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A longitudinal study combining the Double Diamond framework and Behavior Change Wheel to co-create a sedentary behavior intervention in police control-rooms

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Abstract

Background: Police work can be sedentary and stressful, negatively impacting health and wellbeing. In a novel co-creation approach, we used the Behavior Change Wheel (BCW) and Double Diamond (DD) design framework to guide the collaborative design and development of a sedentary behavior intervention in the control-rooms of two British police forces.

Methods: Multiple stakeholders participated in four phases of research. In Phase 1, a literature review, focus groups (*N*=20) and interviews (*N*=10) were conducted to 'discover' the relationship between physical activity and wellbeing in the police. In Phase 2, a steering group consolidated Phase 1 findings to 'define' a specific behavior for intervention. Phases 3 and 4 'developed' the intervention across six workshops with control-room workers and six steering group workshops.

Results: The co-creation process identified contextual sedentary behavior as the target behavior, driven by behavioral regulation, social influence, and social norms. The sedentary behavior intervention targeted these drivers and aimed to engage control-room workers in short bursts of physical activity throughout their shifts. Key intervention features targeted involvement of staff in decision-making and embedding physical activity into work practices.

Conclusions: The BCW and DD can be combined to co-create evidence-based and participant-informed interventions and translate science into action.

Keywords: Intervention development, co-creation, sedentary behavior, police, wellbeing, Behavior Change Wheel

Introduction

Policing is a high stress occupation which can negatively impact the health and wellbeing of the workforce(1). The Police Covenant(2) outlined a UK Government legislative pledge to improve the working experience of people in policing. To fulfil the Police Covenant, evidence-based approaches to supporting wellbeing are needed(3). Using a co-creation approach, this research explored stress and wellbeing in two British police forces and aimed to develop a sedentary behavior intervention with police control-room workers, to support their wellbeing.

Co-creation is a collaborative approach to research in which participants (e.g., stakeholders, participants with lived experience, end-users) are equal partners in the research process(4). In line with nominated definitions of co-creation(5), the term is used in this study to encompass the involvement of police stakeholders in decision-making throughout the research process, including co-design methods within the broader co-creation process. A quantitative exploration of stress and wellbeing in the police workforce(6) identified that police workers who engaged in the World Health Organization(7) recommendations for physical activity had significantly improved relationships between perception of work demands, organizational stress and wellbeing. Consequently, it was police stakeholders' priority to focus on a sedentary area of their workforce, where wellbeing could potentially be supported through increased physical activity behavior. Police control-rooms were identified as a sedentary area of policing, where employees (e.g., emergency call handlers, dispatch officers) work in a unique environment and are susceptible to experiencing high work-related stress, physical ill-health and mental ill-health(1,8). In other areas of policing, physical activity interventions have benefitted police officer mental health(9). Physical activity interventions often target interdependent behaviors under the umbrella term of 'physical activity' (e.g., interruptions in sedentary behavior are replaced with light physical activity)(10). Intervention descriptions and development processes are, however, not fully reported; resulting in minimal understanding of the mechanisms through which physical activity interventions can successfully be translated into action in a police context.

Intervention development

Medical Research Council (MRC) guidance for complex intervention research(11) emphasizes the need to describe clearly the development process(12) and the steps taken to understand the context into which interventions are to be implemented(13). Despite this, interventions often fail to adequately report the process of intervention development(14).

Using a co-creation approach, our research provides new knowledge on the processes of developing a context-specific intervention. Guided by the Double Diamond (DD)(15), our research was underpinned by divergent (exploration) and convergent (consolidation) thinking processes and a set of design principles which emphasized the importance of relationships (e.g., be people centered, communicate). The DD framework (see Figure 1) is widely used to guide how researchers move from understanding a problem to working with end-users to answer it(16).

Appropriate use of theory is another core element of complex interventions within the MRC guidance(11). In our research, to systematically develop a theory-based intervention, the Behavior Change Wheel (BCW)(17) was followed. The BCW synthesizes across behavior change theories to provide a framework that has been used with collaboration approaches aiming to change physical activity and sedentary behavior(18,19). The Capability, Opportunity and Motivation model (COM-B)(20) sits at the center of the BCW and assists consideration of context-specific behavioral influences in intervention development. Starting with a COM-B analysis, researchers then follow the BCW to target the contextually relevant theoretical constructs in their interventions. To make the theoretical constructs within the intervention clear, the mechanisms of action (MoA) tool(21) can be used alongside the BCW to develop program theory (understanding how and why the intervention might be effective). We, therefore, integrated the DD and BCW and, by doing so, provided a novel co-creation *and* theory-based framework for the development of a sedentary behavior intervention with police control-room workers. Something required within the extant behavior change literature (13)(22).

Method

Research Design

Four phases were undertaken that followed the Discover, Define, Develop, and Deliver model of the DD (see Figure 1). The Discover phase involved exploring wellbeing in the police and understanding participants using a focus group and semi-structured interview research design. The insight gathered was consolidated in the Define phase to focus on a specific behavior and context. In the Develop phase, a range of context-specific interventions were explored, to produce a framework of an intervention in the Deliver phase.

INSERT FIGURE 1 HERE.

Participants

Two police forces were recruited to the study. Force A was a large, urban police force (circa 5,000 employees). Force B was a smaller, rural police force (circa 2,500 employees). Multiple levels of stakeholders from each police force participated in the multiphase research process. These included:

- Steering group: Comprised two members of the research team and a member of senior management from each police force (*N*=4). Other senior leaders co-opted in over the seven-year research period. The steering group met bi-monthly and were engaged in all four phases of the DD process, overseeing research progress and driving longitudinal engagement with the workforce.
- Focus groups: 20 participants took part in four focus groups (two per police force) during Phase 1 of the study (Discover). Purposeful random sampling was used to identify a diversity of roles and rank within each workforce. Police workers were excluded if their role and rank had already been represented by other focus group participants.
- Interviews: Also during Phase 1 (Discover), ten interviews were conducted with police workers (Force A, *N*=6; Force B, *N*=4). Criterion-based and key informant sampling were used to recruit 'inactive' police employees who did not engage in physical activity. As a 'hard-to-reach' group, steering group members identified departments with low work-related physical activity for potential participants (e.g., sedentary custody and control-room workers). Physically active police workers were excluded.
- Intervention development: Steering group and control-room workers (Force A, *N*=67; Force B, *N*=33*)* participated in intervention development phases (2-4). Police workers not working in the control-room were excluded.

Procedure

The intervention development process was prefaced by a quantitative exploration of stress and wellbeing in the police(6). To support methodological rigor, member reflections, critical friends and reflexivity were applied throughout the intervention development process(23). Ethical clearance from the lead author's institution was granted (references: 18-7-03R; 1873). The study was conducted over seven years, from 2016 – 2023.

Phase 1 (Discover)

To understand physical activity behaviors, stress, and wellbeing in the workforce, a

literature review was conducted to discover potential theoretical determinants and whether any effective physical activity interventions already existed(12). Focus groups explored the relationship between physical activity and wellbeing across the workforce; key findings aligned to the COM-B model and informed the interviews. Interviews established the barriers and facilitators to the physical activity behavior of inactive police workers.

Phase 2 (Define)

In a workshop with the steering group, Phase 1 findings were consolidated to focus on sedentary behavior in the control-room. Building on the COM-B concepts identified, the BCW guidance was followed to develop a context-specific intervention in Phases 3 and 4.

Phase 3 (Develop)

In Phase 3, researchers observed the control-room context and collaborated (via workshops) with control-room workers to learn about the feasibility and acceptability of intervention options. Workshops were repeated six times, across morning, day and night shifts in each police force to understand sedentary behavior and potential solutions in context (BCW Stage 1). Findings from the control-room workshops were refined with the steering group to identify interventions options (BCW Stage 2). Using the Acceptability, Practicability, Effectiveness, Affordability, Side-effects and Equity criteria (APEASE)(20) and further reviews of intervention evidence, an intervention option was selected.

Phase 4 (Deliver)

In Phase 4, feedback from senior management in the control-rooms of both police forces was gathered in a workshop. The feedback informed the intervention content and implementation options (BCW Stage 3).

Materials for Data Collection

A focus group guide with personas was used to facilitate participants in considering the role of physical activity in wellbeing from the perspective of others, as well as their own (Supplement File 1). Each persona was of a police force worker with low physical activity behavior and prompted focus groups participants to discuss how physical activity might relate to the wellbeing of each persona. Personas were developed by co-creation with the steering group and a pilot focus group was conducted with control room staff and other police workers to gain further feedback on how ‘real’ the personas were to their working context.

A semi-structured interview guide (Supplement File 2) was developed to understand a ‘typical’ working day for participants and prompt discussion on COM-B concepts in relation

to physical activity at work.

Results

Phase 1 (Discover)

Full Phase 1 results are available in a literature review preprint(24) and in Supplement File 3. A summary is provided here.

Literature Review

Literature review findings(24) coalesced around two themes: physical activity mechanisms and physical activity interventions. Reported mechanisms suggest that physical activity might: buffer the negative effects of work-related stress on health(25); provide detachment and recovery from work(26); offer a strategy for coping with stress(27); and improve wellbeing through eudemonic processes (e.g., fulfilling psychological needs, feelings of mastery)(28). Physical activity interventions in the police have been delivered primarily through exercise programs(29), team competitions(30,31), and/or sedentary behavior interventions through e-health software(32). Few interventions were theoretically informed, although motivational interviewing and the BCW have been used(30,33). Together, the research suggests that social support(30,31), involvement in decision-making(33) and embedding the activity into work practices(29) might be important to the feasibility and efficacy of interventions.

Focus groups

Our reflexive thematic analysis(34) identified two mechanisms to explain why physical activity was related to wellbeing in the police workforce. First, through the perception of stress (physical activity enabled reappraisal of stressful situations and/or was perceived as an effective way of coping). Second, through feelings of self-determination (physical activity fulfils relatedness, competency, autonomy). Focus group discussions reflected the COM-B concepts, as participants spoke about: the influence of others (e.g., supervisors) in permitting physical activity at work (social opportunity); the need to enjoy physical activity (motivation, psychological capability); and the work context (physical opportunity) as influential in physical activity behavior.

Interviews

Our reflexive thematic analysis found psychological capability, social opportunity, automatic motivation and reflective motivation were prominent barriers and enablers to physical activity behavior (see Table 1). Physical capability and physical opportunity were

less prominent; possibly because the barriers for police employees using gyms at work were not solely related to facility availability (e.g., the perceived need for permission to be active in an autocratic and hierarchical work context). There were exceptions in that some work locations did lack facilities, highlighting a need for context-specific interventions.

INSERT TABLE 1 HERE

Phase 2 (Define)

In a steering group workshop, Phase 1 results (Supplement File 3) were reviewed, and the control-room emerged as the context for the intervention development and that sedentary behavior was the target intervention behavior. Phase 1 participants had stated that the control-room was a restrictive environment where access and opportunity to increase physical activity was problematic. Steering group members explained the restrictions meant that control-room workers often felt unable to access existing police wellbeing initiatives that mostly coalesced around physical activity type interventions (i.e., a context-specific intervention was needed). Leaning on the COM-B concepts identified in Phase 1, initial steering group intervention ideas included education, exercise prompts (psychological capability), social support, modelling (social opportunity), rewards (automatic motivation) and personal plans (reflective motivation). For the control-room specifically, steering group members perceived that the intervention should focus on psychological capability and social opportunity, as it was important to reach the whole department (i.e., unlike personal plans), but not favor the control-room over other departments in the workforce (i.e., unlike rewards). It was also suggested that existing interventions might be lower cost and help buy-in, if there was previous evidence that the intervention was effective. The workshop concluded by defining the next phases of the intervention development (see Figure 1).

Phase 3 (Develop)

Control-room workshops

It was identified that sedentary behavior in the control-rooms was driven by work demand and social norms. The high levels of emergency calls and incidents meant that staff had little awareness of their own wellbeing needs (e.g., the need to move). The only reason not to be sat at a workstation was if a staff member was ‘doing a tea round’ for their team or going to the toilet. Supervisor permission was needed to do this. Apart from one 36-minute break during an eight to12 hour shift, staff thought there were no opportunities for movement within their role, although they wanted to move more. Control-room workers were accustomed to monitoring computer screens, and so a program prompting their movement

was deemed a feasible intervention.

Steering group workshops

The APEASE criteria were used with the steering group to refine intervention options from the understanding gained in the control-room workshops. Guided by the BCW, it was agreed that enablement, modelling, training and education intervention functions could all be influenced through service provision and regulation policy categories(17). Specifically, e-health software could deliver a service to prompt a change in the sedentary habits of control-room workers, implemented by shaping social norms.

The researchers sourced six existing e-health software programs and met with representatives of two of the programs to discuss their features, functionality, and scope for adaptation. The programs were demonstrated to the steering group in a workshop. The Exertime software(35) was preferred as a bespoke version could be created for the control-room context. The original Exertime software prompts users to stand and engage in a short bout of physical activity in the vicinity of their work desk. The duration of each exercise is determined by the user (typically one to two minutes), and users are prompted to complete an activity every 45 minutes. The prompt can be ignored, but only for 15 minutes, at which point Exertime takes over the computer screen to 'force' users into exercise and make it more difficult to continue with the existing sedentary habit (a passive prompt).

Phase 4 (Deliver)

Control-room senior management gave feedback on the e-health software. In Force B, supervisors were positive about the intervention and recognized their role in supporting staff (e.g., encouraging staff participation, providing different types of support to staff). They volunteered to be filmed demonstrating the software exercises to model behaviors and show their support. Further, supervisors suggested introducing the exercises to staff in training days so that they could practice the exercises, building their self-belief and confidence to participate. In Force A, leaders were generally positive but had some concerns that staff would use the software to take excessive breaks, negatively impacting performance. The workshop feedback was integrated into the intervention materials. As a result of the co-creation process, adaptations to Exertime for use in the control-room setting included removing the forced prompt, extending the prompt to every hour, and including video demonstrations of the supervisors completing the exercises in the control-room environment.

The COM-B concepts, intervention functions, MoAs, behavior change techniques (BCTs) and mode of delivery are in Table 2. The key MoAs targeted in the sedentary

behavior intervention are behavioral regulation, social influences and social norms (see logic model in Supplement File 5). Additional MoAs are present in the intervention following the workshop feedback (e.g., staff practicing the exercises in training is linked to beliefs about capabilities; see Table 2). Further insight into the operationalization of the BCTs in the intervention is in Table 3.

INSERT TABLE 2 AND 3 HERE

Discussion

Main finding of this study

This research aimed to develop a sedentary behavior intervention with police control-room workers. We found that the DD and BCW can be combined to co-create theoretically informed and contextually relevant interventions across multiple stakeholders in longitudinal multiphase research. Phase 1 (Discover) found that psychological capability, social opportunity and motivation were potential enablers for increasing the physical activity behavior of inactive police workers. In Phase 2 (Define), the control-room context was identified as a high stress police force area in need of specific wellbeing support. Sedentary behavior was identified as the target intervention behavior. The COM-B concepts identified in Phase 1 and 2 informed the BCW approach used in Phase 3 (Develop) and 4 (Deliver) to systematically develop the intervention. Workshops conducted in the police control-rooms found that sedentary behavior was driven by demand (i.e., psychological capability) and social norms (i.e., social opportunity). Over a series of workshops in an iterative, rigorous approach, the sedentary behavior intervention was developed to target behavioral regulation, social influence and social norm mechanisms and prompt physical activity in the control-rooms.

What is already known on this topic

Complex health interventions need to describe the intervention process clearly, understand the context, and have a theoretical basis(11). However this is rarely achieved in research(14). Co-creation approaches can bring theory and context together in interventions, yet the underpinning processes are unclear(5). Within the control-room context of this study, research had identified the sedentary, stressful environment as risk factors for worker health(1)(8), but had yet to explore how interventions could be developed to support control-room worker health and wellbeing.

What this study adds

Our findings provide a novel method by which researchers can include theory, workforce engagement and a strong appreciation of context in their interventions. Our method combined the DD and BCW frameworks in a co-creation approach driven by iterative divergent and convergent processes. These processes enabled the BCW to be introduced into the research procedure as it was identified in Phase 1 findings. The BCW was needed within the DD framework because it provided a systematic process to develop a theory-informed and context-specific intervention. The BCW steps also encouraged consideration of how the intervention was implemented and translated into action (i.e., BCTs and mode of delivery). These steps were central to including activities in the intervention which targeted social influence mechanisms (see Supplement File 5). To make the theoretical mechanisms in the intervention clear (see Table 2 and Supplement File 5) we used an additional step in the BCW by adopting the MoA. This novel step is needed to advance health behavior change theory(22). Without our identification of contextual implementation options and proposed mechanisms, an 'off-the-shelf' existing software option would have been adopted by steering group members; something less-likely to change behavior and translate into action(36).

Our research has high ecological validity, was conducted in a novel context, and used robust methods over multiple phases in a longitudinally theoretically driven manner. Individually, these are clear strengths(11), and collectively address gaps in knowledge regarding co-creation research(37,38). The findings make original contributions to knowledge about the drivers of behavior in an under-researched context and the co-creation processes can be used by future researchers.

Limitations of this study

There are two main limitations to the research. The co-creation processes were not formally evaluated; doing so could further determine the impact and potential benefits of participatory research(4). Second, as the research was iterative, findings relate to physical activity, exercise, physical inactivity, sedentary behavior, and there is a need to understand how these different terms relate to wellbeing in the police.

Research should now pilot the intervention and test the mechanisms identified; this could be done through the protocol detailed in Supplement File 4. Future research should explore physical activity interventions with other departments in the police workforce (e.g., with firearms officers(39)) to develop an evidence-base that could inform police wellbeing policy (e.g., the Police Covenant(2)). Theoretically informed and well-reported interventions

are needed to achieve this(3), as demonstrated in the method in this research.

Conclusion

This research iteratively and robustly developed a sedentary behavior intervention to support wellbeing in police control-rooms; a novel, under-researched area of policing. We demonstrated that sedentary behavior in such contexts is driven by work demand and social norms. Co-creation, guided by the DD and BCW, developed an intervention targeted towards behavioral regulation, social influence, and social norms mechanisms. The intervention also targeted support for and involvement of staff in decision-making and embedding physical activity into work practices. The process of developing an intervention using the DD and BCW appears efficacious and can be applied to support various health and wellbeing behaviors to deliver context-relevant interventions.

Author statements

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Author contributions

HO, OT, KC, MJ and AQ conceived the study and acquired the data. HO, OT, RN, RJC and TM analyzed the data. KC, MJ and AQ contributed to the interpretation of data. HO drafted the article, OT, RJC, RN, and TM contributed to revisions of the paper. All authors approved the final version of the article to be submitted.

Data availability

The data underlying this article cannot be shared publicly for privacy reasons. The data will be shared on reasonable request to the corresponding author.

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