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Introduction of an Applicant Job-Related Task Assessment (JTA) and the Effects on the Health and Fitness of Police Recruits

Brief Running Head: JTA Introduction and Police Recruit Fitness

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Abstract

BACKGROUND: In 2020, a police department in the south-eastern USA introduced a Job-Related Task Assessment (JTA). The JTA included running, climbing, crawling, balance, direction changes, stair climbing, dragging, pushing, and simulated controlling of a struggling subject and needed to be completed by applicants in 6:57 min:s. It is not known whether introducing the JTA in the hiring process affected the health and fitness of hired recruits.

OBJECTIVE: To compare the health and fitness of recruits hired prior to, and following, the JTA introduction.

METHODS: Analysis was conducted on recruit data split into academy training year: 2016 (n=91), 2017 (n=129), 2018 (n=167), 2019 (n=242), and 2020 (n=37). The 2020 group was hired after the JTA introduction and included one academy class. The following were recorded for all recruits: age, height, body mass, and body mass index; systolic and diastolic blood pressure (BP); sit-and-reach; grip strength; push-ups; sit-ups; 2.4-km run; and a physical ability test (PAT). A univariate ANOVA, with sex and age as covariates and Bonferroni post hoc, determined between-year differences.

RESULTS: The recruits from 2020 were significantly lighter than 2018 recruits ($p<0.031$), had higher systolic and diastolic BP than recruits from 2016-2018 ($p\leq0.006$), completed the 2.4-km run faster than recruits from all years ($p<0.001$), and completed the PAT faster than the 2016 and 2019 ($p=0.006$-0.007) recruits.

CONCLUSIONS: The JTA introduction led to the selection of recruits with lower body mass, and better aerobic (2.4-km run) and job-specific fitness (PAT). However, 2020 recruits also had higher BP which should be monitored.

Key words: aerobic fitness; blood pressure; law enforcement; physical ability test; tactical

1. Introduction

Law enforcement organizations often use physical fitness testing as part of their hiring process [1-5]. Currently, there are no national standards within the USA regarding the type of fitness tests or expected benchmarks. Indeed, these decisions are left to individual states or law enforcement organizations and police departments as to what fitness tests, if any, they wish to use. Nonetheless, fitness testing that is used as part of the police recruit selection process can generally include physical stamina or agility tests, normative-referenced fitness or wellness tests, or job simulation exercises [2, 6]. In a situation where fitness testing is included within the hiring process, if an applicant does not attain the required standards they are typically not considered eligible to commence training to become a police officer [2].

Numerous studies have demonstrated that recruits who have better performance in general fitness tests are more likely to graduate from a law enforcement training academy [7-13]. General fitness tests, with some common examples being push-ups, sit-ups, and running assessments (e.g., 2.4-kilometre [km] or 1.5-mile run, 20-metre multistage fitness test [MSFT]), provide an indication of general health, fitness, and well-being [14]. To provide some specific examples, Korre et al. [8] found that the number of push-ups completed in 60 seconds (s) and 2.4-km run time were predictors of academy graduation in Massachusetts police recruits. Dawes et al. [9] found that those recruits who graduated outperformed those that did not by 9-30% in 60-s push-ups, 60-s sit-ups, the vertical jump, and the MSFT. Moreover, Dawes et al. [9] documented that push-up repetitions was a predictor of academy graduation. Lockie et al. [11] found that in recruits from a southern Californian law enforcement training academy, those recruits who graduated performed significantly ($p < 0.01$) better in a 75-yard pursuit run, 2-kg seated medicine ball throw, 60-s push-ups, 60-s sit-ups, 60-s arm ergometer revolutions, and the MSFT.

Some law enforcement organizations also include tests of occupational-specific fitness in the hiring process. Occupational-specific fitness tests are sometimes used after a training academy to assess a recruit's readiness to perform the job [15-18]. However, some agencies use job-related tasks as part of their hiring process, such as smaller obstacle courses (i.e., expected completion times of less than 2 minutes) or discrete tasks such as a body drag [19, 20]. These tests are generally designed to screen applicants for the minimum physical fitness requirements necessary to serve as a police officer [21]. A longer duration, larger scale Job-Related Task Assessment (JTA) is less common in police hiring tests. A JTA involves job-specific tasks completed in succession and places a greater physical demand on the participant. An example in first responders is the Candidate Physical Ability Test (CPAT) for firefighter candidates, where individuals must navigate eight events (stair climb, hose drag, equipment carry, ladder raise and extension, forcible entry, search, rescue drag, and ceiling breach and pull) completed in succession within 10 minutes and 20 seconds (10:20 min:s) [22]. Due to the nature and combination of these tasks, anaerobic and aerobic capacity, and muscular strength, power, and endurance are all stressed in the individual [23, 24]. The inclusion of a police-specific JTA by a police department could mean that applicants who have the capacity to pass this task would demonstrate better health and fitness than applicants who cannot pass this task.

Part of the reason why fitness is beneficial for recruits is that a training academy can be very physically demanding for recruits. In addition to physical fitness training, which can often require maximal effort [25-28], there is the added stress of learning specific policing job tasks and skills. For example, defensive tactics training can elicit maximal-to-near maximal heart rate responses [29, 30], providing some indication of the intensity associated with this type of training. This would suggest law enforcement organizations and police departments would benefit from

recruiting individuals with higher levels of fitness. However, even prior to 2020 and the COVID-19 pandemic, nationwide recruitment issues had been identified in law enforcement [31, 32]. Roufa [32] noted that a lack of physical fitness in the general population has led to a decreased pool of potential recruits. This led numerous police organizations to lower, or even remove, fitness standards as part of their hiring process [33-35]. However, if a police department was to introduce a JTA to their hiring process, this could have a marked influence on the fitness of incoming recruits.

Therefore, the purpose of this study was to compare the health and fitness of recruits hired in 2020, after the introduction of a JTA by a police department, to recruits hired in the previous four years (2016-2019). The police department that was analysed was from a large south-eastern city in the USA that employed more than 3000 sworn police officers [36]. Thus, the data would have application to other national and international law enforcement organisations. The 5-year time period was selected as prior to 2016 the police department in question had undergone a multiple-year hiring freeze. The JTA was novel to the police department and included simulation of numerous police-specific tasks that were to be completed within 6:57 min:s [37, 38]. It was hypothesised that the 2020 recruits would demonstrate superior health and fitness compared to recruits from 2016-2019.

2. Methods

2.1. Participants

Retrospective analysis of a convenience sample of recruit health and fitness data from five years belonging to one large city police department was performed. This sample comprised 666 recruits data sets, including 449 men and 217 women. Age, height, and body mass data for men,

and women by year is shown in Table 1. The number of recruits varied per year, as the intake of recruits to specific academy classes is generally controlled by a police organization's human resources department [39]. All identifying information was coded by the agencies' training staff before being received for analysis and all recruit data sets that were available were included in the analysis. The exclusion criterion was data sets with clearly incorrectly entered data. As secondary data was utilised in this study, G*Power software (v3.1.9.2, Universität Kiel, Germany) was used to confirm post hoc that the sample size of 666 was sufficient for an analysis of covariance (ANCOVA) such that data could be interpreted with a small effect level of 0.2 [40], and a power level of 0.97 when the alpha level was set at 0.05 [41]. Similar to other studies investigating law enforcement recruits [10, 39, 42-44], no control was assigned to the fitness training and dietary practices of individual recruits period prior to their respective academy and thus any training programs before academy were generally completed at the individual-level only. Based on the retrospective nature of this study, the institutional ethics committee approved the use of pre-existing data (ED-19-146-STW). This research was conducted according to the Declaration of Helsinki [45].

INSERT TABLE 1 ABOUT HERE

2.2. Procedures

For the 2020 recruit sample, these individuals completed the JTA as part of the hiring process prior to acceptance to a training academy. Recruits from all other years did not have to complete the JTA. The JTA will be described first, followed by the health and fitness tests that were completed within the first two weeks of the recruit's respective training academy. All testing

was conducted on-site by the staff at the training institute for this police department. Every staff member involved with testing was trained in the required procedures for each test, which remained consistent over the 5-year period from which the study data was drawn. Further, all staff were required to follow set instructions for each test, which aids in limiting variation across the years of data collection. Academy classes, and thus fitness tests, were completed year-round due to the need for the police department to recruit and hire personnel. While fitness test performance could be impacted by different weather conditions [46], this was an unavoidable limitation. Moreover, year-round testing and training of recruits is typical for police departments [39, 46], and arguably essential due to many departments reporting shortfalls in recruitment [31, 32]. Prior to performance of the fitness tests, height, body mass, and blood pressure (BP) were measured first. A doctor's beam scale was utilized to collect body mass measurements (Cardinal; Detecto Scale Co., Webb City, MO). Body mass index (BMI; measured in kg/m^2) was derived via the formula: body mass / $height^2$. The fitness test battery was designed to assess multiple fitness components and was conducted in a manner that followed testing guidelines from the National Strength and Conditioning Association [47]. This testing order reduced the impact of fatigue on the performance of each subsequent test. Where appropriate, recruits rotated through each test as a group which allowed for sufficient recovery periods. For the push-up and sit-up tests, recruits where partnered up and alternated completing each test. This testing process is common in police research [5, 11, 39, 42, 44, 46, 48]. Fitness tests were performed in the order presented.

2.3. Job-Related Task Assessment (JTA)

The JTA was designed to reflect what was minimally required for adequate job performance within this police department [49]. The researchers were not involved with the design

or validation of the JTA. Nonetheless, the JTA was established and implemented by the police department as part of their hiring process and performed outdoors at the department's training facility. Applicants completed an application and then scheduled a testing date [38], so the applicant data included in this study was likely recorded on different days. Nonetheless, testing staff were required to follow standard procedures for all applicants [37, 38]. Applicants were instructed to consume "plenty of fluids 2-3 days prior to their testing and a light meal 2-3 hours prior to testing" [38]. All events within the JTA were completed in succession. Applicants were required to complete the JTA in 6:57 min:s in order to be accepted to a training academy. The JTA course is shown in Figure 1, and the requirements will be described [37, 38].

INSERT FIGURE 1 ABOUT HERE

On the start command, applicants ran approximately 370.33 m (1111 feet) on an asphalt track in an anti-clockwise direction, returning to the start point. After the applicant returned to the start point, they continued running onto the grassed area in the middle of the track to climb over a 1.22-m (4-foot) wall. They then proceeded to a crawl under and through a 0.91-m (3-feet) x 1.52-m (5-feet) enclosure. The applicant then negotiated five hurdles that were up to 0.61 m (2 feet) tall. If the applicant knocked a hurdle off its stand, they had to return to the start of this section. The applicant then weaved through five cones set-up to provide a serpentine section. They then climbed up and over a 3.66-m (12-foot) ladder structure. The applicant then ran around the turning post and towards the rescue drag platform. They performed the drag using a harness on a 68.04-kg (150-lb) dummy over 15.24-m (50 feet). After completing the drag, the applicant ran to a 5.49-m (18-foot) balance beam that had directional changes every 1.83 m (6 feet). If the applicant fell

185 off the balance beam, they had to return to the start of this event. The applicant then ran to, and
186 climbed through, a simulated window before running up and down a stair climb (7 steps on each
187 side) three times. The applicant then moved onto the scuffle, which simulated controlling a
188 struggling subject. They first pushed and pulled an 81.65-kg (180-lb) sled over 4.57 m (15 feet).
189 The applicant then had to complete 10 repetitions manoeuvring a battle rope over a cone, returned
190 back to the sled to push and pull it over 4.57 m, before completing another 10 repetitions with the
191 battle rope. The applicant then sprinted to the finish line (the original start position).
192
193 *2.4. Blood Pressure (BP)*
194 Procedures for the measurement of BP have been described by Lockie et al. [50]. Recruits
195 were seated with their feet flat on the floor and their left arm in a supported, relaxed position at
196 heart level. Clothing was removed or repositioned such that the cuff was placed on bare skin
197 without any compression above the cuff. The cuff position was above the crease of the elbow and
198 encircled approximately 75-100% of the arm [51]. Staff then followed the standard procedures
199 required for manually measuring BP [52].
200
201 *2.5. Sit-and-Reach*
202 The sit-and-reach provided a measure of hamstring flexibility [53], and staff utilized
203 procedures that have been described in the literature [50]. Recruits removed their shoes and sat
204 with both feet flat against the sit-and-reach box (Novel Products, Inc., Rockton, USA). They then
205 positioned their hands one on top of each other with the tips of the middle fingers aligned and
206 palms down. The recruit then flexed forwards at the hips and slowly reached as far along the scale
207 as possible, held this position for approximately 5 s, and the scale was measured to the nearest

centimeter (cm) where the middle fingers touched. The knees were to remain extended throughout the reach; if there was any flexion of the knee, the test was reattempted.

2.6. Grip Strength

Grip strength can provide a metric for total-body strength [54]. The procedures used by staff were adapted from established methods [44, 55]. A handgrip dynamometer (Takei Scientific Instruments, Japan) was used and adjusted so that when placed in the recruits' hand, the base of the first metacarpal along with all four fingers were firmly in contact with the pressure-sensitive handle. Staff then instructed the recruits to squeeze as hard as possible on the handle for approximately 2 s, while standing and keeping the arm flush against the side of the body. Three attempts were completed for each hand and recorded to the nearest kg, with the dominant hand tested first. The best attempt for each hand was summed to derive combined grip strength.

2.7. Push-ups

Upper-body muscular endurance was assessed via a maximal push-up test where the recruit completed as many repetitions as possible in 60 s. The procedures used by staff at the police department were similar to that from the literature [9, 11, 44, 55]. Recruits started in the typical 'up' position, with the body taut and straight, the hands positioned approximately shoulder-width apart, and the fingers pointed forwards. For male recruits, a partner placed a fist on the floor directly under the recruit's chest to ensure they descended to the appropriate depth. Female recruits were tested without the use of a fist at the chest. Instead, they were observed to make sure their head broke the plane of the elbows when in the down position. This was done to prevent any inappropriate contact or variability in body types that would alter depth in the down position. On

231 the start command, the tester began the stopwatch and the recruit flexed their elbows, lowered
232 themselves until they reached the correct down position before they extended their elbows to return
233 to the start position. The recruit performed as many push-ups as possible with this technique in the
234 allotted time period.
235
236 *2.8. Sit-ups*
237 Abdominal muscular endurance was measured by the sit-up test, where recruits completed
238 as many repetitions as they could in 60 s. The technique used by staff at this police department
239 was similar to that from previous research [2, 39, 50, 56]. Recruits laid in a supine position with
240 their knees flexed to approximately 90° and heels flat on the ground. They could either place the
241 fingers behind the ears or position the hands across the chest in contact with shoulders. Recruits
242 were assigned a partner to help anchor them to the ground by holding their feet flat throughout the
243 sit-up movement. To complete a sit-up, recruits flexed their trunk, elevated their shoulders off the
244 ground and sat up until their elbows touched the top of their knees in the up position. They then
245 descended back down until their shoulder blades contacted the ground. On the start command, the
246 tester began the stopwatch and recruits performed as many sit-ups in the described manner as they
247 could in 60 s.
248
249 *2.9. Physical Ability Test (PAT)*
250 Staff also used a physical ability test (PAT) to emulate policing occupational tasks and test
251 the physical capacities of recruits. To reiterate, there is no national standard for PATs and it is
252 generally up to the agency to determine how the PAT will be constructed [21]. Prior to initiating
253 the PAT, recruits were seated in a full-size automobile with their seat belt on and hands on the

steering wheel at the 2 o'clock and 10 o'clock positions. The trunk key was in the vehicle's closed glove compartment and a handgun and baton were in the vehicle's closed trunk [57].

To commence the PAT, the recruit exited the car as quickly as possible and retrieved items from the trunk. They then ran 201 m (220 yards) to the obstacle course. First, the recruit performed a 1.02-m (40 inches) wall climb then ran 3.05 m (10 feet) to a series of three hurdles, set 1.52-m (5 feet) apart. Each hurdle was different in height, with the first being 60.96 cm (24 inches), the second 30.48 cm (12 inches), and the last being 45.72 cm (18 inches). Next, the recruit ran 3.05 m to the serpentine course, where they had to navigate between nine pylons set at 1.52-m intervals. Upon completion of the serpentine course, the recruit ran 3.05 m (10 feet) to a 2.44 m (8 feet) low crawl underneath a 0.69-m (27 inch) open-air barrier. Then the recruit sprinted 15.24 m (50 feet) to a 68.04-kg (50-lb) dummy drag. Similar to previous research [15-17, 58, 59], the dummy was positioned face-side up, in a supine position, requiring the cadets to hook their arms underneath the arms of the dummy and lift by extending at the hips and knees until they were able to get a solid grasp across the dummy's torso. The recruit then dragged the dummy 30.48 m (100 feet) on a cut grass surface. The recruit then completed the obstacle course again but in reverse, before completing another 201-m run. For the final tasks of the PAT, the recruit was required to draw, assume a proper firing position and fire six rounds using the dominant hand and six rounds with the supporting hand (in no particular order). The revolver used by recruits had no firing pin, and a complete trigger pull was the only measure of success. They then replaced the weapon in the trunk, re-entered the vehicle and placed the hands upon the steering wheel to conclude the test [57]. Time was recorded in min:s.

277 *2.10. 2.4-km (1.5-mile) Run*

278 After a 30-45 minute break following the other fitness tests, recruits completed a 300-m
279 run and 2.4-km (1.5-mile) run. Data for the 300-m run was not included in the dataset provided to
280 the researchers so was not included in this study. The 2.4-km run was used to assess aerobic
281 capacity [43, 60]. The 2.4-km run was conducted on an 400-m (437.45-yard) asphalt track, which
282 had minimal changes in terrain. Recruits were instructed to complete six laps of the course as
283 quickly as possible with time recorded to the nearest 0.10 second on a stopwatch.

284

285 *2.11. Statistical Analyses*

286 Statistical analyses were processed using the Statistics Package for Social Sciences
287 (Version 27; IBM Corporation, New York, USA). Descriptive statistics (mean ± standard deviation
288 [SD]) were calculated for each variable. The analysis for this study was adapted from previous
289 research [50]. The sample was divided into five groups based on the year data were collected:
290 2016, 2017, 2018, 2019, or 2020. Only one academy training class was included in the 2020 data
291 provided to the researchers, which as will be shown in the results, influenced between-year sample
292 size differences. Nevertheless, previous law enforcement research has also featured between-group
293 analyses that can have sample size discrepancies [5, 48]. Levene's test for equality of variances
294 assessed the homogeneity of variance of the data, with significance set at $p < 0.05$. If data were
295 found to be heterogeneous, the alpha level required for between-group significant interactions was
296 adjusted to $p < 0.01$ to reduce Type I errors [50, 61]. A univariate ANCOVA was used to determine
297 whether there were significant differences between the groups. Within the year groups, the sexes
298 were combined [5, 39, 44, 48, 50]. However, sex was used as a covariate as previous studies have
299 documented differences between the sexes in general and occupational-specific fitness test

performance of law enforcement personnel [2, 3, 15, 39, 42]. All variables except for age and height were also independently analysed with age as an additional covariate [61]. This was because age can influence body mass and fitness test performance of law enforcement personnel [3, 42]. If a significant interaction between the groups was found, a Bonferroni post hoc adjustment for multiple pairwise comparisons was adopted ($p < 0.05$).

3. Results

The mean data recorded from recruits in each year is shown in Tables 2 and 3. Homogenous data was indicated for age ($F_4 = 0.119$, $p = 0.976$), height ($F_4 = 0.509$, $p = 0.729$), body mass ($F_4 = 1.650$, $p = 0.160$), BMI ($F_4 = 1.801$, $p = 0.127$), sit-and-reach ($F_4 = 1.600$, $p = 0.173$), grip strength ($F_4 = 1.476$, $p = 0.208$), 2.4-km run ($F_4 = 1.864$, $p = 0.115$), and the PAT ($F_4 = 1.422$, $p = 0.225$). The alpha level for significance for these variables was set to $p < 0.05$. Heterogeneous data were indicated for systolic BP ($F_4 = 3.290$, $p = 0.011$), diastolic BP ($F_4 = 6.735$, $p < 0.001$), push-ups ($F_4 = 3.160$, $p = 0.014$), and sit-ups ($F_4 = 4.703$, $p < 0.001$). The level for significance for these variables was set to $p < 0.01$.

INSERT TABLE 2 ABOUT HERE

INSERT TABLE 3 ABOUT HERE

There was a significant interaction for body mass ($F_4 = 2.418$, $p = 0.047$), systolic BP ($F_4 = 19.612$, $p < 0.001$), diastolic BP ($F_4 = 14.615$, $p < 0.001$), sit-and-reach ($F_4 = 4.650$, $p = 0.001$), sit-ups ($F_4 = 3.906$, $p = 0.004$), 2.4-km run ($F_4 = 19.035$, $p < 0.001$), and the PAT ($F_4 = 3.590$, $p = 0.007$). The 2020 recruits were lighter than the 2018 recruits ($p < 0.031$). The 2019 and 2020

323 recruits had significantly higher systolic and diastolic BP than recruits from 2016-2018 ($p \leq 0.006$).
324 The 2017 recruits had a further sit-and-reach than the 2018 ($p = 0.013$) and 2019 ($p < 0.001$)
325 recruits. The 2018 recruits completed significantly more sit-ups than the 2019 recruits ($p = 0.010$).
326 The 2020 recruits completed the 2.4-km run significantly faster than recruits from all other years
327 ($p < 0.001$). The 2019 recruits completed the 2.4-km run faster than the 2016 ($p < 0.001$), 2017 (p
328 $= 0.002$), and 2018 ($p = 0.015$) recruits. The 2020 recruits also completed the PAT significantly
329 faster than the 2016 ($p = 0.006$) and 2019 ($p = 0.007$) recruits. There were no significant between-
330 group interactions for age ($F_4 = 2.209$, $p = 0.067$), height ($F_4 = 1.125$, $p = 0.344$), BMI ($F_4 = 2.294$,
331 $p = 0.058$), grip strength ($F_4 = 0.492$, $p = 0.741$), and push-ups ($F_4 = 2.536$, $p = 0.039$).
332
333 **4. Discussion**
334 This study analysed how the introduction of a JTA by a large south-eastern USA city police
335 department within the hiring process impacted the fitness of incoming recruits compared to
336 previous years after a hiring freeze. It was hypothesised that the recruits from 2020, who were
337 hired after the JTA introduction, would demonstrate better health and fitness compared to recruits
338 from the years 2016-2019. The hypothesis was proven partially correct. The 2020 recruits had a
339 significantly lighter body mass than 2018 recruits, were significantly faster in the 2.4-km run
340 compared to recruits from all years, and were also significantly faster in the PAT compared to the
341 2016 and 2019 recruits. It is plausible that the introduction of the JTA led to the hiring or recruits
342 who had health and fitness capacities that could be beneficial for persevering through the rigors of
343 the training academy. However, the 2020 recruits did have higher BP compared to recruits from
344 the other years, which is a cause for concern given the risk of cardiovascular disease (CVD) in
345 police personnel [62, 63]. As will also be discussed, it is not known how the JTA could impact

graduation rates within this police department, which needs to be reconciled given the hiring challenges being experienced by law enforcement organizations across the USA [31, 32].

The age, height, and body mass data were similar to other recruit populations from the literature [5, 9, 39, 44]. In this study, there were also no significant between-group interactions for age, height, or BMI across the years in the recruits. However, the 2020 recruits were significantly lighter than the 2018 recruits. Further to this, when viewing the mean data, the 2020 recruits did have the lowest body mass across all the years. It is possible that the smaller sample with a relatively high percentage of women (13/37 or 35%, compared to 31-33% for all other years) could have contributed to this data. It is also plausible that the introduction of the JTA also impacted these data. Dawes et al. [29] found that overweight police officers had a greater physiological response (higher heart rate responses and blood lactate increases) compared to healthy officers during a defensive tactics exercise, indicating a negative influence of higher body mass. As the JTA in this study required a succession of policing tasks to be completed continuously, with a target time of less than 7 mins, it is possible that lighter recruits were more successful in this test. The potential longer-term impacts of hiring lighter police officers is a consideration and avenue for future research. This is because Baran et al. [64] has documented that lighter law enforcement personnel tend to carry a duty load that is a greater percentage of their body mass, and the long-term impacts of this are not known.

With regards to the fitness tests, the most pronounced difference that was observed was aerobic fitness measured by the 2.4-km run. The 2020 recruits were 18-26% significantly faster than recruits from all other years in this study. It should also be noted that the 2019 recruits were faster in the 2.4-km run compared to the recruits from 2016-2018, although the difference (5-11%) was not as great compared to the 2020 recruits. It should be noted that the mean 2.4-km run times

from the recruits in this study were slower than those from law enforcement recruits reported in the literature (11:49 ± 1:26 min:s) [43]. Nonetheless, previous research has shown the value of aerobic fitness relative to occupational tasks in law enforcement personnel. Two separate studies specifically documented significant relationships between 2.4-km run time and time to complete a 99-yard obstacle course in law enforcement recruits ($r = 0.25$ and 0.26, $p < 0.01$ for both studies) [16, 17]. Aerobic capacity would be required in the JTA because of the successive performance of occupational tasks while continuously running to the different events. Better recruit aerobic fitness could be also be beneficial for graduation rates within this police department. Numerous studies that shown that greater aerobic fitness can contribute to training academy graduation success [7-11], with a meta-analysis by Tomes et al. [65] finding that poor metabolic fitness, as measured through fixed-distance timed run events (i.e., the 2.4-km run), was unequivocally associated with an elevated risk of injury during initial tactical training. Moreover, better aerobic fitness has been linked to a reduced risk of CVD [66], which is an important consideration in police officers given their job demands (i.e., occupational stress, shift work, disrupted sleep, dietary impacts) [63, 67] and greater risk of CVD when compared to the general population [62, 63]. The introduction of the JTA appeared to lead to the selection of recruits with superior aerobic fitness, which over the long-term could be beneficial for the workforce of this police department.

The 2020 recruits also had the fastest mean PAT time compared to all other years (by 9-12% compared to 2017-2019) and were 12% significantly faster than the 2016 recruits. Both the JTA and PAT provided simulations of policing job tasks. There are no national mandates relative to the structure of a police PAT, and the one featured in this study was specific to the police department that was investigated. Nevertheless, several studies have documented relationships between tests of muscular strength, endurance, power, anaerobic capacity, and aerobic fitness with

job task simulations or training exercises in law enforcement [16, 17, 56, 58]. As a result, if recruits are accepted into the training academy with better job-specific fitness as measured by the JTA, it is likely that they will enter the academy with a higher capacity for job-specific physically challenging tasks – in this instance, measured by the PAT. A consideration for the introduction of a test such as the JTA, or even the completion of a PAT prior to academy commencement, is the department may be asking applicants or recruits to complete policing job task simulations before they have been technically trained in these tasks. While this is a nationally recognized process for firefighter trainees with the CPAT [22-24], this approach is less common in law enforcement. The PAT does incorporate more specific law enforcement skills that are not present in the JTA that should be trained during the academy (e.g., trigger pull with an inert firearm [i.e., modified with no firing pin]). Nonetheless, department staff should also consider that suboptimal recruit test performance may not always be related to fitness, but potentially to limitations in the execution of specific skills (e.g., poor dragging technique or weapon manipulation). This information could also be used within an ability-based training approach to develop any skill limitations in recruits.

Previous research has documented differences in fitness test performance for recruits across different academy classes [39], so it is not surprising that the data indicated some recruit fitness variation across the years for this department. In this study, the 2017 recruits had a further sit-and-reach compared to the 2018 and 2019 recruits. The mean sit-and-reach values for recruits in this study was similar to that for civilian jailer recruits from southern California (~33 cm) [68], but lower than police recruits from Massachusetts (~44 cm) [8]. The 2018 recruits completed more sit-up repetitions than the 2019 recruits. The recruit sit-up data from this study was similar to that reported from previous law enforcement research [2, 3, 5, 10, 11, 44, 46, 48]. The data from this study data help indicate the value of fitness testing to highlight specific limitations in recruits that

could be targeted within appropriate physical training programs and highlights the dangers of taking a single cross-sectional sample to categorize a population. In support of previous research [26, 39, 69], the current study indicates the potential value of ability-based training for police recruits to assist with addressing fitness needs to that could benefit occupational performance and overall health and fitness.

BP is an important measure for law enforcement personnel as it can be an indicator for CVD [70], and as stated police officers are at high risk for CVD due to their job demands [63, 67]. The 2020 recruits had a significantly higher systolic and diastolic BP compared to recruits from 2016-2018, and the mean values would classify this group as having Stage I hypertension when compared to guidelines provided by the American College of Sports Medicine [71]. The environment of 2020 could have influenced these results. The COVID-19 pandemic occurred during this year, in addition to major civil unrest incidents in numerous cities in the USA [72, 73]. The stress of 2020 could have been reflected in the BP recruit data. Indeed, Lockie et al. [50] documented a significant increase in systolic blood pressure of police officers within a health and wellness program in 2020. Although not documented, applicants from 2020 could have also had COVID-19 during this time, and this could have affected the BP data. However, even though the 2019 recruits also had a significantly higher systolic and diastolic BP compared to recruits from all other years, it is important to note that the mean diastolic values for all groups would be classified as elevated (systolic value between 120-129 mmHg) [71]. This highlights the need that even at the recruit-level, department staff should be providing resources to individuals to manage their blood pressure. Supplemental to the physical exercise recruits are likely getting during a training academy, they could also receive education about issues such as stress management and diet.

Although the 2020 recruits had lighter body mass, better aerobic fitness (2.4-km run), and better job-specific fitness (PAT), the graduation rate of these recruits is not currently known. Indeed, this study did not analyse how the JTA may have influenced the number of recruits accepted to a training academy, nor was there analysis of any changes to graduation rate for the department. Given the current challenges associated with law enforcement recruitment [31, 32], it is essential to determine whether the introduction of a test such as the JTA leads to less recruits being accepted but a greater percentage of these numbers graduating (i.e., graduation rates either do not change or improve). This would be a positive outcome, and could potentially save a police department money through a reduction in recruit separation rates [26]. Conversely, a negative outcome from introducing the JTA could be less recruits being accepted but the separation rate remaining unchanged, which would lead to a lower graduation rate and less recruits transitioning into becoming sworn police officers. Further research is required to determine the long-term impacts of the JTA, how this affects the numbers of sworn officers hired, and whether hiring fitter recruits influences factors such as workers compensation due to injuries, illness, etc.

There are limitations with this study that should be noted. The 2020 recruit sample size was small (n = 37) compared to the other 4 years (n = 91-242). Future research should analyse larger samples of recruits post the introduction of the JTA to observe the longer-term impacts on fitness of incoming recruits. There was a discrepancy between men and women in the study sample, although this is typical in law enforcement research and reflective of the population. Moreover, the relative number of females in this study (33% of the total sample) is actually higher than previous research (16%) [39]. Given that many police organizations are attempting to hire and retain more female personnel [74], and the established differences in fitness test performance between the sexes [2, 3, 15, 39, 42], future research could investigate how the introduction of a

JTA (or a similar test) could affected recruitment of men and women. The fitness testing battery did not include a test of lower-body maximal strength. Previous research has indicate the importance of lower-body strength to tasks such as a body drag [58], which was an event in the JTA and PAT. Lastly, the JTA was only implemented by the police department investigated in this study. Any specific job-specific fitness tests that are implemented by a department prior to academy should be specifically analysed relative to how it impacts the fitness of incoming recruits to a training academy, in addition to the resulting graduation rates.

5. Conclusion

The introduction of the JTA led to the selection of recruits with lower body mass, and better aerobic (2.4-km run) and job-specific fitness (PAT). This could be beneficial for graduation rates within this department, as greater recruit fitness may improve success within a training academy. However, the 2020 recruits also had higher BP, which should be scrutinized by staff within this organization, with a view towards potential interventions (e.g., education programs about fitness, stress management, and diet). These data could be the result of the numerous challenges encountered by law enforcement personnel during 2020 (i.e., the COVID-19 pandemic, social unrest within the USA). Nonetheless, given the increased risk of CVD for police officers [62, 63], any indication of increased blood pressure by recruits at the start of their careers should be monitored. Although the JTA appeared to result in the hiring of recruits with superior aerobic and job-specific fitness, what should be noted is that many law enforcement organizations have indicated challenges with recruitment. More research is needed to determine whether more stringent hiring practices affect overall recruit hiring and graduation rates.

Ethical approval (name of institute and number)

Oklahoma State University; ED-19-146-STW.

Informed consent

Not applicable (retrospective data used for analysis).

Conflict of interest

None of the authors have any conflict of interest.

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709 **Table 1.** Descriptive data (mean ± SD) for age, height, and body mass for men and women recruits from 2016-2020.

Year	2016	2017	2018	2019	2020
Men	n = 61	n = 88	n = 115	n = 161	n = 24
Age (years)	28.34 ± 6.50	29.74 ± 6.79	29.16 ± 6.44	30.61 ± 6.63	31.33 ± 6.63
Height (m)	1.78 ± 0.07	1.78 ± 0.07	1.77 ± 0.07	1.77 ± 0.07	1.76 ± 0.07
Body Mass (kg)	92.23 ± 16.17	92.16 ± 15.94	91.58 ± 18.29	92.06 ± 15.40	86.04 ± 13.86
Women	n = 30	n = 41	n = 52	n = 81	n = 13
Age (years)	28.70 ± 6.57	30.71 ± 6.47	29.27 ± 5.71	29.42 ± 6.26	31.54 ± 5.70
Height (m)	1.62 ± 0.06	1.64 ± 0.06	1.64 ± 0.07	1.61 ± 0.07	1.61 ± 0.05
Body Mass (kg)	70.58 ± 11.79	75.49 ± 13.37	78.29 ± 13.48	71.28 ± 13.27	66.15 ± 9.97

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Table 2. Descriptive data (mean ± SD) for age, height, body mass, body mass index (BMI), and systolic and diastolic blood pressure (BP) in police recruits from 2016-2020.

Year	2016 (n = 91)	2017 (n = 129)	2018 (n = 167)	2019 (n = 242)	2020 (n = 37)
Age (years)	28.46 ± 6.49	30.05 ± 6.68	29.19 ± 6.20	30.21 ± 6.52	31.41 ± 6.24
Height (m)	1.73 ± 0.10	1.73 ± 0.09	1.73 ± 0.09	1.72 ± 0.11	1.71 ± 0.10
Body Mass (kg)	85.09 ± 18.00	86.86 ± 17.01	87.44 ± 17.99	85.10 ± 17.67	79.05 ± 15.76ϕ
BMI (kg/m^2)	28.43 ± 4.60	28.81 ± 4.57	29.27 ± 4.91	28.68 ± 4.38	26.95 ± 3.67
Systolic BP (mmHg)	120.64 ± 15.46	120.34 ± 13.47	121.19 ± 12.63	128.31 ± 11.85§	134.35 ± 13.51§
Diastolic BP (mmHg)	71.70 ± 11.77	72.10 ± 9.46	74.05 ± 9.90^	77.53 ± 7.71§	81.70 ± 8.24§

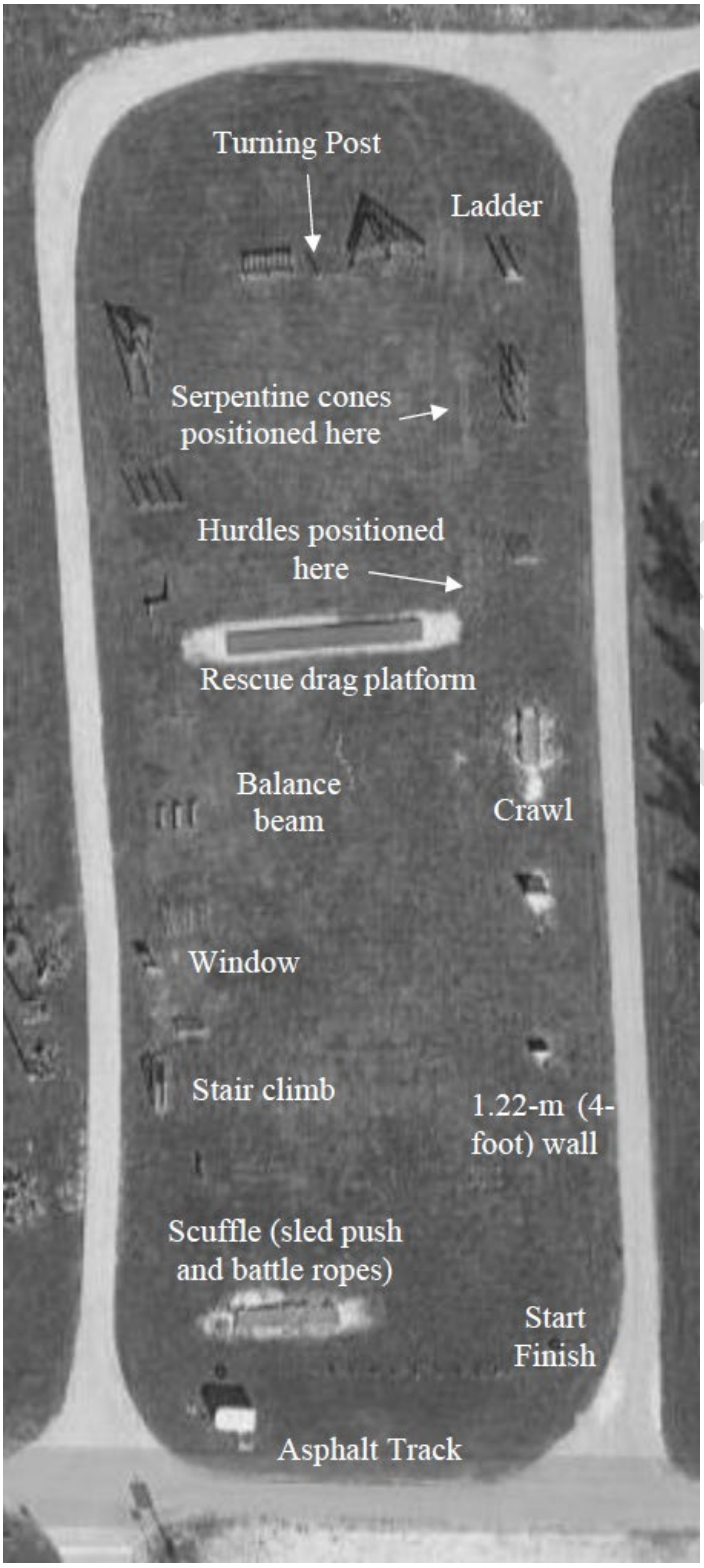
ϕ Significantly ($p < 0.05$) different from 2016. § Significantly ($p<0.05$) different from 2016-2018.

Table 3. Descriptive data (mean ± SD) for sit-and-reach, grip strength, push-ups, sit-ups, 2.4-km run, and physical ability test (PAT; min:s) in police recruits from 2016-2020.

Year	2016 (n = 91)	2017 (n = 129)	2018 (n = 167)	2019 (n = 242)	2020 (n = 37)
Sit-and-Reach (cm)	32.07 ± 7.55	34.22 ± 7.63^	31.56 ± 7.67	30.97 ± 7.71	31.19 ± 9.96
Grip Strength (kg)	97.98 ± 23.20	98.80 ± 24.01	98.89 ± 22.21	96.31 ± 25.43	98.14 ± 24.21
Push-ups (repetitions)	44 ± 21	45 ± 23	49 ± 24	44 ± 23	51 ± 16
Sit-ups (repetitions)	38 ± 9	39 ± 10δ	40 ± 12δ	36 ± 13	40 ± 8δ
2.4-km Run (min:s)	15:33 ± 3:39	15:03 ± 3:11	14:42 ± 3:17	13:54 ± 3:09§	14:25 ± 3:20*
PAT (min:s)	4:24 ± 1:09	4:15 ± 1:15	4:13 ± 1:08	4:25 ± 1:23	3:53 ± 0:40#

^ Significantly ($p < 0.05$) different from 2018 and 2019. δ Significantly ($p < 0.05$) different from 2019. * Significantly ($p < 0.05$) different from 2016-2019. § Significantly ($p < 0.05$) different from 2016-2018. # Significantly ($p < 0.05$) different from 2016 and 2019.

718 **FIGURE LEGEND**



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720 **Figure 1.** Job-related task assessment (JTA).