Differences in Physical Characteristics and Performance Measures of Part-Time and Full-Time Tactical Personnel: A Critical Narrative Review

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Abstract

Background: Tactical personnel such as military, law enforcement and fire and rescue personnel routinely perform physically strenuous occupational tasks, requiring strength, endurance and cardiovascular fitness. Tactical populations are comprised of part-time and full-time personnel, with both groups expected to perform similar tasks at an equivalent level.

Purpose: To critically review existing literature comparing physical characteristics and physical performance of part-time and full-time tactical personnel.

Material and Methods: Literature databases were searched using key search terms. Studies meeting inclusion and exclusion criteria were critically appraised and data extracted for critical narrative synthesis.

Results: Six articles were retained for evaluation, with a mean methodological quality score of 58% (range 57% to 61%). Studies included both genders and examined military, law enforcement and firefighter populations.

Conclusion: Available research indicates that, typically, part-time tactical personnel exhibit higher BMI and body fat levels and lower aerobic capacities and strength than full-time tactical personnel. However, findings regarding aerobic capacity and strength are variable. These differences may impact rates and patterns of injuries sustained while on duty. Further research is needed to more adequately profile the physical characteristics and rates and patterns of injuries in part-time tactical personnel.

Keywords: Reserves, Fitness, Military, Tactical

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Introduction

Tactical personnel such as those from military, law enforcement and fire and rescue services, whether employed on a part-time or full-time basis, are routinely required to perform physically strenuous occupational tasks which require a high level of fitness[1-3]. Physical performance measures have therefore been used to inform the selection of applicants for these tactical organisations, ensuring recruits can successfully perform the required arduous occupational tasks[4]. To this end, minimum entry standards have been set by some tactical organisations to ensure new recruits are capable of meeting the physical demands of the job[5].

Moving beyond applicants and new recruits in the tactical services, it is important to recognise that fully qualified tactical personnel must also maintain adequate muscular strength, endurance and cardiovascular fitness to enable them to continue to effectively perform the required occupational tasks and meet mandatory fitness requirements[6]. Common physical measurements used to assess tactical personnel include anthropometric measures, measures of cardiovascular endurance, field tests and performance in simulated occupational tasks[7-12]. Research also suggests that physical fitness plays a significant role in determining injury risks. Some examples of this are as follows: (a) a decreased level of fitness increases injury risk during load carriage tasks[13]; (b) Australian Army recruits who have low aerobic fitness are at a 25% increased risk of not completing training due to injury[14]; and (c) low aerobic and muscular endurance have consistently been associated with increased injury risk[15].

To date, research comparing fitness and anthropometric differences in tactical personnel has typically focussed on: a) male to female differences and the impacts of gender on meeting physical performance standards[5]; b) occupational task requirements across different occupations, e.g. law enforcement and fire and rescue[6], and c) risks of injury, illness, training failure and attrition in tactical personnel with differing physical characteristics and physical capacities[14,16-18] . However, one area that is starting to gain interest in research and strategic planning is the comparison of part-time and full-time personnel in tactical populations.

Many tactical populations are comprised of both relevantly qualified part-time and full-time personnel, with both well represented in military, law enforcement, and fire and rescue services across the world. Occupational expectations are similar in both part-time and full-time personnel, with both groups typically having to pass the same physical capacity tests (e.g. Basic Fitness Assessment or Physical Employment Standards) and being expected to perform tasks at an equivalent level[9,10]. Despite the fact that part-time tactical personnel are tending to be utilised at a higher rate than previously has been the case, and despite part-time personnel being deployed on the same combat operations and in the same roles as full-time personnel[19], their on-the job physical training typically continues to be at a lower frequency than that of full-time personnel[10,11,20]. Part-time personnel often have to balance other occupations and work demands with their tactical role, and so frequently have to be responsible for their own individual, self-directed physical training sessions[10,11]. These factors have the potential to contribute to differences in fitness levels between part-time and full-time tactical personnel.

With previous research showing a strong link between the level of physical conditioning and injury risk[14,17,18,] any differences between part-time and full-time tactical personnel in levels of specific conditioning, when considered against the requirement for part-time personnel to perform tasks at a similar level to that required of full-time personnel, are likely to increase risks and rates of injury among part-time personnel when they undertake tactical duties. This likelihood is supported by findings of the Australian Defence Health Status Report of 2000 that rates of reported injuries in part-time Australian Defence Force personnel during physical training and military training, when adjusted for days of service, appeared to be three times higher than those of their full-time counterparts[21].

The aim of this review is to critically appraise and discuss the findings of existing research that has compared the physical characteristics and physical performance capacities and associated physical training or physiological work demands of part-time and full-time tactical personnel.

Methods

Literature search, screening and selection

To identify all relevant literature for this review, several search strategies were employed. Initially, key search terms were entered into five literature databases, with the exact terms and use of Boolean operators modified to suit each individual database's search capabilities. The databases searched and search terms used are detailed in Table 1.

Table 1: Details of literature search: databases used, search terms and inclusion filters

Database	Filters applied	Number after inclusion criteria applied	Number after exclusion criterion applied	Duplicates	New articles
PubMed	1994-2014	994	10	0	10
CINAHL	1994-2014	314	5	5	0
EBSCO- Academic search complete	1994-2014, Scholarly peer reviewed journals, academic journals	1411	6	6	0
EBSCO-SPORTDiscus	1994-2014	169	3	1	2
Web of Science	1994-2014, English, article	1030	9	9	0

Search terms: ("full-time" OR "part-time" OR "reserve") AND ("home guard" OR "army" OR "defence" OR "defense" OR "police" OR "military" OR "soldiers" OR "firefighters" OR "first responder").

To the extent possible in each database, the inclusion and exclusion criteria for the review were applied as filters during the search of the databases. The inclusion criteria were: (a) the study was published in the English language; (b) the study involved human participants; c) the study was published in 1994 or later; (d) the study involved participants from one of three tactical populations (military, law enforcement or firefighters/first responders); and (e) the study included both part-time and full-time participants, to allow for direct comparison. The exclusion criterion was any study that did not examine anthropometric or physical performance measure(s).

Following the initial search, the inclusion and exclusion criteria were manually applied during initial screening of all article titles and abstracts. Once potential articles were selected by this screening process, duplicates were removed and copies of the remaining articles were obtained in full text. Six colleagues with experience in this field as researchers and service providers were asked to identify any additional articles for review, and these were similarly obtained in full text. All full text articles were once again subjected to the inclusion and exclusion criteria to arrive at the final included set of articles. The reference lists of these final included articles were searched by hand to identify any additional, pertinent references, but yielded none.

Critical appraisal

Included articles were each critically appraised using the Downs and Black protocol[22] to determine their methodological quality. The Downs and Black protocol is comprised of a 27-item checklist that can be used to appraise both randomised controlled trials and other quantitative observational studies. The checklist contains five subcategories, including *reporting quality*, *external validity*, *internal validity - bias, internal validity - confounding*, and *statistical power*. Most checklist items are scored dichotomously, such that 'yes' equals one point and 'no' or 'unable to determine' equals zero points. Two questions are scored on a larger scale. Item five, in the *reporting quality* subcategory, can be scored from zero to two points, with one point given for 'partially describing confounders' and two points for 'clearly describing confounders'. Item 27, within the *statistical power* subcategory, is normally scored from zero to five points based on the adequacy of *a priori* estimated *statistical power* yielded by the sample size. For the purposes of our study, however, a modified Downs and Black approach was employed, as previously described[23], where item 27 was scored dichotomously, with one point awarded where the results of a *statistical power* or sample size calculation were reported and zero points awarded where such was not reported.

Data extraction and analysis

All of the included studies were independently rated by two authors (DM, RO), with the level of initial agreement determined by a Cohen's Kappa Analysis of all raw scores (28 item scores per paper). Any disagreements in points awarded for individual items were settled by discussion of reasons for points awarded and subsequent consensus. The third author (RP) was available if needed to mediate final scores assigned for any items, but mediation was not required. The final total score from the Downs and Black checklist for each article was converted to a percentage by dividing the sum of each total score by 28 (total possible points) and then multiplying this figure by 100. To provide a further indication of the quality of the included articles, the total raw scores for all articles were graded using the grading system proposed by Kennelly[24]. Kennelly proposed that a total Downs and Black score greater than or equal to 20 should be considered a *good quality* study, scores between 15 and 19 reflect a *fair quality* study, and scores of 14 and below indicate a *poor quality* study[24]. Given the modification of the checklist to a score out of 28, the grading scales suggested by Kennelly were adapted to a percentage score, allowing comparison to the percentage scores employed in this review. As such, a score greater than or equal to 62.5% should be considered a *good quality* study, scores between 47% and 62.5% reflect a *fair quality* study, and scores of below 47% indicate a *poor quality* study.

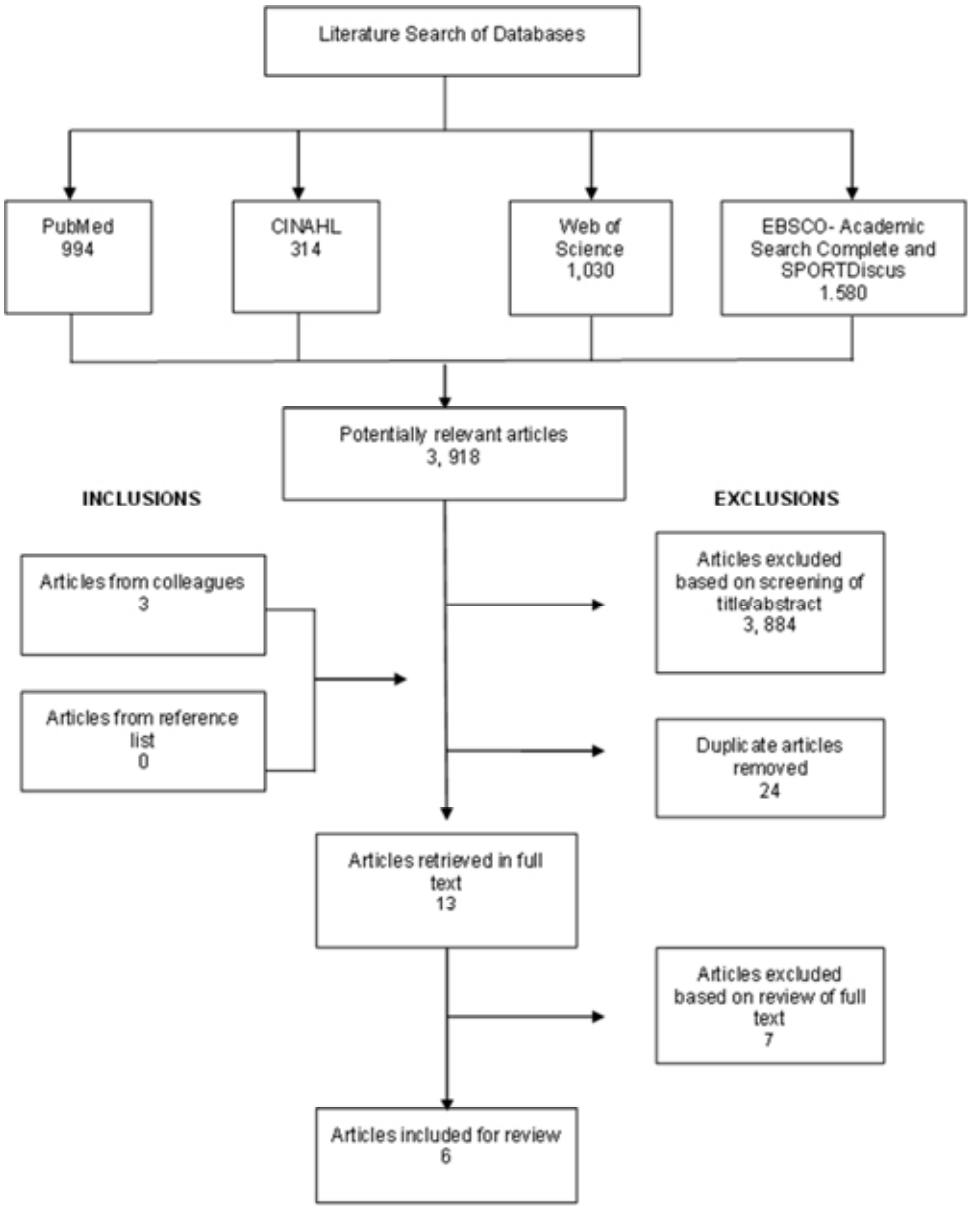
Data were systematically extracted from each article to populate a summary data table. Data analysis involved critical narrative synthesis of the key findings of individual articles, in which the methodological quality of each study was considered.

Results

Search and selection results

The results of the literature search and selection processes are depicted in the PRISMA flowchart at Figure 1. In total, six articles investigating physical characteristics and physical performance measures in part-time and full-time tactical personnel[7-12] were identified, selected and retained for evaluation.

Figure 1. PRISMA flowchart depicting the literature search and selection process



Key data and methodological quality of included studies

Table 2 provides key data extracted from each included study, along with the methodological quality score yielded by the critical appraisal of each article. These methodological quality scores, based on the Downs and Black checklist[22] ranged from 57% to 61%, indicating that the available and included studies were all of only *fair quality*, according to the grading system proposed by Kennelly[24]. The kappa statistic for inter-tester agreement of the methodological quality of the studies indicated an 'almost perfect' agreement (k=0.923)[25].

The critical appraisal indicated that the most common limitations of the included studies were a lack of blinding of subjects or assessors and a lack of random allocation to observed groups. Only one of the studies was considered to be representative of the entire population[8] when assessed using the Downs and Black protocol[22]. Participants and respondents in all other studies were selected on the basis of convenience[7, 9-12] and in one study[12], included only new recruits from the tactical population.

The participant samples in the included studies (Table 2) were heterogeneous, including only male personnel in three studies[7,10,11], male and female personnel in two studies[8,12] and male tactical personnel and both male and female civilians in the remaining

TABLE 2. Summary and critical appraisal of included articles in this review.

Author Year Title	Participants	Physical Characteristic or Performance Measured	Outcome Measures	Results	Critical Appraisal Score
Dawes et al. 2013	Two groups of Special Weapons and Tactic Teams, all males: (retrospective data) 21- Part time 29- Full time	• Anthropometrics • Muscular endurance • Lower-body power • Anaerobic endurance	• Anthropometric Measurements (height and weight) • Three site skin fold (Body fat %) • BMI • Two-minute push-up to fatigue • Two-minute sit-up • Vertical jump height • 300 Metre run	Significant differences between part-time and full-time Special Weapons and Tactics (SWAT) in bodyweight, percent body fat, fat mass and Body Mass Index (BMI). Part-time SWAT officers mean percent body fat was 19.5% compared to full-time at 10.71%. Part-time SWAT officers mean ± SD fat mass 18.28 ± 5.2 kg compared to full-time at 9.1 ± 2.7 kg. Mean ± SD BMI of part-time SWAT was 30.1 ± 3.2 (kg/m^2) and for full-time SWAT was 26.3 ± 2.3 kg/ m^2. Full-time SWAT performed better on muscular endurance, lower body power and anaerobic endurance tests than part-time SWAT officers. Part-time SWAT: mean±SD vertical jump height 55.40 ± 6.65 cm, 56.52 ± 12.89 repetitions in 2-minute maximal sit up test, 64.52 ± 14.05 repetitions in 2-minute maximal push up test. Full-time SWAT: mean±SD vertical jump height 68.94 ± 9.55 cm, 82.7 ± 8.52 repetitions in 2-minute maximal sit up test, 89.46 ± 12.95 repetitions in 2-minute maximal push up test. Part-time officers' mean ± SD age was 36.05 ± 4.06 years and for full-time officers was 40.1 ± 6.4 years.	57%
Williams 2005	Two groups of military recruits and one control group, all males: 14- Territorial Army (Reserve group) 11- British Army (Regular group) 20- Controls	• Aerobic fitness • Body composition	• Body Mass, Stature • % Body Fat • Shuttle run (VO2 max) • Training Log	Both the Reserve and Regular recruit training programs resulted in improvements in body composition and aerobic fitness. Reserve and Regular training significantly increased fat free mass and Maximal Volume of Oxygen (VO2max) and decreased percentage body fat. Reserve training effected greater reductions in body mass and greater increases in fat free mass. The training given to Regular soldiers effected greater improvements in VO2max than Reserve training. Reserve soldier organised training volume was 10 x 45 minutes over 11 weeks, concentrated in five training weekends. Regular soldier organised training volume was 90 x 40 minute periods over 11 weeks. Reserve soldier mean ± SD BMI, body fat (%), estimated VO2max, and age were 23.5 ± 4.4 kg/ m^2, 14.0 ± 4.4 %, 40.9 ± 6.1 mL/ kg/ min and 23 ± 5 years, respectively. Regular soldier mean ± SD BMI , body fat (%), estimated VO2max , and age were 22.0 ± 2.1 kg/ m^2, 11.8 ± 3.7 %, 44.8 ± 4.9 mL/kg/min, and 18 ± 1 years, respectively. Concluded it is likely that training adaptations would be enhanced in Reserves with increased training volume.	61%

Williams & Evans 2007	Two groups of British Army male soldiers from the Royal Corps of Signals: 23- Reserve 15- Regular	• Body composition • Cardiovascular fitness • Physical activity levels • Strength	• % Body Fat • Fat-free Mass • Baecke physical activity questionnaire • Shuttle run (VO2 max) • Repetitive lift and carry • Single lift maximum	No statistically significant differences between Reserve and Regular soldiers for any variables assessed. Reserve soldiers' mean ± SD body fat (%), fat free mass, estimated VO2max , and age were 20.4 ± 3.5 %, 63.8 ± 6.2 kg, 47.2 ± 3.4 mL/kg/min, and 29 ± 6 years, respectively. Regular soldiers' mean ±SD body fat (%), fat free mass, estimated VO2max and age were 18.9 ± 4.0 %, 63.1 ± 5.4 kg, 49.5 ± 4.8 mL/kg/min, and 25 ± 6 years, respectively. Reserve soldier military physical training was 1 x 45 min per month. Regular soldier military physical training was 10 x 45 min per month ± 1 or 2 sessions. Reserve soldiers predominantly trained outside of duties while Regular soldiers' training took place both within and outside of duties. Concluded that it appears that both Reserve and Regular soldiers have sufficient training volume and intensity to maintain similar performance levels between the two groups.	61%
Lindberg & Malm 2014	Questionnaire sent out to Fire and Rescue services in 2000 and 2010. Total questionnaires sent out in 2000 were 160. Total respondents in 2000 numbered 125, with: 94% males and 6% females; and 46% part-time and 54% full-time. Total questionnaires sent out in 2010 were 84. Total respondents in 2010 numbered 68, with: 91% males and 9% females; and 47% part-time and 53% full-time.	Self-rated physical demands of work tasks, including: • Aerobic demands • Muscle strength requirements • Ranked worked posture requirement • Ranked body control requirement	Questionnaire examined self-ratings of: • Aerobic demands of work tasks • Requirements of hand muscle strength • Requirements of arm muscle strength • Requirements of leg muscle strength • Requirements of trunk muscle strength • Posture requirements	Significant differences observed between part-time and full-time firefighters. More part time firefighters rated questions regarding aerobic demands as 'I don't know' where full time firefighters rated them as 'somewhat hard, hard, or very hard.' More part time firefighters rated questions regarding muscle strength demands as 'I don't know' where full time firefighters rated them as 'high or very high'. The most physically strenuous work tasks, considering aerobic fitness, muscle strength, work posture and body control in both full-time and part-time personnel were: • Smoke diving upstairs • Victim rescue • Carrying a stretcher over terrain • Pulling a hose Concluded that work related exercise is important to address the variation in on-the-job tasks performed by full time and part time firefighters.	57%
Wynn & Hawdon 2011	Two groups of Fire and Rescue Service recruits involving males and females: Group 1: Minimum recruit cardiorespiratory fitness standard of 42 mLO2/kg/min: 48 Part-time 308 Full-time Group 2: No direct cardiorespiratory fitness standard: 206 Part-time 198 Full-time	Cardiorespiratory fitness exhibited in two conditions: (1) application and (2) non-application of a cardiorespiratory fitness standard of 42 mL O2/kg/min.	• Cardiorespiratory fitness in mL O2/kg/min if available. • Chester step test- submaximal estimate of VO2max.	Part-time recruits with higher VO2max had lower incidence of injuries. Full-time recruits with no cardiorespiratory standard were more likely to get injured. Part-time recruits' mean ± SD estimated VO2max and age were 47.69 ± 7.64 mL/kg/min and 28.91 ± 7.86 years, respectively. Full-time recruits' mean ± SD estimated VO2max and age were 50.10 ± 7.05 mL/kg/min and 27.8 ± 5.58 years, respectively. Concluded that adverse health and employment outcomes are associated with the removal of a cardiorespiratory fitness standard. However, there was no evidence of adverse outcomes with a reduction in cardiorespiratory standard from 45 to 42 mL O2/kg/min.	57%

Lindberg, Oksa & Malm 2014	Firefighters from Fire and Rescue services and male and female civilians in Northern Sweden. The study included 38 participants: 10- Male Part time firefighters 8- Male Full time firefighters 8- Male civilians 12- Female civilians	• Physical capacity • Physically demanding work tasks • Laboratory tests • Field tests	Eight Laboratory tests: • Isokinetic maximal and endurance muscle power and dynamic balance Ten Field tests: • Maximal and endurance muscle performance • Seven simulated firefighting work tasks	No overall statistically significant differences observed between part-time and full-time firefighters. There were significant correlations between laboratory and field tests indicating that field tests may be used instead of costly and time-consuming laboratory tests. Recommended tests to measure firefighter work capacity are maximal handgrip strength, bench press, chin-ups, dips, upright barbell row, standing broad jump, and barbell shoulder press. Part-time firefighter mean ± SD BMI and age were 25 ± 4.0 kg/m^2 and 28 ± 4.7 years, respectively. Full-time firefighter mean ± SD BMI and age were 25 ± 1.3 kg/m^2 and 39 ± 9.1 years, respectively.	57%
SWAT= Special Weapons and Tactics police. VO2max = Maximal volume of Oxygen. BMI = Body Mass Index					

included study[9]. The tactical personnel investigated in the studies variably included military[10,11], law enforcement (SWAT)[7], and firefighter[8,9,12] personnel.

When comparing the physical characteristics and physical performance capacities of part-time and full-time tactical personnel (Table 2), a range of relevant measures were reported. Physical characteristics were measured using: (a) anthropometry[7] and (b) other measures of body composition[10]. Physical performance capacity was measured in terms of: (a) muscular endurance[7,9], (b) lower-body power[7,11], (c) anaerobic endurance[7], (d) aerobic fitness[10-12], (e) physical activity levels[11], and (f) physical work capacity or work levels[8,9].

Synthesis and Discussion

The aim of this review was to critically appraise and discuss the findings of existing research that has compared the physical characteristics and physical performance capacities and associated physical training or physiological work demands of part-time and full-time tactical personnel. Prior to synthesis and discussion of the results, it is important to note that the methodological quality of all six of the identified research reports of relevance to this aim was found to be of a *fair quality*. On this basis, caution should be applied to the interpretation of the results and their application in practice. Further research is needed to further elucidate this topic area and strengthen the associated evidence base. Considering this, it should be noted that the ability to conduct studies (notably laboratory studies) within these populations is constrained by the challenges of access to, and time availability of, tactical personnel.

The magnitude of differences in physical characteristics and physical performance capacities between part-time and full-time populations varied across the included studies (Table 2). For example, Dawes et al.[7] reported significantly higher body weight, percentage body fat, fat mass and Body Mass Index (BMI) in part-time compared to full-time SWAT officers. Conversely, two of the research articles identified no significant differences between part-time and full-time personnel[9,11]. Williams et al.[11] found no differences between regular army and reserve army personnel when examining body composition, estimated VO2max, muscular strength and self-reported physical activity levels. Likewise, Lindberg, Oksa and Malm[9] identified no significant differences in the work capacities of part and full-time firefighters (refer to Table 2 for full results). Overall, the evidence provided by these articles indicates that part-time personnel are typically less fit than their full-time counterparts, though this finding was not consistent across all studies. The part-time participants scored lower than full-time participants in estimated VO2max[10-12], and in two minute maximal sit up and push up repetitions[7]. In addition, part-time participants typically exhibited higher BMI (kg/m^2) and body fat (%) levels than full-time participants [7,10,11].

Reported physical training regimes for part-time personnel also varied across the papers (Table 2), but part-time personnel were consistently observed to have lower 'on-duty' training times and more intermittent periods of training while on active duty than their full-time counterparts. For example, the volume of training in 'on-duty' physical training regimes was found to be significantly less for the part-time army personnel in two studies[10,11]. Both studies led by Williams[10,11] found differences in on-duty training received. In these two studies, Reserve personnel received organised training involving 10 sessions of 45 minutes over 11 weeks, concentrated in five training weekends, or 1 session of 45 minutes per month, respectively[10, 11]. In contrast, regular recruits received 90 40 minute sessions over 11 weeks, or

10 45 minute sessions per month, respectively[10, 11] – nearly a tenfold greater on-duty training volume than that provided to Reserve personnel. The results of these studies indicate that the training provided to regular recruits yielded greater improvements in estimated VO2max than that provided to Reserve recruits, while reservist training achieved greater improvements in fat-free mass[10]. A final example of physical training differences between full-time and part-time personnel that is noteworthy is the finding of Dawes et al.[7] that part-time SWAT officers were largely responsible for developing and maintaining their own training program while their full-time counterparts were given 3-4 hours per week with a strength and conditioning specialist.

Anthropometrics and body composition

It has been theorised by Boyce et al.[6] that police officers who have increased body mass and are obese may not be able to perform their job as effectively as their counterparts with greater fat-free mass. This statement is supported by the research of Dawes et al.[7], reported in the current review, who found that part-time SWAT personnel exhibited a higher level of fat mass (mean±SD 18.28 ± 5.2 kg) when compared to full-time personnel (mean±SD 9.1 ± 2.7 kg) and scored lower on tests related to muscular strength and endurance[7,26,27]. This is noteworthy for tactical populations generally, as many tactical tasks require significant amounts of muscle strength and endurance[11,27].

In the current review, the studies that reviewed body composition[7,9-11], found that the mean BMI of part-time tactical populations ranged from 23.5 ± 4.4 kg/m^2[10] to 30.1 ± 3.2 kg/m^2[7], and that their body fat percentages ranged from 14.0 ± 4.4 %[10] to 20.4 ± 3.5 %[11]. Full-time populations exhibited mean BMI ranging from 22.0 ± 2.1 kg/m^2[10] to 26.3 ± 2.3 kg/m^2[7], and body fat percentages ranged from 10.7 ± 2.6 (%)[7] to 18.9 ± 4.0 (%)[11]. These results support the finding noted above that part-time tactical personnel typically have higher BMI and body fat levels when compared to their full-time counterparts. These increased BMI and body fat loads in part-time personnel mean that these personnel may find physical tasks more difficult to complete and be more susceptible to injuries[6,7,26,27].

Physical performance capacities

Cardiovascular fitness

Cardiovascular fitness is an important attribute that enables tactical personnel to undertake their job duties[10-12]. When comparing cardiovascular fitness between part-time and full-time tactical personnel in the current review[10-12], it was found that the estimated mean VO2max for part-time tactical personnel ranged from 40.9 ± 6.1 mL/kg/min[10] to 47.69 ± 7.64 mL/kg/min[12] and for full-time tactical personnel ranged from 44.8 ± 4.9 mL/kg/min[10] to 50.10 ± 7.05 mL/kg/min[12]. Based on these results, it appears that although part-time and full-time personnel have somewhat similar cardiovascular capacities, capacities of part-time personnel are typically lower. However, in contrast to this finding, two other studies looking exclusively at part-time firefighters and home guard personnel found these part-time tactical personnel to have an estimated VO2max of 53 ± 5 mL/kg/min[28] and 50.1 mL/kg/min[29] - mean values that are higher than those in the studies reported in this review for part-time, and even for full-time, personnel. Further research is therefore needed to more fully investigate differences in aerobic fitness levels between full-time and part-time tactical personnel in varying roles and contexts.

Of note, increasing age corresponds with a decrease in aerobic fitness (VO2max). This correlation has been identified as potentially contributing to the decrease in physical fitness exhibited by part-time personnel[30]. However, the part-time and full-time participants in the studies included in this review were of similar ages. Part-time participants ranged from a mean of 23 ± 5 years[10] to a mean of 36.05 ± 4.06 years[7] and full-time participants from 18 ± 1 years[10] to 40.1 ± 6.4 years[7]. These similar age ranges among part-time and full-time personnel in the current review may explain some of the similarities observed between the part-time and full-time tactical populations in aerobic fitness levels.

Musculoskeletal fitness

Strength and endurance are important in the selection of tactical personnel[7,10,11]. These physical characteristics also influence the performance of job tasks and may play a role in injury prevention in these populations[7,26]. In the current review, Dawes et al.[7] found that, as a group, part-time tactical personnel exhibited lower strength and muscular endurance when compared to their full-time counterparts (Table 2). The associated scores for each test (Table 2) indicate substantial differences in muscular endurance and strength, which may lead to part-time tactical personnel being at a disadvantage and being more susceptible to injury when completing similar job tasks as full-time personnel[6,7,26,27].

Task Differences

Molloy[15] suggests that there are several risk factors that increase training related injuries, and overall fitness levels play a significant part in influencing

these injury risks[15]. The limited research available regarding part-time tactical personnel has indicated they typically exhibit lower levels of fitness when compared to their full-time counterparts, though this is variable[7,9-11]. The observed typically higher BMI and body fat levels combined with lower muscular strength and endurance in part-time tactical personnel reported in this review are likely to place part-time tactical personnel at an increased risk of injury[7,10,11]. This hypothesis is supported by the Australian Defence Health Status report of 2000, showing overall injury rates for part-time and full-time personnel of 28.5% and 9.1% of full-time equivalent personnel per annum, respectively[21]. Considering that part-time personnel are being employed in full-time duties at a higher rate than previously, these heightened risks for part-time tactical personnel have serious implications for the readiness of part-time personnel to complete similar tasks at equivalent levels of intensity to those undertaken by full-time personnel[19,20]. Given these findings and the moderate methodological quality of the studies included in the current review, high quality research investigating fitness differences between part-time and full-time tactical populations and profiling the physical characteristics, risks and rates of injuries, is needed.

Implications

With occupational duties similar between part-time and full-time personnel, the reported typical differences in physical characteristics and physical performance capacities between part-time and full-time tactical personnel are likely to place part-time personnel at higher risk of injury and reduce their operational effectiveness when compared to their full-time counterparts[7,9-11]. The observed differences in access to organised, 'on-duty' physical training or a viable alternative may compound these issues and warrant additional consideration and remedial action.

Limitations

The purpose of this review was to critically evaluate and synthesise findings from the existing research literature comparing physical characteristics and physical performance capacities of part-time and full-time tactical personnel. While the literature search was exhaustive, the identified studies were only of moderate quality and very limited in number, with only six articles identified for inclusion[7-12]. In addition, only articles that were available in English were included and this may have introduced a language bias. Caution should therefore be exercised in interpretation of the findings of the review and in the application of these findings in practice. Further high quality research on these issues is needed.

Conclusion

Acknowledging that there was limited research of moderate quality, the available evidence indicates that typically part-time personnel exhibit higher BMI and body-fat levels and lower levels of aerobic capacity and strength than full-time personnel. However, findings regarding aerobic capacity and strength are variable and may reflect variation across populations in differences between part-time and full-time personnel in regular work frequencies and intensities, and individually and institutionally-arranged physical training regimes. In addition, the review has revealed that access to 'on-duty' physical training sessions is much more limited for part-time personnel than for full-time personnel, and this may account for some of the observed differences in physical characteristics and physical performance capacities. These physical differences, in turn, are likely to place part-time tactical personnel at greater risk of injury and reduce their effectiveness in their job roles, when compared to their full-time counterparts. Given the moderate methodological quality and low quantity of available research in this area, caution should be applied in the interpretation and application of these findings to practice. Further high quality research is needed.

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