Environmental Modifications to Reduce Blood Pressure Among On-Duty Firefighters

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Introduction: HTN and disturbed sleep are highly prevalent problems among on-duty firefighters. Our previous research has suggested nearly 60% of firefighters experience disturbed sleep and more than 70% have HTN per 2017 American Heart Association (AHA) Blood Pressure (BP) Guidelines. HTN has been associated with poor health outcomes and may be a result of disturbed sleep. Rather than using lifestyle modification approaches which are difficult to sustain, we have developed and piloted an intervention which modifies the sleeping environment in order to improve sleep and reduce BP. Environmental modification interventions do not require consistent and continuous commitment by firefighters to individually improve their sleep quality and reduce their BP, thus environmental interventions are powerful and sustainable. Here, we discuss the results from a small pilot study to see if an improvement in sleep quality was associated with a reduction in the prevalence of HTN in a firehouse in Rochester, NY.

Methods: The bunkroom intervention involved eliminating unnecessary alarms, optimizing room temperature for sleep hygiene, and reducing light for 6 weeks. Sleep quality was self-reported from 0 (poor) to 5 (good). Actigraph to the non-dominant wrist was applied to classify disturbed sleep. Disturbed sleep was defined as meeting 2 of the following 4 criteria: total sleep time less than 6 hours; total sleep latency greater than 30 minutes; sleep efficiency less than 85%; or, wake after sleep onset greater than 30 minutes. Actigraph was also used to measure the amount of time a firefighter was out of bed during their sleep window. BP was measured as the average of two readings taken 5-minutes apart with the firefighter in the sitting-up position. HTN was defined as a BP greater than 130/85 mm Hg per 2017 AHA BP Guidelines. Lastly, we assessed firefighters’ compliance and measured their satisfaction with the intervention as a means to measure sustainability. Continuous variables were reported as mean ± standard deviation, and categorical variables as frequencies and percentages. Pre- and post-assessment were examined using paired t tests. Significance was set to 0.05 or less for a two-tailed test.

Results: Twenty-four firefighters enrolled in the study, but only 11 firefighters participated in post-test assessment due to department transfers (mean age= 42 ± 9.5 years; 95% male; 92% overweight or obese). Compliance to the intervention was mixed: temperature remained within the prescribed range (range 63 °F- 67 °F), light as measured by luminesce dropped significantly (p<0.05) but noise level changed minimally (p>0.05). Sleep quality significantly improved after the 6 weeks (p=0.007). Although not statistically significant, on average it took 5 fewer minutes for on-duty firefighters to fall asleep (18.2±14.9 minutes vs 13.3 ± 8.2 minutes; p>0.05). 60% of the firefighters had disturbed sleep per wrist actigraph at baseline, and after the intervention 41% were classified as experiencing disturbed sleep (p>0.05). The mean amount of time a firefighter was out of bed during their sleep window fell from 22.94±39.6 minutes to 7.37± 20.1 minutes (p=0.01). The prevalence of HTN dropped from 37% to 11% (p<0.05). Firefighters self-reported willingness to adopt the intervention after the pilot study and reported overall satisfaction with the intervention.

Conclusions: In this small pilot study using an environmental modification intervention in the bunkroom of a firehouse, improvements in sleep quality were associated with a reduction in the prevalence of HTN among on-duty firefighters. Both disturbed sleep and HTN are highly prevalent problems among professional on-duty firefighters. Firefighters also reported willingness to adopt the intervention and were satisfied with the intervention. Given this environmental modification intervention does not require consistent and continuous commitment by firefighters to individually improve their sleep quality and reduce their BP, environmental modifications such as this may be powerful and sustainable.
Title:
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Abstract Summary:
Hypertension (HTN) and disturbed sleep are prevalent problems among on-duty firefighters, and lifestyle modifications are difficult for firefighters to sustain. Our pilot data suggest the intervention using environmental modifications improves sleep quality and reduces HTN prevalence and may be a sustainable intervention for firefighters to maintain.

Content Outline:
Introduction

1. Disturbed sleep and hypertension are prevalent problems among on-duty firefighters, and the two may be linked.
2. An intervention using environmental modifications to improve sleep quality may also reduce the prevalence of hypertension.

Body

Main Point #1 An intervention which eliminates unnecessary alarms, optimizes room temperature, and reduces light for 6 weeks in the bunkroom of a firehouse improves sleep quality among on-duty firefighters.

1. Supporting point #1
Self-reported sleep quality significantly improved after 6 weeks of the intervention (p=0.007).

2. Supporting point #2

On-duty firefighters fell asleep, on average, 5 minutes sooner after 6 weeks of the intervention (18.2±14.9 minutes vs 13.3 ± 8.2 minutes; p>0.05).

3. Supporting point #3

The mean amount of time a firefighter was out of bed during their sleep window fell from 22.94±39.6 minutes to 7.37±20.1 minutes after 6 weeks of the intervention (p=0.01).

4. Supporting point #4

The prevalence of disturbed sleep as determined by wrist actigraph fell from 60% to 41% after 6 weeks of the intervention (p>0.05).

Main Point #2 An intervention which improves sleep quality in the bunkroom of a firehouse is associated with a reduction in the prevalence of hypertension among on-duty firefighters.

1. Supporting point #1

The prevalence of hypertension dropped from 37% to 11% after 6 weeks of the intervention (p<0.05).

Main Point #3 On-duty firefighters report satisfaction and willingness to adopt this intervention which uses environmental modifications.

1. Supporting point #1

Firefighters self-reported satisfaction with the intervention and a willingness to adopt the intervention after this pilot study.

III. Conclusion

1. An intervention using environmental modifications including eliminating unnecessary alarms, optimizing room temperature, and reducing light for 6 weeks in the bunkroom of a firehouse improves sleep quality among on-duty firefighters.
2. An improvement in sleep quality among on-duty firefighters is associated with a reduced prevalence of hypertension.
3. On-duty firefighters reported satisfaction and willingness to adopt the intervention; thus, interventions which use environmental modifications may be sustainable.

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manuscripts under review or in press focused on cardiovascular health and electrocardiography (ECG).
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Author Summary: As a developing nurse scientist, Dillon J. Dzikowicz BS, RN has made a contribution
and commitment to nursing to identify and reverse modifiable risk factors for the development of
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Author Summary: The overall goal of Dr. Carey's program of research is to improve the
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