

**The Impact of Shift Length in Policing on Performance, Health, Quality of Life, Sleep,
Fatigue, and Extra-Duty Employment**

EXECUTIVE SUMMARY

By:

Karen L. Amendola, PhD
David Weisburd, PhD
Edwin E. Hamilton, MA
Greg Jones, MA
Meghan Slipka, MA

March 31, 2011



This project was supported by award number 2005-FS-BX-0057 awarded by the National Institute of Justice, Office of Justice Programs, US Department of Justice. The opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the Department of Justice.

© 2011 Police Foundation. All rights reserved.

Background and Problem Statement

Most law enforcement agencies have traditionally deployed their patrol officers based on a 40-hour workweek in which personnel work five consecutive, 8-hour shifts, followed by two days off. In recent years, however, an increasing number of agencies have moved to some variant of a compressed workweek (CWW) schedule in which officers work four 10-hour shifts per week or three 12-hour shifts (plus a time adjustment to make up the remaining four hours of the standard 40-hour workweek). While this trend towards CWWs has been moving apace, there have been few, if any, rigorous scientific studies examining the advantages and disadvantages associated with these work schedules for officers and their agencies.

Over 25 years ago, in a National Institute of Justice (NIJ)-funded study of work scheduling, researchers surveyed 160 agencies regarding their practices and reported that almost 25% of departments had implemented 9-, 10-, 11- and even 12-hour schedules for one or more shifts (Stenzel & Buren, 1983). Because no national data have been reported since that time, we conducted surveys with a random sample of law enforcement agencies in 2005 and 2009. The results of our national surveys seem to suggest that there is a great variation in shift schedules employed in U.S. law enforcement, but there has been little available data on the advantages and disadvantages associated with these shifts. Nevertheless, there has been considerable conjecture about the benefits of compressed work schedules in law enforcement, e.g., it will increase employee morale, result in lower costs, and reduce overtime and absenteeism. There are, however, limited data to support these claims in law enforcement.

There has been extensive research on CWWs across a variety of industries dating back to around the early 1970s, although much of it falls short due to less than rigorous scientific

designs, methodological issues, and measurement problems. Nevertheless, much of that work has been summarized in various reviews and meta-analyses in order to assess the overall impacts of these schedules on a variety of criteria, such as performance and productivity, safety, job satisfaction, fatigue, sleep, and health, but much of that has been inconclusive. Many have emphasized the need for more research in the area of CWWs, including experimental research (Glueck, 1979) inclusive of more scientifically rigorous, well-designed studies (e.g., Harrington, 1994), as well as research to better address the impact of shift length, overtime, and other related issues (Caruso, Hitchcock, Dick, Russo, & Schmit, 2004).

Because there are significant policy implications associated with compressed workweeks in law enforcement, there is a great need for an examination of both current national practices with regard to CWWs in law enforcement, as well as the impact of such schedules on performance and safety, health, quality of life, sleep, fatigue, and extra-duty employment (i.e., overtime and off-duty work). In this report, we aim to address this gap by providing both the results of the first comprehensive, randomized experiment of the effects of shift length in policing, as well as descriptive data on current shift practices and trends.

National Survey

At the outset of our research in 2005, we conducted a randomly selected survey of 300 local police departments drawn from the local police portion of the *2000 Census of State and Local Law Enforcement Agencies*¹ (Reaves, 2002) conducted by the U.S. Department of Justice, Bureau of Justice Statistics. The sample consisted of agencies with 50 or more sworn officers, including large agencies (more than 201 officers), midsize agencies (101-200 officers), and

¹ The 2000 census was the most recent database we could access.

smaller agencies (50-100 officers). The smallest agencies (< 50 officers) were not sampled because well over 70% of all local law enforcement officers in the United States work in agencies with 50 or more sworn officers (see Reaves, 2007). We then surveyed the same agencies in 2009. Our response rates were 96% in Time 1 and 100% in Time 2.

In these surveys, we found a trend away from 8-hour shifts (from 40% in 2005, to 29% in 2009). In addition, there was an increase in the number of agencies employing more than one shift length, from 6% to 11%. Furthermore, 9- and 11-hour workdays, while very uncommon in 2005 (2.7%), became more common by 2009, with 11.3% of agencies employing 9-, 11-, and even 13-hour schedules. The results of this initial descriptive study suggest that regardless of a lack of scientific information upon which to base such decisions, agencies have been moving apace in their adoption of alternative and compressed work schedules.

Experimental Study

Method.

Multicenter Trial. While we had two sites for our research (Detroit, Michigan, and Arlington, Texas), we implemented one tightly controlled experiment in order to pool data across sites. This type of approach is a special type of replication study in which the sites are not replications per se but rather part of the overall design (e.g., Fleiss, 1982; Weisburd & Taxman, 2000). In order for multicenter trials to be valid, researchers must maintain consistency in research protocols, something we were able to control by using the same researchers across sites and employing standardized protocols for treatment and measurement. The selected agencies were identified because their officers worked the standard five, 8-hour duty tours, the agencies' leaders were interested in examining the pros/cons of various schedules, and the respective

union/association had expressed an interest in switching to a compressed workweek schedule. We also selected these sites because they were sufficiently large enough to ensure minimal impact on regular police operations and to provide a sufficient number of cases for our study. This study was conducted during the period of January 2007 through June 2009.

Sampling procedures. Officers were recruited for the study on a voluntary basis. After obtaining volunteers, we randomly assigned officers to one of three conditions: (a) five consecutive 8-hour days, (b) four consecutive 10-hour days, and (c) three consecutive 12-hour days.² The agencies agreed to maintain the conditions (shift length, time of day, and district) throughout the course of the six-month period of the study.

Sample size and power. A total of 326 officers across both sites volunteered to participate in the study. These volunteers were randomly assigned to one of three conditions: the 8-hour shift ($n = 109$), 10-hour shift ($n = 109$), or 12-hour shift ($n = 108$). Our power analysis suggested that a sample of 300 officers would be more than sufficient to ensure a high level of statistical power for detecting small to medium effects (Cohen, 1988, p. 284).

In Time 1, we had a 15.6% attrition rate (voluntary and involuntary), leaving 275 participants (128 in Detroit and 147 in Arlington). In Time 2, our overall attrition rate was 18.1%, leaving 88 participants from Detroit and 138 from Arlington, or a total sample of 226. This allowed us sufficient power to detect medium effect sizes but insufficient power to detect smaller effects.

Measures and constructs. The selection of measures to employ in our study was based on a number of factors including past reliability and/or validity, fidelity, ease of administration,

² In order to ensure all officers worked 80 hours in each two-week period, officers assigned to 12-hour shifts worked three consecutive 12-hour shifts in week one, and three consecutive 12-hour shifts followed by a single 8-hour shift in week two, a configuration that is common among agencies operating on 12-hour shifts.

and, to a lesser extent, cost. Additionally, because the National Institute of Justice was interested in a variety of outcomes, we used a systematic process of identifying specific general constructs to gain a broad-brush understanding of the impacts of CWWs in law enforcement. These constructs included: (a) work performance and safety; (b) health and stress; (c) quality of life; (d) sleep, fatigue, sleep disorders, and alertness; and (e) extra-duty employment (overtime and off-duty work). We identified a number of objective and self-report measures to assess these constructs and, to increase power, sometimes created composite measures in order to reduce the number of individual analyses. Our data sources included: (a) performance, fatigue, and safety simulations we conducted in a laboratory setting in the police agencies; (b) daily statistics obtained from both departments; and (c) surveys and other self-report instruments. We collected data at two points in time—before treatment implementation (the pretest) and at the end of the 6-month³ study period (the posttest).

Laboratory-based simulations were conducted in fixed locations in both agencies. During these sessions, most officers also turned in their self-report data and completed a simulation day survey, which included questions related to the previous 24-hour period. Participants were required to complete five simulations during the last 2.5 to 3 hours of their work shifts.

Work performance and safety. The first performance measure in this category was departmental data (self-initiated activities that included arrests, citations and/or summonses, reports, and self-initiated stops). We also assessed interpersonal performance using the *Behavioral Personnel Assessment Device (B-PAD[®])*, which captures interpersonal skills and judgment using a set of video-based vignettes to which officers respond. Our measure of safety

³ Because it took approximately two weeks to administer the performance simulations in each agency (we were able to run 10-12 officers through the exercises per day), the post measure was done as early as 5.5 months after the treatment but no longer than six months after.

was based on driving using the STISIM[®] driving simulator (System Technology, Inc.). We created a composite index of driving performance using a number of driving behaviors captured by this simulator: (a) off-road accidents, (b) collisions, (c) pedestrians hit, (d) speed exceedances, (e) traffic light tickets, and (f) illegal turns. Finally, we assessed shooting performance using the MILO[®]/RANGE 3000[®] simulator (IES Interactive Training). The system uses video and interactive technology to simulate a variety of environments and situations, and records data from active shooting scenarios and fixed target shooting.

Health and stress. We examined health inclusive of gastrointestinal problems and cardiovascular health (Barton et al., 1995), as well as a composite measure of stress made up of the Police Stress Questionnaire (McCreary & Thompson, 2004), the Police Daily Hassles Scale (Hart, Wearing & Headey, 1994), and the Work Environment Inventory (Lieberman et al., 2002).

Quality of life. This construct consisted of two measures: quality of personal life and quality of work life. Quality of personal life consisted of a composite of two measures of work-family conflict (Carlson, Kacmar, & Williams, 2000; Netemeyer, Boles, & McMurrian, 1996). Quality of work life was a composite measure of: (a) job satisfaction (Weiss, Dawis, England, & Lofquist, 1967), (b) schedule satisfaction (adapted from Barton et al., 1995), (c) organizational commitment (Allen & Meyer, 1990), and (d) job involvement (Kanungo, 1982). Each scale score was transformed to a z-score in order to combine measures into a single composite score of quality of work life.

Sleep, fatigue, sleep disorders, and alertness. In order to assess sleep, officers completed a sleep diary in which they indicated the amount of hours in a 24-hour period in which they slept (including naps), worked (primary and secondary job), commuted, and engaged in other

activities, as well as the quality of their sleep. Fatigue was assessed using two independent, objective measures. The first was the *Fitness Impairment Tester (FIT[®])*, a short, noninvasive pupil-response test developed by PMI to measure involuntary eye movements in order to detect human impairment related to fatigue. The other was the *Psychomotor Vigilance Test (PVT)*, used to assess reaction time (Dinges & Powell, 1985). We assessed sleepiness using a composite measure of the Epworth Sleepiness Scale (Johns, 1991), along with some other questions developed by Czeisler et al. (2005) for the Harvard Work Hours, Health, and Safety Study, and Dr. Anneke Heitmann, our sleep expert. Alertness was assessed via an alertness log in which officers indicated their alertness level during each hour of their shifts, using the Karolinska Sleepiness Scale (Åkerstedt & Gillberg, 1990). Finally, we assessed sleep disorders such as insomnia using subscales from the Harvard Work Hours, Health, and Safety Study (Czeisler et al., 2005), along with questions from the Berlin Questionnaire (Netzer, Stoohs, Netzer, Clark, & Strohl, 1999) to assess sleep apnea.

Off-duty employment and departmental overtime. The final category consisted of reported hours of off-duty employment and departmental overtime worked.

Research design. We employed a randomized block experiment to assess the impact of shift length on a variety of measures of law enforcement officer health, safety, performance, sleep, fatigue, quality of life, and extra-duty employment (i.e., overtime and off-duty). Shift length served as the treatment and the blocks were site and time of shift (day, evening, midnight). This design allowed us to take into account variability of the blocking factors, as well as possible interactions between shift length and those factors (see Weisburd & Taxman, 2000).

Analysis plan. The results presented in this study are based primarily on comparisons of means for the three treatment conditions (8-, 10-, and 12-hour shift lengths) and statistical tests to indicate the probability of obtaining a difference between the three groups. General linear model (GLM) analyses were conducted because this method provides a more conservative analytical approach than ANOVA, as it does not rely on the assumption of equal cell sizes among all groups. Importantly, since we employed a pretest/posttest design, we followed the analytical approach suggested by Huck and McLean (1975) in which the baseline pretest measures were used as a covariate to control for initial group differences in conjunction with the posttest measures to examine treatment effects. Using an analysis of covariance “will result in a more sensitive test of possible differences among treatments” (Huck & McLean, 1975, p. 516). Throughout our discussion of the results of the present study, we present Cohen’s f (Cohen, 1988) effect size index to measure the influence of the intervention (i.e., length of shift) that is being investigated by taking the ratio of the magnitude of the differences between the means of the experimental groups divided by the pooled standard deviations of those groups (see Cohen, 1988).

Results

Work performance, safety, and health. Using GLM analysis, with Time 1 measures as a covariate, there were no significant differences between the shift length groups in terms of any of our measures of performance, safety, or health. While the effect size we obtained for our measure of interpersonal performance was small ($f = .12$), all of the others were very small and of little consequence. These included the following: driving ($f = .04$), shooting ($f = .08$), self-

initiated activity ($f = .07$), cardiovascular health ($f = .01$), gastrointestinal problems ($f = .08$), and work stress ($f = .03$).

Quality of Life. The analysis of our composite quality of personal life measure (work-family conflict) also resulted in no significant differences across shift lengths when considering Time 1 measures, with an effect size of $f = .04$. However, the results of our analysis for the composite measure of quality of work life (QWL) revealed a significant effect of shift length, $F(2,197) = 3.94, p = .021$, after controlling for the effect of the pretest measure, which translates to a small to medium effect ($f = .16$). A pairwise comparison of the adjusted group means revealed that the QWL for those on 10-hour shifts was significantly higher (mean = 0.93) than for those on 8-hour shifts (mean = -1.29), whereas the same was not true for those on 12-hour shifts (mean = 0.03).

For QWL, there was also a significant interaction between shift length and site, $F(2,197) = 4.76, p = .010$. In Detroit, those on the 8-hour shifts had the lowest mean level of QWL but the differences were not statistically significant. In Arlington, the main effect of shift length was $F(2,125) = 8.49, p = .000$, which translates to an effect size of $f = .31$ (medium). The 10-hour group had a significantly higher quality of work life (mean = 3.08) as compared to those in the 8- and 12-hour groups (mean = -0.63, $p = .001$, mean = -0.13, $p = .004$).

Sleep, fatigue, and alertness. The analysis of the average hours of sleep showed a significant effect among groups with respect to length of shift, $F(2,147) = 3.23, p = .043$, after controlling for the effect of the average number of hours sleep in the pretest. The strength of association of the effect on shift length using the Cohen's f effect size index indicated a small to medium effect ($f = .19$). A pairwise comparison test of the adjusted group means revealed that

the average hours of sleep for officers in the 10-hour shift were significantly greater (mean = 7.86) than the average hours of sleep among officers on the 8-hour shift (mean = 7.27, $p = .036$), but that was not the case for the 12-hour group (mean = 7.63, $p = ns$). While significant differences were found in the average amount of sleep across different shift lengths, the same effect was not present in our examination of the quality of sleep. No statistically significant differences were found among the groups with respect to shift length; all participants indicated their average quality of sleep as “good” with little variation, resulting in an effect size of $f = .09$.

There was a significant effect of shift length on the sleepiness composite, $F(2,222) = 5.75, p = .004$. Testing the magnitude of the sleepiness construct resulted in a small to medium effect ($f = .20$) for shift length. A pairwise comparison test of the adjusted group means revealed that the average level of sleepiness for officers on the 12-hour shift (0.77) was significantly higher than for those on the 8-hour shift (mean = -0.72, $p = .003$).

In assessing fatigue using scales from both the Fitness Impairment Test (FIT[®]) and the Psychomotor Vigilance Test (PVT), we did not find a significant impact of shift length on fatigue with effect sizes of $f = .02$ and $f = .11$, respectively. In addition, there were no significant differences among the shift length groups with respect to our composite sleep disorders measure ($f = .04$).

Using an average alertness level over a two-week period, there was a significant effect, $F(2,132) = 4.42, p = .014$, representing a small to medium effect size ($f = .21$). A pairwise comparison test of the adjusted group means revealed that the average level of alertness for officers on the 12-hour shift was significantly lower (mean = 6.11) than the average alertness

level among officers on the 8-hour (mean = 6.74, $p = .012$), but not the 10-hour (mean = 6.31, $p = ns$) shift.

There was also a very significant treatment by site interaction for level of alertness, $F(2,132) = 6.01, p = .003$.

In Detroit, there was a medium to large effect size ($f = .34$), but the comparison did not reach statistical significance. The limited sample size in Detroit makes this finding hard to interpret. However, it appears that those working 8-hour shifts in Detroit are most alert (mean = 6.89) than either those on 10s (mean = 5.85) or 12s (mean = 6.22), suggesting alertness decrements for either compressed schedule. On the other hand, in Arlington, the main effect of shift length was $F(2,91) = 8.47, p = .000$, with an effect size of $f = .29$ (medium). Those on 12-hour shifts were significantly less alert (mean = 6.10 hours) than those on the 10-hour (mean = 6.74, $p = .000$) and 8-hour shifts (mean = 6.53, $p = .037$), showing a clear disadvantage for those working 12-hour shifts but not for those on 10-hour shifts.

Off-duty employment and overtime. While the officers on 10-hour shifts worked the least amount of off-duty work, the differences across groups were not statistically significant with an effect size of $f = .05$. The following are the means for each group: 8-hour = 6.83, 10-hour = 5.32, and 12-hour = 7.53. On the other hand, when considering amount of departmental overtime, there was a statistically significant result: $F(2,145) = 15.42, p = .000$. The strength of the effect for length of shift using the Cohen's f effect size index indicated a large effect ($f = .42$). An examination of the group means adjusted for the effect of the pretest overtime hours revealed that the average amount of overtime among officers in the 8-hour shift (5.75 hours) was

significantly higher than the average hours for officers in the 10-hour (mean = 0.97 hours, $p = .000$) and 12-hour (mean = 1.89 hours, $p = .000$).

There was also a significant interaction effect for shift length by study site when considering amount of overtime, $F(2,145) = 5.86, p = .004$. The analysis revealed that while officers on 8-hour shifts in both sites worked the most amount of overtime, those in Detroit worked considerably more hours (mean = 8.76⁴) than those in Arlington (mean = 2.74). Indeed, in both sites, there was a significant difference across groups. In Detroit, the main effect of shift length was $F(2,44) = 7.39, p = .002$, which translates to an effect size of $f = .53$ (large). The 8-hour group had significantly more overtime hours (mean = 9.01) than both the 10-hour group (mean = 1.49, $p = .002$) and 12-hour group (mean = 3.02, $p = .013$), indicating that either type of compressed schedule in Detroit results in less overtime than for 8-hour shifts. In Arlington, the main effect of shift length was $F(2,104) = 3.03, p = .053$ ⁵, which translates to a medium effect size ($f = .25$). The 8-hour group had more overtime hours (mean = 2.54) than those on the 10-hour shift (mean = 0.75, $p = .064$)—a comparison that approached statistical significance—and the 12-hour shift (mean = 1.04), but the latter was not significant.

Discussion

Since at least as early as the 1970s, compressed workweeks have been implemented in a variety of employment settings and for a variety of reasons. To date there has been considerably less research in the area of public safety, partially because public safety is not regulated by the federal government, but rather is a state and local function. In our research, we found a recent trend away from 8-hour shifts and an increase in the number of agencies using nontraditional,

⁴Adjusted for pretest overtime hours.

⁵ Just reaching statistical significance.

compressed schedules. The main goal of our research was to comprehensively examine the impact of the two most typical compressed work schedules (4/10s and 3/12s) in law enforcement upon performance and safety, health, quality of life, sleep and fatigue, as well as off-duty employment and overtime usage. Due to the limitations with much of the previous research, it is important to note that, unlike other study designs, our use of a randomized control trial limited experimental biases and threats to validity.

While our study focused on unique, police-specific measures of work performance (e.g., interpersonal performance, driving safety, shooting performance, and self-initiated activity), we found no statistically significant differences across shift length groups. Although Knauth (2007) reported a greater number of studies finding an association with longer work hours and accidents, we found no significant differences in driving performance based on shift length. Though we were not able to identify any past studies of CWWs in which shooting performance was used as a performance criterion, our study did not reveal any significant differences among shift length groups for shooting. Finally, with regard to self-initiated activity, a few past studies in nursing have shown that those on 12-hour shifts had a reduced work effort (e.g., Duchon, Smith, Keran, & Koehler, 1997), a decrease in activities (e.g., Reid, Robinson, & Todd, 1993), and saw fewer patients (Jeanmonod, Brook, Winther, Pathak, & Boyd, 2008). In our study examining several types of self-initiated activities (traffic stops, reports completed, etc.), we found no impact of shift length.

We also found no negative or positive impacts of shift length on our measures of health (cardiovascular health, gastrointestinal problems, and work stress). This is consistent with Knauth's (2007) review in which the results across studies were equivocal. While some studies

in policing showed some positive health outcomes associated with CWWs, these had methodological limitations or poor sample sizes.

Nevertheless, our findings suggest that while 8-hour shifts are the most commonly implemented schedules, they have some disadvantages over 10-hour shifts, without demonstrating any unique advantages. In our research, those officers working the 10-hour shifts got more sleep per night than those on 8-hour shifts (greater than four hours more per week). However, the perceived quality of sleep did not significantly differ across groups. Furthermore, those officers assigned to 8-hour shifts worked significantly more overtime than did those on 10- or 12-hour shifts (more than five times as much as those on 10-hour shifts, and more than three times as much as those on 12-hour shifts). While there was an interaction effect between shift length and site for overtime, this simply reflected that the magnitude of the difference was much greater in Detroit than in Arlington. Whereas the differences in Arlington were in the same direction as those in Detroit, the paired comparisons within Arlington did not reach statistical significance.

Also, our findings regarding quality of work life demonstrated that those working 10-hour shifts had a significantly higher quality of work life than those on the 8-hour shifts. This finding is consistent with most of the past research across work domains indicating that those on compressed schedules tend to rate them favorably or have increased job involvement or satisfaction (e.g., Armstrong-Stassen, 1998; Axelsson, 2005; Bendak, 2003; Facer & Wadsworth, 2010; Pierce & Dunham, 1992). On the other hand, while much of the past research on CWWs has found a positive impact on personal life (Armstrong-Stassen, 1998; Knauth, 2007; Lowden, Kecklund, Axelsson, & Akerstedt, 1998; McGettrick & O’Neill, 2006; Mitchell & Williamson,

2000) or reduced work-family conflict (Facer & Wadsworth, 2008; Facer & Wadsworth, 2010), our study did not result in any significant findings for quality of personal life (operationalized as work-family conflict).

Perhaps most interesting and surprising was our finding that officers working 10-hour shifts averaged significantly less overtime per two-week period than those on 8- and 12-hour shifts. As previously noted, there was a significant interaction between shift length and site for overtime; however, that simply reflected a much stronger effect in Detroit. This result suggests a potential cost savings for agencies that implement CWWs, especially 10-hour shifts in which officers worked an average of 4.58 hours less per two-week period than those on 8-hour shifts. While we did not examine the particular scheduling strategies and efficiency of such practices, it is yet to be determined whether there may be efficiency losses or increased personnel costs when implementing 10-hour shifts. Both 8- and 12-hour shifts can be equally distributed across the 24-hour spectrum, whereas the same is not true of 10-hour shifts. Nevertheless, the gains in quality of work life, increased sleep, and overtime savings associated with 10-hour tours may result in a net benefit to law enforcement agencies.

While it may be expected that some advantages associated with 10-hour shifts would inure to those on 12-hour shifts, we did not find that in this study. For example, those on 10-hour shifts had a higher reported quality of work life than those on 8-hour shifts, but those on 12-hour shifts did not. Also, while those on 10-hour shifts had significantly more sleep than those on 8-hour shifts, the same was not true for those on 12-hour shifts. Although the mean level of sleep for officers on the 12-hour shifts was higher than for those on 8-hour shifts, these differences did not reach statistical significance.

In addition, there were some disadvantages related to 12-hour shifts, including greater reported levels of sleepiness and lower levels of alertness while at work as compared to those on 8-hour shifts. Because past researchers have indicated that people underestimate their fatigue levels (e.g., Rosekind & Schwartz, 1988), these findings should be reason for further concern. The fact that the benefits associated with 10-hour shifts—better quality of work life and greater average sleep amount—did not extend to 12-hour shifts indicates a nonlinear effect. Indeed, the lower levels of alertness and higher levels of sleepiness for those on 12-hour shifts suggest diminishing returns for the 12-hour shift configuration, although in one site alertness was diminished for the 10-hour shift as well. Nevertheless, consistent with findings by Axelsson (2005), the 12-hour schedules were less detrimental in our study than may have been anticipated. However, Axelsson’s findings that long working hours should not include monotonous tasks, physically hard work, or solitary work should be considered carefully since these conditions may be more common in law enforcement. In addition, given the prior warnings by researchers related to fatigue in positions of public security, agencies should be concerned with managing fatigue in extended shifts, particularly those of 12-hours or more, inclusive of overtime work.

There were some limitations to this study. For example, the rate of attrition in Detroit was higher than that in Arlington, and it was greatest for the 8-hour shift. The fact that those with less favorable attitudes dropped out of that condition suggests that the negative findings related to quality of work life for those on 8-hour shifts may have been even greater had they participated, and may have resulted in greater work-family conflict. While numerous studies have found performance and safety problems associated with longer shifts, we were not able to provide evidence to support any potential performance decrements, although given the greater

levels of sleepiness and lowered alertness for those on 12-hour shifts (and possibly for those on 10-hour shifts), caution should still be exercised by agencies planning on implementing those shifts, as we did not consider all potential forms of performance, nor did we examine individual driving behaviors. While there is research showing time of day effects, our primary variable of interest was shift length, and so we did not test for main effects of time of day worked. However, we found no interactions between shift length and time of day for any of our outcome variables.

While this study has provided considerable information about the impacts of CWWs on performance, health, quality of life, sleep, fatigue, and extra-duty employment, it also suggests a need for additional research. For example, while we found significant advantages of 10-hour shifts, we did not examine how to most efficiently implement those schedules. It is also important that future research focus on the extent to which law enforcement agencies have implemented overtime policies, and whether they monitor and assess excessive overtime or off-duty work. As some have argued, it is possible that there are a variety of individual difference variables such as age or health conditions that may influence resiliency and coping with longer work hours, as well as differences in how longer shifts affect them (e.g., Calvasina & Box, 1975; Dunham & Hawk, 1977; Reid & Dawson, 2000). As such, there is a need for more research on individual characteristics that may interact with shift lengths in producing varied outcomes. Finally, a study of managerial decision making in the public sector revealed that managers are much more likely to implement alternative work schedules on the basis of organizational issues (i.e., productivity, ease of supervision, economics, costs and benefits, and administrative demands) rather than employee issues (Duxbury & Haines, 1991), which is why we focused on

both performance and overtime issues, as well as health and quality of life issues. Indeed, we examined sleep, fatigue, and safety as issues that may impact both employer and employee. Nevertheless, there is an ongoing need for research that examines the cost-benefit ratios of balancing worker and employer issues in implementation of alternative work arrangements, especially CWWs in law enforcement, and especially in light of the current economically challenged environment in which public organizations operate.

As agencies strive to implement policies and practices that are more efficient and effective, it is important that they implement evidence-based strategies and policies. Of course, decisions about what practices to employ best lay with police executives who are challenged with balancing employee considerations with operational responsibilities. Nevertheless, in the past, many of these decisions were made without the benefit of scientific data because such information in law enforcement was limited. In recent years, agency leaders have been receiving increased pressure from police associations and unions, while also experiencing increasing competition for the best personnel and limited resources. These factors, coupled with a rapidly increasing trend away from 8-hour shifts, have led some executives to make swift decisions about alternative shift schedules without solid evidence or comprehensive examination of the advantages and disadvantages. It seems that when it comes to shift practices, opinions, preferences, or beliefs stemming from nonscientific information have driven the decisions, most likely due to a lack of solid research findings.

It is hoped that the findings of this study will provide important information for law enforcement leaders (management and union), as well as other policy makers, to consider when examining the most efficient and effective practices in their agencies, while also allowing them

to maximize safety and quality of life among their personnel, as well as that of the public they serve.

References

- Åkerstedt, T., & Gillberg, M. (1990). Subjective and objective sleepiness in the active individual. *International Journal of Neuroscience*, 52(1-2), 29-37. doi: 10.3109/00207459008994241
- Allen, N., & Meyer, J. P. (1990). The measurement and antecedents of affective, continuance, and normative commitment to the organization. *Journal of Occupational Psychology*, 63, 1-18.
- Armstrong-Stassen, M. (1998). Alternative work arrangements: Meeting the challenges. *Canadian Psychology/ Psychologie Canadienne*, 39(1-2), 108-123. doi: 10.1037/h0086799
- Axelsson, J. (2005). *Long shifts, short rests and vulnerability to shift work*. (Doctoral Dissertation) Stockholm University: Stockholm. Retrieved from <http://www.su.diva-portal.org/smash/get/diva2:194082/FULLTEXT01>
- Barton, J., Costa, G., Smitt, L. R., Spelten, E. R., Totterdell, P. A., & Folkard, S. (1995). The Standard Shiftwork Index Manual: A battery of questionnaires for assessing shiftwork-related problems. *Work and Stress*, 9, 3-30.
- Bendak, S. (2003). 12-hour workdays: Current knowledge and future directions. *Work & Stress*, 17(4), 321-336. doi: 10.1080/02678370310001643478
- Calvasina, E. J., & Boxx, W. R. (1975). Efficiency of workers on the four-day workweek. *Academy of Management Journal*, 18(3), 604-610. doi:10.2307/255689
- Carlson, D. S., Kacmar, K. M., & Williams, L. J. (2000). Construction and initial validation of a multidimensional measure of work-family conflict. *Journal of Vocational Behavior*, 56(2), 249-276. doi:10.1006/jvbe.1999.1713
- Caruso, C. C., Hitchcock, E. M., Dick, R. B., Russo, J. M., & Schmit, J. M. (2004). *Overtime and extended work shifts: Recent findings on illness, injuries, and health behaviors* (DHHS Publication No. 2004-143). Cincinnati, OH: National Institute for Occupational Safety and Health.
- Cohen, J. (1988). *Statistical power analysis for the behavior sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Czeisler, C. A., Barger, L. K., Landrigan, C., Lockley, S., Rararatnam, S., Cade, B., Ronda, J. M., O'Brien, C., & Edwards, S. (2005). Harvard Work Hours Health, and Safety Study. Unpublished instrument. Retrieved from <http://sleep.med.harvard.edu/research/labs/86/Harvard+Work+Hours+Health+and+Safety+ Group/>

- Dinges, D. F., & Powell, J. W. (1985). Microcomputer analyses of performance on a portable, simple visual RT task during sustained operations. *Behavior Research, Methods, Instruments and Computers*, 17, 652-655.
- Duchon, J. C., Smith, T. J., Keran, C. M., & Koehler, E. J. (1997). Psychophysiological manifestations of performance during work on extended workshifts. *International Journal of Industrial Ergonomics*, 20(1), 39-49. doi:10.1016/S0169-8141(96)00030-3
- Dunham, R. B., & Hawk, D. L. (1977, December). The four-day/forty-hour week: Who wants it? *The Academy of Management Journal*, 20(4), 644-655.
- Duxbury, L., & Haines Jr., G. (1991). Predicting alternative work arrangements from salient attitudes: A study of decision makers in the public sector. *Journal of Business Research*, 23, 83-97. doi: 10.1016/0148-2963(91)90060-B
- Facer, R.L., & Wadsworth, L. (2008). Alternative work schedules and work-family balance: A research note. *Review of Public Personnel Administration*, 28(2), 166-177. doi:10.1177/0734371X08315138
- Facer, R.L., & Wadsworth, L. (2010). Four-day work weeks: Current research and practice. *Connecticut Law Review*, 42(4): 1031-1046.
- Fleiss, J. L. (1982). Multicentre clinical trials: Bradford Hill's contribution and some subsequent developments. *Statistics in Medicine*, 1(4), 353-359. doi:10.1002/sim.4780010413
- Glueck, W. F. (1979). Changing hours of work: A review and analysis of the research. *The Personnel Administrator*, 24(3), 44-67.
- Harrington, J.M. (1994). Shift work and health: A critical review of the literatures on working hours. *Annals of Academy of Medicine Singapore*, 23(5), 699-705.
- Hart, P. M., Wearing, A. J., & Headey, B. (1994). Perceived quality of life, personality, and work experiences: Construct validation of the police daily hassles and uplifts scales. *Criminal Justice and Behavior*, 21(3), 283-311. doi: 10.1177/10093854894021003001
- Huck, S. W., & McLean, R. A. (1975). Using a repeated measures ANOVA to analyze the data from a pretest-posttest design: A potentially confusing task. *Psychological Bulletin*, 82(4), 511-518. doi:10.1037/h0076767
- Jeanmonod, R., Brook, C., Winther, M., Pathak, S., & Boyd, M. (2008). Declining resident productivity over time in the emergency department. *Annals of Emergency Medicine*, 51(4), doi:10.1016/j.annemergmed.2008.01.065

- Johns, M. W. (1991). A new method for measuring daytime sleepiness: The Epworth sleepiness scale. *Sleep, 14*(6), 540-545.
- Kanungo, R. N. (1982). Measurement of job and work involvement. *Journal of Applied Psychology, 67*(3), 341-349. doi:10.1037/0021-9010.67.3.341
- Knauth, P. (2007). Extended work periods. *Industrial Health, 45*(1), 125-136. doi:10.2486/indhealth.45.125
- Liberman, A. M., Best, S. R., Metzler, T. J., Fagan, J. A., Weiss, D. S., & Marmar, C. R. (2002). Routine occupational stress and psychological distress in police. *Policing: An International Journal of Police Strategies & Management, 25*(2), 421-439. doi:10.1108/13639510210429446
- Lowden, A., Kecklund, G., Axelsson, J., & Akerstedt, T. (1998). Change from an 8-hour shift to a 12-hour shift, attitudes, sleep, sleepiness and performance. *Scandinavian Journal of Work, Environment, & Health, 24*(3), 69-75.
- McCreary, D., & Thompson, M. (2004). The development of a reliable and valid measure of stressors in policing. A Summary of Findings from WSIB Development Grant #02-051. Toronto, ON: Stress and Coping Group, Defence R&D Canada.
- McGettrick, K. S., & O'Neill, M. A. (2006). Critical care nurses: Perceptions of 12-hour shifts. *Nursing in Critical Care, 11*(4), 188-197. doi:10.1111/j.1362-1017.2006.00171.x
- Mitchell, R. J., & Williamson, A. M. (2000). Evaluation of an 8-hour versus a 12-hour shift roster on employees at a power station. *Applied Ergonomics, 31*, 83-93.
- Netemeyer, R. G., Boles, J. S., & McMurrian, R. (1996). Development and validation of work-family conflict and family-work conflict scales. *Journal of Applied Psychology, 81*(4), 400-410. doi:10.1037/0021-9010.81.4.400
- Netzer, N. C., Stoohs, R. A., Netzer, C. M., Clark, K., & Strohl, K. P. (1999). Using the Berlin Questionnaire to identify patients at risk for the sleep apnea syndrome. *Annals of Internal Medicine, 131*(7), 485-91.
- Pierce, J. L., & Dunham, R. B. (1992). The 12-hour work day: A 48-hour, eight-day week. *Academy of Management Journal, 35*(5), 1086-1098. doi:10.2307/256542
- Reaves, B. A. (2002). *Census of State and Local Law Enforcement Agencies, 2000*. Washington, DC: U.S. Department of Justice, Bureau of Justice Statistics.
- Reaves, B. A. (2007). *Census of State and Local Law Enforcement Agencies, 2004*. Washington, DC: U.S. Department of Justice, Bureau of Justice Statistics.

- Reid, K., & Dawson, D. (2000). Comparing performance on a simulated 12 hour shift rotation in young and older subjects. *Journal of Occupational & Environmental Medicine*, 58, 58-62. doi:10.1136/oem.58.1.58
- Reid, N., Robinson, G., & Todd, C. (1993). The quantity of nursing care on wards working 8 and 12 hour shifts. *International Journal of Nursing Studies*, 30(5), 403-413. doi:10.1016/0020-7489(93)90050-5
- Rosekind, M. R., & Schwartz, G. E. (1988). Perception of sleep and wakefulness: Accuracy and certainty of subjective judgments. *Sleep Research*, 17, 89.
- Stenzel, W., & Buren, R. (1983). *Police work scheduling: Management issues and practices*. Evanston, IL: Northwestern University Center for Public Safety.
- Thorne, D. R., Johnson, D. E., Redmond, D. P., Sing, H. C., Belenky, G., & Shapiro, J. M. (2005). The Walter Reed palm-held psychomotor vigilance test. *Behavior Research Methods*, 37(1), 111-118.
- Weisburd, D., & Taxman, F. (2000). Developing a multicenter randomized trial in criminology: The case of HIDTA. *Journal of Quantitative Criminology*, 16(3), 315. doi: 10.1023/A:1007574906103
- Weiss, D. J., Dawis, R. V., England, G. W., & Lofquist, L. H. (1967). *Minnesota studies in vocational rehabilitation: XXII. Manual for the Minnesota satisfaction questionnaire*. Minneapolis, MN: University of Minnesota.