Evidence-Based Lifestyle Strategies to Improve Health of Shift Workers

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An estimated 8 to 15 million Americans perform shift work that may encourage lifestyle choices that negatively affect health. We present 2 patient cases elucidating some of the issues faced by shift workers and provide counseling strategies for changing dietary behaviors. Nutr Today. 2013;48(3):119–126

An estimated 8 to 15 million Americans perform shift work. They include nurses, doctors, pilots, law enforcement, and many others who work outside a regular 8-to-5 schedule. Shift workers frequently complain of fatigue and other physical issues including gastrointestinal (GI) symptoms such as upset stomach, nausea, diarrhea, constipation, heartburn, insomnia, and general feelings of being unwell. They also experience more accidents and injuries. Evidence links shift work with increased risk for cancers, cardiovascular disease, depression and mood disorders, diabetes and metabolic syndrome, obesity, problems with fertility and pregnancy, and serious GI problems. Some of these signs and risks are a result of the lifestyle that shift work encourages. Other potential harms are related to physiology. For example, recently, long-term sleep loss has been associated with the development of obesity and diabetes. The exact mechanisms are unknown, but it is thought that sleep modulates hormone secretions that may impact glucose utilization, insulin sensitivity, appetite regulation, and resting energy expenditure. Sleep may have an impact on circulating leptin, ghrelin, thyroid-stimulating hormone, and cortisol levels.[1]

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The observed health effects of shift work, especially sleep disturbances, are collectively referred to as shift work disorder, which received formal recognition in the 2005 revision of the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* as "circadian rhythm sleep disorder, shift work type."[2] Nuvigil (armodafinil), a prescription medication approved for use in adults experiencing excess sleepiness due to obstructive sleep apnea, shift work disorder, or narcolepsy, may be used to improve wakefulness.[3] In this article, we present a discussion of 2 shift workers whose lifestyles are contributing to increased risk for chronic health conditions and provide evidence-based recommendations for lifestyle changes and approaches to counseling.

CASE 1: SHIFT WORKER WITH RENAL CALCULI, OBESITY, AND CHRONIC DEHYDRATION

S.K. is a 49-year-old African American woman. She is married with 2 teenaged children. She works as a registered nurse on a busy intermediate care unit in a tertiary care center. Her usual work assignment is 7 AM to 7 PM for 3 to 5 days straight, followed by 3 to 4 days off and returning for another 3 to 5 days of work. In addition, she works a 7 PM to 7 AM shift approximately 3 times per month.

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S.K. is obese with body mass index (BMI) of 34 kg/m^2 (weight, 190 lb; height, 5′3″), a waist circumference of 40 inches (101 cm), and a history of renal calculi times 3. Twice she passed a stone, and once she required lithotripsy. Her family history includes type 2 diabetes, hypertension, and renal failure. She does not regularly monitor her blood pressure, but reports it has ranged between 130/80 and 160/82 mm Hg when she had it checked at health fairs and doctor visits. She takes no medications and was interested in something to keep her more alert.

She stated she did not exercise as she does not have time when she works, and on her days off she is too tired. She complained of constant fatigue, despite getting 7 hours or more of sleep every night. She would like to work a more normal schedule to be able to spend more quality time with her family but has financial concerns. She reported her beverage intake consisted of regular colas, sugar-sweetened tea, and fruit juice, although when working she restricted her intake to one 20-oz regular soft drink from the vending machine so she would not have to leave her floor and patients to urinate too frequently. She does not like water as a drink and described her diet as "good southern foods," which are high in fat and sodium. She reported eating food from the "candy cart" that comes to the floor and hamburgers at the snack bar while at work, and on the way to work usually stopping to purchase a sausage biscuit and large sweet tea. Table 1 reflects laboratory work recently drawn at an employee health visit. Based on her waist circumference (>88 cm in a woman) and abnormal laboratory results (triglycerides, ≥150 mg/dL; high-density lipoprotein, <50 mg/dL), which meet the criteria

TABLE 1 Laboratory Values for Case 1

Test	Patient Value	Normal Value
BUN, mg/dL	29 (high)	10–20
Na, mEq/L	151 (high)	136–145
K, mEq/L	3.8	3.5–5.0
Glucose, mg/dL	101	70–110
Creatinine, mg/dL	1.6 (high)	0.5–1.2
AST (serum glutamic-oxaloacetic transaminase), U/L	35	0–35
ALT (serum glutamic-pyruvic transaminase), U/L	46	4–36
GGT, U/L	12	8–36 (varies age, sex)
Total cholesterol, mg/dL	230 (high)	Desirable <200
		Borderline high 200–239
		High >240
Triglycerides, mg/dL	189	20-200
HDL, mg/dL	36	High risk for coronary heart disease <35
		Negative risk for coronary heart disease >60
LDL, mg/dL	132 (high)	Desirable <130
		Borderline high 130–159
		High ≥160

Norms from Pagana 2013 Mosby's Diagnostic & Laboratory Test Reference.

Abbreviations: ALT, alanine transaminase; AST, aspartate transaminase; BUN, blood urea nitrogen; GGT, γ-Glutamyl transpeptidase; HDL, high-density lipoprotein; K, potassium; LDL, low-density lipoprotein; Na, sodium.

for metabolic syndrome, a case manager from the employee wellness program has contacted her and offered to provide coaching on lifestyle changes.[4]

Considerations

Surprisingly, there is minimal literature specifically describing the effect of 12-hour shifts on the health and well-being of nurses. Most studies have focused on the role of shifts and breaks on fatigue and its effects on performance, productivity, or patient safety.[5–8]

The Link Between Unhealthful Work Schedules and Obesity

Han and coworkers[9] demonstrated an association between long work hours and obesity among nurses. Among more than 2000 nurses in their study, 55% were overweight or obese, and based on their findings, they called for increased attention to scheduling and healthy food environments in the workplace to protect the health of workers. Although the discussion of change in unhealthful scheduling is outside the scope of this article, it is important for the dietitian counseling a patient working shift work to acknowledge its contribution to obesity, as it may be a risk factor the person does not perceive as modifiable.

In 1 study, where 40% of the shifts exceeded 12 hours, nurses took meal breaks free of patient care responsibilities on only 47% of the shifts worked during a month.[8] In that same study, there were 10% of shifts studied in which nurses had no opportunity to sit down for a break or a meal. One study reported that 6% of nurses said they never took a break, 15% almost never, and 16% only sometimes.[10,11] Reports suggest that at times nurses are "their own worst enemy" and choose to care for their patients over taking a break.

Although nurses often report eating differently on their 12-hour shifts than on days off, 1 study showed no real difference in total energy intake. Timing and the frequency of meals may be affected however, which can lead to decreased alertness and inappropriate eating.[5–7] In 1 study,[8] it was concluded that skipping meals or breaks did not lead to an increase in errors but may contribute to nurse burnout and likely jeopardize health.

Skipping meals or breaks may contribute to nurse burnout, and most likely jeopardize nurse's health.

Mediterranean-Style Eating Pattern

Individuals following the Mediterranean-style eating pattern have been shown to have lower risks for heart disease, stroke, diabetes, and obesity.[12,13] It is currently recommended for the treatment of metabolic syndrome.[14] There is actually no single Mediterranean "diet" but simply an eating pattern emphasizing whole foods, especially fruits, vegetables, whole grains, legumes, seeds and nuts, olive or canola oil, and limited amounts of animal meat and fats. Other "good fats" in this pattern include oils from sunflower, safflower, peanut, pistachio, almond, and the avocado fruit. Total fat content of the diet should be between 25% and 35% of calories, with saturated fat being only 7% to 8% of calories. Meat intake should consist of moderate fish intake, up to 5 servings per week; moderate chicken intake, no more than 3 servings per week; and red meat intake of no more than 16 oz per month. Some descriptions of the Mediterranean diet also include a daily glass of wine (5 oz), beer (12 oz), or spirits (1½ oz) for health benefits (www.oldwayspt.org). Assessment tools are available to help patients determine if their eating pattern approaches the Mediterranean diet.[15–17] Nurses following the DASH (Dietary Approaches to Stop Hypertension) eating pattern, another dietary approach based primarily on plant foods and including a focus on reduced sodium intake, have also demonstrated lowered risks for heart disease and stroke.[18]

A report by Zitkus[19] suggests we reconsider how we traditionally approach dietary change with nurses. She observed that nurses were more successful in weight loss attempts if they did not use a specific diet regimen. Weight management programs based on "mindfulness," however, have been shown to be effective.[20] Increasingly programs such as these are more accessible to shift workers because they are delivered through work-site wellness programs and the Internet. One example is the 15-week Eat Smart, Move More, Weigh Less program (http://esmmweighless.com).

The Link Between Lifestyle and Kidney Stone, Fluid Deprivation, and Performance

Meschi et al[21] provided recommendations for reducing the risks for kidney stones and suggested a diet that is antilithogenic with adequate water intake and appropriate amounts of protein, salt, fruits and vegetables, milk and dairy products, carbohydrates, fats, and vitamins. The eating approach the authors described would be consistent with a Mediterranean or DASH eating pattern. Although there is consensus that water is an appropriate fluid, the role of other beverages in promoting or preventing kidney stones is controversial. Meschi et al[21] noted that studies suggest soft drink consumption, perhaps because of fructose, sucrose, and phosphoric acid content, may lead to an increase in risk of calcium and uric acid stone disease. They noted that large epidemiologic studies have documented an increase in the risk of kidney stones with higher BMI and waist circumference, although the role of body composition remains unclear.

In addition to adequate hydration for kidney stone prevention, fluids are required to maximize mental and physical performance.[22] For most adults, thirst and consumption of beverages at meals are adequate to maintain hydration, but experts suggest adult women need 2.7 L (11.5 cups or 91 oz) of liquid each day, with about 9 cups (72 oz) from beverages, including water. Men require about a liter more per day, about 13 cups (104 oz) from beverages.[22]

Negative effects of mild dehydration on health and human performance have been reported when just 1% or 2% of body weight is lost.[22] Pross[23] reported that acute fluid deprivation, as might be experienced in daily living, negatively affects mood, sleepiness, fatigue, alertness, and vigor. Exercise performance capacity and cognitive function also decline, whereas physiological strain (ie, heart rate, tissue heat storage) increases.[22] As a physiological response to dehydration, thirst is a reliable indicator of 1% to 2% dehydration. If an individual feels "a little thirsty," he/she can assume to be mildly dehydrated. Contrary to widespread belief, beverages that contain caffeine do contribute to the daily fluid needs and are not dehydrating unless infrequently consumed.[22] The use of caffeine, however, especially in amounts in excess of 250 mg/d, can affect sleep and/or cause symptoms such as jitters or anxiety.

Acute fluid deprivation, as might be experienced in daily living, negatively affects mood, including sleepiness, fatigue, and lower alertness and vigor.

Breakfast

High-protein diets have been shown to improve satiety and retention of lean body mass and potentially positively affect weight maintenance after weight loss.[24,25] Some experts suggest adults following a weight loss diet should have at least 25% of calories from protein and recommend a high-protein breakfast (25 g), with at least 6 g of the amino acid leucine to reduce hunger later in the day, which is thought to occur because of suppression of the appetite hormone ghrelin. Meal replacement shakes containing this level of protein are available. Other sources of leucine are egg whites, soy protein isolates, whey protein, tuna, turkey, pork, and fish. Eating breakfast has been linked to a reduced urge to consume more calorie-dense foods, improved attention span, and increased energy levels which encourage increased physical activity.[26]

Ensure Adequate Vitamin D

One sign of vitamin D deficiency, defined as a 25-hydroxyvitamin D level less than 20 ng/mL, is fatigue. Nurses, particularly those working night or rotating shifts, may have limited sun exposure and are at greater risk of this deficiency. They should ensure they meet the Dietary Reference Intake of 600 IU/d.

Participation in Employee Wellness

Many hospitals have made significant environmental and policy changes to ensure healthy, affordable foods and beverages are available to their staff 24/7.[22] The Centers for Disease Control has encouraged hospitals to build prevention into their strategic framework to support employee, patient, and community health and create healthy food environments.[27] Although many hospitals have created healthier food environments and now provide expanded opportunities for physical activity, in the authors' experience many employees are unaware of these initiatives. In some hospitals, medical nutrition therapy for weight management has been added as a medical plan benefit. Many second- and third-shift workers may be unaware that healthier foods and beverages have been made available to them in cafeterias and/or vending machines or that incentives have been provided for being physically active. Some wellness programs identify champions or individuals who have recognized their own barriers to health, sought out resources to overcome them, and are eager to share their stories and strategies.[28] Connecting employees with champions who have similar work and family schedules may be one way dietitians and health coaches can respond to employees' complaints that counselors who do not work shifts cannot provide feasible recommendations.

Revisit the Case

With S.K., the health coach uses a patient-centered approach[29] in the counseling session. Specifically, the coach follows the 5 A's approach recommended by the US Preventive Services Task Force: Assess, Advise, Agree, Assist, and Arrange.[30] As part of the 5 A's, the *Advise* step gives a brief overview of strategies known to be effective in managing metabolic syndrome and preventing kidney stones. S.K. says she is thankful for the advice but is just not ready to adopt a Mediterranean style of eating. She is very interested in preventing another kidney stone and agrees to track her beverage intake and to drink at least 80 oz of fluids each day, with no more than 1 drink being a sugar-sweetened beverage. She agrees to study the breakfast menu at her favorite drive-thru restaurant and replace her sausage biscuit with a fruit and yogurt parfait at least 2 days a week. She will also bring a meal replacement shake from home 2 days a week for lunch and make an effort to select items marked as "healthy choice" for her snack from the candy cart or vending machine.

Specifically, the coach follows the 5 A's approach recommended by the US Preventive Services Task Force: Assess, Advise, Agree, Assist, and Arrange.

The health coach asks S.K. to brainstorm ways she can take appropriate work breaks and take advantage of the wellness benefits offered by her employer. S.K. agrees to think about making an appointment with the dietitian and attending an orientation for the online weight management class. The health coach provides her with a Mediterranean diet screener, and she agrees to complete it and identify foods she and her teens like. She also agrees to consider substituting plant-based foods for her animal-based food products and makes plans to talk with the health coach in 2 weeks.

CASE 2: SHIFT WORKER WITH HYPERTRIGLYCERIDEMIA

J.W. is a 37-year-old white man, employed as a sheriff's deputy who works straight 12-hour night shifts alternating 3 to 4 shifts of 5:30 PM to 5:30 AM followed by 3 to 4 days off. He is single and lives alone. His meals, when working, consist primarily of foods from fast-food restaurants, diners, or convenience stores. He sips on coffee sweetened with sugar or other caffeinated, sugar-sweetened beverages throughout his shift. On days off, he eats with friends at chain, sit-down restaurants. He drinks at least three 16-oz cans of beer per day. He states he is cutting down on Copenhagen, a smokeless tobacco, which he uses to keep himself alert. He does not smoke or use any other substances. Although he has a gym membership, he rarely goes, perhaps 3 to 4 times per month. He has been in good health and was last seen by a physician about 7 years ago, before discharge from the Army.

He recently had a job physical examination which included a baseline lipid panel. His family history includes a father alive at age 73 years with hypertension, prostate cancer, and type 2 diabetes; a mother who died of lung cancer at age 72 years (smoker); and an older brother, aged 43 years, who is alive and well. He has no history of elevated cholesterol or triglycerides or coronary artery disease. According to his physical note, J.W. denied chest pain or shortness of breath, and examination and review of systems were negative. His height was 5′9″, and weight was 192 lb, with BMI of 28.5 kg/m^2. Waist circumference was 37 inches. Blood pressure was 120/84 mm Hg, and pulse was 92 beats/min. His laboratory values are noted in Table 2. His physician referred him to the registered dietitian (RD) for weight management and medical nutrition therapy for hypertriglyceridemia.

Considerations

The bulk of literature describing the role of shift work in potential health outcomes among law enforcement was done 15 to 20 years ago. Only recently have we heard calls for interventions and workplace programs to promote health and fitness of law enforcement.[31] Long hours worked by law enforcement personnel are associated with larger waist circumferences, higher BMI, metabolic syndrome, and increased cardiovascular risk.[31–33] Those who work the midnight shift more often meet the criteria for metabolic syndrome.[33] Results from prospective observational studies found an approximately 40% excess risk of coronary heart disease in employees working long hours.[34] Uetani et al[35] concluded the effect of shift work on lipid regulation among Japanese workers was likely influenced by BMI. Ramey[36] found law enforcement officers had a greater prevalence of hypercholesterolemia, overweight, and tobacco use than the general population yet perceived their health as "good to excellent." She suggested these officers had inflated perceptions of their health that would require a healthcare provider to create awareness of risk before empowering them to change behaviors. Anshel and Kang[37] demonstrated that the use of motivational-interviewing strategies could impact the eating and exercise habits of police officers.

Lifestyle Changes to Lower Triglycerides

The American Heart Association's Scientific Statement on Triglycerides and Cardiovascular Disease[38] includes statements that marked triglyceride lowering in the range of 20% to 50% can occur with diet strategies that include weight loss, reduced consumption of simple carbohydrates at the expense of increasing dietary fiber, limiting industrially produced *trans*-fatty acids, restricting fructose and saturated fat, implementing a Mediterranean-style diet, and consuming marine derived omega-3 fatty acids. The American Dietetic Association[39] issued an evidence-based practice guideline on disorders of lipid metabolism calling for 3 or more visits with an RD for instruction on a calorie-controlled, cardioprotective dietary pattern that avoids extremes in carbohydrate and fat intake, with emphasis given to selecting high-fiber/complex carbohydrates and avoiding refined carbohydrates and simple sugars. Physical activity to lower triglycerides is also suggested.

Although there is limited supporting evidence, based on the fact that elevated triglycerides are a component of metabolic syndrome, the guideline encourages following recommendations for people with metabolic syndrome when triglycerides are borderline or higher. If overweight, a weight loss of 7% to 10% from baseline is also suggested.

TABLE 2 Laboratory Values for Case 2

Test	Patient Value	Normal Value
BUN mg/dL	17	10–20
Na, mEq/L	137	133–145
K, mEq/L	5.2	3.5–5.0
Glucose, mg/dL	95	70–110
Creatinine, mg/dL	1.6	0.5–1.2
AST (serum glutamic-oxaloacetic transaminase), U/L	33	0–35
ALT (serum glutamic-pyruvic transaminase), U/L	42	4–36
GGT U/L	116	8–38 (varies age, sex)
Total cholesterol, mg/dL	228	Desirable <200
		Borderline high 200–239
		High >240
Triglycerides, mg/dL	648	20–200
HDL, mg/dL	52	High risk for coronary heart disease <35
		Negative risk for coronary heart disease >60
LDL, mg/dL	Unable to calculate	Desirable <130
		Borderline high 130–159
		High ≥160

Norms from Pagana 2013 Mosby's Diagnostic & Laboratory Test Reference.

Abbreviations: ALT, alanine transaminase; AST, aspartate transaminase; BUN, blood urea nitrogen; GGT, γ-Glutamyl transpeptidase; HDL, high-density lipoprotein; K, potassium; LDL, low-density lipoprotein; Na, sodium.

For individuals without cardiovascular disease, 2 servings (4 oz each) of fish per week are recommended for obtaining marine-derived omega-3 fatty acids, or for those not obtaining these fatty acids from dietary sources eicosapentaenoic acid and docosahexaenoic acid omega-3 fatty acid supplements may be encouraged. Use of high-dose (2–4 g/d) supplemental eicosapentaenoic acid and docosahexaenoic acid has been shown to lower triglycerides in persons with levels greater than 200 mg/dL.[39] Alcohol intake should be limited to 2 or fewer drinks per day for men, with 1 serving equal to 5 oz of wine, 12 oz of beer, or 1.5 oz of spirits.[39] Specific guidelines are expected from the National Cholesterol Education Program's forthcoming ATP IV panel report (http://www.nhlbi.nih.gov/guidelines/cholesterol/atp4/index.htm).

Although data are inconclusive, studies demonstrate gum chewing can increase alertness, concentration, and oral health and decrease stress, tension, and snacking.[40,41] Chewing gum in the afternoon has been shown to reduce late-in-the-day hunger and can be a replacement for snacks such as candy while contributing only 10 to 15 calories.

Chewing gum in the afternoon may reduce hunger late in the day.

Approaches to Changing Behavior

The small changes approach to addressing obesity, that is, small reductions in conscious energy intake and increases in physical activity, has been proposed[42] and at least in 1 case[43] led to weight loss among participants in a group-based program. Tate et al[44] used beverage replacement as the primary weight loss strategy in a study of overweight and obese adults. They demonstrated that replacing

caloric beverages with water or diet beverages resulted in average weight losses of 2% to 2.5% in overweight and obese adults over a 6-month period.[44] Additionally, they found better adherence among study participants who were allowed diet beverages in addition to water. Anshel and Kang[37] demonstrated that using motivational-interviewing techniques with male police officers resulted in weight loss and adherence to lifestyle changes. In their study, officers created an action plan that included a time management schedule that created a structure for at least 3 exercise sessions per week, desirable eating habits, and other changes in routines to impact weight and lipid levels. In the authors' experience, using the SMART Goals framework[29] is an effective way to end a patient-centered session. SMART goals are S—specific, significant, stretching; M—measurable, meaningful, motivational; A—agreed upon, attainable, achievable, acceptable, action-oriented; R—realistic, relevant, reasonable, rewarding, results-oriented; and T—time-based, timely, tangible, trackable.

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Revisit the Case

The RD uses motivational interviewing and, after receiving permission to explore solutions, gives a brief overview of the lifestyle choices known to be effective in managing elevated triglycerides. J.W. is appreciative of the advice provided and states a desire not to continue to gain weight, but actually lose some weight. He states he would also like to be in "better shape." He is not interested in taking fish oil, stating he "feels good," and his low-density and high-density lipoprotein cholesterol levels seem fine to him, although he does admit to being a bit shocked by how high above normal his triglycerides are. He is willing to make some changes and return for at least 1 more visit with the dietitian to see if the changes have made any difference. He says his buddies taking fish oil pills complain about the cost, fishy taste, and GI symptoms, and he is not agreeable to this option but will try to order tuna or salmon, not fried, at least 2 and maybe 3 times a week. He admits to noticing, but not being influenced by, icons noting healthier options at restaurants and convenience stores and agrees to pay more attention to them and focus on choosing fresh fruit, canned fruit in fruit juice, whole-grain snacks, and unsalted nuts. He is not ready to prepare more meals at home or go on a "diet" but agrees to replace his high-calorie beverages with noncaloric ones as a weight loss strategy. He is intrigued by the notion that sugar-free gum may be used as an alternative to smokeless tobacco and sets as a SMART goal to chew gum instead of tobacco at least once a day until the next visit. He agrees to limit beer intake to two 12-oz beers, or one 12-oz beer and 1 small red wine each day as suggested in the American Dietetic Association guideline on alcohol intake for lipid disorder management.[39] On a scale of 1 to 10, he rates his confidence in being able to meet these goals as a "9." He is less confident that he would get to the gym more regularly and agrees to get information about the employee wellness program his friends attend.

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