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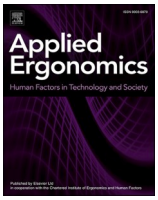

The feasibility of workload monitoring among law enforcement officers: A multi-methodological approach

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ABSTRACT

This study examined the feasibility of workload monitoring to assess internal workload in law enforcement officers (LEO) using a multi-methodological approach. Fifty front-line LEO completed workload surveys on workdays for eight weeks. Retention and adherence were assessed across the survey period. LEO completed usability and likelihood to continue questionnaires, while departmental administrators (n = 8) received workload reports and completed utility and sustainability questionnaires. A subsample of LEO and administrators participated in semi-structured interviews, following consensual qualitative research design. LEO retention (96%), survey adherence (94%), and usability scores (88.3/100) were high, with a moderate likelihood to continue to use the survey. Administration reported high utility and sustainability. The high adherence rates and usability scores, coupled with strong administrative support, suggest that workload monitoring may be a feasible strategy among LEO to monitor occupational workloads. The LEO and administration feedback highlight areas of improvement (e.g., data transparency, departmental collaboration) to inform future implementation.

1. Introduction

Law enforcement officers (LEO) provide critical emergency services to the community in which they work. However, due to the intermittent, intense, and unpredictable nature of their job, they experience one of the highest rates of occupational injuries including 8.5–9.2 per 100 FTE (1 FTE = 2000 h) (Reichard and Jackson, 2010). Musculoskeletal (MSK) injuries in LEO, including strains and sprains, are estimated to occur at a rate three times higher than all other US workers (Tiesman et al., 2018). These injuries are often attributed to non-contact slips, trips, and falls, operational training (Lyons et al., 2017), and a recent rise in violence/assaults (9.5% increase from 2003 to 2011) (Tiesman et al., 2018). Furthermore, a recent report from the International Association of Chiefs of Police (IACP. Reducing Officer Injuries, 2013) reported an estimated cost of more than three million dollars due to work-related injuries, with an average of 4.5 work days lost per incident. Previous research (Folkard and Tucker, 2003; Gerber et al., 2010; Violanti et al., 2012) has suggested that shift work and perceived stress may contribute to poor health and occupational injury in LEO. These factors have also been shown to contribute to occupational workload, a multidimensional outcome including both the physical and psychological job-related demands, which has been suggested to influence health- and performance-related outcomes in public safety personnel (Sandrin et al., 2019; Tan et al., 2022; Oron-Gilad et al., 2008; Bolghanabadi et al., 2020). However, an important gap exists in our understanding of job-related workload among LEO and its influence on work-related MSK injuries and job performance.

Survey-based workload monitoring is a time-efficient tool that has

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gained popularity in team sports to improve injury prevention efforts (Eckard et al., 2018; Hulin et al., 2016). This specific method quantifies total workload as a product of external (i.e., physical demand) and internal load (i.e., psychophysiological response to those demands). Recent studies utilizing survey-based workload monitoring have noted that greater total workload and week-to-week changes in workload can increase the risk of injury within contact sports (Eckard et al., 2018; Hulin et al., 2014; Watson et al., 2017). Given LEO-specific workload is multifaceted including both physical and mental exertion, workload monitoring presents a practical injury prevention strategy for LEO. While many LEO departments currently capture external load including the number and duration of calls, internal load is more multifaceted. Traditionally, a simple rating of perceived exertion (RPE) value has been used to assess internal load (Eckard et al., 2018; Watson et al., 2017), but due to the complex nature of the job, including both mental and physical demands, a more comprehensive tool is warranted. The National Aeronautics and Space Administration-Task Load Index (NASA-TLX) has been considered the "gold standard" for subjective workload and has shown to be a valuable tool within shift-working nurses and tactical populations (Tan et al., 2022; Oron-Gilad et al., 2008; Habibi et al., 2015; Hart, 2006; Hoonakker et al., 2011; Giuliani-Dewig et al., 2022; Greenwood-Ericksen et al., 2004). For example, Habibi et al. (2015) showed that the NASA-TLX total workload was significantly associated with MSK disorders in nurses ($r = 0.28$, $P = 0.001$). Additionally, workload increases in response to greater task difficulty among police officers (Oron-Gilad et al., 2008; Greenwood-Ericksen et al., 2004). Specifically, greater values on the mental demand component of the NASA-TLX was associated with poorer shooting performance in this population (Oron-Gilad et al., 2008; Greenwood-Ericksen et al., 2004). However, these studies and others utilizing the NASA-TLX in tactical populations have been limited to acute settings (e.g., immediately following single tasks).

Although workload assessments have gained traction in athletic populations as a feasible approach to determine injury risk (Eckard et al., 2018; Hulin et al., 2016), there is limited research applying these assessments within public safety populations longitudinally. Integrating current LEO reporting systems and user-friendly workload monitoring may provide a feasible and user-friendly strategy to address the growing burden of musculoskeletal injuries in LEO. However, prior to beginning a randomized control trial (RCT) or the large-scale implementation of a novel instrument in a new setting or population, recent literature has highlighted the importance of conducting feasibility trials (Avery et al., 2017; Bowen et al., 2009; Donald, 2018). Previous studies (Bowen et al., 2009; Donald, 2018; El-Kotob and Giangregorio, 2018) have suggested examining retention and adherence rates, perceived demand, integration (e.g., perceived sustainability), and acceptability of use (e.g., adherence, intention to continue). These outcomes are chosen in order to preserve efficiency in RCTs by refining inclusion and exclusion criteria of the participants, determining the barriers to adherence (e.g., time demand, participant satisfaction), and reducing the threats to internal and external validity of future trials (Avery et al., 2017; El-Kotob and Giangregorio, 2018; Tickle-Degnen, 2013). While most outcomes are quantitative in nature, previous literature suggests the feasibility phase of research should include both quantitative and qualitative outcomes; however, only 28% of published articles have reported qualitative research (O'Cathain et al., 2015). Qualitative analyses can provide more robust feedback and lived experiences with the tool or intervention through open-ended questions, thereby further informing future implementation efforts (O'Cathain et al., 2015). Thus, due to the lack of workload assessments in LEO, the purpose of this study was to examine the feasibility of workload monitoring among LEO by determining retention and adherence rates, as well as the usability and acceptability of workload monitoring among LEO and their departments' administrative officials. Further, qualitative interviews were conducted to provide context to our quantitative feasibility measures. Because of the limited research within LEO specifically, our central aim was to provide preliminary data that workload monitoring may offer a promising strategy to examine self-reported LEO workload with minimal time commitment and high value (e.g., usability, utility) for both the officers and administration.

2. Materials and methods

2.1. Participants

Fifty full-duty career LEO (see Table 1) aged 21–55 years old volunteered for this study from local police stations, which represents the age range of nearly all US frontline LEO (Tiesman et al., 2018). Participants were included from three local police departments (departments A, B, and C) and one Sheriff's office (department D). Departments A, B, and C employ approximately 119, 24, and 65 officers, respectively, while department D employs approximately 90 deputies. Participants volunteered from the local departments via mass email following approval from the administration and were compensated monetarily for their participation in the study. Participants were excluded if they were currently injured and unable to complete the physiological assessments associated with the larger study or were involved in an active workers' compensation or personal injury case. Additionally, eight administrative officials, including Chiefs of Police, the County Sheriff, Lieutenant, and a Training Captain, volunteered to participate in surveys after the workload implementation period to gauge the acceptability of using workload monitoring and potential adoptions of these methods in their departments.

2.2. Experimental design

An eight-week longitudinal design was utilized for this study. We employed a multi-methods approach to examine the feasibility of workload monitoring that included surveys and semi-structured interviews (Anguera et al., 2018). At the onset of the study, participants were instructed on how to complete the workload survey on their smart phone. The surveys were sent directly to them 30 min following each work shift (approximately 28–30 shifts within eight weeks). A reminder text message was sent an hour following the first to those who did not yet complete the survey. After the eight-week implementation period, all LEO completed surveys regarding the usability of the workload survey and the likelihood to continue workload monitoring, while the administrative officials completed surveys regarding the utility and acceptability of the workload reports. Additionally, a cluster-randomized LEO subsample (1–3 per department) as well as a purposive subsample of administrative officials (one per department) participated in semi-structured interviews. This study was approved by the Institutional Review Board (IRB #21–1168) for the protection of human subjects. All participants signed a written informed consent document and provided verbal permission to audio-record their interviews.

Table 1
Baseline demographics and participant characteristics (mean ± standard deviation [SD] or %).

	Enrolled (n = 50)		Officers Interviewed (n = 9)	
	Mean ± SD or %	Range	Mean ± SD or %	Range
Age (years)	37 ± 10	22–53	36 ± 10	24–50
Employment Tenure (years)	10.7 ± 8.4	0.5–27.0	10.8 ± 8.9	1.5–25.0
Body Mass Index (kg/m^2)	29.6 ± 6.6	19.2–53.2	27.1 ± 4.9	22.6–37.7
Sex (% Female)	18	–	22	–
Race (% White)	76	–	67	–

2.3. Workload survey

The workload survey included seven total questions and aimed to examine internal workload (e.g., psychophysiological response). The internal workload survey was created within Qualtrics software, and a link was sent via text message to participants as described above. The first six questions included the National Aeronautics and Space Administration – Task Load Index (NASA-TLX), which captures six domains of workload, including mental demand, physical demand, temporal demand, effort, frustration level, and performance (Hart, 2006). This questionnaire has previously shown good reliability ($\alpha = 0.80$) and good structure validity (Rubio et al., 2004). The officers responded to each domain individually on a scale of 1–100, with 1 representing low demands or performance and 100 representing high demands or performance. Additionally, participants reported a single rating of perceived exertion (RPE) on a scale of 0–10 (i.e., "How difficult was your workday?").

2.4. Feasibility questionnaires

Following the eight-week survey time period, usability was examined using the System Usability Scale (SUS), which includes 10 questions (see Table 3) about the ease of use and confidence about using the workload tool in the future and has previously shown good reliability ($\alpha = 0.97$) (Lewis, 1992). All questions were scored based on a Likert-type scale from 1 to 5 (strongly disagree to strongly agree). Adjusted scores were calculated by subtracting one from the reported value then summed as a composite score, per previous authors (Lewis, 1992). Scores were then multiplied by 2.5 and reported out of 100, according to previous research (Sauro and Lewis, 2011). The likelihood to continue to use was examined using a visual analog scale from 0 to 10, which has previously demonstrated good reliability (*rho* = 0.94) (Pincus et al., 2008), with 10 representing a high likelihood to continue to use.

Additionally, administrators within the participating LEO departments received a one-page sample workload report at the conclusion of the eight-week implementation period that provided aggregated data of their workers on adherence, composite workload score, and all six component workload scores. The administration officials were asked to complete a survey examining the perceived usefulness and perceived sustainability of the workload monitoring on a Likert-type scale from 0 to 10, with 10 representing high utility and sustainability, respectively. To examine perceived sustainability, officials were asked, "What is the likelihood of implementing daily workload monitoring in the future for the officers within your department?" To examine perceived utility, officials were asked, "How useful do you perceive the report to be?"

Table 2
Law enforcement officers' (LEO) retention and adherence rates, missed surveys, and feasibility questionnaire values, as well as administrative officials' (admin) feasibility questionnaire values.

	Mean ± SD	Range
Law Enforcement Officers (LEO)		
LEO retention (%)	96.0	
Survey adherence – all LEO enrolled (%)	93.9	68.0–100.0
Survey adherence – LEO completed post-testing (%)[a]	94.5	68.0–100.0
LEO missed surveys	1.7 ± 2.1	0–8
LEO System Usability Scale[a]	88.3 ± 11.2	52.5–100.0
LEO intent to continue to use[a]	6.8 ± 2.9	0–10
Administrative Officials (Admin)		
Admin sustainability	8.9 ± 0.9	7.6–10
Admin utility	9.0 ± 1.0	7.5–10

[a] n = 48.

Table 3
Mean ± standard deviation (SD), and range values for the ten question System Usability Scale (scale = 0–4).

	Mean ± SD	Range
1. I think I would like to use the survey frequently	2.69 ± 0.95	0–4
2. I found the survey to be simple	3.71 ± 0.62	2–4
3. I thought the survey was easy to use	3.73 ± 0.54	2–4
4. I think that I could use the survey without the support of a technical person	3.83 ± 0.52	1–4
5. I found the various functions in the survey were well integrated	3.33 ± 0.88	1–4
6. I thought there was a lot of consistency in the survey	3.52 ± 0.71	1–4
7. I would imagine that most people would learn to use the survey very quickly	3.83 ± 0.43	2–4
8. I found the survey very intuitive	3.19 ± 0.79	1–4
9. I felt very confident using the survey	3.73 ± 0.57	2–4
10. I could use the survey without having to learn anything new	3.85 ± 0.41	2–4

2.5. Semi-structured interviews

One experienced interviewer (GRG) conducted all semi-structured interviews with a subset of participants (nine officers, four administrators). Officer demographics are listed in Table 1. Of the nine officers who completed interviews, five reported special responsibilities such as being a canine handler (n = 2), being a shift supervisor (n = 1), and being with a trainee on several occasions during the eight-week period (n = 2). The four administrators were male, held a title of Chief, Sheriff, or Captain, and had an average of 27 ± 9.9 (range = 19.8–41.5) years in law enforcement. Each interview lasted approximately 30 min. In-person interviews began in October 2021 and continued until March 2022. Once an interview was completed, a professional transcription company (https://www.thelai.com; Landmark, Phoenix, AZ) transcribed the audio file. Any identifying material (i.e., names, places) were deleted from each transcript to protect the participant's anonymity.

2.6. Quantitative data analysis: feasibility questionnaires

Quantitative analysis was primarily descriptive and included data from all participants. First, the flow of participants through the study (i.e., recruitment, enrollment, retention) was summarized. We assessed retention by determining the percentage of LEO retained following the implementation period (while collecting the reasons for dropouts), and adherence by evaluating the number of surveys completed by each individual, and collectively within the entire sample. Quantitative analyses were conducted using R (version 3.5.1) within RStudio (version: 1.1.546; Integrated Development Environment for R. RStudio, Inc., Boston, MA). The Shapiro-Wilk test was used to determine normality. Where appropriate, mean, standard deviation, and range values are reported for all demographic and survey variables.

2.7. Qualitative data analysis: semi-structured interviews

Qualitative analyses followed a consensual qualitative research (CQR) tradition that is based in grounded theory and phenomenology to allow researchers to understand and analyze participants' experiences. With the use of multiple researchers to establish consensus, CQR creates a rigorous methodological approach to analyze interview data. The research team consisted of three coding individuals (GRG, HKGD, undergraduate research assistant), ranging from novice to intermediate with respect to their experience with qualitative research. The use of

novices in CQR has been noted to bring new perspectives to data analysis and reduce researcher bias (Hill et al., 2005). An additional research team member with expert qualitative experience served as an auditor (JKRM) to ensure all aspects of data analysis were considered and to further reduce researcher bias. The auditor had no role in data collection, consensus, or management. CQR uses four progressive stages, including: (1) identification of key words; (2) establishment of categories/themes; (3) cross-analyzation of multiple transcripts' keywords, categories, and themes; and (4) establishment of data frequency (Hill et al., 2005). Each individual coder completed stages 1–3 independently before meeting as a group to establish consensus with respect to the identified categories and themes. The auditor served to moderate the initial codebook meeting and was consulted if a disagreement arose to ensure all viewpoints were considered before forming a consensus decision. Once a consensus codebook was established, it was used by the research team members to individually code interviews. After the interviews were coded, the research team met again to confirm consensus of the data placement. Subsequently, frequency was established for each category within the theme that emerged for officer and administrator around feasibility of workload monitoring and reporting, respectively. For the present study, a category was considered general if applied to at least 32 participant cases, typical if applied to 16–31 cases, variant if applied to 5–15 cases, and rare if applied to less than five cases (Welch Bacon et al., 2017).

3. Results

3.1. Quantitative

The flow of participants through the study is included in the CONSORT diagram (Fig. 1) and all feasibility metrics are included in Table 2. Fifty individuals were enrolled in the study, while only 48 participants completed post-implementation surveys. Participant demographics at baseline for the entire sample and for the interview subsample are included in Table 1. There were 14, 7, 20, and 9 participants from Departments A, B, C, and D, respectively. Two participants dropped from the study due to transferring police departments (n = 1) and a family emergency (n = 1).

The workload survey adherence for the LEO was 93.9% for all enrolled participants (n = 50) during their time in the study and 94.5% for all participants who completed the entire eight weeks (n = 48), with an overall median of 96.4% (IQR: 92.3–100). There was an average of 1.7 surveys missed per LEO (range = 0–8). The LEO reported an average System Usability Scale (SUS) score of 88.3 ± 11.2 (out of 100; see Table 3) and an average of 6.8 ± 2.9 (out of 10) for the likelihood to continue to use the workload survey. Regarding the workload reports, the administrative officials at each department (n = 8) reported an average of 8.9 ± 0.9 and 9.0 ± 1.0 (out of 10) for sustainability (i.e., willingness to implement) and utility (i.e., usefulness), respectively.

3.2. Qualitative

Eight categories of data emerged regarding the officer experience of reporting workload whereas five categories emerged from the administrator experience of receiving the workload report of their officers. These categories are represented in Table 4 along with the frequency of participant cases per category. Additionally, representative quotations are presented in Table 5 for each category for officer and administrator, respectively. In general, officers expressed that the timing, frequency, and length of the workload survey were appropriate for this job. Additionally, they thought the survey was easy to use and "encompassed all of the job" but suggested that the slider function and the broad 0–100 scale may be areas for future improvement. Some suggestions included

Table 4
Frequency of cases for officer and administrator categories for workload tracking and reporting.

Interviewee	Category	Frequency	Number of Cases
Officer	Timing of post-shift workload tracking	General	48
	Ease of use of workload tracking	General	45
	Feedback/suggestions for workload tracking	General	52
	Interface of workload tracking on smartphone	Typical	24
	Frequency of workload tracking	Typical	16
	Text reminder timing and frequency	Typical	31
	Length of workload tracking survey	Variant	15
	Workload reporting results and products	General	30
Administrator	Timing of workload reporting to administration	Typical	18
	Captured data on workload reporting	Typical	24
	Feedback on workload reporting	General	40
	Value of workload reporting	General	48
	Communication workload reporting	General	29

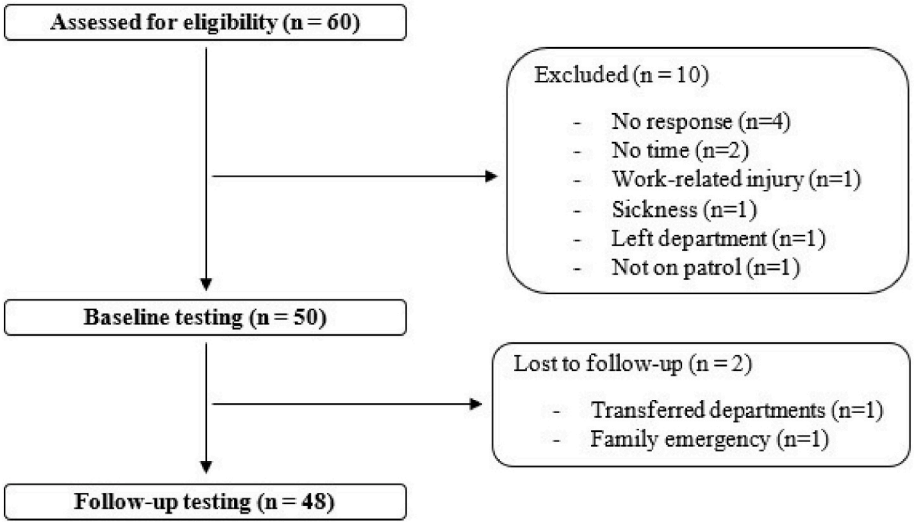

Fig. 1. CONSORT diagram demonstrating the flow of participants.

Table 5
Representative quotes from interviews with officers (n = 9) and administration (n = 4).

Officer	
Category	Example Quotes
Timing of post-shift workload tracking	"Depending on if I was tired or not and the workload that I had that night, if I would like—if I had a lot of stuff that I had to do, that last thing I wanted to do was fill out the survey." "I think it's honestly like a balancin'—at the end of the shift, it's easy to complete 'cause it's right there, everything's fresh on your mind. You can do it right then and there, but if you had that hour after your shift, then I would think you'd be fresher."
Ease of use of workload tracking	"It went straight to my phone, and it's as easy as it gets, in my opinion." "All the questions were very straightforward and concise, easy to follow, and they all kind of made sense to our day."
Feedback/suggestions for workload tracking	"I perceive my workload to be both mental and physical. It asks questions about both of them. I thought it was pretty spot on." "… it encompasses all of the job." " …. shortening that scale … The 0–10 or like I said, just that 5 choice of that scale of strongly disagree to strongly agree." "Sometimes I didn't know how to answer the question if it was a slow day."
Interface of workload tracking on smartphone	"It just flowed well." "… click, click, click, click, click. No login, no password." "[*The sliders made it*] a little bit longer … I felt it may be a little bit longer to take."
Frequency of workload tracking	"No, I think after every—fillin' it out after every shift would be very helpful, 'cause no two days are the same. One day can be super mellow. The next day could be super hectic." "I would rather do it that way [*daily*] than do it at the end of the week … 'cause by the end of the week, there's so much that goes on. You can't really gauge—day by day is better." "I think that that was the best way of doing it was doing it at the end of each shift. I don't think doing it during a shift would work that well."
Text reminder timing and frequency	"… if you forget to fill out the survey after you get the first two text messages, I think just maybe one more would help. It would probably be a good, beneficial one, especially for guys like me that work on night shifts." "I actually got a reminder to fill it out before I was off work because I got held over, but, yeah, that was fine. Most of the time, it was good timing. It gave me enough time to get home and get out of uniform and everything, so, yeah, that was good."
Length of workload tracking survey	"… it was less than 5 min. Everyone has that." "It didn't take any time at all. It was very short. It didn't disrupt any part of my day."
Workload reporting results and products	"… after fillin' out the survey, it gave me a better understanding of my workload." "Like I said, if they see it even more about how some of these things filter out on us personally, families, and everything, I think it would just really be an amazing study to see." "… whenever I was busier, in my mind, the scales were higher, closer to 100, my satisfaction normally went up." "Sometimes we get a little nervous and we start putting our initials on stuff and be honest about where we are. People might not want to be as open about stuff."
Administration	
Timing of workload reporting to administration	"… it would be tremendous amount of value for me to see quarterly." "I think something of this nature'd be beneficial quarterly. That'll keep track on any trends. It would be too overburdening on a monthly basis, but when you get into a six-month basis, that might—we might miss something. Quarterly probably would be beneficial."
Captured data on workload reporting	"It would be interesting to dive a little bit deeper in here and parse out day versus night, and how long folks have been on nightshift, and how that might affect their physical characteristics." "… none of this is surprising to me. It does help me articulate, and it gives me the ability to explain the data … It does give me ammunition of an unbiased objective look at the information, and that does help me in a tremendous way …"
Feedback on workload reporting	"This is a great snapshot." "… shorter, clearer, high-level takeaways are better with the ability to seek more granularity if you want to, so I like 1-page. I'd prefer 1-page." "… there'd have to be some type of continued study or continued input by the officers to really have the benefit over a longer term."
Value of workload reporting	"… early intervention, early warning system." "Finding a way to better balance our service delivery and officer well-being with the downtime … that has potential." "Somebody has been here 12 h, 12 busy hours, do you want them going to a really serious, complex, potentially high-risk call, with 5 min left in their shift? Are they as they prepared as they were in the beginning of their shift? … I could imagine, over time, as we learn more about it and understand more, it could have real effects on how we train, how we schedule, how we dispatch people throughout the day."
Communication around workload reporting	"It's really helpful to get information like this in a way that we could ask questions kind of in an interactive way." "—looking at it without the benefit of the conversation, I wasn't sure what I was looking at. I think looking at it with you all here, it's very clear."

using multiple choice bubbles, Likert-type scales (i.e., strongly disagree to strongly agree), adding other anchors/examples to the scale values, and/or shortening the scale to 0–10. Further, officers highlighted that the following would be helpful to maintain compliance and sustainability: (1) continuing to use a reminder text message with the potential to tailor the timing to the individual and (2) greater transparency about the tangible products that would result from reporting and how their departments would utilize the data.

The administration reported high value of the workload report, stating that it was a simple yet comprehensive "snapshot" of the workload of their officers, and may provide an opportunity to inform training, scheduling, and overall monitoring of the department. They all mentioned wanting to receive the report quarterly, suggested that aggregated data would be important to maintain trust among their workers, and that continued long-term monitoring would be necessary for making departmental decisions. Moreover, having the ability to discuss the data in an interactive way may provide better understanding of workload results. Several suggestions for reporting and visualizing the data emerged such as examining differences in age, tenure, and day and night shift workers for informing future programming or interventions.

4. Discussion

The current study characterized the feasibility of survey-based workload monitoring in LEO. The primary findings indicated high retention (96%) and adherence (94.5% completion) rates, high usability (88.3 ± 11.2 out of 100), and a moderate willingness to continue using the survey-based workload monitoring (6.8 ± 2.9 out of 10) among LEO.

Further, there was strong administrative support from department leadership reporting a high utility (9.0 ± 1.0 out of 10) and willingness to implement workload monitoring (8.9 ± 0.9 out of 10). Our qualitative findings also reinforced the high usability for officers and utility for administrators, and indicated that officer willingness to continue workload monitoring would be greater with known departmental buy-in.

As noted by previous authors, feasibility studies are critical to inform the development and implementation of larger surveillance studies and RCTs (Avery et al., 2017; Brown and Topcu, 2003). Our study examined the retention rate while monitoring the reasons for drop-out, finding a high retention (96%) with only two dropouts. The reasons noted for the two participants who dropped were unrelated to our study and included leaving the department (n = 1) and a family emergency (n = 1). Most previous studies examining workload, or training load, have been conducted within athletic teams, inherently retaining all team members. However, similar retention rates (96.7–100%) have also been reported in studies examining physical activity interventions (Xu et al., 2018; Choi et al., 2016). For example, Xu and colleagues (Xu et al., 2018) showed 100% retention to a daily health tracking intervention. Individuals reported that learning about their physical activity and monetary incentives positively contributed to their participation (Xu et al., 2018). Similarly, the present study also offered information about the participants' health and fitness, in addition to monetary incentives, which may have contributed to the high retention. Our study also found a high adherence rate to the online workload survey (94.5%), similar to or higher than previous literature (31–97%) (Watson et al., 2017; Giuliani-Dewig et al., 2022; Xu et al., 2018; Pexa, 2019). Our results significantly contrast that of a recent study (Giuliani-Dewig et al., 2022) examining workload monitoring among firefighter recruits, which found a poor adherence (5.3–61.4%; 42% at eight weeks) across 26-weeks during a recruit academy. Although the study by Giuliani-Dewig et al. (2022) used an online survey similar to the present study, the higher adherence here is likely due to the survey design and length of study. For example, the survey used within the firefighter recruits was 18 questions long and the time of observation was 26 weeks (~ five surveys per week; Mon - Fri) (Giuliani-Dewig et al., 2022), whereas the current survey included significantly less questions (seven total) and only tracked participants for eight weeks (~3–4 surveys per week). In support of this, one LEO specifically stated that "it didn't take any time at all … It didn't disrupt any part of my day." Further, the present study's high retention and adherence rates may also be attributed to social support (Faghri et al., 2008), as participants working similar shift schedules often enrolled during parallel time frames. This suggests departments implementing workload surveys should encourage peer-accountability between officers to further ensure involvement (Ho et al., 2016; Lemstra et al., 2016).

Previous literature suggests that usability, or the perceived usefulness and ease of use, is a significant predictor of behavioral intent, and ultimately an individual's behavior (Dabbs et al., 2009; Papakostas et al., 2021). The LEO within the present study reported overall high scores (88.3 ± 11.2 out of 100) on the SUS. According to the Sauro-Lewis curved grading scale (Lewis, 2018), this SUS score would be an A+, suggesting that it is very user-friendly within this population. Our usability scores are similar to other studies using app-based health surveys (72.3–83.6) (Giuliani-Dewig et al., 2022; Babbage et al., 2019; Rudberg and Motylinska, 2021). For example, Babbage and colleagues (Babbage et al., 2019) reported a mean SUS score of 72.3 for a mobile application designed to evaluate and manage fatigue in multiple sclerosis patients. Interestingly, the authors (Babbage et al., 2019) found that while the majority of participants felt it was "easy to use" and "consistent," only 27% agreed or strongly agreed that they would like to use the app frequently. Our results were also similar to a recent study examining an online workload survey within firefighter recruits, who reported an overall SUS score of 83.6 ± 13.6 but a decreased willingness to complete the survey frequently throughout the time in the study (Giuliani-Dewig et al., 2022). When examining the ten individual SUS questions in the present study, our participants also reported the lowest score regarding willingness to use the survey frequently (see Table 3). Although our survey was short in length (seven questions total) and only sent to LEO on their workdays (28–30 shifts over eight weeks), it is possible that survey frequency could influence their long-term adherence. Interestingly, our qualitative findings indicate the LEO did not mind the frequency, reporting that "fillin' it out after every shift would be very helpful, [because] no two days are the same." However, the LEO reported only moderate scores for "likelihood to continue to use" (6.8 ± 2.9 out of 10). Lee and colleagues (Lee and Cho, 2017) suggested that a participant's willingness to continue to use a tool can be influenced by both technical factors (e.g., recordability, comprehensibility, credibility) and user-oriented motives (e.g., entertainment, trendiness). The findings of our qualitative interviews also uncovered potential barriers, such as the scale (0–100) being too broad and "sliders" within the survey's interface increasing the time to complete the survey. While completing the survey provided a better understanding of their workload, the specific questions were more difficult to answer on "slow" workdays, possibly contributing to decreased motivation. Additionally, because previous studies (Xu et al., 2018; Church, 1993) have suggested that incentives could influence participation, departments should consider the best methods of motivating their officers to adhere to the workload survey, such as dedicated on-shift time and supervisor support.

This study also examined the utility (i.e., usefulness) and sustainability (i.e., willingness to implement) of workload reporting among administrative officials (e.g., department chiefs, Sheriff, captains) within the participating departments. Overall, they reported a high utility (8.9 ± 0.9 out of 10) and sustainability (9.0 ± 1.0 out of 10), suggesting it may be a useful tool for the department and a high likelihood to implement this form of workload monitoring in the future. Specifically, the administration suggested that this type of workload report could be valuable in influencing the way they train, schedule, and dispatch their officers within their departments. Further, officials emphasized its ability to provide "unbiased, objective data" to inform departmental decisions. The workplace has been identified as a strategic setting to improve employee health and fitness (Prodaniuk et al., 2004; Shephard, 1996). While most worksite interventions focus on the individual-level, it has been shown that the environment and support from leadership also have significant influence on the long-term behavior for change within workers (Prodaniuk et al., 2004; Dobson et al., 2013). For example, leadership-initiated worksite health promotion programs have been shown to improve health, increase productivity, and increase job satisfaction (Faghri et al., 2008; Chan et al., 2004). Further, Staley and colleagues (Staley et al., 2011) have shown within other first responders (i.e., fire departments) that management support is related to the employees' willingness to participate in physical activity. Therefore, buy-in from the leadership could have a positive trickle-down effect on the LEO within their departments, which may ultimately improve implementation efforts for this tool in the future. The discrepancy between the administration's responses and the LEO's willingness to continue to use workload monitoring within this study should be noted and is likely due to the present study's research design. For example, the majority of the LEO who were interviewed mentioned the value of workload reporting, but admitted that adherence would depend on administrative support, specifically the need for supervisors to say "this is what the purpose of it is …" In the present study, assessments for the LEO and administrative officials were intentionally kept separate to minimize the effect of LEO hierarchy on open and honest feedback as utilized in other first responder groups (Mayer et al., 2013). Thus, future studies seeking to examine workload monitoring with public safety personnel should consider implementation strategies (e.g., participatory approaches) that include a collaborative effort between the administration and LEO (Baker et al., 1994; Poplin et al., 2015).

4.1. Practical applications and future work

Musculoskeletal injuries are of significant concern within public safety personnel, exhibited by a greater rate of injury than other occupations and high economic burden (Tiesman et al., 2018; IACP. Reducing Officer Injuries, 2013). These injuries are often attributed to the high levels of work-related mental and physical stress and workload (Gerber et al., 2010; Violanti et al., 2012); however, little research has examined occupation-related workload longitudinally. In order to associate occupational workloads with MSK injury risk or physical performance, sufficient workload data are necessary, as previous work has shown that week-to-week changes have significant influence (Hulin et al., 2014, 2016; Watson et al., 2017). This study found that a simple internal workload survey (i.e., NASA-TLX) was feasible among LEO across eight weeks. Further, departmental administration found workload reports a valuable means to enhance officer well-being and inform department procedures. Based on the current findings, this tool could be a time-efficient method for practitioners to implement in conjunction with current reporting systems to examine both internal and external occupational workloads. Further work is needed to investigate the influence of acute (e.g., weekly) and chronic (e.g., monthly) occupational workloads on injury risk factors and predictors of job performance.

5. Conclusion

In summary, the findings of this study indicate survey-based workload monitoring may be a feasible tool within LEO and their departments. Specifically, we found excellent retention and adherence rates, in addition to high usability among the LEO. Further, departmental administration showed strong support, suggesting the potential for long-term implementation. Our qualitative findings reinforced the perceived value of workload monitoring among both LEO and the administrative officials and highlighted the need for future research to examine the best strategies to mitigate barriers to long-term adherence within LEO and create a cooperative effort between the administration and LEO.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could inappropriately influence the work reported in this paper. The funding sources of the project had no involvement in the data or representation thereof.

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