

Finding the Right Fit: Understanding Health Tracking in Workplace Wellness Programs

Chia-Fang Chung^{1*}, Nanna Gorm^{2*}, Irina Shklovski², Sean A. Munson¹

¹Human Centered Design & Engineering
DUB Group, University of Washington
{cfchung, smunson}@uw.edu

²IT University of Copenhagen
Denmark
{nanj, irsh}@itu.dk

*These authors contributed equally to this work.

ABSTRACT

Workplace health and wellness programs are increasingly integrating personal health tracking technologies, such as Fitbit and Apple Watch. Many question whether these technologies truly support employees in their pursuit of better wellness levels, raising objections about workplace surveillance and further blurring of boundaries between work and personal life. We conducted a study to understand how tracking tools are adopted in wellness programs and employees' opinions about these programs. We find that employees are generally positive about incentivized health tracking in the workplace, as it helps raise awareness of activity levels. However, there is a gap between the intentions of the programs and individual experiences and health goals. This sometimes results in confusion and creates barriers to participation. Even if this gap can be addressed, health tracking in the workplace will not be for everyone; this has implications for the design of both workplace wellness programs and tracking technologies.

Author Keywords

Self-Tracking; Health and Wellness Program; Workplace

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

INTRODUCTION

Personal health tracking devices such as Fitbit, Jawbone UP, or the Apple Watch, are rapidly becoming common fixtures in workplace health and wellness programs [7,22,29]. One industry report estimates that more than 27.5 million wearable devices will be ordered by enterprise customers in 2020, compared to just 166,000 units in 2013 [29]. In some cases, companies are incentivizing the use of these devices by offering financial benefits to employees who are physically active and share their personal health

data, such as steps, heart rate, and sleep patterns with workplace or insurance health and wellness programs. Employees may be rewarded for their activities with virtual points that can be exchanged for company swag or gifts, or companies may offer a discount on health insurance premiums or deductibles. The popularity of such programs that capitalize on the easily available health tracking data often hinges on an argument that a healthy workforce is a more productive workforce with the resultant declines in healthcare expenditures.

As participants in health and wellness programs begin to share health tracking data with their employers and insurance providers, there is a need to understand perceived benefits and concerns about the sharing, and how these experiences might evolve over time [28]. Knowing how employees value (or do not value) the use of health trackers can inform the design and development of wellness programs. Well-designed programs can lead to greater uptake and sustained engagement with healthy behaviors.

To illustrate the range of experiences employees have with integration of tracking into workplace wellness programs, we present findings from an empirical study conducted in three phases. First, we interviewed employees and wellness program administrators across seven US companies to understand their experiences with health tracking in a workplace wellness program. Analysis of these interviews informed a survey of over 500 employees and 45 wellness program administrators. Finally, we conducted follow-up interviews with selected survey respondents.

Our findings reveal many positive and negative attitudes among employees toward workplace activity tracking and frustrations among program administrators in the limitations of current technologies. On the positive side, many employees felt that the wellness programs demonstrated that their employers care about their health and working conditions beyond mere measures of productivity. Some also acknowledged that their use of health tracking improved their own awareness of activity levels. At the same time, many criticized the health tracking programs for failing to support individual health goals in favor of easily defined and measurable one-size-fits-all metrics. Some found health tracking stressful and a few were concerned about personal data disclosure, privacy and an enforced blurring between work and personal life. Many program administrators hoped to support more holistic

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.
CHI 2017, May 06 - 11, 2017, Denver, CO, USA
Copyright is held by the owner/author(s). Publication rights licensed to ACM.
ACM 978-1-4503-4655-9/17/05...\$15.00
DOI: <http://dx.doi.org/10.1145/3025453.3025510>

views of health, yet current programs so far tended to incentivize mostly what is easily measured and tracked: steps. In the following sections, we review current literature about workplace health and wellness programs and the recent movement of bringing health tracking into these programs. We then provide an in-depth discussion of employee challenges, goals and expectations when participating in such program, as well as reasons for deciding not to participate. We consider the tension between the design and the practice of these programs as well as implications for implementation.

BACKGROUND

Workplace health programs are not a new development. The first workplace health programs emerged in response to government oversight of workplace safety conditions in factories and mills going back as far as the Industrial Revolution. These programs primarily consisted of physicians investigating safety conditions through in-person visits [2]. Workplace safety is now regulated in most developed countries and health programs now encompass not only safety but also health more broadly. Today, employee health promotion in the workplace is an “international trend” [6], and investments in these programs are rising [5].

The most common components of workplace health and wellness programs include screening activities, preventive interventions of health risks, and health promotion activities for healthy lifestyles [2,24]. With increasing healthcare costs, organizations explore options that might motivate their employees to pursue healthier lifestyles, such as being more physically active. Wellness programs are often coupled with incentives for participation or competition, and encourage employees to use fitness centers [10], maintain physical activities during winter [4], and increase physical activity levels toward a pre-set goal [19,25]. With the advent of digital health tracking, integration of these technologies into wellness programs is an obvious step for many companies.

Health Tracking in Workplace Wellness Programs

In this study, we define health tracking as using a means to keep track of any aspect of health. That is, in addition to automatic sensing, we also include health and wellness programs that implement manual tracking or self-report of health data as part of the investigation. As organizations currently implement health tracking in various ways, this allows us to explore employee perceptions and experiences broadly.

In this section, we present three types of health tracking implementation and their incentive models derived from the literature as well as our interview and survey data. These implementations are not exclusive – one company might implement multiple options simultaneously. We also do not claim this to be an exhaustive list. Our goal is to provide an overview of the health and wellness programs we studied to help situate our findings.

Subsidizing activity trackers or gym memberships

Many companies provide their employees with discounts for fitness trackers or reimbursement for gym membership to encourage employees to exercise on their own [16,24,33]. One recent US nation-wide survey reported that around 18% of companies also provide onsite exercise facilities [30]. These programs usually do not require employees to report their use or participation but also do not provide incentives for maintaining or improving healthy behavior. Some research shows that free gym membership supplemented with educational resources, coaching or incentives for participation time can better improve employee physical activities than when these measures are implemented alone [16].

Short-term events or challenges

Some companies organize events or challenges to promote awareness of healthy behavior and to encourage employees to increase levels of physical activity [4,17,19]. These events or challenges usually range from one to three months in length with incentives such as gift cards or cash rewards. In some cases, companies offer employees free tracking devices, while in others employees must purchase their own devices to participate. Sometimes such events are designed as competitions, during which employees might compete as individuals or in teams for prizes. Others have predefined goals, such as average steps/miles per day or number of days biking to work, and any employee who reaches the goal can receive incentives.

Long-term programs

In long-term programs, employees receive incentives based on their health tracking data [25]. For example, employees might receive virtual points according to their accumulated physical activity levels (e.g., 1 step = 1 point) or when reaching certain activity goals in a given time (e.g., averaging 7,000 steps per day). These virtual points can then be exchanged for cash rewards, gift cards, or insurance discounts. Some of these programs are scheduled based on calendar year during which the virtual points might expire at the end of each year, and employees have to opt-in or opt-out at the start of each calendar year. This is particularly common when the program is sponsored by an insurance provider. Other programs are operated on an on-going basis, which means that employees can ‘save’ their virtual points for longer periods of time.

Criticisms of workplace health tracking programs

The integration of health tracking technologies in workplace health and wellness programs has not gone unnoticed by media, who has largely reported critically on the subject. Concerns of a blurring of work and private life spheres have been put forward, and questions of whether employees actually have a choice to participate or a coerced into participation have been raised [22].

These concerns are echoed and elaborated in research taking a more theoretical approach to the development. The increasing quantification of employees is worrisome

because all other things that make up well-being, but that are not easily measured, can be undermined [27]. Researchers highlight how incentivized health tracking, when connected to the workplace, risks disciplining employees with implications for those who cannot afford to say no, that there is a risk of reducing health to numbers, and voice concerns that data can be de-anonymized and used for other ends than expected by the employee [7].

Nissenbaum and Patterson have applied the lens of contextual integrity to the area of health tracking in the workplace [28]. They suggest that health tracking technologies challenge informational norms due to the close monitoring and gathering of personal information, and the ability of these data to be used by third parties without the knowledge of the user. Nissenbaum and Patterson argue how this area is “*sorely lacking fundamental factual details*” [28]. Responding to this call for research, we focus on whether and how these potential challenges are experienced in practice.

Even though researchers call for more empirical research in the area [7,27], only a few studies have investigated the use of health tracking devices in the workplace from the perspective of the employees. For example, one empirical study of Danish employees participating in a three-week step-counting campaign found that while steps may seem like an obvious entity, participants in the campaign put effort into figuring out what counted as a step [17]. Different devices count steps differently, as participants found out, and they then had to negotiate this to be able to fairly compare to each other. This demanded time and effort. The same study also points out that the campaign influenced the workday of both participants and non-participants, because non-participants could not easily join conversations or activities revolving around step-counting [17]. Masson et al. gave 13 participants from within their own company activity tracking devices. They found that all participants ceased using their device within 3 months, and that all participants were concerned about the privacy of the collected data [23]. While these studies focus on the experiences of employees, both studies involve short-term health tracking and include relatively small groups of participants. In the study at hand, we consider short-term tracking (such as event based tracking) as well as long-term tracking.

STUDY DESIGN

To understand the design and practice of health tracking in workplace health and wellness programs, we conducted exploratory interviews, a survey, and follow-up interviews with survey respondents. The study was conducted with employees and wellness program administrators from North American companies from March to August in 2016.

Exploratory Interviews

To get insight into various options and implementations of health tracking in the workplace, we initially conducted semi-structured interviews with three wellness program administrators and seven employee participants from seven

different companies. We recruited participants using snowball sampling through mailing lists and authors’ social networks. Interviews with wellness program administrators focused on their goals, design process, and the implementation details of their programs, as well as their roles in implementing and maintaining the program. Interviews with employees explored prior experiences with health tracking in general as well as experiences with the health and wellness program offered by the workplaces.

Three interviews were conducted in person, and all other interviews were conducted via phone or video conferencing and lasted from 30 to 90 minutes. Each interview participant was compensated with a USD\$10 gift card. All interviews were audio recorded and transcribed for analysis. Two researchers read through the transcripts and discussed emergent themes iteratively. We then used these themes as a basis for designing survey questions intended to reach out to a broader set of participants.

Survey

We sent out the survey through wellness program administrators who agreed to help distribute it during the exploratory interviews. We also recruited participants using authors’ social networks. We received 606 complete responses. After excluding 25 respondents who were unaware of any health and wellness programs offered in their workplace, we had 581 valid responses with 45 from wellness program administrators and 536 from employees. We sought to reach a broad audience, but one particular wellness administrator shared the survey particularly broadly and enthusiastically. As a result, most survey responses (539 out of 581 responses) came from one particular company (hereafter ‘Company X’) since our survey was distributed through their internal mailing list. This provides us an opportunity to gain an in-depth understanding of perception and experience of a large (over 5000 employees) company (Table 1) while also analyzing responses from at least 13 other companies (Table 2) for comparison.

The survey consisted of open- and close-ended questions. Employees were asked what type of health tracking programs were offered in their workplace health and wellness program, and what factors they have considered when deciding whether to participate. If they had participated or were participating in such programs, we asked about their experience of participation, whether they considered that the program supported their health goal, and their overall perception of the program. Wellness program administrators were asked about their goals, experience, and challenges of developing and deploying health tracking in the health and wellness program. Survey respondents were enrolled into a raffle with one of six gift cards (one USD\$50 and five USD\$20) if they provided an email address at the end of the survey.

Follow-up Interviews

We conducted follow-up interviews with 11 survey respondents to gain a more in-depth understanding of their

perceptions and experiences. We recruited participants with different roles (wellness program administrators vs. employees), experiences (participation vs. non-participation), and attitudes toward the programs (positive, ambivalent, or unenthusiastic). We also strove for diversity in program type and features. We conducted all follow-up interviews via phone or video conferencing. Interviews lasted from 30 to 45 minutes. Each interviewee was compensated with a USD\$10 gift card. All interviews were audio recorded and transcribed for analysis.

Interview transcripts and open-ended survey responses were coded using open and iterative coding. Two authors coded separate sections, and then discussed these codes and emergent themes, identifying tensions or overlaps. All authors then engaged in an iterative process of identifying main themes in the analysis and writing.

Participant company and program information

In our data set, we have most responses from employees from Company X. Due to the anonymization process of the survey we could not always determine which company respondents were affiliated with. However, some provided links to the health and wellness program used in their company, and we were thus able to determine that we have responses from at least 13 companies besides Company X. As we analyzed interviews and survey responses we paid special attention to potential discrepancies between attitudes and experiences expressed by employees of Company X and all other companies. We found, however, the determining factor of experience and attitudes was in the nuance of what was offered at their local office or company, not whether they were employees in Company X. Across all survey questions, most responses between employees from Company X and other companies are within 5% of each other. We hereafter present the results of responses as split percentages (X: x%, O: o%) for Company X and other companies, respectively. We discuss nuance in differences. In the following we first present some background information to show the various tracking options available to employees in Company X.

Company X is a US-based technology company with 5,000-10,000 employees located in more than ten North American cities. Its employees have mostly desk jobs but with flexible working hours. The health and wellness program is a point-based system, where employees can earn virtual points

Company X	
Employees (N=504)	
Age	Mean = 30
Gender	Female (282), Male (222), Unstated (1)
Education level	High school (7), College (271), Graduate (227), Unstated (1)
Wellness program administrators (N=35)	
Age	Mean = 30
Gender	Female (28), Male (6), Unstated (1)
Education level	High school (1), College (16), Graduate (18)

Table 1 Survey participants from Company X

from various health and wellness activities. This includes, for example, filling out wellness surveys or participating in educational seminars. Employees can then use these virtual points to purchase company swag or fitness products from an internal online wellness store. The company provides a wide range of options to encourage healthy behavior and relevant tracking. These include:

- *On-going health tracking program.* Employees can connect their trackers or apps to or manually input their data into the program app or website. These data are then converted into virtual points.
- *Onsite gym/class participation.* The company provides an onsite gym in most office sites and a wide range of fitness classes during lunch and afternoon break. Participation is automatically tracked when they swipe their employee ID card upon entering and converted to the virtual points.
- *Short-term events.* Company X also works with third-party companies to provide various short-term health and wellness events, such as stress or food tracking activities, which can also be converted to the virtual points.
- *Gym membership reimbursement.* For employees who wish to use their preferred gym or activities outside of the company, the program will reimburse the membership or class fees up to a fixed allowance. However, this participation is not tracked in the virtual point system.

In analysis of our findings we have noted which company participants were from for clarity, and we recognize that most quotes we provide are from Company X due to the majority of responses. However, this dataset of both Company X and all other responses provides a broad variety of experiences on which we base our findings.

Other companies	
Industries and company size	
Technology	0-50 (2), >5000 (4)
Health	201-1000 (2), 1001-5000 (1), >5000 (1)
Finance	0-50 (1), 1000-5000 (1)
Education	> 5000 (1)
Employees (N=32)	
Age	Mean = 34
Gender	Female (21), Male (11)
Education level	High school (1), College (5), Graduate (15), Unstated (1)
Company size	0-50 (4), 51-200 (1), 201-1000 (5), 1000-5000(6), 5000+ (16)
Program sponsors	My own company (24), An insurance company (9), A third-party company (8)
Wellness program administrators (N=10)	
Age	Mean = 39
Gender	Female (8), Male (2)
Education level	College (1), Graduate (9)
Company size	0-50 (1), 51-200 (1), 201-1000 (5), 1000-5000(1), 5000+ (2)
Program sponsors	My own company (10), An insurance company (7), A third-party company (5)

Table 2 Survey participants from other companies

In this study, we also interviewed and surveyed people who played a role in implementing and/or maintaining workplace health and wellness programs, and refer to these as “wellness program administrators.” Some of these administrators had development, implementation, and maintenance of workplace wellness programs as their main job responsibilities. These employees were usually in human resources departments. Others had management and development of the programs as an added role in their job.

FINDINGS

In the following sections, we first present and discuss participant perception of health tracking in health and wellness programs. Most (X: 81%, O: 66%) survey participants perceived health tracking programs useful to support their health goals. Variations in different programs could cause people to have different experiences. Also, Company X, as described in the previous section, has a particularly comprehensive program, which may contribute to the higher perceived usefulness. Other participants expressed some reservations. Second, we found that time commitment was a main concern for those employees who had chosen not to participate in health tracking in the workplace health and wellness program. However, aspects such as different personal health goals, a disinterest in tracking overall, and technological challenges also surfaced. A small group of non-participating employees voiced privacy concerns, to which we pay special attention.

Prior tracking experience affected employee opinions

Some participants noted that they already used a tracker outside of their workplace health and wellness program. This aligns with research from 2013 showing that 69% American adults already track some health indicators, and one in five do so supported by technology [15]. Previous experience with activity tracking devices plays a role in the reactions towards workplace health and wellness programs. For example, employees who already tracked some aspects of health, but in a looser or paper based manner, appreciated how the health tracking system setup in their workplace made it easier for them: *“As a reminder and single source tracker (as opposed to losing journals, etc.)”* (E113, Company X, survey). Another respondent explained: *“It was able to save me some manual work”* (E498, Company X, survey). These employees had some experience with tracking prior to entering the health and wellness program, and were positively tuned towards health tracking.

Other survey respondents were more negative. For example, one respondent explained: *“I have had previous negative experiences with tracking (obsessive/disordered behavior) so I choose not to track anymore”* (E288, Company X, survey). This respondent, and others who voiced similar concerns, feared that health tracking could end up being an obsession, and potentially lead to lower health levels: *“Tracking using apps ends up causing me stress”* (E361, Company X, survey). Concerns of overuse and obsession with tracking technologies have also been

voiced by participants in studies of short-term activity tracking workplace wellness campaigns [17].

Still other participants were engaged in health tracking as part of their own practices but did not find it useful to connect their trackers to the workplace health and wellness program: *“as part of the wellness program not at all. The health tracker was useful to me though personally”* (E236, Company X, survey). In these cases, incorporating existing health tracking practices with the workplace programs could be perceived as burdensome: *“[I wish the workplace program has] better integration with the health/fitness app I already use so I don't have to track my activity in multiple apps”* (E383, Company X, survey).

Health tracking in the workplace wellness programs

In this section, we present attitudes and expectations from employees and wellness program administrators to provide an overall understanding of health tracking implementation in the workplace wellness program.

It's nice the company cares

Most (X: 75%, O: 75%) employees who participated in health tracking programs expressed positive attitudes. Employees liked how their companies made health and activity a subject to be taken up at work, and in turn it made them feel that the company cared for them.

A majority of all participants (X: 83%, O: 78%) said they would recommend health tracking programs to new colleagues. They felt that providing financial incentives to encourage physical activity delivered a positive message regarding how the company cared about employee health: *“Companies that invest their time and effort into keeping their employees healthy and active make their employees feel valued beyond just their work contribution, and make the office a happier, more fulfilling place”* (E160, Company X, survey). One respondent said: *“It's a fun way to be motivated and reach your goals, to talk about it with your colleagues. And I appreciate that the company motivates me to stay fit!”* (E253, Company X, survey). Knowing that the company wanted employees to be active made it easier to prioritize physical activities throughout the day.

We asked participants about their overall opinions on workplaces that offer health tracking. Responses to this open-ended question were overwhelmingly positive. For example, a respondent said: *“I would prefer to work for a company that offers health tracking over a company that does not. I find health tracking to be a good way to get employees engaged in the program and with each other”* (E110, Company X, survey).

Diversity in physical activity is problematic

Some employees thought health tracking programs might be more useful for people who are new to health tracking and who are not active: *“I think the program offers great solutions for those who are entry level health/wellness users”* (E111, Company X, survey). As a result, employees who are more active wanted the health tracking program to

provide more flexibility to adapt to their personal goals: *“There should be an option to customize the program to fit your personal needs, like set your own goals or small team goals etc. and not just a global company goal”* (E33, Company X, survey).

For example, some employees wanted the programs to accommodate different routines: *“I wish it was more customizable since different people practice different workouts that require different tools”* (E94, Company X, survey). Some (X: 14%, O: 14%) voiced reservations about recommending the program to others: *“Depends on their fitness levels, for people who need to get a boost to start doing some exercise sure but for sports enthusiasts not really”* (E33, Company X, survey).

Even though Company X provides incentives to encourage other activities, employees still felt step counts were the most emphasized because they were better integrated in the system employees used. For example, one participant expressed his frustration when he first logged into the web application: *“You had to select one of those before you moved forward and you had to select what you're good at what you do frequently and the options are only running, cycling, walking, and one more thing. You couldn't say okay, I do martial arts or I do weight lifting or I do cross training”* (E404, Company X, follow-up interview). In this case, the concept of what constitutes physical activity for the program failed to account for the diversity of employee practices: *“There was no personalized fitness plan or outcome, the goal was to log miles but my personal goal is a combination of running, crossfit, weight training. Goals were misaligned and no other personal incentives to provide the data”* (E33, Company X, survey).

Program administrators: holistic views not supported

In contrast with some employee perceptions, wellness program administrators emphasized their goal of supporting a more holistic view of health and wellness. For example, one administrator said: *“Wellness to you could be gardening and yoga, wellness to me could be eating really healthy, and running marathons”* (IP09, other companies, exploratory interview), and explained how they tried to account for that in their programs. In most cases, these wellness program administrators promoted other activities by providing subsidies for gym membership or class fees as well as incentives for participation.

These wellness program administrators were also aware that their programs favored some physical activities, especially step counts, over others, due to the prevalence of devices and apps that track these activities: *“Right now, steps are emphasized all the time. It's all about movement. That's cool, but you can smoke a cigarette and go for a walk.”* (IP10, Company X, exploratory interview). They noted the difficulty of changing these programs and realized that there is more work to do: *“it is a system set up to acknowledge what you track. We can't change the whole program right now. We're looking to improve the program*

and make it easier, and we're trying to ask questions of people and listen, but no formal change at this moment. We're just in the process” (P12, other companies, follow-up interview).

On the one hand, many employees are positive about health tracking technologies in workplace health and wellness programs and consider it useful for increasing physical activity levels. However, even though program administrators tried to encourage a range of activities related to health and wellness, both employees and program administrators recognized that activities that can be easily tracked shape the programs.

Awareness, incentives and accountabilities

Increasing awareness

Consistent with prior research on why people adopt fitness trackers [13,20], many survey respondents (X: 54%, O: 50%) said in an open-ended question (*“Describe your health goals before signing up for the wellness program with the health tracking option”*) that they wanted to develop awareness of and increase their physical activity level. These participants found their wellness program's health tracking option helpful for supporting these goals: *“...tracking helped me realize I was not as active as previously thought and allowed me to continuously track and improve towards my goals”* (E114, Company X, survey). Several respondents enjoyed the awareness health tracking gave them of their habits and activity levels, and how it enabled them *“to monitor my fitness, even when it wasn't top of mind”* (E475, Company X, survey) In this way, health tracking supported participants by reminding them to focus on walking more steps or sleep more hours in a busy day, when many other priorities competed for their attention. Participants felt it was motivating to see how they progressed: *“I enjoy keeping track of my improvements”* (E291, Company X, survey).

Financial incentives

Some participants enjoyed the financial incentives provided by health and wellness program: *“It's been an added motivator - the rewards for gaining points from running races and gaining step milestones are a great incentive to be active”* (E496, Company X, survey). Others were quite honest about participating only to get the bonuses or points offered in the program. As one respondent bluntly put it: *“I don't care about exercise or eating super foods, I did it for the money, and I'm glad to be done with the most recent challenge so I can go back to being my lazy self”* (E376, other companies, survey). In this way, the incentive becomes an “added motivator”. However, the financial incentive was the only reason E376 tracked, and so here the incentive is more coercive, matching concerns by researchers and media [7,26]. Financial incentives can be that final nudge to employees because they appreciate their efforts are rewarded. However, the financial incentives could also force participants more than just a gentle nudge, in a manner we suspect is unlikely to be sustainable.

Developing internal and external accountability

Some survey respondents (X: 15%, O: 19%) felt that workplace health tracking keeps them accountable to their health goals, but preferred different sources of accountability. Some respondents (X: 8%, O: 9%) found that health tracking helped them be accountable to themselves: *“Helps for personal accountability. Looking at data makes it hard to lie to yourself”* (E76, Company X, survey), or as another respondent put it: *“it created a degree of self-accountability”* (E370, Company X, survey). Others (X: 6%, O: 9%) found it useful to see their health data compared to others: *“It makes me want to be more active as I can see how many steps others are taking and if I am falling behind.”* Another participant responded: *“Seeing what my peers are doing push myself harder.”* Being able to interact or compete with colleagues also encouraged people to move more: *“By making the program company-wide available and promoting it and inspiring people to participate which led me to pay extra attention on how active I was compared to others”* (E5, other companies, survey).

Some participants could socialize with other people with whom they did or did not have direct working relationships and develop “workout buddy” relationships with them: *“Sharing daily and weekly goals and providing a buddy system which creates a support system and also accountability system which worked really well for me”* (E169, Company X, survey). The social nature of the workplace health and wellness programs provided externally driven accountability to help employees make progress toward their goals.

Overall, we found that many participants did appreciate feeling accountable, whether internally or externally. This is in conflict with prior research that has shown how being held accountable for physical activity at work can be straining [17]. We recognize that in a survey and interview study such as ours, the negative aspects of accountability were less likely to surface as clearly as in long-term ethnographic studies. However, our findings suggest that there may be instances when accountabilities can work positively in workplace health and wellness program.

Why some chose not to track

To get an overall view of opinions on health tracking in the workplace, this study also included participants who had not taken up this opportunity. Out of our 536 responses, 107 respondents from Company X (20%) and 4 from other companies (13%) replied that they had chosen not to use health tracking in their workplace health and wellness program. The lower percentage of non-participation in other companies might result from self-selection bias for our study. These participants were then asked to comment on their choice in a follow-up, open-ended question (*“In the previous question you said you chose not to use health tracking in the health or wellness program offered in your workplace. Why is that?”*). Participants often mentioned more than one concern in these responses.

16% of responses from Company X (0 from other companies) mentioned either technical problems or uncertainties that hindered participation. For example, the app or device offered by their companies worked only with certain types of smartphones. Others explained that they were uncertain of the sign-up process. For some programs, participants had to purchase a tracker without reimbursement. This deterred them from participation: *“You had to purchase the product and it was not something I thought I would use after the program.”* (E67, Company X, survey). As such, financial and technical problems did play a role when employees decided not to use health tracking. However, other themes also emerged and will be discussed more in-depth in the following sections.

Concerns with tracking as additional workplace demands

Consistent with prior work [31], 51% of the responses from Company X and 2 responses from other companies mentioned concerns about time commitment. These concerns pertained to time spent uploading and interpreting data as well as to long-term use. Some participants felt that they just did not have time, and that wearing a tracking device and understanding its data would be *“one more thing to do in a busy day”* (E34, Company X, survey). Thus, some felt that health tracking would be one more workplace demand difficult to accomplish in an already hectic schedule. One participant explained: *“requires too much work / effort on my end and I don’t necessarily have the time to follow through on a daily basis”* (E246, Company X, survey). These participants saw the potential of tracking to offer insights, but objected specifically to the long-term, daily use the program encouraged: *“Why do I have to track ALL THE TIME? it’s sickening to having to do that. I only need maybe once a quarter at MOST”* (E73, Company X, survey). Previously, we highlighted how some participants appreciated that physical activity was connected to the workplace, however, here we see others interpreted this same intervention as yet another workplace responsibility.

Already active and/or different health goals

In previous sections, we noted that participants felt tracking technologies did not support or fit well with their preferred physical activities. Responses from non-participants show that this deterred them from starting using health tracking in the health and wellness program in the first place.

28% of responses from Company X and 2 responses from other companies noted that they were already active, and did not feel they needed to use a tracking device to stay active: *“I have my own personal tracking system.”* (E528, Company X, survey). Previously we discussed how participants who already kept track of one or several health indicators in their minds or by pen and paper were generally positive towards switching to technology supported tracking. However, for participants who already used technology supported tracking, switching to the technology used in the health and wellness program was a hurdle.

Moreover, not everyone had goals that can be easily tracked using fitness trackers and apps and therefore are not easily awarded points or credit in the health and wellness programs. For example, although it might be possible to manually journal weight training, employees often cannot input these data into the system. Similarly, some participants had healthy eating goals, but these data were also not part of the incentivized activities: *“It’s not so much about getting in shape anymore, but more about paying attention to how I treat my body. What I eat and working out go hand in hand”* (E96, Company X, survey). Others just did not see how tracking would help overall health levels: *“While I completely agree that health is important, I don’t see how tracking these features day-to-day is important”* (E399, Company X, survey).

The discrepancy between individual health goals and what fitness trackers and apps can track created tensions. While some respondents were potentially interested in switching from their own tracking routine to using a tracking device in connection to their wellness program, they felt it did not fit their overall wellness goals, or did not feel tracking could support them in reaching their goals.

Tracking uninteresting

In responses about why employees had chosen not to track as part of their workplace health and wellness program, 18% from Company X (0 from other companies) mentioned that health tracking and wearable devices were just not interesting to them. For example, one respondent noted: *“Generally not interested in wearable technology”* (E173, Company X, survey). We were not, however, able to follow up with survey respondents who had noted disinterest as a reason for non-participation. We also recognize that non-use is complex and fluid, and not necessarily a problem to be solved [32]. Although prior research has informed why people abandon their trackers after use [9,20], future research should look into refusing to use from the start to understand non-use in general.

Concerns of privacy

Three participants (3%) from Company X and two participants from other companies voiced privacy concerns. While many respondents in our study felt that their employers’ interest in their health was a good thing, some felt it was invasive and thus chose not to participate.

To some respondents this concern related to the boundary between personal life and workplace: *“I feel my stats are personal. I don’t need work involved in my personal wellness tracking because it goes beyond my work day. I don’t want to feel like my every move is being monitored by work. It just feels uncomfortable”* (E534, Company X, survey). People have different tolerances for how they prefer work and private life to merge, and this diversity is likely to always be present to some degree. However, if financial incentives become great enough, some people might choose to utilize health tracking, even if it overrules their personal preferences. While we did not see many

participants express these concerns, it is still important to acknowledge them, and to realize that this can lead to feelings of coercion regardless of financial compensation.

For others, concerns revolved more around data disclosure at large: *“I don’t want a 3rd party to have any more data about me than necessary so I choose against any wearables. I don’t like the idea of being monitored”* (E444, Company X, survey). Current systems do not give the user control of their own data, and people are usually confused about how their data are used by these systems [1]. Finally, while we do not have data to support this, it is not unreasonable to think that employees might have fewer privacy concerns because they trust their companies to choose tracking devices that protect their data.

DISCUSSION

Overall, employees who participated in our survey had many positive things to say about health tracking in workplace health and wellness programs. Yet they also expressed a diversity of concerns. The sources of these concerns ranged from the design limitations of current activity tracking technologies to significant individual differences in attitudes towards personal health, the need for separation between work and personal life and financial limitations. In the space below we first discuss the issues that emerged most prominently in our data. This is what Ackerman has called “the socio-technical gap” [1] between the diversity of what people conceptualize as health and wellness, the more holistic goals of the administrators of health and wellness programs and the limits of technologies to support health tracking. We then consider why, despite much criticism about privacy issues, so few of our participants expressed this concern.

The social-technical gap

Ackerman described the social-technical gap as *“the divide between what we know we must support socially and what we can support technically”* [1]. Health tracking, in its current form, has largely been limited by what technology can reliably sense, such as step counts and distance. Despite recent efforts to include functionality to algorithmically recognize other activities from sensor data, most such technologies rely on heart rate and movement measures to estimate effort, resulting in relatively unreliable and limited feedback to the user. Thus, there is often a gap between the diversity of forms that health and wellness activities can take and the activities that could be technologically tracked in workplace health and wellness programs. This gap frustrates both employees and program administrators.

Overall, the program administrators of Company X and the other companies expressed in the survey that the most important goal of the health and wellness programs was to help employees maintain a healthy lifestyle and learn about healthy lifestyle choices, and to support a better working environment. For example, in Company X, the health and wellness program was designed based on a particular

conception of wellbeing, which focused on nutrition, hydration, breathing, movement, thoughts, and rest.

To motivate employees, Company X offered a variety of health and wellness activities, and the incentives were designed to include more than just step counting or distance tracking. For example, employees could also participate in meditation classes, join an ironman race, or go to the gym more than three times a week. However, many of these activities required manual self-report whereas step counting was integrated directly into the tracking systems, and thus more easily reported. This led to most attention being paid to step-counting and leaderboards favored walking and running more than other activities, even though the website and app allowed employees to manually log and convert some of their other activities into miles. Because of this, some employees interpreted step counting as a company-wide goal (one million miles). In addition, simply presenting the number of times an employee engaged in an activity does not provide enough information to help employees pursue or maintain more sophisticated health goals. For example, number of gym visits may not be helpful to support goals such as improving strength level.

As a result, many employees considered health tracking technologies more useful for people who were new to tracking and exercise. People who already were active often did not see the value of counting steps and therefore did not participate in the program or only participated to get the financial incentives. Program designers put effort into encouraging a diversity of activities, supporting individual variation in health goals. However, the ease and prevalence of fitness tracking technologies, combined with leaderboards that clearly acknowledged only steps and distances, caused employees to focus on activities that could be tracked with wearables.

Most employees who completed our survey and interviews perceived their incentivized workplace health and wellness program as a sign that their employer cares about employee health and happiness. This is consistent with findings from another recent workplace survey where the implementation of a workplace program helped to increase employee identification with their company [11]. However, the potential discrepancy between health tracking technologies and the overall goals of the wellness program might affect employee relationship with the company. Future research should consider implementations of health tracking and the influence on employee-employer relationship in detail. The disconnect between the limits imposed by technologies on what can qualify as health and wellness in workplace programs and employee health goals and health practices could result in employees feeling coerced to use health tracking technologies especially in long-term programs where financial incentives are involved. Furthermore, where many appreciated employer interest in employee health and wellness activities outside the workplace, some quite legitimately felt this sort of attention was intrusive.

Therefore, employers should think about how to better design and promote a diversity of components for their wellness programs that can help support individual health goals without overstepping boundaries.

Privacy is not a primary concern, yet

In our study, we strove to understand overall concerns about health tracking in health and wellness programs. Therefore, we included open-ended questions, such as “Overall, what is your opinion on workplaces that offer health tracking as part of their health and wellness programs?” We chose open-ended questions, rather than specific privacy questions, as research suggests that directly asking about privacy may result in biased responses [3]. Most of our survey and interview participants did not voice concerns about privacy in regards to sharing their health tracking data with their employers. This stands in contrast with recent concerns of both researchers and the media [7,27,29]. However, this does not mean that privacy is not an issue. In this section, we discuss several possible explanations. We also note that as other concerns are addressed, privacy concerns may become more important.

Program fit is a more immediate concern than privacy

Health tracking programs, in their current forms, impose other more concerning challenges on employees than their privacy expectations. For example, some employees struggled with the balance between busy work schedule and fitting workout into their routine. Although employees appreciated employer interest in physical activities, long-term, everyday health tracking can become burdensome for some. Positive health and wellness promotion rhetoric in the workplace influences employee choices to participate, and they expect positive outcomes. However, such efforts can also force an unwelcome renegotiation of boundaries between work and private life for some [18].

On-going, continuous health tracking program can be useful in some cases and employees in our study disagreed with each other. Where some were in agreement with prior research [17,23] and appreciated the limited length of health promotion efforts, others wanted more. Some survey participants and interviewees whose companies offered short-term health tracking events expressed a preference for continuous health tracking options: “health is not for three months”. However, we urge companies to consider the goals and appropriate use cases for each option and to explicitly communicate these goals to their employees when implementing health tracking programs. While continuous health tracking might help people who want to develop consistent, regular routines of working out, it may not be useful for everyone. In this case, the incentives should be designed to encourage consistency rather than fixed, step-count goals [8]. Short-term events are effective to increase employee attention and to boost activity level in a short period of time [4]. People also might be able to continue the habit and apply the knowledge obtained from participating in short-term events and use it independently

[12]. However, companies should also consider how to help sustain the behavior if employees wish to. These short-term events should also account for a diversity of health goals, activities, and work routines. In this way companies need to understand which challenges the individual employees are facing, and find the right fit to respond to that need, rather than forcing one-size-fits-all wellness programs.

Transparent policy about how data is handled

Most of the companies in our study were very transparent about their data collection process and access policies. These companies usually adopted third-party platforms to implement health tracking programs. As part of the system design, employers often do not have individual health tracking data but receive aggregated, anonymous reports at the end of each program period. Wellness program administrators also strove to openly address the potential privacy concerns by explaining the data use policy in newsletters (P7, P10) and by having an open, standard FAQ in response to employee concerns (P9). There remains, however, an issue in the fact that a third-party is introduced into the process of intimate disclosure of health data between the employees and the workplace.

Minimal use of health tracking data

The most common outcome variable measured by wellness program administrators we surveyed and interviewed is engagement (i.e., participation rate) in the health tracking program. As health tracking is relatively new, most wellness program administrators are preoccupied with increasing employee interest in tracking their health and in motivating them to shift from a sedentary lifestyle to a more active level.

This transparent and minimal use of health tracking data might have eased current employee concerns. On the other hand, some employees felt their data were underused and wished their programs would provide in-depth analysis of their data, creating more opportunities to help achieve their health goals. As more and more employees have experience with health tracking data, employers might need to put thought into how to provide personalized information to support individual health goals while assuaging privacy concerns. Building on the citizen science movement, individual-lead collective health data analysis has drawn attention from research [14]. As employees see the need to derive better value from the tracked data shared with wellness programs, there is potential in employees participating in the decision of how these data can be used. Future research should investigate employee expectations and concerns with regard to employee-driven data analysis.

Limitations

Our survey respondents and interviewees are relatively young (*median* = 35 vs. 42 of the labor force in USA [21]) and largely from tech-savvy companies. Because incentives for the health tracking program in our case study site, Company X, were implemented as a virtual point system, our data better describe programs that offer monetary discounts or virtual point systems than those offering

insurance discounts. Therefore, employees participating in insurance sponsored health tracking program might have substantially different experiences or concerns and their attitudes about sharing data might differ. However, analysis of data from the small sample of participants in insurance sponsored program indicated that the social-technical gap between health tracking technologies and health and wellness goals is just as relevant. We also found similar needs to support various health goals and routines from participants of both types of programs. Future studies should investigate how employee experiences and concerns might differ in other types of programs.

CONCLUSION

Companies increasingly include health tracking as an element in their workplace health and wellness programs. This may include manual tracking or self-report, but also increasingly includes the use of tracking technologies such as the Fitbit, the AppleWatch and other devices that can automatically sync data with the health and wellness program. Companies incentivize sharing of health data from these devices in various ways. For example, some employees may receive virtual points in a gift shop, while other employees receive discounts on insurance premiums. Among researchers and media, this has caused privacy concerns, discussions of datafication of health and disciplining of the employees.

This paper makes two primary contributions. First, it uses empirical data to provide an understanding of employee experiences and attitudes towards health tracking in workplace health and wellness programs. We found that program fit turned out to be a more immediate concern than privacy. Second, we found that program administrators in our study were already aware of the gap between a holistic view of health and what is incentivized because it is easy to reliably track (often this is steps). We encourage the program administrators to continue their work to develop and promote programs with holistic views of health that incentivize and support more than what is easily tracked. We call for research to help administrators in this quest, which will lead to a better fit between what employees want from their workplace wellness program and what they get.

ACKNOWLEDGMENTS

We are thankful to all of our participants. We also thank Andrew Miller for helping with early study design as well as Andrew Berry, Elena Agapie, and reviewers for thoughtful feedback on earlier version of this paper. This work was funded in part by Nordea Life and Pension, Denmark, the National Science Foundation (award #IIS-1553167), and Microsoft.

REFERENCES

1. Mark Ackerman. 2000. The Intellectual Challenge of CSCW: The Gap Between Social Requirements and Technical Feasibility. *Human-Computer Interaction* 15, 2, 179–203. http://doi.org/10.1207/S15327051HCI1523_5
2. Steven Allender, Derek Colquhoun, and Peter Kelly. 2006. Competing discourses of workplace health. *Health* 10, 1, 75–93. <http://doi.org/10.1177/1363459306058989>
3. Alex Braunstein, Laura Granka, and Jessica Staddon. 2011. Indirect Content Privacy Surveys: Measuring Privacy Without Asking About It. *Symposium on Usable Privacy and Security (SOUPS)*, 15. <https://doi.org/10.1145/2078827.2078847>
4. Lorraine R Buis, Timothy A Poulton, Robert G Holleman, Ananda Sen, Paul J Resnick, David E Goodrich, LaVaughn Palma-Davis, and Caroline R Richardson. 2009. Evaluating Active U: an Internet-mediated physical activity program. *BMC public health* 9, 331. <http://doi.org/10.1186/1471-2458-9-331>
5. Business Wire. 2015. Companies Are Spending More on Corporate Wellness Programs but Employees Are Leaving Millions on the Table. Retrieved from <http://www.businesswire.com/news/home/20150326005585/en/Companies-Spending-Corporate-Wellness-Programs-Employees-Leaving>
6. Ruey-Yu Chen and Li-Hui Yu. 2016. Following the trend for a comprehensive healthy workplace in Taiwan. *Global Health Promotion* 23, 1 Suppl, 35–45. <http://doi.org/10.1177/1757975916635505>
7. Mads Christophersen, Tue Langhoff, and Pernille Bjørn. 2015. Unforeseen Challenges: Adopting Wearable Health Data Tracking Devices to Reduce Health Insurance Costs in Organizations. In *International Conference on Universal Access in Human-Computer Interaction*, 288–299. http://doi.org/10.1007/978-3-319-20684-4_28
8. Chia-Fang Chung and Catalina Danis. 2016. Integrating Population-based Patterns with Personal Routine to Re-engage Fitbit Use. *10th EAI International Conference on Pervasive Computing Technologies for Healthcare*, 154–161. <http://doi.org/10.4108/eai.16-5-2016.2263334>
9. James Clawson, Jessica A Pater, Andrew D Miller, Elizabeth D Mynatt, and Lena Mamykina. 2015. No Longer Wearing: Investigating the Abandonment of Personal Health-Tracking Technologies on Craigslist. *Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp 2015)*, 647–658. <https://doi.org/10.1145/2750858.2807554>
10. Daniel J Crespin, Jean M Abraham, and Alexander J Rothman. 2016. The effect of participation in an incentive-based wellness program on self-reported exercise. *Preventive Medicine* 82, 92–98. <http://doi.org/10.1016/j.ypmed.2015.11.001>
11. Stephanie L Dailey and Yaguang Zhu. 2016. Communicating Health at Work: Organizational Wellness Programs as Identity Bridges. *Health Communication*, 1–8. <http://doi.org/10.1080/10410236.2015.1120698>
12. Daniel A Epstein, Monica Caraway, Chuck Johnston, An Ping, James Fogarty, and Sean A Munson. 2016. Beyond Abandonment to Next Steps: Understanding and Designing for Life After Personal Informatics Tool Use. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2016)*, 1109–1113. <http://doi.org/10.1145/2858036.2858045>
13. Daniel A Epstein, An Ping, James Fogarty, Sean A Munson, Computer Science, and Human Centered Design. 2015. A Lived Informatics Model of Personal Informatics. *Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp 2015)*, 731–742. <http://doi.org/10.1145/2750858.2804250>
14. Barbara J Evans. 2016. Barbarians at the Gate: Consumer-Driven Health Data Commons and the Transformation of Citizen Science. *American Journal of Law & Medicine* 42, 4, 1–34.
15. Susannah Fox and Maeve Duggan. 2013. Tracking for Health. *Pew Internet*, October, 1–40. Retrieved from <http://www.pewinternet.org/Reports/2013/Tracking-for-Health.aspx>
16. Julie A. Gazmararian, Lisa Elon, Kimberly Newsome, Laura Schild, and Kara L. Jacobson. 2013. A randomized prospective trial of a worksite intervention program to increase physical activity. *American Journal of Health Promotion* 28, 1, 32–40.
17. Nanna Gorm and Irina Shklovski. 2016. Steps, Choices, and Moral Accounting: Observations from a Step-Counting Campaign in the Workplace. *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (CSCW 2016)*, 148–159. <https://doi.org/10.1145/2818048.2819944>
18. Nanna Gorm and Irina Shklovski. 2016. Sharing Steps in the Workplace: Changing Privacy Concerns Over Time. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2016)*, 4315–4319. <https://doi.org/10.1145/2858036.2858352>
19. Beverly B Green, Allen Cheadle, Adam S Pellegrini, and Jeffrey R Harris. 2007. Active for Life: A Work-Based Physical Activity Program. *Preventing Chronic Disease* 4, 3, A63.
20. Amanda Lazar, Christian Koehler, Joshua Tanenbaum, and David H Nguyen. 2015. Why we use and abandon smart devices. *Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp 2015)*, 635–646. <https://doi.org/10.1145/2750858.2804288>

21. Marlene A Lee and Mark Mather. 2008. U. S. Labor Force Trends Population Bulletin. *Population Reference Bureau* 63, 2, 16. <http://www.prb.org>
22. Stephanie M Lee. 2016. Workers May Soon Have To Share Health Data — Or Pay A Penalty. *BuzzFeed*. <https://www.buzzfeed.com/stephaniemlee/wellness-v-privacy>
23. Cécile Boulard Masson, David Martin, Tommaso Colombino, and Antonietta Grasso. “The Device is Not Well Designed for Me” On the Use of Activity Trackers in the Workplace? *Proceedings of the 12th International Conference on the Design of Cooperative Systems (COOP 2016)*, 23-27. http://doi.org/10.1007/978-3-319-33464-6_3
24. Soeren Mattke, Hangsheng Liu, John P Caloyeras, Christina Y Huang, Kristin R Van Busum, Dmitry Khodyakov, Victoria Shier. 2013. Workplace Wellness Programs Study Final Report. *Rand Corporation*. <https://www.basicknowledge101.com/pdf/health/wellnessstudyworkplace.pdf>
25. Ray M Merrill, Beverly Hyatt, Steven G Aldana, and Dan Kinnersley. 2011. Lowering Employee Health Care Costs Through the Healthy Lifestyle Incentive Program. *Journal of Public Health Management Practice* 17, 3, 225–232. <http://doi.org/10.1097/PHH.0b013e3181f54128>
26. Phoebe Moore and Lukasz Piwek. 2016. Regulating Wellbeing in the Brave New Quantified Workplace. *Employee Relations*. <http://eprints.mdx.ac.uk/id/eprint/20974>
27. Phoebe Moore and Andrew Robinson. 2015. The quantified self: What counts in the neoliberal workplace. *New Media & Society*. <http://doi.org/10.1177/1461444815604328>
28. Helen Nissenbaum and Heather Patterson. 2016. Biosensing in Context: Health Privacy in a Connected World. In *Quantified: Biosensing Technologies in Everyday Life*, 79.
29. Parmy Olson. 2015. More Bosses Expected To Track Their Staff Through Wearables In The Next 5 Years. <http://www.forbes.com/sites/parmyolson/2015/06/01/wearables-employee-tracking/#6ec1ef16ec9>
30. Stephen J Onufrak, Kathleen B Watson, Joel Kimmons, Liping Pan, Laura Kettel Khan, Seung Hee Lee-Kwan, Sohyun Park. 2016. Worksite Food and Physical Activity Environments and Wellness Supports Reported by Employed Adults in the United States, 2013. *American Journal of Health Promotion*, 0890117116664709. <http://doi.org/10.1177/0890117116664709>
31. Ashley Lynne Person, Sarah Elizabeth Colby, Jessica Ann Bulova, and Janie Whitehurst Eubanks. 2010. Barriers to participation in a worksite wellness program. *Nutrition research and practice* 4, 2, 149–154. <http://doi.org/10.4162/nrp.2010.4.2.149>
32. Neil Selwyn. 2003. Apart from technology: Understanding people’s non-use of information and communication technologies in everyday life. *Technology in Society* 25, 1, 99–116. [http://doi.org/10.1016/S0160-791X\(02\)00062-3](http://doi.org/10.1016/S0160-791X(02)00062-3)
33. Timothy S Wells, Ronald J Ozminkowski, Michael P McGinn, Kevin Hawkins, Gandhi R Bhattarai, Seth A Serxner, and Chris Greame. 2016. Incorporating Reporting Efforts to Manage and Improve Health and Wellness Programs. *Population Health Management*. <http://doi.org/10.1089/pop.2016.0046>.