresses for a follow up interview.

A link to the survey was shared on social media platforms through groups related to personal informatics tools, such as Reddit (e.g., subreddit r/Fitbit) and Facebook groups (e.g., the Samsung Health Global group). In addition, posters with QR codes linked to the survey were distributed around our university campus. In the recruitment material, we stated we were looking for participants at least 18 years old that (1) owned a personal informatics tool and (2) had changed their health goals at least once in the past 6 months, such as (but not limited to) deciding to participate in a new race, changing habits due to a "New Year's resolution", and changing ongoing goals due to life events (e.g. illness, injury). By focusing on participants who had changed their goals recently (i.e. within the past 6 months), we aimed at minimizing potential recall and temporal biases that might occur by recollecting experiences that had taken place in more distant periods of time (as discussed in [87]). Survey participants were not compensated for their participation.

3.1.2 Interview Study. Building on the breadth of motivations for goal changes that surfaced in the surveys, we sought a deeper understanding of how these motivations and changes unfolded in participant's daily lives. We invited survey participants to an interview where we discussed the role that their broader environment

might have played in their recent goal changes. Our conversations included the people, tools, events, and personal aspirations surrounding these changes. With this we aimed at understanding goal change in terms of people's lives and circumstances, or in Rooksby and colleagues terms [74], a lived perspective of people's goal changes and tracking use.

Interviews were semi-structured, lasting 53 minutes on average. Given the geographical spread of participants, the interviews took place both physically and online. The interviews were audio recorded via a phone or computer recording tool. Interview participants were compensated for their participation with a € 15 Amazon gift card.

For the interviews, a prompt activity with a timeline was used to support participants in remembering and reflecting on their goal changes, (as used in [45, 52]). We prepared a timeline on a Miro board [61] which the first author used to guide and prompt discussions and reflections with the interview participants (an anonymized filled in example of this activity can be seen in Figure 1 a blank example in supplement). The interviewer supported participants in filling and writing in the timeline during the interview. First, participants were informed of the purpose of the study, that they could stop the interview at any time, and their data would be anonymized. Participants were then asked to (1) think of the different health goals they had been, or were, pursuing over the past 6 months and, situate the goals chronologically on the timeline. We encouraged participants to think of and represent goals they were pursuing concurrently, and transitions between goals. This were used as starting points for discussing goal changes. Participants were then asked to note of any (2) surrounding events and motivations that may have changed their goals, and (3) if and how they used their personal informatics tools as they pursued and changed these goals. Following, we asked participants to draw a line (4) describing their motivation levels towards each goal and (5) how successful they felt were at achieving their goal and how that
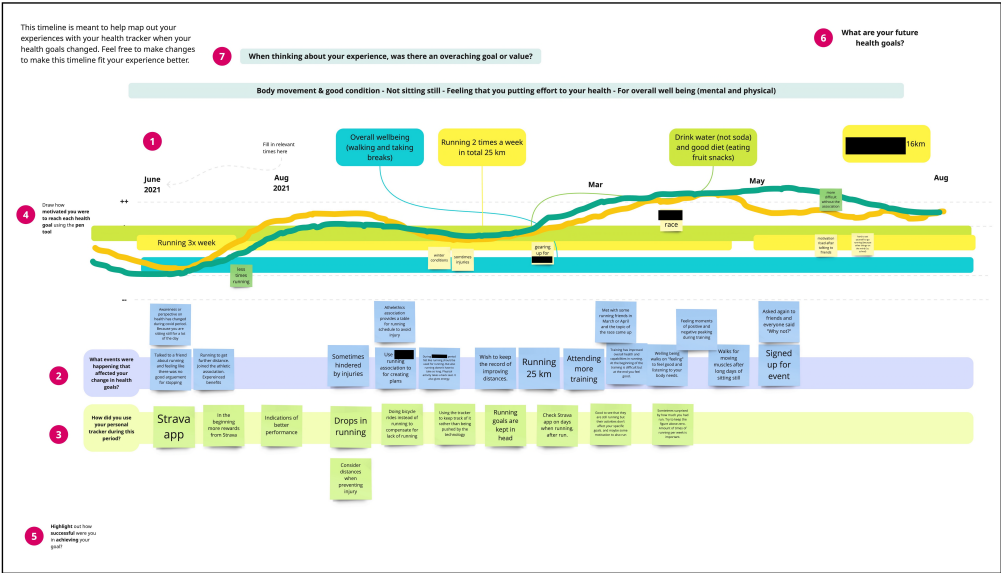
Figure 1: Blue squares mark events that affected people's goal changes and green ones describe the related use of their personal informatics tool. The green line represents motivation towards a goal and yellow line the success in achieving the goals.

changed over time. With this we wanted to understand if motivation and success played a role in goal changes. We asked if they had any (6) future goals, to see if any goals were being planned in being changed soon. We lastly asked participants to reflect (7) if they had any higher-level goals to understand if they had underlying goals, that they were aware of, they were relating their present goals to. Participants were then asked to reflect on the relation between goals.

3.2 Participants

In the following lines, we describe survey participants as N_{sur} and interview participants as N_{int}, quoting them as Sx and Px, respectively. We received 101 survey responses between February and June 2022. Of these, 20 were discarded due to being incomplete, resulting in 80 responses. Survey participants were mainly male (N_{sur}=51), young adults, between the ages of 25-34 (N_{sur}=38), 35-44 (N_{sur}=19), and 18-24 (N_{sur}=10). The majority were from western countries, from Europe (N_{sur}=62) or North America (N_{sur}=16). We further interviewed 10 survey participants, who had indicated through the survey their willingness to participate in the follow-up study. Interview participants were mostly male (N_{int}=7), of similar ages as the survey participants: 18-24 (N_{int}=2), 25-34 (N_{int}=4), and 35-44 (N_{int}=4), from western countries, Europe (N_{int}=9) and North America (N_{int}=1).

3.3 Data Analysis

Survey and interview responses were analyzed through a thematic analysis [12]. We analyzed instances in which participants described what lead them to change their goals. We performed the first three steps of the thematic analysis for the interviews and surveys independently (i.e., familiarization, generating initial codes, and searching for initial themes).

To carry out the analysis, the survey responses were downloaded from Qualtrics and transferred to a Microsoft Excel. They were first descriptively analyzed through an inductive thematic analysis. The first author read through the survey responses (*familiarization*) and open coded them (*generating initial codes*). The second and third authors separately coded half of the responses and there were discussions afterwards to create alignment in the codes.

We used Otter.ai to transcribe the interviews verbatim and Atlas.ti to analyze the interview data (*familiarization*). The first author open coded the interview transcripts (*generating initial codes*). Discussions between the authors were done to begin generating the themes (*searching for initial themes*). For the interviews, a codebook was created and the second and third authors each coded 20% of the transcripts to check for intercoder reliability [67].

We used a mix of inductive and deductive approaches in our analysis process. We began in an inductive and exploratory coding process and found that often participants discussed their goal changes with two main relations to the goals: (1) with who or what influenced goals choices and (2) in the way they were influenced. We then used this as framework to follow the rest of our coding process to deepen our understanding of how these relations were affecting goal changes. We looked for who and what was involved in participants goal change process, such as the tools, people, and surrounding environment. We defined this as the different *actors* affecting and supporting the goal choices. We followed Cila and DiSalvo's vision of *actors* as the dynamic entanglements in human and non-human relationships [16] – namely, in the case of our study, the role of PI tools and people's broader environment in goal changes. We then looked at the way in which these actors influenced and affected participant's goal changes choices. We defined these as *factors* involved in goal change.
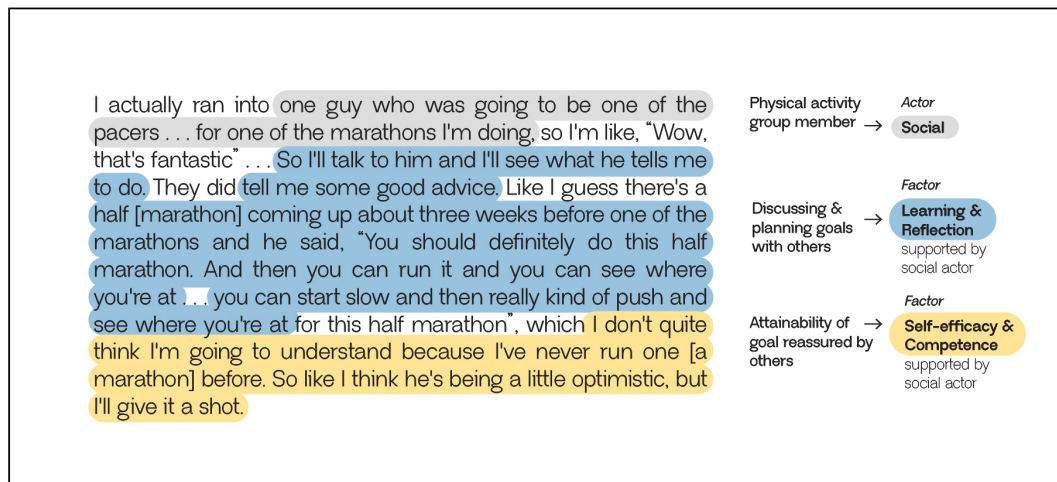
Figure 2: Example of Coding. In this quote, the participant describes how talking to a physical activity group member (i.e., a social actor) motivated their goal change, followed by the factors in which this actor affected goal change decisions (i.e., through (1) learning and reflection and (2) self-efficacy and competence).

The initial themes created for the survey were then compared and combined with the themes created in the interview analysis (*reviewing themes*). This helped us understand the roles actors played in influencing and affecting participant's goal decisions through the different factors. We show an example of our coding in Figure 2. We began to define and better understand the essence of each theme and how they affect the goal change process (*defining and naming*).

4 Results

Participants used various tools to track their health goals (see Table 2 for more information on the tools) and often had multiple goals. Most participants reported three health goals in the survey (N_{sur}=62), some two goals (N_{sur}=17), and a couple only reported one goal they were pursuing (N_{sur}=2). During interviews, participants reported between 3-6 goals in their timeline (see Table 3 for reported goals). Note that interview participants may have spoken about more behaviors and activities they were doing and tracking, but the table contains the goals they chose to put on their interview timeline (e.g., even though multiple participants talked about recovering from an injury, not all of them marked that as their goal, but as an event affecting a different goal). In the survey, participants described their goals in several ways. Most participants had a qualitative goal they were aiming for, such as *"Manage my stress better"* (S76) and *"Staying fit after becoming a dad and being ready for any adventure I can think of"* (S45) (N_{sur}=50). Participants also had quantitative goals they were aiming towards, such as *"Run 5K under 25 minutes"* (S66) and "Lose 10 lb" (S36) (N_{sur}=25). Many participants described their goals in ways of creating a specific routine, such as *"Do yoga 15 minutes every night"* (S4) *and "4 sessions of heavy training per week"* (S24) (N_{sur}=33). Participants also sometimes stated long-term events they were aiming for their goals, for example *"Race in a full distance Ironman"* (S21) and *"Climb mount Whitney in July"* (S41) (N_{sur}=28).

4.1 Actors Involved in Goal Change

When looking at who and what drove goal change, four actors were identified. The **actors are the entities that shape or influence goal change.**

Internal actors are emotions, motivations, and needs relating to goal decisions. Most survey participants (N_{sur}=75) and all interview participants (N_{int}=10) described an internal actor as the reason why they changed their goals. These reasons could be clearly linked to a goal, such as intrinsic motivation, a need for challenge, or wanting to improve oneself. Participants would want to also change goals for personal reasons, such as being bored or wanting to discover new things. This would cause participants to make changes to their goals by adjusting a goal or switching to a new goal.

Personal informatics (PI) **tools** as actors are the tools people use to track behavior. When participants were asked the *reason* why they changed their health goals, only 2 survey participants explicitly answered personal informatics. However, many (N_{sur}=57) stated that their personal informatics tool *played a role* in changing their health goal, such as by showing progress or increasing responsibility. PI tools were also discussed by all interview participants (N_{int}=10) as part of the goal change process. PI tools affect participants' goals through facilitation of goal planning, such as by having step-by-step goal pursue plans made for them. In addition, participants changed goals when reflecting on data presented by their PI tool, such as by feeling accomplished when seeing progressed or realizing they wanted to change something about their current health habits.

Social actors are the surrounding people that impact decisions and implementations of goals. While only 2 survey participants mentioned other people as part of the reason why they changed their health goal; all interview participants described different social actors as a part of their goal change process. All interview participants discussed their goals with peers and people in their social circle, such as partners, friends, family, and physical activity

Table 2: Personal informatics tools participants used

Type of PI Tool	Personal Informatics Tool	# Survey Participants
Smart Watch	Garmin	30
	Apple Watch	20
	Oura Ring	4
	Fitbit	4
	Other smart watch	3
App	Strava	19
	Samsung Health	5
	Apple Health App	3
	MyFitnessPal	3
	Google Fit	2
	Other apps	10
Smart Tool	Smart scale	7
	Smart Water bottle	4
	Peloton	2
	Withing's blood pressure monitor	2
	Stryd (pedometer)	1
	CGM	1
	Nintendo Switch	1
Self-Made Tools	Excel Sheet	1
	Written Diary	1

Table 3: Goals interview participants marked on their timeline

Types of Goals	Interview Participants
Running a certain distance/event (e.g., 8Km, 10km, half marathon or full marathon) or in a certain time	P1, P2, P5, P6, P8, P9
Walk 10,000 steps/day or increasing step count	P3, P4, P5, P6, P7, P9, P10
Weight management goal (loss or maintenance)	P2, P3, P4, P8
Having a sporting activity (swimming, rowing, cycling, yoga)	P3, P7, P8, P10
Strength / CrossFit training	P1, P3, P5
Drinking water	P3, P6
Sleeping	P3, P7
Fasting	P4
Have passive good habits	P4
Recover from injury	P5
Having a regular running routine	P6
Eating healthy	P6
Reduce stress	P7
Improve health and fitness	P8
Digestion Tracking	P9

group members. In addition, experts affected interview participants' goals, such as coaches and healthcare providers (N_{int}=5). Participants were impacted by their social circles such as by seeing what their partner is doing, discussing their health goals with their doctor, or discussing their goals and data with other people in their physical activity group. They also discussed being impacted by knowledge found online (N_{int}=3) and expert knowledge provided by researchers and organizations (N_{int}=2), for instance the World Health Association (WHO).

Contextual actors are events that happen around one's life that affect goal choices. Many survey participants (N_{sur}=30) and all interview participants (N_{int}=10) discussed contextual actors as a reason changing their goals. Events were sometimes centered around their goals, such as a competition or a holiday requiring physical fitness. Routines, such as work schedule and weather, affected when and how people choose goals. In addition, people's goals are affected by future planned and unexpected events, such as holidays, injury, and moving homes. Life events, like wanting

to have a baby and finishing a degree, also affected people's goal choices and changes.

4.2 Factors Affecting Goal Change

Five factors were identified in our analysis. As stated previously, **factors are the ways in which the actors influenced goal change**.

4.2.1 Challenge and Self-Improvement. Goal changes happened as participants identified health *improvements* they wanted to make in their lives (N_{sur}=37, N_{int}=4). Some interview participants changed goals after feeling "*a need to do more*" about their health (N_{int}=6), such as P1 setting a new running goal to fight evening sedentarism. P2 discussed his weight-loss journey and how he wanted to prevent going back to obesity, *"I was overweight [...] I was like, almost 300 pounds [...] So, it's not fun [...] you don't feel good [...] I never want to be in that situation again."*

Goal changes also happened as people identified health aspects they wanted to improve. For example, P3 started a new weight training goal after realizing she was not able to carry her snowboarding equipment up and down a mountain without running out of breath. Others challenged themselves with more demanding goals as their abilities grew (N_{sur}=15, N_{int}=4), and successfully achieved existing goals (N_{sur}=8, N_{int}=4). For example, S61 said, "*I reached my previous goals, and it was time for a new, scary goal*" and started a new 300 km bike goal. Changing to more demanding goals helped participants keep motivated in their health pursuits. Perhaps unsurprisingly, sport events were commonly referred to when participants mentioned goal changes related to challenge and self-improvement. Many (N_{sur}=16, N_{int}=8) had goals that were specific to a sport event (e.g., running a marathon in a certain time) and would re-evaluate their goals once these events were completed (e.g., a new time goal for a marathon after completing it, P9) or as they progressed towards these events.

Some interview participants mentioned being challenged and inspired to improve through others (N_{int}=3). For example, P8 was inspired to work out more after seeing how physically active one of her co-workers was during a sports activity, which caused her to reflect on her own physical activity and set more challenging goals.

> *"Actually, we did the first bootcamp and so one colleague was showing us how to do things. And he was much better than us [. . .] and in this snap, 'I need to improve.' You know, so I guess not competitive spirit, but like I don't know why, but I felt my goal is to do one pull up by the end of all this."* (P8)

Others were inspired to improve and change goals through conversations with friends and family (N_{int}=3). These conversations and comparisons were also facilitated by a personal informatics tool, through the sharing of data. Two participants mentioned how they enjoy the competitive element of seeing other people's health data – and knowing their own data would also be seen by others - making them think of more ambitious goals that others could see them pursuing. There were also negative effects of being challenged too much. P2 stated after he had a minor injury to his knee, he still decided to join a trail running group and this caused him to worsen the injury.

4.2.2 Self-Efficacy and Competence. Goal changes were often driven by participant's desire to foster feelings of competence and self-efficacy – the feeling of confidence to be able to achieve a goal (N_{sur}=9, N_{int}=9). Participants gravitated towards new goals they thought were more likely to be achieved (N_{sur}=1, N_{int}=9). For example, P1 set a lower time goal for a half marathon as he felt he could achieve it. Similarly, a couple of participants made their goals less demanding to increase their chances of reaching it (N_{sur}=1, N_{int}=1). P10 gave herself a bit more time to achieve her original month-long goal. By choosing to pursue the goal within a longer duration, she was able to reduce pressure and increase confidence in the goal pursuit.

Successfully reaching a goal would also lead participants to set new goals (N_{sur}=12, N_{int}=4). For example, each running goal achievement helped P9 feel confident to set another more demanding time goal.

> *"I think the last time I ran it [the half marathon], where I really thought, **'Well, I can improve on this.'** That was September last year [...] I ran a really good time there [...] And then in December, I actually ran another half marathon [...] That was the run I talked about - with a lot of ice - and so actually, that motivated me a lot because I hit a very good time. And the weather conditions were quite bad."* (P9)

Reaching goals would often lead people to think of more challenging goals. Personal informatics often played a role in these reflections, by helping participants see their goal progress (N_{sur}=7, N_{int}=8). P4 described how seeing her physical activity levels increase in her personal informatics' dashboard was surprising and motivated her to set a more demanding goal. Being able to see progress motivated participants in their goal pursuit and changes. For example, after P5's tendon surgery, seeing how he was able to increase the amount of weight to put on his leg, grew his confidence and motivation towards his rehabilitation goal even though progress was slow. Receiving achievement badges was also described as motivational (N_{int}=5) and prompted reflections on one's ability to pursue different (e.g. more demanding) goals. In contrast, participants also described goal changes motivated by less positive interactions with their data, particularly when seeing themselves stagnate, or regress in their goals (N_{int}=3). For example, P7 found it challenging that his running statistics went to zero after an injury and decided to change to a cycling goal to maintain progress on health data.

Seeing other people successfully reach a goal inspired participants to set new, and even mimic other's goals (N_{int}=3). For example, P2 said *"But you see people go nuts. And you're like, 'Hey, oh, I'll give that a shot.' I mean, like, she just ran, you know, 45 miles, maybe I could do a marathon?"* However, this also led to comparisons and feelings of inadequacy as participants identified differences in the difficulties and abilities related to the goals they were pursuing, as described by P10, *"But honestly, I was feeling ashamed in the beginning, because Strava is being used by hardcore exercise people, you know, and I'm just sharing there my walking."*

Some participants distanced themselves from feeling a need to accomplish a goal by focusing on *"trying things out"*. Participants described having this attitude when trying a new goal (N_{int}=5).

For example, when P6 was asked by his running friends if wanted to join a race, he thought *"Why not?"*. In this way participants committed to goals without being attached to a specific quantitative achievement of a goal.

Goal changes also resulted from conversations with loved ones, and groups of people with whom they shared similar goals (N_{int}=7). P9 discussed his training plan with people who were more experienced than him, gave him a better understanding and more confidence on how to achieve his goal.

4.2.3 Changing Priorities. Goal changes also often happened as people's goal priorities changed. Having a busy schedule at work (N_{int}=6) or going on holidays (N_{int}=5) led participants to pause ongoing goals and set goals better aligned with their context. For example, P8 indicated how his health goal conflicted with enjoying his holidays, leading him to prioritize his goal less: *"So now lots of things have been happening this summer. So, I've been plateauing on that one [goal] for a while, but then after all the holidays and stuff, I'll go continue my progress hopefully."* P3 felt guilt for not being able to achieve a daily step count goal, even if it was to do with external circumstances, like holidays or travel.

Often, changes were connected to people's surrounding environment, and the affordance it gave them for pursuing a certain goal. For instance, P9 paused his long-distance running goal during his navy service as he was placed on a small ship and focused instead on weight training goals. He later resumed his running goal when he was at home and had more space to run. Similarly, P3 decided to choose a weekly swimming goal because the pool was on her way to work, so she knew she would stop by and swim every week. A few participants also discussed seasonal goals (N_{sur}=1, N_{int}=3). When the weather is colder in winter months, participants chose indoor activities to pursue, such as yoga and swimming, and when the weather is warmer in the summer, participants chose outdoor activities, like running or cycling. Sociocultural environments tied to location would cause participants to switch their routines. For example, when moving from China to Germany, P4's eating goals changed, and he no longer followed the fasting routine he was previously following due to the change in social environment. This caused him to gain weight and he started a new weight loss goal, which was more fit to his new environment.

Life events, such as finishing a degree, moving, pregnancy, or retiring, were also frequently mentioned as reasons to change goals (N_{sur}=9, N_{int}=4). Medical events (e.g., cancer), illness (e.g., Covid-19), or injuries (N_{sur}=8, N_{int}=4) also led people to adjust their goals to accommodate these events. Some participants described the process they went through when re-engaging with these goals following such events. This process often involved planning and the support of others. For example, P5 would start running again after a tendon rupture and then realize he was again feeling pain in his tendon and need to go back to his physiotherapist to make a different goal plan. Societal events like the Covid-19 pandemic triggered several goal changes. Many participants described setting new walking and cycling goals because they were cooped inside and not doing normal daily physical activity (N_{int}=4). Relatedly, because they would not want to spend time with others, they would take up individual activities, such as P2 taking up a running goal because he felt like it was a safe activity.

4.2.4 Learning and Reflection. Goals were changed as participants learned and reflected on their behaviors: individually, through interactions with other, and through the feedback provided by personal informatics tools.

For instance, 7 interview participants described being inspired by other people's goals plans, leading to adjustment of their own goals. One example is given by P9, who looked at data from more experienced people in their running club and realized how slight changes to their pace and steps would make large impacts on their running performance. Participants would learn from others' behaviors and model them into their own goal setting strategies (N_{int}=6). P10 described using a past partner's running goals, personal informatics use, and ways of developing physical activity goals as a starting point to set her own goals and track her own behaviors.

> *"Before I met my ex-boyfriend, I think I wasn't active at all [...] But since I spent a lot of time with him, he kind of introduced me to all these ways to be active and showed me it's quite fun. It went under my consciousness. He used to say, 'try different activities.' I was watching and observing him. And he was like, 'Oh, this [workout] doesn't work for me. This [one] worked well, so I'm gonna do this more.' [...]* **And then I started using Strava by myself, because [of what] I saw from him** *- so now I want to also build like, a nice routine for myself."* (P10)

Sometimes goal change was motivated by wanting to avoid undesirable behaviors (N_{int}=2). For example, P3 stated that seeing the impact of patients having health problems, such as diabetes and cardiovascular issues, everyday due to her job as a physiotherapist, reminds her to focus on her fitness goals.

Further, goal changes resulted from discussing and analyzing past data together with others (N_{int}=3), such as P1 adjusting his running pace after discussing it with a partner, and P5 looking at his data with his physiotherapist to plan his injury recovery plan. Discussing one's goals with others that had experience in pursuing similar goals helped participants gain awareness of challenges and adjust their goals to fit their own abilities.

Participants also described goal changes and learning resulting from interactions with their personal informatics tools. Tracking helped participants reflect on and be aware of their behavior (N_{sur}=28, N_{int}=9). For some participants, this would be a wakeup call to set new goals that would help change their behavior patterns. For example, for P2 getting a cheap pedometer and seeing his daily step count lead him through a weight loss journey, from being obese to being able to run marathons. Being able to look back at one's data also helped participants in understanding how fitting a goal was, and if adjustments needed to be made (N_{sur}=22, N_{int}=9). For instance, P3 described how seeing a lack of progress in his physical activity data was a trigger to set a different goal.

A few participants used past data to change their goals (N_{sur}=3, N_{int}=2) by keeping track of whether they were able to reach goals (or not) and adjusting accordingly. Some also mentioned how their personal informatics tools helped them keep perspective on their longer-term goals, and how PI tool planned short-term goals would help them achieve these goals (N_{sur}=8, N_{int}=4). For example, S5 discussed how the Couch to 5K app provides a daily guided workout
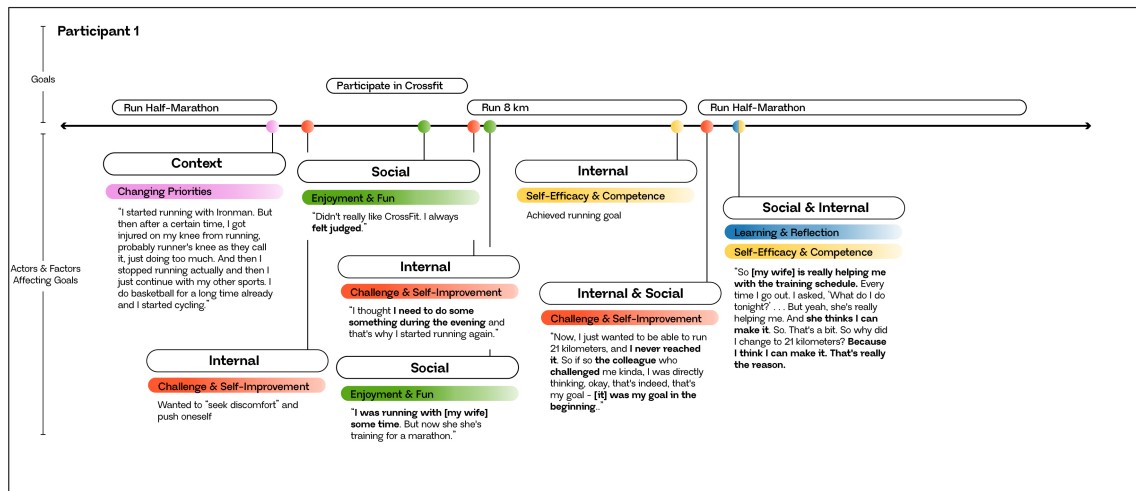
Figure 3: Participant 1's timeline demonstrates the sequential and network of influences from actors and factors the goal change decisions.

which leads to moving toward the long-term goal of running a 5K. Further, 13 participants described how goal suggestions given by personal informatics tool (N_{sur}=7, N_{int}=6) lead them to change a goal. Personal informatics also showed some participants (N_{sur}=1, N_{int}=3) new metrics to track which inspired them to try new goals.

4.2.5 Enjoyment and Fun. Goal changes were often referred to as attempts to make goals more engaging and fun to pursue. Participants would start new and adjust ongoing goals to enjoy the experience of achieving a goal and doing the activity (N_{sur}=4, N_{int}=7). For example, S50 who started a new half marathon goal said: "Running is becoming more and more fun to me, and I want to do it more." For some, this meant changing an ongoing goal to another they would enjoy rather than having to perform and focus on completing goals. P10, for example, described changing from a running and performance goal to a walking goal as walking helped her relax and discover new areas in her neighborhood. Similar stories were mentioned by other participants, where goal changes were attempts to get more joy from pursuing a goal and move away from often prescriptive, performance-oriented goals (e.g. P1, who was tired of the overcompetitive nature of CrossFit and switched to a running goal). This often involved changing to goals participants had enjoyed in the past.

Changes were also driven by attempts of having fun with others (N_{sur}=2, N_{int}=8). For example, P6 started a running goal because he signed up for a relay race with his friends. In addition, the social environment of physical activity clubs supported participants in starting new goals. For instance, P9 mentioned how his athletics club would plan smaller events in relation to the bigger running goals. Participants who like the gamification features PI tools offer, would start new goals because of achievement badges they would receive (N_{sur}=2, N_{int}=3).

4.3 Interplay Between Actors and Factors

Goal change often occurred over time where several actors and factors affected goals. Sometimes, participants described abrupt changes that were due to some sort of contextual actor affecting their goals, such as P5 experiencing an injury and having to stop his running goal. However, most other goals were changed over time and had compounding actors and factors affecting them.

To further illustrate these findings, we show an overview of two participants' goal change timelines in Figure 3 and Figure 4. In these figures, the actors and factors mark the moments participants are quoted about specific events that affected their goal decisions. In Figure 3, we illustrate how for P1, a larger network of different actors and factors affected goal change. Figure 4 shows how P3 was stacking her goals over time and how similar factors affected her goal change.

P3, is an example of how some participants were more often influenced to change goals by a single factor, such as being supported in feelings of self-efficacy. The participant described multiple instances of being challenged, by herself and by realizing something due to her contextual surroundings (see Figure 4). Her goals were affected over time, but her decisions to change goals came from a limited set of actors (i.e., mostly internal and context actors). P3 enjoyed using her PI tool to track steps and sleep, which led her to add a new drinking water goal (i.e., personal informatics actor with enjoyment and fun). She often wanted to challenge herself by adding a new goal. For example, she felt she was not as fit as she used to be, leading her to decide to start swimming 2 km per week (i.e., internal actor with challenge and self-improvement). She had chosen to do the swimming goal also because she thought this would be the easiest way to make sure she was committed to her goal – she would always pass by the pool on her way to work (i.e., contextual actor with changing priorities). Experiencing a lack of fitness when going on a snowboarding holiday caused her to decide to start strength training as well (i.e., internal and contextual actor with challenge and self-improvement).
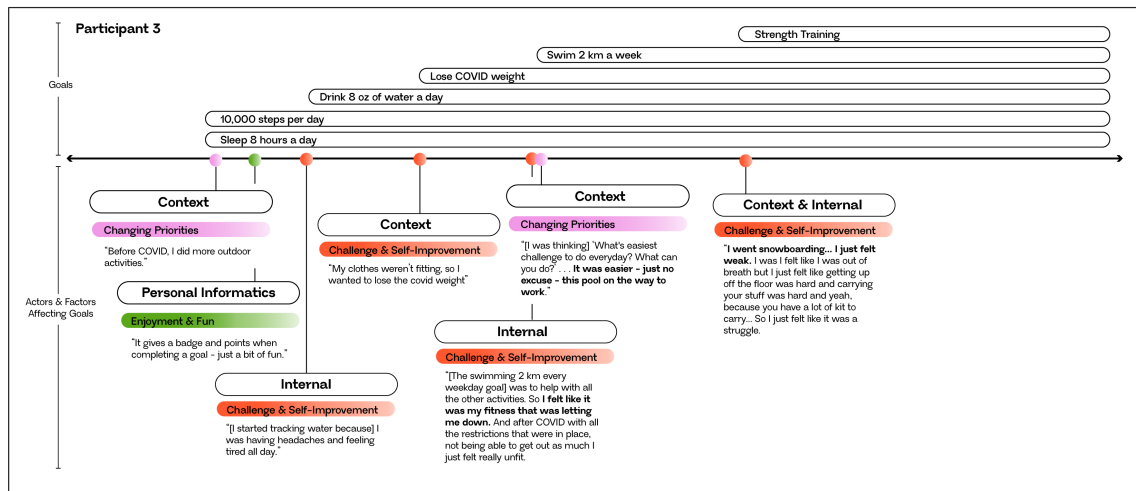
Figure 4: Participant 3's timeline on goal change shows how different experiences and often similar actors and factors supported her to continuously stack goals on top of other goals.

Other participants were affected more by a **bigger network of factors** that together supported goal change. For P1 we see how many different events and multiple actors helped shape decisions on goals (see Figure 3). P1 originally had a half-marathon running goal that was stopped due to having pain in his knee when running (i.e., contextual actor with changing priorities). He tried different fitness goals, such as going to CrossFit, but did not enjoy the social environment of CrossFit (i.e., social actor with enjoyment and fun), which led him to stopping that goal. He then switched back to trying running and eventually was challenged by a co-worker to run a half-marathon (i.e., social actor with challenge and self-improvement). But he also felt supported by his own internal motivation because he had wanted to previously achieve this goal (i.e., internal actor with challenge and self-improvement). Additionally, because his partner was a marathon runner, she gave advice on how to tackle the run and increased his confidence because she believed he could achieve his goal (i.e., social actor with learning and reflection and self-efficacy and competence). For P1, different actors helped goal change through supporting similar factors.

The goal changing process of P1 illustrated, shows an example of the interplay of actors and factors. In this example, we see how **social actors** often had a supportive role, reinforcing other actors and factors (the partner giving advice and increasing confidence). Social actors were prominently discussed by the interview participants in combination with most of the factors: challenge and self-improvement (N_{int}=7), self-efficacy and confidence (N_{int}=5), changing priorities (N_{int}=9), learning and reflection (N_{int}=10), enjoyment and fun (N_{int}=9)

Next to this, **internal actors** often influenced the challenge and self-improvement (N_{sur}=77, N_{int}=10) and self-efficacy and competence (N_{sur}=2, N_{int}=9). Participants with high self-efficacy felt confident in starting a new goal. For example, P1 began another challenging running goal after achieving his 8 km goal, which had boosted his self-efficacy.

Personal informatics were often related to self-efficacy and competence (N_{sur}=7, N_{int}=8) and learning and reflection (N_{sur}=53, N_{int}=10). Participants discussed how reflecting on past data and seeing progress – even slower than expected progress – would facilitate feelings of confidence in their own abilities.

Overall, participants discussed how the changes to goals were reflected over time. This showed how some factors were shown to work together in a sort of chain reaction to support participants in changing goals. One prominent interplay between factors was **learning and reflection, self-efficacy and competence, and challenge and self-improvement.** Learning and reflection on past goals and accomplishments would result in participants feeling more self-efficacy. Becoming confident would lead participants to feeling comfortable to challenge themselves towards a new goal. These factors would be supported by various actors, for example having learning and reflection being supported by data in the PI tool and being able to discuss the data with a social actor.

In addition, another aspect of **learning and reflection** helped participants feel **self-efficacy and competence** when changing goals. Learning through discussion and planning of goals, helped participants feel confident and secure in their goal pursuit, even if they needed to change goals because they were not achieving the previous goal. Participants also had interplays between **self-efficacy and competence** with **enjoyment and fun** by letting go of feeling the need to achieve something and doing the goal just for fun. In addition, a sense of competence and believing that one could improve through past experiences, enabled participants to approach a goal without the expectation of immediate success. P2 detailed this interwoven process when he decided to start a new running goal with his friends, after becoming more physically active in cycling:

> "So, some friends did [a race]. This was back when I was just biking, and I was getting into better shape. And I said, 'Hey, let me let me give this a try.' Because I don't know how to run but maybe I'll maybe I can learn for

next year. So, I learned for next year, and I ran it and it was it was a lot of fun." (P2)

Changing priorities were most often facilitated by contextual (N_{sur}=30, N_{int}=10) and social actors (N_{int}=9). Contextual actors can cause abrupt and forced changes; however, we also saw participants be more focused on changing health goals to adjust to contextual actors if their feelings of challenge and self-improvement were high. For example, P3 liked to challenge herself by adding new goals and would adjust her goals around her daily life. Furthermore, participants would be willing to change goals if they were enjoyable to pursue even if it required to change their priorities and routines. In combination with social actors, participants were also willing to change their goals due to social engagements. For instance, P7 discussed how he changed to a running goal because his friends also had gotten a PI tool, and therefore they could track their running goals together.

5 Discussion

In this paper, we aimed to understand (RQ1) What makes people change their health goals and (RQ2) How personal informatics tools influence and support goal changes. We used a lens to analyze how *actors* (i.e., internal, PI, context, social), influence people's goal changes through different *factors*. We found that, PI were rarely the instigator of goal change, but they rather helped managing existing goals and planning new ones – often by enabling reflection on past data. Goal changes were largely driven by people's shifting priorities, evolving life contexts, and the influence of others around them. Social actors were especially influential in this process, both directly (e.g., through goal discussions) and indirectly (e.g., by modeling behavior). These findings align with prior work, which indicate that PI often fall short in supporting people as their needs and goals change [33, 55].

Our study also examined how multiple actors and factors influence goal changes, often concurrently and over time. For example, some participants described changing their goals based on peer suggestions, and their own intrinsic motivation and self-belief in completing a goal. In this way, the actors worked in tandem to support reflection and goal change. These insights are aligned with the "past self" framework proposed by Yfantidou et al. [92], which emphasizes the interplay of social, contextual and personal influences on people's behaviors. Building on this evidence together, we see an opportunity for PI to scaffold individuals' reflections across these different dimensions – helping individuals make sense of how their motivations, context, social surroundings evolve over time, and how these shifts might inform changes in their goals.

These reflections could extend beyond short-term changes and help people align their goals with longer-term aspirations and experiences, similar to the Goal Evolution Model [65], such as future family plans or wanting to go on a bouldering trip. Our findings show that participants often balanced competing priorities and evaluated multiple goal options simultaneously, while also drawing on past experiences with goal pursuit. Aligned with the Lived Informatics Model [33], we found that people are lapsing their goals and also find that these lapses add new information for people moving forward to next goals. For example, a goal pursued in the past might

still be important for people to pursue again, and seeing others pursue their own goals can shift one's own goal priorities-sometimes subconsciously. This resonates with Sefidgar et al. who highlight the importance of considering how people manage several goals simultaneously and how goals can interconnectedly affect one other [83]. Similarly, Swann et al. observed that people reprioritize goals as they pursue them concurrently [86]. In addition, a like to the Longitudinal Model [1], participants were also juggling, prioritizing, and simplifying between different multiple goals, to find what works for them. In this study, participants had multiple reasons that might result in goal change due to planned (e.g., deliberate choice of signing up for a competition) and unexpected (e.g., injury) events.

At times, however, we reflect that conflicting factors could inhibit and undermine changes, such as reflecting on low improvement in data could cause rumination and negative feelings in self-efficacy and competence towards a goal. In addition, these conflicts could lead to pursuing goals which do not fit people's abilities, (e.g., pursuing a goal because of social enjoyment despite the risk of worsening of an injury). Designing PI that recognize such interdependencies may better support people in navigating these tensions and trade-offs inherent to goal changes.

By investigating various actors that shape people's health goals, we gained a broad perspective on what shapes people's goal changes. This highlighted how individuals often rely on a range of actors when setting and adjusting their goals. In light of this, designers and researchers might explore how PI can better acknowledge and support these influences as part of the goal change experience. For example, we observed people gaining confidence and being reassured about their goals when discussing their planning and feasibility of with others. PI could support and scaffold such interactions by encouraging social reflections on goals. For instance, PI might prompt people to review data that could support discussions (e.g., visualizing the past year's goal achievements and trajectory) or generate a set of goal options for discussion. In this way, the interaction and reflection on personal health goals is deepened with individual and the personal informatics tool. In section 5.3 we examine the role of social actors in goal changes in more detail.

5.1 The Ebb and Flow of Goal Importance

We found that responsibilities, life events, and other contextual actors influence how people prioritize and stay motivated towards their health goals. Changes in priorities often resulted in self-reflection, and surfaced tensions between goals, which ultimately impacted goal commitment. For example, participants who recently became parents reported deprioritizing physical activity goals due to new responsibilities. These insights align with Goal Setting Theory, which suggests that a goal's importance affects one's commitment to a goal if a goal becomes less important, motivation to pursue it tends to diminish [58]. In such moments, people often realign their health goals with evolving priorities and external constraints, which are often beyond their control [21, 30, 37, 62]. Consequentially, PI should be designed not just to maintain motivation for an ongoing goal, but to **accommodate adjustments in the importance of other goals and priorities.** Depending on the specific circumstance, this alignment can involve either increasing

the prioritization of a health goal or adjusting the health goals to better fit into people's current context.

These findings suggest that PI may be more helpful if they **allow for flexibility and adjust to the ebb and flows of goal pursuits**, rather than always enforcing rigid adherence. While our participants were able to make changes to their goals, these adjustments often happened independently of PI. Instead, people stepped away from their goals, such as during a house move. Wrosch et al. argue that goals that can no longer be met should be disengaged with to free resources to them to allow focus attention elsewhere and utilizing alternative goals can support the goal disengagement [91]. In such situations, PI could better support people by facilitating the setting of more attainable or scaled-down goals that reflect their current context.

Consequentially, PI could change framing to be less focused on specific quantitative goals and more on understanding how to create goals that work for overall health and daily lives. Åström et al. propose that PI could help people reassess and modify their goals when falling short in achieving their goals using an "I'm Slipping" feature, which can pause goal commitment [4]. For example, someone who usually exercises three times a week might choose to reduce to once a week during a busy exam period. Flexible goals that offer alternative paths to success, such as a secondary, easier goal [3, 64] or margin-based goals that count as "achieved" if that are "Good Enough" [42], have been shown to support people set goals that fit better to their daily changing lives. Additionally, coping planning and envisioning future scenarios in advance can help people better adapt their goals, such as reflecting on how to make goals apart of their routine [68]. Together, these strategies emphasize a more adaptive approach to goal management. Furthermore, PI can focus on **highlighting goals as a way to create a routine people can commit to**, rather than focusing on goal achievements. Additionally, instead of prompting people only when they fail to meet a goal, PI might proactively check in during known periods of disruption (e.g., holidays or end-of-semester deadlines) and offer context-aware adjustments.

Participants also changed their health goals when reflecting on long-term impacts of current health decisions. For example, witnessing the negative health outcomes of others, such as a reduced mobility or bad eating habits, prompted some participants to challenge themselves and adopt new health behaviors. However, these insights were largely shaped by personal reflection and observation rather than PI. Current PI often fall short in this area, focusing primarily on the present, without encouraging deep reflection on past habits or the future benefits of long-term goals [14, 28]. This points to an opportunity for PI to help **connect present behaviors with future outcomes**. For instance, PI could use prompting questions, such as "*What would you like to be able to do when you are 70?*" and provide related information such as "*Sedentary behavior and lack of daily physical activity affects mobility when aging.*" By framing present goals in terms of future aspirations, PI could drive goal changes by highlighting and forecasting how present activities might affect future abilities.

Moreover, PI could **frame goals around learning, complementing current focuses on goal achievement**. Dynamic approaches to goal setting, such as switching between learning and performance goals, have been suggested to better support individuals in managing their goals [86]. This approach might better accommodate the complexities of people's lives. For example, setting a learning goal of finding a physical activity routine that works for one's work week can then relate to a long-term goal of integrating physical activity habits into people's everyday life. Positive framing also makes goals feels less like failures when temporarily paused and lapsed [86].

5.2 Supporting Vulnerability and Resilience During Goal Change

Goal change is a non-linear and complex process, with goals often paused, changed, and abandoned due to life changes, setbacks (e.g. injuries), and goal failure. These transitions are particularly vulnerable moments and our participants navigated such moments differently. Some maintained high self-efficacy and optimism, while others approached new goals casually - "just for the fun of it" – yet seriously committed to achieving them. This allowed them to experiment with new goals with less stress or fear of failure.

PI significantly **supported participants' self-efficacy during these periods**. Visualizing past achievements and data highlighting progress helped participants reinforce a sense of competence. Our findings indicate that while PI generally provided positive feedback during goal pursuit, they also created feelings of guilt or shame in our participants, inadequately addressing emotional nuances of goal changes. Prior HCI literature has critiqued how PI can lead to feelings of incompetence when framed around performance, where goal completion and failure are the only outcomes [47]. Meanwhile, there are growing concerns about how PI goals and data are framed, as it can negatively impact self-perception [81]. Karapanos et al. has critiqued how PI can for potentially lead to fostering feelings of incompetence when framed around rigid performance metrics, where goal completion and failure are the only outcomes [47]. Meanwhile, there are growing concerns about how PI goals and data are framed, as it can negatively impact self-perception [81]. Postma et al. critique how personal data, especially within the context of sports, cause self-devaluation and demotivation by solely focusing on quantitative data [71]. Bandura and Locke argue that presenting feedback that frame's goal progress as "gains", rather than "shortfalls", can positively influence people's motivations and confidence [9].

These highlight an opportunity for PI tools to **shape how people interpret lapses in goals**. When tracking and reflecting on health goals, PI tools could also incorporate life events that affected people's goals. For example, asking people why they stopped their health goals (e.g., overwhelmed with work) and filling in time slots with this data. Then either people can make goals that account for the lapses, or they can feel less burdened with the gaps as the timeslot is filled why they did not progress (and maybe where they progressed somewhere else in their life). For instance, instead of simply showing that a step count was missed, PI could highlight what was achieved that week or acknowledge efforts during difficult periods: "*You kept moving even during a stressful week - here's how far you've come*".

Participants also valued reflecting on their past accomplishments and progress positively, without seeing failures as "the end", such as

by restarting a past incomplete goal. To focus less on achievement of goals, PI goals can **incorporate qualitative data through personal experiences** of goal pursuit. Self-tracking emotions throughout the day support people in reflecting more holistically on their behaviors, activities, and how they support one another [10, 49]. Quantitative data can be combined with tracking their subjective experiences, so that when people look back at their data it is more personal and supportive. For example, PI interfaces can show comments on how one felt improvements in their running, such as from not running to being able to run 5K and enjoying experiences like a runner's high, to support feelings of self-efficacy for starting a next goal of running 10K. In this way, when changing goals, people can feel comfortable to try something new without the stress of failing to achieve a quantitative goal (e.g., a specific running event) while also remaining committed to a long-term goal (e.g., going running three times a week).

Our findings emphasize a space for PI tools to **take a more active role in scaffolding supporting exchanges with others**. Social support contributed to participants confidence in navigating goal change, such as friends and family members can offer encouragement and help in planning to tackle a goal through shared experiences. These findings align with Social Cognitive Theory, which posits that self-efficacy can be supported by vicarious experience and verbal encouragement [7]. However, our findings showed that PI had limited social support for our participants, usually limited to features like "likes" for encouragement or progress sharing, leaving opportunity for PI to include more social actors during goal change.

5.3 Opportunities for Socially Supportive PI Tools in Goal Change

Our study revealed that social actors play a crucial role in providing support for goal change. Participants frequently discussed goals with their social circles, engaged in planning and breaking down goals, shared doubts, received motivation and reassurance, and had fun together. However, a significant insight from our study is the underutilization of PI tools for seeking and providing social support during goal change.

Although social interactions are pivotal in goal management, PI tools remain focused on individual-centric designs, as opposed to **more socially aware systems** that actively encourage and facilitate conversations about goals within one's social circle. These insights align with prior work, highlighting how social circles can increase goal commitment [10, 58], improve self-efficacy [7], and affect goal pursuit with PI [38, 43, 92]. Most PI research focused on individual tracking, with social elements being a more recent consideration [31, 85, 92]. Prior studies highlight the challenge that PI tools face in incorporating social circles, often centered around competition, social comparison, and recognition [46, 92]. Our findings also emphasize the importance of cooperation and social learning, which are equally significant in the context of goal change. Further, a large body of work on social tracking has looked at how people set and negotiate goals with healthcare professionals [31]. Our study points to the importance of expanding this social circle to include friends and peer connections.

Participants were motivated when changing goals due to long-term goals that are set together. Thus, we suggest PI tools shift beyond competition to features fostering collaborative and supportive interactions, as competition can undermine intrinsic motivations and autonomy [22]. PI could **facilitate shared goal setting activities**, where friends can invite and commit to goals together. PI can also support instigation of these actions by finding different options of long-term goals in order to fit to each person's schedule.

We also observed goal changes influenced by observing and modeling others' health behavior and by committing to goals together. Families using PI tools, for example, seek insights into "ripple effects" between family members (i.e., how one member's actions can have an intertwined affect with another's) [69]. PI tools could help **enhance group reflection on collective health changes,** by helping social groups review how joint activities influence individual goals.

Social discussions helped to make sense of data and plan for future goals, which boosted self-efficacy towards goals. Social sensemaking helps understand patterns in data and share knowledge [15, 19, 70], and is recommended to be used with peers of similar groups (e.g., lifestyle or health) [72, 77]. Our participants also emphasized the importance of learning from people who were slightly more experienced than themselves (e.g., who had achieved their goal already). Saksono et al. recommended that peer data comparison should mitigate comparison upward (i.e., looking down on oneself by comparing to more successful peers) and downward (i.e., boosting oneself by comparing less successful peers) by framing information as a resource for setting progressive goals [77].

PI tools could support this, by integrating **collaborative reflection features discussing both challenges and successes**, allowing joint review of progress data and inviting feedback from experienced peers. PI can support in-person interactions, such as with a shared interface to explore past data together with PI tools suggesting reflective questions. PI tools could also support further connection between people by **highlighting similar patterns of data in each other**, such as related moments when people change their goals, to support discussion. This way people can share their experiences, openly discuss the challenges, and show the "bumpy road" towards a goal. For instance, sharing failures and how people readjusted and persevered to their new goal. This can build confidence for people as they see that others face and overcome similar challenges.

Sharing data with social circles also brings challenges regarding data privacy [19, 72, 77]. To combat this, individuals could choose the types of data to share [25, 73], individuals could be in control of with whom are they comfortable sharing data with [25, 73], and data could be hidden through abstraction [24]. In addition, we did not observe participants having conflicts when discussing their goals with others (e.g., someone disbelieving they could complete a goal). We reflect that this may be due to our participants generally having positive experiences with their goal changes and being able to successfully change their goals. However, this would be worthwhile to address and focus on negative experience with social circles in future work.

Finally, PI tools could **use social support to help individuals during goal disengagement**. Following the work of Kappes et al. [44], PI tools could prompt individuals facing difficulties to reflect

socially on whether their current goals remain useful. Additionally, encouraging exposure to diverse perspectives can help recognized their impact on others. PI could support goal disengagement in a social way by asking people to discuss their goals with others. Expanding on Kittel et al. [51], we see value in enabling users to share not only similarities but also surprising differences. PI tools could prompt on unexpected challenges and experience and encourage users to share insights that could benefit others. For example, PI tools could prompt: *"What did you not expect when you began this goal? Someone you know may be facing what you've just overcome - what would you tell them?".* This could transform PI tools into spaces and that not only track individual progress but foster broader community pursuing and changing goals.

6 Limitations

Our work has some limitations that shape how findings should be interpreted and where future research might expand. First, most participants discussed physical activity goals. Therefore, our results may not be generalized to other health goals, such as managing chronic conditions, pregnancy or mental health, which may involve different motivational dynamics and levels of comfort with data sharing [25]. Our participants also had overall positive outlooks on their health, rather than deteriorating health conditions. In these situations, goals can still be important to people while goal change could have less certain deadlines, be more short-term, and focus on navigational markers of health to adjust [89]. Different types of health goals could have different types of social actors involved at different levels of involvement, such as healthcare professionals.

Second, most of our participants were able to change their goals and generally maintained positive outlooks on their health and goal progress. As a result, the findings may not reflect the challenges and burden of people who struggled to make changes to their goals. Exploring these more vulnerable experiences could be explored in future work – and is a critical step for designing tools that support success but also uncertainty, failure and conflict. Third, our participant pool was predominantly male and largely from western countries. This may limit the relevance of our findings to more gender-diverse and cross-cultural contexts where social norms may differ. For instance, the role of social actors-such as family or friends-in influencing goal change could manifest differently across cultural settings. Fourth, our findings relied primarily on self-reported data and was not longitudinal in nature, which can be affected by recall bias. While we sought to minimize this by limiting recall to the past six months, important moments and experiences might have been overlooked or forgotten.

7 Conclusions

We aimed to understand how personal informatics could better be involved in goal change. We investigated how goal change was affected by actors (*personal informatics, internal, social,* and *contextual*) through several factors (*challenge and self-improvement, self-efficacy and competence, changing priorities, learning and reflection,* and *enjoyment and fun*). Actors and factors affected and supported goal change through a complex interconnected process, however PI were not always a key aspect of people's goal change experience. We identified how PI tools can improve goal change

experiences by considering how outside priorities can be better managed. In addition, people should feel competent in achieving their goal and to not focus on goal failure while beginning a new goal. Future HCI research should consider the larger integration of the different actors, specifically social circles, for people's experience with PI and how they can integrate new interactions with these tools. We still see an open question on what novel ways PI could involve social circles into the goal change process, through in-person interaction, cooperation, and support.

Acknowledgments

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