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Job-Specific Physical Fitness Changes Measured by the Work Sample Test Battery within Deputy Sheriffs between Training Academy and their First Patrol Assignment

ROBERT G. LOCKIE‡[1], RODNEY P. POPE‡[2,3], OLIVIA SAARONI†[4], JOSEPH M. DULLA†[3,5], J. JAY DAWES‡[6], and ROBIN M. ORR‡[3,4]

[1]Center for Sport Performance, Department of Kinesiology, California State University-Fullerton, Fullerton, CA, USA; [2]School of Community Health, Charles Sturt University, Albury-Wodonga, NSW, AUSTRALIA; [3]Tactical Research Unit, Bond University, Robina, Qld, AUSTRALIA;.[4]Faculty of Health Sciences and Medicine, Bond University, Robina, Qld, AUSTRALIA; [5]Recruit Training Unit, Training Bureau, Los Angeles County Sheriff's Department, Los Angeles, CA, USA; [5]School of Kinesiology, Applied Health and Recreation, Oklahoma State University, Stillwater, OK, USA; [6]School of Kinesiology, Applied Health and Recreation, Oklahoma State University, Stillwater, OK, USA

†Denotes graduate student author, ‡Denotes professional author

ABSTRACT

International Journal of Exercise Science 13(4): 1262-1274, 2020. Deputy Sheriffs need to exhibit job-specific fitness throughout their occupational lifespan. This study evaluated job-specific fitness changes measured by the Work Sample Test Battery (WSTB) in deputy sheriffs from training academy to patrol school (refresher program completed before first patrol assignment). WSTB data for 34 deputy sheriffs (28 males, 6 females) was retrospectively analyzed. The WSTB included five tests: a 99-yard obstacle course (99OC); a 165-pound body drag (BD); 6-foot chain link fence (CLF) and solid wall (SW) climbs; and a 500-yard run (500R). WSTB task times measured at the end of academy and start of patrol school were compared by paired samples t-tests, percentage change, and effect sizes (all deputy sheriffs combined and by sex). When data for all deputy sheriffs was combined, there were significant time increases for the WSTB tasks at patrol school ($p \leq 0.009$; $d = 0.45$-1.67), except for the BD ($p < 0.001$; $d = 0.80$). Male deputy sheriffs exhibited the same changes ($p \leq 0.042$, $d = 0.40$-2.37), with very large CLF and SW decrements (34-83%). Females experienced a significant decline in the 99OC ($p = 0.013$; $d = 0.79$), and non-significant declines in all other tasks ($p \leq 0.324$; $d = 0.50$-0.96). Apart from the BD for male deputy sheriffs, job-specific fitness measured by the WSTB declined when deputy sheriffs went on their first patrol assignment. The ability to perform obstacle clearance (CLF, SW) and foot pursuit tasks (99OC, 500R) was particularly reduced. Intervention strategies to aid job-specific fitness maintenance is recommended for deputy sheriffs.

KEY WORDS: Body drag, foot pursuit, occupational testing, obstacle clearance, police, tactical

INTRODUCTION

Law enforcement can feature a number of physically demanding tasks that must be performed when on-duty. For example, deputy sheriffs may be required to operate vehicles (18), clear obstacles (17), lift and drag heavy loads (9, 16, 17, 26, 30), pursue suspects (7, 40, 41), discharge firearms (14, 33), and exert force to apprehend offenders (6, 9, 17, 33). As a result of these job demands, deputy sheriff recruits must undergo specific training before they can become sworn officers. The academy setting is where recruits are trained to tolerate the physical rigors of the profession, while also learning the required procedures and skills necessary for law enforcement (4, 15, 17, 26, 34). As a result, most agencies have set standards that must be achieved by recruits when they are tested in job-specific tasks that incorporate physical fitness (7, 15).

One example of a job-specific examination of physical skills and fitness that has been investigated in several studies of law enforcement personnel is the Work Sample Test Battery (WSTB) (17, 26). The WSTB must be completed by Californian law enforcement recruits before they graduate from their training academy (35). As previously described by Lockie et al. (17, 26), the WSTB consists of five tests: a run around a 99-yard (90.53-m) obstacle course (99OC); a body drag (BD) with a 165-pound (74.84-kg) dummy; a climb over a six-foot chain link fence (CLF); a climb over a six-foot solid wall (SW); and a 500-yard (457.2-m) run (500R). These tests must be completed within specific time limits, which results in points being allocated to each task; a faster task performance results in more points being allocated, with a minimum score of 384 required for graduation (35). Of note, the WSTB was designed to be an indicator for law enforcement job task performance. Accordingly, better or lesser performance on the WSTB could have important implications for how a deputy sheriff performs when on-duty.

Several studies have indicated that the physical fitness and abilities of law enforcement officers tends to decline with age and time spent on the force (26, 32). Orr et al. (32) proposed that the nature of law enforcement occupations, which feature a high volume of sedentary activity and low volume of work-related physical activity, can significantly impact the maintenance of fitness in officers. This was investigated specific to the WSTB in a cross-sectional study by Lockie et al. (26). Following academy, the first posting for deputy sheriffs is to work in custody facilities, which can feature long periods of sedentary activity (e.g., inmate supervision) during a shift. Lockie et al. (26) performed a cross-sectional analysis to assess changes in WSTB performance in deputy sheriffs categorized by time spent working in custody (i.e., time spent out of academy) compared to recruits. The data indicated that deputy sheriffs who had spent up to 47 months out of academy and working in custody were slower in the 500R when compared to recruits at the end of academy. Deputy sheriffs who had worked in custody for 48 months or more were significantly slower on all WSTB tasks except for the BD compared to both recruits and deputy sheriffs who had been working in custody but for less time. The BD seemed less impacted by the time spent out of academy. Lockie et al. (26) theorized that this lack of change to the BD was due to absolute strength, an important quality for the BD, often not the focus of physical training at academy. Thus, deputy sheriffs had less strength to lose relative to the BD over the time spent out of academy. While the data from Lockie et al. (26) is clearly useful, this study was cross-sectional in nature. It would be of benefit to track the WSTB performance of deputy sheriffs from academy to the first patrol posting, and to detail the magnitude of any performance changes. This is very applicable, given the intent for the WSTB to match specific law enforcement job tasks that will need to be performed during patrol (17, 35).

This study utilized a sample of deputy sheriffs and focused on the changes in their time to completion for the WSTB tasks as they transitioned from the academy to patrol school. Patrol school was a three-week skills refresher program completed by incumbents who had been working in custody, as they did not complete any patrol duties during this time (26). Given that the WSTB is used as an indicator for job preparedness in deputy sheriffs (17, 35), it could be assumed that if WSTB performance is maintained, deputy sheriffs would be more physically prepared for the job demands encountered when on patrol (26). This study is important as it provides job-specific performance data for deputy sheriffs almost immediately before they start working patrol. This has direct impact on the safety of the deputy sheriff, their colleagues, and the general public. It was hypothesized that the deputy sheriffs would perform all WSTB tasks slower during patrol school when compared to their performance during academy.

METHODS

Participants

A convenience data sample of 34 deputy sheriffs (age = 30.03 ± 5.00 years, body mass = 83.97 ± 14.23 kg; years sworn = 3.51 ± 2.35 years), which included 28 males (age = 30.00 ± 5.08 years, body mass = 87.60 ± 12.24 kg; years sworn = 3.64 ± 2.43 years) and six females (age = 30.17 ± 5.07 years; body mass = 67.02 ± 10.38 kg; years sworn = 2.92 ± 2.01 years) was analyzed in this study. Age and body mass were recorded at the start of patrol school. Height was not included in the dataset provided to the researchers, a data limitation noted in other tactical research (23). The data encompassed WSTB times from academy and that recorded by deputy sheriffs from two patrol schools. Based on the archival nature of this study, the institutional ethics committee approved the use of pre-existing data (HSR-17-18-370). This research was carried out fully in accordance to the ethical standards of the International Journal of Exercise Science (31). Additionally, the study conformed to the recommendations of the Declaration of Helsinki (42).

Protocol

The data in this study were collected by staff working for one agency, who were trained in the data collection procedures required by the state's governing body (Peace Officer Standards and Training) (35). The WSTB is mandatory for recruits in California, and they must attain a minimum score of 384 to graduate from academy (17, 35). Nonetheless, the point allocation was not the focus of this study, but rather the time to complete each task as a surrogate for the ability to perform them in the field. The WSTB analyzed in this study was drawn from two different time points. The first was that performed at the end of academy as a requirement for graduation. The deputy sheriffs in this study all completed academy training at different time points, so were not all drawn from the same academy class. Nonetheless, all academy classes have to adhere to the standards expected by Peace Officers Standards and Training (36). The second set of WSTB data was recorded when the deputy sheriffs completed patrol school. The data was drawn from two separate patrol school classes, and the deputy sheriffs completed the WSTB within the first few days of the three-week program. The timing of the WSTB data collection during academy and patrol school may vary due to the timetabling differences, and availabilities of training staff, equipment, and locations. Training staff provide some coaching of the technique required for the WSTB tasks during academy and patrol school, relative to the guidelines provided by Peace Officers Standards and Training (36).

The procedures for each test have been presented by Peace Officer Standards and Training (35) and Lockie et al. (17, 26). Nonetheless, each test will be briefly described. The WSTB was performed outdoors on specifically designed structures at the agency training facility. The tests could be completed in any order, except for the 500R which was completed last. While these procedures could be considered a limitation, they meet the required state guidelines and have been consistently performed in this manner by the agency for a long period of time (17, 26, 35). Recruits or deputy sheriffs were provided the opportunity for two attempts for each test, with a minimum of 120 s rest between attempts. Although failing a first attempt (e.g., not being able to scale the chain link or solid wall effectively, stumbling when dragging the dummy) could lead to some fatigue, the provision of the 120-s recovery period was designed to alleviate the impacts of fatigue on WSTB task performance. Time for each test was recorded to the nearest 0.1 sec by a staff member with stopwatch for each attempt. Testers trained in the use of stopwatch timing procedures for athletic performance tests can record reliable data (10). For all WSTB tasks, the fastest time was analyzed from academy and patrol school.

99-yard (90.53-m) Obstacle Course (99OC): This test was designed to simulate a foot pursuit in an urban area and is shown in Figure 1. Recruits or deputy sheriffs completed the 99-yard (90.53-m) course as quickly as possible, while remaining on the concrete track. During the run, they also stepped over three 6-inch x 6-inch (0.15-m x 0.15-m) simulated curbs, and one 34-inch (0.86-m) high obstacle.

165-pound (74.84-kg) Body Drag (BD): For the BD, recruits or deputy sheriffs dragged a 165-pound (74.84 kg) dummy 32 feet (9.75 m). Recruits or deputy sheriffs lifted the dummy by wrapping their arms underneath the arms of the dummy and moved into a standing position by extending the hips and knees. Once standing, the recruit or deputy sheriff informed the tester they were ready and timing was initiated. The recruit or deputy sheriff dragged the dummy by walking backwards over the required distance as quickly as possible. Timing stopped when the dummy's feet passed the finish line.

6-foot (1.83-m) Chain Link Fence (CLF) and 6-foot (1.83-m) Solid Wall (SW) Climbs: Recruits or deputy sheriffs started 5 yards (4.57 m) away from the fence and ran up to and scaled the 6-foot (1.83-m) fence with whatever technique they chose (without using the side supports on the fence). If the recruit or deputy sheriff did not initially climb the fence in their first attempt within a trial, they could continue their attempt (recruits or deputy sheriffs had to scale the fence for the trial to be successful), but the time continued to run. Once the recruit or deputy sheriff cleared the fence, they were to land and run 25 yards (22.86 m) as fast as possible to complete the test. The same instructions and procedures for the CLF were provided for the SW, with the difference being the type of wall that was climbed (which was a solid, wooden wall).

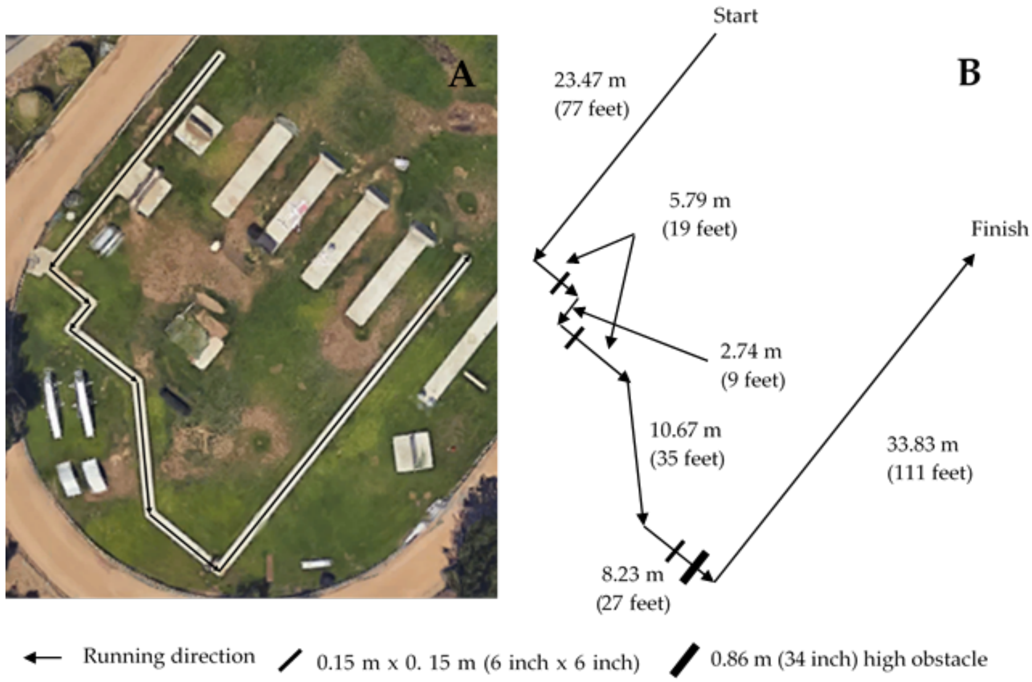

Figure 1. The 99-yard obstacle course. (A) Aerial map of the course. (B) Dimensions and running direction.

500-yard (457.2-m) Run (500R): The 500R was designed to simulate a long-distance foot pursuit. The running distance was marked on the track, and recruits or deputy sheriffs ran the 500-yard (457-m) distance as quickly as possible**.**

Statistical Analysis
All statistical analyses were computed using the Statistics Package for Social Sciences (Version 26.0; IBM Corporation, New York, USA). Descriptive statistics (mean ± standard deviation [SD]) were calculated for each variable. A series of paired-samples t-test were used to determine if there were statistically significant differences between a deputy sheriff's WSTB from the conclusion of academy training compared to those measured during patrol school. Statistical significance was set a priori at $p < 0.05$. The sample was analysed with both sexes combined, in addition to male and female deputy sheriffs separately. There are no corrections for sex in the WSTB (35), so the sample were analysed as a whole. Nonetheless, numerous studies have demonstrated differences between male and female law enforcement populations in different physical fitness assessments (1-3, 8, 19-22, 24, 25, 27), so each sex was also analyzed in isolation. Percentage differences and effect sizes (Cohen's *d*) for WSTB comparisons between academy and patrol school were also calculated. Cohen's *d* was derived from the difference between the means divided by the pooled standard deviations (5). A *d* less than 0.2 was considered a trivial effect; 0.2 to 0.6 a small effect; 0.6 to 1.2 a moderate effect; 1.2 to 2.0 a large effect; 2.0 to 4.0 a very large effect; and 4.0 and above an extremely large effect (11). Lastly, scatter plots were produced

in Microsoft Excel (Microsoft Corporation™, Redmond, Washington, USA) for each deputy sheriff to document the individual percentage changes for each WSTB task.

RESULTS

The descriptive data for all deputy sheriffs combined, males, and females is shown in Table 1. A positive percentage change indicates deputy sheriffs were slower in the WSTB task during patrol school (poorer performance); a negative percentage change indicates they were faster. When considering all deputy sheriffs combined, the 99OC (small effect), CLF (large effect), SW (large effect), and 500R (moderate effect) were all performed significantly slower, while the BD was faster (moderate effect). The same significant differences were found for the male deputy sheriffs. The 99OC differences again had a small effect, while the BD (faster), CLF (slower), and 500R (slower) had moderate effects. There was a very large effect for the slower SW. For the female deputy sheriffs, only the slower 99OC from patrol school was significantly different from academy (moderate effect). Nonetheless, although non-significant, there small effects for the slower BD and SW from patrol school, and moderate effects for the slower CLF and 500R.

Table 1. Descriptive data (mean ± SD) for all, male, and female deputy sheriffs for the five WSTB tasks measured at the end of academy training and during patrol school.

	Academy (Mean ± SD)	Patrol School (Mean ± SD)	% Change	*p*	*d*
All Deputy Sheriffs (N = 34)					
99OC (s)	17.81 ± 1.28	18.59 ± 2.11*	+4.44	0.009	0.45
BD (s)	7.01 ± 1.34	5.71 ± 1.87*	-18.14	<0.001	0.80
CLF (s)	6.86 ± 1.42	8.79 ± 1.20*	+31.28	<0.001	1.47
SW (s)	5.33 ± 2.09	8.74 ± 1.99*	+74.70	<0.001	1.67
500R (s)	84.38 ± 10.03	104.12 ± 22.02	+23.20	<0.001	1.15
Male Deputy Sheriffs (n = 28)					
99OC (s)	17.74 ± 1.28	18.48 ± 2.26*	+4.12	0.042	0.40
BD (s)	6.97 ± 1.40	5.23 ± 1.55*	-24.07	<0.001	1.18
CLF (s)	6.60 ± 1.20	8.63 ± 1.13*	+33.53	<0.001	1.74
SW (s)	4.83 ± 1.02	8.60 ± 2.01*	+82.62	<0.001	2.37
500R (s)	82.75 ± 9.36	103.61 ± 22.95*	+24.78	<0.001	1.19
Female Deputy Sheriffs (n = 6)					
99OC (s)	18.08 ± 1.40	19.12 ± 1.22*	+5.94	0.013	0.79
BD (s)	7.21 ± 1.11	7.93 ± 1.69	+9.52	0.125	0.50
CLF (s)	8.07 ± 1.87	9.52 ± 1.38	+20.76	0.092	0.88
SW (s)	7.70 ± 3.89	9.39 ± 1.91	+37.78	0.324	0.55
500R (s)	92.00 ± 10.35	106.50 ± 18.68	+15.80	0.059	0.96

* Significantly ($p < 0.05$) different from academy.

The individual deputy sheriff percentage change data from all WSTB tasks is shown in Figure 2. There is a great spread of scores for the 34 deputy sheriffs in the five tasks. Seven of the 34 deputy sheriffs were faster in the 99OC during patrol school compared to academy, although the majority were slower. Most deputy sheriffs were faster in the BD, although one male and four females were slower. Almost all deputy sheriffs were slower in the climbing tasks (CLF and SW) and 500R during patrol school compared to academy.

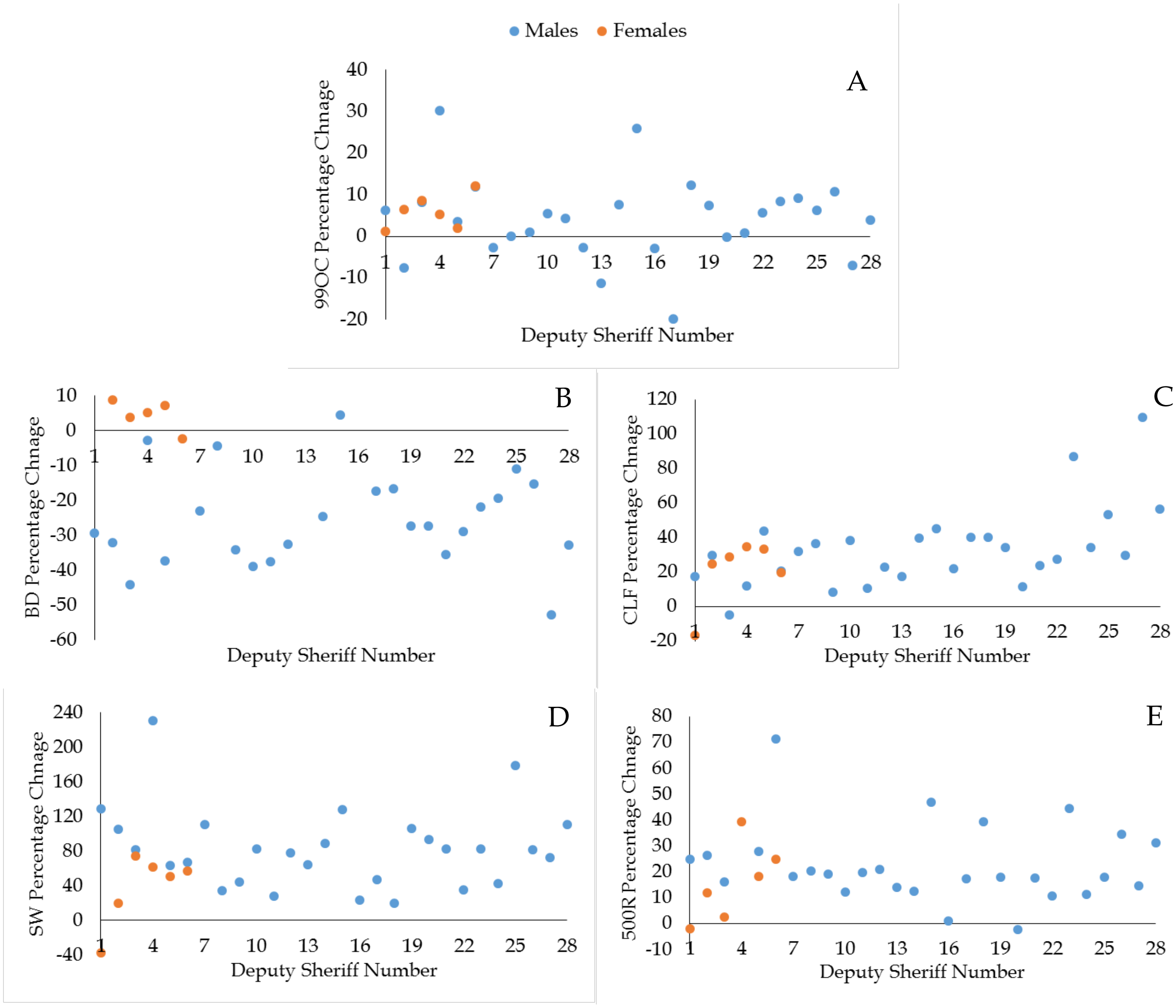

Figure 2. Individual percentage change data for each deputy sheriff from academy to patrol school for the 99-yard obstacle course (99OC; A), body drag (BD; B), chain link fence climb (CLF; C), solid wall climb (SW; D), and the 500-yard run (500R; E).

DISCUSSION

This study analyzed the change in job-specific fitness as measured by the WSTB in deputy sheriff recruits just prior to their first patrol posting after leaving academy and working in custody. Previous research has suggested that the requirements of the law enforcement occupation can lead to reductions in general (32) and job-specific (26) fitness. This is potentially a major issue for deputy sheriffs, as a decline in job-specific fitness could have effects on the ability of the deputy sheriff to maintain their own safety, and the safety of the public. The deputy sheriffs in this study generally experienced a decline in WSTB performance from academy to just before their first patrol assignment, with the exception of the BD for male deputy sheriffs. This supported previous cross-sectional findings from Lockie et al. (26). However, this study involved data that tracked the deputy sheriffs from academy to patrol school, and documented some very marked performance decrements, especially for the CLF and SW. As the WSTB is used as a surrogate for job task performance (17, 26, 35), these findings have implications as to whether deputy sheriffs could efficiently perform certain job tasks when on-duty.

Almost all male and female deputy sheriffs from this study experienced a decline in the CLF and SW performance from academy to patrol school. For some deputy sheriffs, the performance time for the CLF or SW doubled at patrol school. There was not a significant decline for the female deputy sheriffs for the SW, although the patrol school time was slower with a small effect. This is notable as the CLF and SW from the WSTB provide a test of how well a deputy sheriff can scale an obstacle, similar to what they might encounter in urban areas (17). Lockie et al. (26) found that deputy sheriffs who had worked in custody for 48 months or longer completed the CLF and SW slower than deputy sheriffs who worked in custody for 47 months or less and recruits. Slower CLF and SW performance may be indicative of a loss of upper-body strength and muscular endurance, as these qualities have been related to faster performance in these tasks in law enforcement recruits (17). The change in work hours (32, 38) and greater volume of low-intensity work (12, 13, 27) from academy to a deputy sheriff's first patrol posting could have influenced the decline in job-specific task performance measured by the CLF and SW. Slower performance in climbing tasks such as the CLF and SW could indicate limitations in a deputy sheriff's ability to perform these tasks in the field. It should be noted that deputy sheriffs can make tactical decisions when on-duty that may mitigate the need to scale obstacles. For example, if the deputy sheriff feels their safety would be compromised by scaling an obstacle (i.e. an offender may be waiting on the other side to ambush the deputy sheriff), they should not do it. However, a deputy sheriff may also make this decision based on the belief they may not be able to scale the obstacle efficiently and safely. This has implications on public safety, especially if the inability to quickly scale an obstacle may mean an offender has time to evade arrest.

The 99OC and 500R are designed to simulate a foot pursuit within an urban area, or over an extended distance, respectively (35). When all data combined were considered, there were significant increases in 99OC and 500R times measured during patrol school. When the sexes were analyzed separately, the male deputy sheriffs were slower in both tasks at patrol school, while the females were only significantly slower in the 99OC. This may have been a function of the small sample size, however, as the slower 500R for female deputy sheriffs in patrol school had a moderate effect. Similar to the CLF and SW results, Lockie et al. (26) found that deputy sheriffs who had worked in custody for 48 months or longer were slower in the 99OC and SW compared to recruits and deputy sheriffs who worked in custody for less time. Previous research has suggested that muscular endurance and anaerobic capacity are physiological attributes that relate to the ability to efficiently complete a simulated foot pursuit (17). Lockie et al. (17) also found that the 500R also had a large correlation with the 2.4-km run, which suggested aerobic fitness may influence the ability to complete an extended foot pursuit. In an analysis of a different foot pursuit simulation (the 75-yard pursuit run), Post et al. (37) found that greater lower-body strength measured by the isometric mid-thigh pull, greater lower-body power measured by different jump tests, and faster linear and change-of-direction speed all related to a faster 75-yard pursuit run in male and female civilians. Clearly, foot pursuit ability involves a range of physical capacities. Although this study cannot extrapolate the specific qualities, a decline in any, or all, of these qualities could lead to slower foot pursuit performance in deputy sheriffs. Although deputy sheriffs can make tactical decisions as to whether they pursue an offender, lacking the physical capacity to do so effectively could place themselves, their colleagues, and the general public at risk.

When considering the total sample of deputy sheriffs, the BD was performed significantly faster during patrol school compared to academy. After dividing the sample by sex, it was clear that the male deputy sheriffs generally performed this task faster during patrol school, while the same was not the case for the female deputy sheriffs. Lockie et al. (26) found that performance of this task was less influenced by time spent working in custody, as those deputy sheriffs who worked in custody for 47 months or less did not perform the BD significantly different compared to recruits at the end of academy training. Maximal lower-body strength, as measured by a one-repetition maximum hexagonal bar deadlift, significantly related to a faster drag time in male and female civilians (16). Additionally, there is a specific technique required to perform the BD (16, 17, 26, 30, 35). It is possible that the male deputy sheriffs were stronger and more technically proficient in the BD following academy and just prior to their first patrol posting. This would need to be confirmed by research that specifically tracked the strength of deputy sheriffs following their graduation from academy. Nonetheless, the BD was the only WSTB task, specific to male deputy sheriffs, that was not found to have degraded at patrol school.

The results from this study have important implications for deputy sheriffs and law enforcement populations in general. In line with previous research (26), the data inferred that the job-specific fitness of deputy sheriffs declined following academy training. This is not surprising, given the job for recruits is to train to become deputy sheriffs. Once sworn, the deputy sheriff will generally have less opportunity to be active given the sedentary job demands (12, 13, 27) and inconsistent work hours (32, 38). Deputy sheriffs may not have the dedicated time to train such as they did when recruits. Nonetheless, it is highly recommended that law enforcement agencies at least provide some opportunity for physical conditioning in order to limit any job-specific fitness losses. Indeed, Rossomanno et al. (39) found that a six-month supervised exercise program for law enforcement officers, which incorporated aerobic training and calisthenics, could improve performance in an obstacle course incorporating specific law enforcement skills (e.g., running, jumping, obstacle clearance, dummy drag, and shooting). This provides some evidence that enhancing general fitness could have downstream effects on job-specific fitness, such as that measured by the WSTB. This could then enhance the ability for the deputy sheriff to perform these tasks more effectively when on-duty.

There are study limitations that must be noted. Multiple agency staff members were involved with data collection, which could affect the results even though all staff were trained in, and required to follow, established protocols by the agency and state (35). The sample was not split into years sworn, and the number of years away from academy can have an impact on WSTB performance (26). The time between academy and patrol school for each deputy sheriff was not a consideration in this study, as the focus was to show longitudinal performance changes for deputy sheriffs just prior to the first time they are sent on patrol. Although the relative percentage between the male and female deputy sheriffs in this study was similar to that from the literature (1, 3, 15, 17, 19, 25, 26, 28, 29), the sample size for females was low. However, this was the only data provided by the agency that had WSTB data tracked from academy to patrol school. It would also have been beneficial to investigate changes in lean body mass, fat mass, and overall body mass from academy to patrol school. Given previous cross-sectional research has shown that male police cadets have lower body fat than officers (32), future research should investigate longitudinal changes in the body composition of deputy sheriffs from academy to patrol school. The WSTB is only mandatory in the state of California in the USA (16, 17, 26, 30, 35). Other states and countries may use different job-specific tests, and these should be analyzed specifically for each agency, state, or country.

In conclusion, this study demonstrated that job-specific fitness of deputy sheriffs as measured by the WSTB tended to decline from academy to patrol school. This is notable, as patrol school is completed just before the deputy sheriff's first patrol assignment. The only WSTB task that did not decline was the BD, which male deputy sheriffs completed faster during patrol school. In contrast, climbing and obstacle clearance (CLF and SW) and foot pursuit ability (99OC and 500R) showed marked decrements in performance, which could have implications for deputy sheriffs if they are required to perform these tasks when on-duty. It is recommended that deputy sheriffs be provided access to some form of physical conditioning so they can limit any losses in job-specific fitness. This could allow the deputy sheriff to better maintain the physical ability and fitness required to perform tasks that are necessary for public safety.

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