ABSTRACT: Professional ski patrollers work in demanding and risky environments where stress is considered part of the job. Based on a previous study, the number of ski patrollers who reported having experienced avalanche-related accidents or near misses on the job was alarming. When these avalanche professionals were asked what led to their experiencing such events, they pointed to failure of personal decision-making. We hypothesize that too much or too little stress leads to decision failure—a result we define as workplace complacency. We measure stress cortisol levels via saliva samples among experienced ski patrollers (n=9) while conducting avalanche mitigation work, on duty days not requiring avalanche mitigation, and on days off. Cortisol concentrations were compared across the three days multiple times during the 2015/16 ski season. Our results suggest that avalanche mitigation is not a significant source of stress compared to non-work related stressors. Further, results also seem to demonstrate that an increase in stress and the associated cortisol concentration elevation is influenced by an individual’s operational responsibilities more so than by environmental stresses related to conducting the dangerous avalanche mitigation work itself.

KEYWORDS: Stress, Cortisol, Avalanche Mitigation, Ski Patrol.

1. INTRODUCTION

In a previous study, we set out to learn about the causes of avalanche-related accidents and near misses experienced on the job among professional ski patrol (Bergeron and Johnson 2015). We reported over 80% of survey respondents (n=151), stated they had experienced an avalanche-related accident or near miss on the job. The three most frequent contributing factors in accidents were: “poor personal decision-making”; “pre assumptions” (decisions based on past data or experience); and “loss of situational awareness.” All three can be traced back to failure by the individual rather than operational pressures or other causes outside of one’s control. Based on the collinearity of the three variables/causes, we suggested that they may be connected, and that any one of these contributors can easily lead into another in a cyclical, multidirectional fashion. In order to conceptualize this cycle, we created “The Triangle of Complacency.” Our representation suggests that ski patrollers conducting avalanche mitigation can get caught in this dangerous cycle without even realizing it.

Complacency is a feeling of uncritical satisfaction, especially when unaware of upcoming trouble. The question is- why do highly trained individuals in potentially high-risk terrain and consequences get complacent? One possible explanation is stress is either very high to the point of inaction or very low so as to lose the mental acuity required to operate safely in risky situations. In between, there may be levels where our decision-making capacity is diminished.

The literature on stress and decision making behavior has received a good deal of attention in recent years and a consensus is emerging. Stress results from a decision space where the demands of making a decision exceed personal resources. The result is undesirable physiological, emotional, cognitive and social changes (Salas et al. 1996). In emergencies, such personal resources (knowledge, skills, and abilities) are the key management factors. Some observe stress-induced deficits in spatial reference (where am I?), working-memory (I should be doing what?), and behavioral flexibility (heuristics) (Sousa, et al. 2008; Liston, et al. 2009).
A recent study (Soares, et al. 2012) indicates that chronic stress biases decisions. Rather than continually moving toward problem solving, we revert to decisions made on habit and so constrain our choices and consideration of new data. This has obvious implications in the continually changing environment of avalanche mitigation. They point out that automatization (i.e. “autopilot”) of recurring decision processes can sometimes be considered advantageous because it increases efficiency as we move cognitive resources to more demanding tasks. However, they state that the ability:

to adapt to ever-changing life conditions, the ability to select the appropriate actions to obtain specific outcomes based on their consequences is of utmost importance. The capacity to shift between habit-based and goal-directed actions is a condition for appropriate decision-making. (Soares, et al. 2012)

Viewed this way, complacency may be better understood as the effects stress has on individual decision making as indicated by the three causes identified by survey respondents. The cycle of complacency is the result of an inability to shift from habit-based actions toward situational or goal oriented decisions.

In order to test the above assumption, we first need to determine the amount of stress (if any) patrollers experience on the job. At this point, we are not making claims about the role of stress, rather, we are looking for the presence or absence of stress as a factor in our future studies of complacency.

Measuring stress is problematic, as there exists stressors, and the accompanying response to those stressors. If we ask respondents for self-reported stress levels, we often find individuals unstressed by conditions that severely stress others and so are actually measuring a psychological response to stressors. Some may not recognize stress and so may underreport stress levels. In any case, it is a highly subjective notion. However, stress is also associated with a chemical response in the brain.

We determined the most feasible way to measure the level of on the job stress in ski patrollers was to measure cortisol concentrations via saliva samples. Cortisol, the primary stress hormone, is secreted by the adrenal glands in response to perceived stress. It is a product of the sympathetic nervous system’s “fight or flight” response, and acts physiologically to increase blood glucose levels to be utilized by the body’s muscles. The concentration of cortisol in saliva is a commonly used technique to quantitatively assess stress levels in humans. This technique is often favored due to its non-invasive, non-stress inducing collection process, therefore effectively minimizing procedural bias in the sample collection step of the analysis.

2. PROCEDURE

Cortisol levels follow a daily cyclical change unique in level for each individual so sampling for conditioned-induced stress must take into account normal shifts. Generally speaking, we experience a peak in cortisol levels mid morning (i.e. @ 8 am). As the day wears on, it falls gradually, reaching its lowest levels in mid afternoon (i.e. @ 3-4 pm) (Chan and Debono, 2010). To account for this cycle, we adopted a time series sampling procedure that allows us to compare changes in cortisol levels throughout the workday. In order to understand the role of work-related functions, we sampled an off day, a workday with no avalanche mitigation duties, and a workday with avalanche mitigation duties. Avalanche workday and day off saliva samples provided baseline cortisol levels for comparison to the avalanche mitigation cortisol levels in that individual.

The cortisol concentrations were collected from nine male study subjects who are experienced professional ski patrol at Big Sky Ski Resort located in Big Sky, Montana. To the degree practicable, all avalanche and topographic variables are constant. On sample days, subjects were given six Salivette® tubes in a collection kit and were instructed how and when to collect their saliva while actively engaging in avalanche mitigation work. The study subjects collected their saliva in this fashion at six times during the collection process at forty-minute intervals starting at 7 am on a collection morning. The study subjects were then given two more collection kits to collect saliva in the same fashion just described on their next workday that did not involve avalanche mitigation work, and on their next day off. The saliva samples were analyzed using ELISA assay cortisol concentration measurement techniques (Dressendörfer, et al. 1992).

3. RESULTS

Initial results showed a bimodal distribution of stress among the nine participants. The first group of individuals (Group 1) are “line patrollers” with no extraordinary duties beyond avalanche mitigation,
EMS provision, and general patrol duties. This group did not experience elevated stress levels as measured by their salivary cortisol concentrations when compared to their baseline levels. Interestingly, stress hormone elevations were higher for four out of six of these individuals on their regular work days or days off than on avalanche mitigation days. In other words, these individuals exhibited higher levels of stress off the job than during avalanche mitigation days. Overall, this group exhibited little to no elevated stress on avalanche mitigation workdays. Additionally, it was implied by these individuals' questionnaire data that elevated stress levels were mainly the result of stressors associated with family/home life and other non-avalanche, non-work-related stressors.

The second group (Group 2) individuals are those who fulfill at least some supervisory or management role pertaining to the avalanche mitigation work (i.e. forecasters, managers, and directors who supervise line patrollers). These individuals displayed elevated cortisol levels above their baseline during avalanche workdays. These individuals fulfill big-picture avalanche mitigation management roles as well as perform active mitigation. Group 2 individuals are in charge of the avalanche mitigation efforts and their associated results for the ski patrol and the ski resort as a whole. Not surprisingly, the questionnaire data provided by these individuals imply the additional duties and responsibilities associated with their management roles were the primary causal factor related to their elevated stress levels while avalanche mitigation work was being conducted.

Based on the preliminary results of this pilot study, avalanche mitigation work per se does not seem to increase stress levels in our group of line patrollers and does not seem to be associated with the behaviors we would describe as “stressed out”. Instead, other non-avalanche work-related stressors or non-work-related stressors are being shown as the cause for elevated stress as measured by cortisol concentrations in the saliva of these individuals. For others with supervisory responsibilities, avalanche mitigation is associated with increased stress-related cortisol but we leave open the possibility that operational pressures may be the ultimate stressor.

4. DISCUSSION

The sample of professional ski patrol presented here is clearly not representative of the industry but it provides insight into the sources of stress on the job for these unique EMS providers. Our results present us with a dilemma.

On one hand, we find that active avalanche mitigation is not a source of stress for line patrollers. Given the potentially fatal outcome of a mistake with explosives, we might be more sanguine if we detected a higher level of stress. On the other hand, we measured relatively high levels of stress among those in a supervisory or management role. For this group, stress may have an undesirable effect on the performance or individual patrollers. In both cases, we suggest that stress (or lack of) could begin transition into complacent behaviors.

We also find that stress and sources of stress for even a small group of patrollers is not homogeneous and that stress reduction is likely more personalized than many workplace programs would suggest. Most literature on stress and the workplace is focused on controlling the work environment so as to reduce stressors for the overall workforce.

Coping mechanisms most often cited include reducing noise; finding time to be alone; creating a time management plan; or balancing schedule, responsibilities, and daily tasks. Most are unrealistic for professional ski patrollers; stressors are part of the job. For some, even high consequence dangerous work is not stressful, for others, one’s role in the organization, as well as home and family life might be major sources of stress.

Managing stressors is unrealistic for most HR programs at ski resorts, as they are simply not equipped to offer family counseling or other non-work-related aids. Stressor relief in these cases is largely the responsibility of the individual and family just as they are in other professions. Future research could focus on what patrol employers provide in the way of these services and how individuals cope with non-work-related stressors. Professional EMS organizations might play an effective role in educating avalanche professionals about employee assistance programs available via membership.

For the second group, stressors are directly related to their job description where operational responsibility lies, in part, with decisions made by the individual. We posit that it may be these broader job responsibilities that act as the job stressor; on mitigation days these stressors may be more acute than during non-mitigation. In these
cases an argument can be made that the employer should be proactive in reducing stress. In addition to making calls on snow conditions, coordinating the use of explosives, and calling runs open or closed, they also administer first aid and deal with the skiing public. While some may cope with these stressors successfully, others may suffer the effects of stress buildup.

Finally, if avalanche mitigation work is not as stressful as one might expect this may point to the effectiveness of focused high quality training and tenure on the job. If so, it highlights the efficacy of continued and ongoing training as a way to reduce stress.

5. CONCLUSION

In this small exploratory study of experienced patrollers we find evidence of varying levels of stress during avalanche mitigation. For some, mitigation efforts are not stressors, for others with broader responsibilities mitigation is associated with high stress levels however, we leave open the possibility that the job duties on mitigation days are the ultimate stressor.

This winter we hope to continue with monitoring cortisol levels in a wider sample of ski patrol and will continue to determine sources of stress. Eventually we hope to understand more about the causes of AVPRO accidents and how patrol organizations can manage them.

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6. REFERENCES


