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The Effects of Sleepwalking on Violence: Does Stress Play a Part in Sleepwalking?

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It is projected that 2.5% of individuals are affected by sleepwalking (Kales et al., 1980; Umanath, Sarezky, & Finger, 2011). Under the REM stages of three and four, a sleepwalker has the ability to perform purposeful acts, and show high responsiveness. Sleepwalking episodes usually occur in the first one-third of the night and usually follow with complete or partial amnesia (Lam, Fong, Yu, Li, & Wing, 2009). I propose a study which will explore the ways in which stress effects sleepwalking violence. This proposed study may lead to the development of stress reduction techniques in order to reduce sleepwalking violence.

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Within the general population, 2.5% of individuals are affected by sleepwalking (Kales et al., 1980; Umanath, Sarezky, & Finger, 2011). 15% of children will experience at least one sleepwalking episode (reviewed by Vgontzas & Kales, 1999). Compared to females, males have a higher rate of injury and lethal behavior that stems from sleep disorders (reviewed by Siclari et al., 2010). In certain cases, an individual can be sentenced to jail because of their actions that result from sleepwalking. It is unclear whether a person who sleepwalks has a motive for the violence that occurs (Cartwright, 2004).

Different sleep disorders, such as sleepwalking, are often associated with a particular stage in the sleep cycle. A sleep cycle consists of four stages. During these stages, the electroencephalogram (EEG) progressively slows and muscle tone, respiratory, and cardiac rates decrease (reviewed by Fenwick, 1987). Usually, after one or two hours of slow wave sleep (SWS), the REM stage begins. This is where an absence of muscle tone or dream sleep is experienced (Fenwick, 1987). This stage of REM sleep lasts for about 10 to 15 minutes. During the night, each sleep cycle tends to be about 90 minutes long (Pinel, 2007). As the night progresses, sleep cycles shift

and more time is spent in the REM sleep stage than in any other (Pinel, 2007). During REM sleep, heart and respiratory rates accelerate, becoming irregular. REM sleep promotes procedural memories for skills (Kopasz et al., 2010).

Nightmares are classified by emotional and physiological arousal, along with clear dream imagery that is usually terrifying and vividly remembered upon awakening (Fenwick, 1987). Eight percent of the general population suffers from nightmares (Antunes-Alves & De Koninck, 2012). During a nightmare, a person may experience difficulty moving. During the waking stage, there is a possibility of feeling paralyzed and rooted to the spot for a short period of time (reviewed by Fenwick, 1987). A period of confusion may also be present for a short amount of time; the transition will occur during the awakening stage (reviewed by Fenwick, 1987). The period of confusion is when the body is changing from the paralyzed stage to the movement stage, making it almost impossible to act out the dream (reviewed by Fenwick, 1987).

Unlike nightmares that occur during REM, night terrors occur during stage four (SWS) and within two hours of going to bed. During a night terror a person is partially aroused and exhibits fear. Their dreams can be acted out; one might rush out of the bedroom and down to the kitchen. They may give a sudden loud piercing scream, a series of screams, moans, or a cry for help

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(Fenwick, 1987). Night terrors become less common as children grow older and are rarely seen in adulthood (Fenwick, 1987; Kales et al., 1980). It is more common for night terrors to occur during stressful times (Fenwick, 1987; Vgontzas & Kales, 1999). Sleepwalking can sometimes be preceded by a night terror: both phenomena are strongly familiar, and both can be provoked by drugs affecting the central nervous system (reviewed by Oswald & Evans, 1985).

Sleepwalking can be preceded by a night terror; it also occurs during stages three and four, normally within two hours of sleeping. Episodes usually occur in the first one-third of the night and usually follow with complete or partial amnesia (Lam, Fong, Yu, Li, & Wing, 2009). Typical episodes of sleepwalking can last for several minutes and consist of one sitting up and making repetitive movements (Fenwick, 1987; Vgontzas & Kales, 1999). As reviewed in Vgontzas and Kales (1999), episodes should not be interrupted because that can cause confusion and frighten the sleepwalker even more. A partner may admit that during these sleep periods they are kicked and bruised. The sleepwalker will either go back to bed immediately or prolong the episode by leaving the room and occasionally leaving the house (Fenwick, 1987). A sleepwalker can carry out purposeful acts, including dressing themselves and opening and closing doors (reviewed by Fenwick, 1987). In the past, sleepwalkers have walked onto fire escapes, fired guns, and driven cars, all of which have ended in self-injury and/or injury to others (Fenwick, 1987).

Sleepwalkers show a high degree of responsiveness during episodes, which can make it difficult to diagnose that they are asleep. The eyes of a sleepwalker are open and constantly search out movements, which is how they are able to navigate around obstacles put in their way (Fenwick, 1987). When a sleepwalker awakens from slow wave sleep it is gradual; the person is confused and disoriented, and has poor memory (reviewed by Umanath et al., 2011). There are many cases where the sleepwalker does not realize what he/she is doing or will only recall part of what had happened throughout their episode (Oswald & Evans, 1985; Pillman, 2009; Randall, 2013). When we sleep, we do not pay attention, which is the reason why we have such difficulty trying to recall the events that happened during our dreams (Oswald & Evans, 1985). If one tries to speak to a person in a sleep-walking state, the sleepwalker will either respond with nonsense, or not respond at all (Oswald & Evans, 1985).

Sleepwalking, as in night terrors, becomes less common as children grow older and it is uncommon in adulthood (reviewed by Kales et al., 1980; Szelenberger, Niemcewicz, & Dąbrowska, 2005). A majority of adult sleepwalkers are people who had childhood-onset sleepwalking; it is rare to find adult-onset sleepwalking (Lam et al., 2009). About 24% of adult sleepwalkers report self-injuries (reviewed by Seeman, 2011). A

sleepwalking episode can be provoked by an onset of stress (Kales et al., 1980; Vgontzas & Kales, 1999).

Sleepwalking is often comorbid with psychological distress, panic disorder, phobias and suicidal thoughts that can be induced by a variety of psychotropic agents (reviewed by Ferentinos & Paparrigopoulos, 2009). Someone who has nocturnal frontal lobe epilepsy can have seizures that occur exclusively during sleep and can be associated with violence (reviewed by Siclari et al., 2010). For a person with epilepsy, a seizure can occur throughout any stage of sleep (Siclari et al., 2010). This is similar to sleepwalking in the way that violence can occur, such as kicking, biting, screaming, showing anger, hitting, grasping, and threatening (reviewed by Siclari et al., 2010). These violent acts are abrupt and for a short duration (Siclari et al., 2010). They usually are not intentionally directed towards others and they do not involve intricate skills or purposeful movements (Siclari et al., 2010).

As noted earlier by Oswald and Evans (1985), sleepwalking can be preceded by a night terror, which can be provoked by drugs affecting the central nervous system. The administration or withdrawal of certain drugs, including alcohol, induces changes in the frequency, intensity, and disturbing content of dreaming (reviewed by Vgontzas & Kales, 1999). These drug treatments can result in an increase of REM sleep, causing a temporary increase in the intensity of the dream occurring in possible nightmares (Vgontzas & Kales, 1999). There are drugs that suppress stage three and four sleep. As reviewed in Vgontzas and Kales (1999), the drugs diazepam and flurazepam, are prescribed for adults in psychotherapy who deal with night terrors or sleepwalking. There are also drugs that can induce somnambulism-like episodes such as: lithium, high doses of neuroleptic drugs, and triazolam (Vgontzas & Kales, 1999). Tricyclic medications and some of the new altered central serotonin (5HT reuptake blockers), are used commonly for depression or obsessive compulsive disorders (OCD), and eliminate REM sleep atonia (reviewed by Guilleminault et al., 1998). This pharmacological property increases the number of small abnormal movements during sleep, which can be responsible for abnormal activity during REM sleep (Guilleminault et al., 1998). Some substances that have been known to bring on parasomnias have been associated with altered central serotonin (5-HT) activity (Seeman, 2011). It is also noted that paroxetine, a serotonin reuptake inhibitor (SSRI) that is taken before sleep can also trigger somnambulism (reviewed by Seeman, 2011). Paroxetine is similar to sertraline and these SSRIs are known to increase slow wave sleep, relating them to sleepwalking (Seeman, 2011). Another medication that can trigger an onset of sleepwalking is asthma (reviewed by Pillman, 2009). In one case, it is believed that ineffective asthma medication led a man to have nocturnal shortness of breath and sleep

fragmentation which was a possible cause to his sleepwalking.

There are certain medications that can induce sleepwalking in people. For example, the medication of a person with Schizophrenia can induce sleepwalking. When patients with Schizophrenia are tested with the polysomnography (a test that measures sleep, respiration, heart rate and other variables), they show disturbed sleeping patterns for 30-80% of the time (reviewed by Seeman, 2011). When taking antipsychotic medication, obesity can increase the risk of sleepwalking (reviewed by Seeman, 2011). Many psychotropic drugs as well as antipsychotics can be associated with parasomnias (Seeman, 2011).

New neuroscientific approaches for the diagnosis of sleepwalking are being used (reviewed by Cartwright, 2004). The sleep EEG is a test that measures the electrical activity of the brain; it measures muscle tone, respiratory and heart rates (Cartwright, 2004). According to Cartwright (2004), a lower level of slow-wave (delta) activity during the night is present in a sleepwalker in comparison to a non-sleepwalker. Another approach is the brain imaging test, which captures behavioral arousal episodes by using a single photon emission computed tomography (Cartwright, 2004).

Sleepwalking can involve violence (Oswald & Evans, 1985; Pillman, 2009; Randall, 2013). For example, a 22 year old man who was an office sales assistant in good health lived with his wife. One night around 1:00 a.m., he awoke with his hands gripping the throat of his wife. Since the age of seven, the man has had vivid dreams consisting of him sitting up and shouting in his sleep. His mother raised him and his father left when he was small. His mother died one week before his wedding and he continues to lash out at night (reviewed by Oswald & Evans, 1985).

In another case, a 27 year old man who is in good health worked as a fishmonger (reviewed by Oswald & Evans, 1985). He and one of his two brothers have sleepwalked since their childhood (usually in association with night terrors; particularly with the fear that the walls would crush him). At age 10, he awoke from sleep and threw a butter dish out of the window claiming to his parents that he believed it to be a bomb. At age 20, while struggling in his sleep one night to escape through a window, he cut the tendons of his hand so deeply that he needed plastic surgery. He lived with his second wife for a month before their wedding; three nights after, and two hours after retiring he jumped out of bed and tried to climb out of the window.

According to Oswald and Evans (1985), a 14 year old boy stayed overnight with his brother at his aunt's house. Earlier that day he had gotten into an argument with his friends. He seemed to be distraught about it throughout the night. At two a.m., the boy rose, entering the kitchen for some bread and butter. Shortly after, he stabbed his five-year-old girl cousin with the butter

knife, severely injuring her. He was down in the kitchen when he awoke to the cries of his cousin. He explained that he remembers having difficulty falling asleep and that he dozed off. He remembers going to the kitchen to eat some bread and butter and then upstairs to the bathroom. When he came out, he heard a noise from his cousin's room, so he went and checked on her. The next thing he remembered was finding himself downstairs with the knife and hearing the commotion he had caused. They believe that the boy was dreaming that he was fighting off his friends, due to the argument he had earlier in the day.

Similarly, Randall (2013) reviews the case of a 59 year-old man who lived in a motor home with his wife and had been married to her for almost 40 years. One night they went to bed after dinner and the man thought he was awoken by rowdy teenage boys around 11:30 p.m. He believed he was fighting them off, but when he snapped out of it, he realized there were no rowdy boys; it had been his wife that he was strangling the whole time. He immediately called 999 (911), but it was too late.

Another case depicts the role of lack of restful sleep in possibly triggering sleepwalking violence. Pillman (2009), describes how a 26 year-old man awoke from his sleep and brought his four month old daughter up to the attic. He tied her to the clothes line using her sleeves and put a napkin in her mouth to stop her from crying. He thought that child welfare was at the door and all he had to do was save his daughter and hide her. His wife came up to the attic, after waking up when he had left the room. After a second he snapped out of sleepwalking, realizing that it was his wife and not someone from child welfare. The baby was checked and no harm was done to her. He was admitted into a psychiatric hospital; doctors believe that he had this episode because of the change in his asthma medication and the stress from his work. His asthma medication was not working, causing him to have nocturnal shortness of breath and sleep fragmentation. His sleep had been inadequate for three to four weeks due to the night asthma attacks and during the daytime his concentration was slightly impaired.

These case studies collectively suggest that sleepwalking must be stemmed from childhood onset. Every one of these patients mentioned above had some case of sleepwalking before as a child. Some patients have an ongoing history of acting out during the night in comparison to other patients whose episodes came out of nowhere, possibly from an onset of stress. There are many causes and cases for sleepwalking but not many answers.

Case reports have indicated a person's state of mind during a violent sleepwalking episode undergoes a period of emotional stress before the attack (reviewed by Cartwright, 2004). The emotional stress is what issues an emergency response to the particular threat (Cartwright, 2004). A person who is sleepwalking can

walk, climb and drive without harm but not recognize a family member's face because the two pathways that involve facial recognition and guide movement are different (Cartwright, 2004). In our brain, our posterior parietal cortex is what guides our movement, but our midtemporal cortex is what allows us to recognize faces (Cartwright, 2004). In sleepwalking violence, sleepwalkers appear not to hear their victims cry out; they also do not register pain when they hurt themselves (Cartwright, 2004). A sleepwalking episode can worsen upon fever, sleep deprivation, and stress (reviewed by Ferentinos & Paparrigopoulos, 2009).

Stress is when a body feels it has been exposed to a harm or threat and results in a cluster of physiological changes (reviewed by Pinel, 2007). Stressors can be psychological (the loss of one's job) or physical (long-term exposure to cold) (Pinel, 2007).

Most of the data on sleepwalking violence is collected from case studies, and while often rich in information, are few in number and cannot be generalized. The case studies and evidence from past research offer the possibility that stress might contribute to sleepwalking violence. The aim of the current study is to explore ways in which physical stress has an effect on sleepwalking violence. I predict that sleepwalkers who engage in high levels of physical stress (exercise) will act out more during the night than sleepwalkers who engage in less stressful exercises.

PROPOSED METHOD

Study Design

This is a between subjects experimental study that will evaluate physical stress on sleepwalking violence.

Participants

This study will include children between the ages of 11 and 16 years old. There will be a total of 200 participants, both male and female. In order to participate in this program, children are required to have a recent or ongoing history of sleepwalking and must have experienced at least three to four sleepwalking episodes in the last eight weeks. Participants must be willing to attend a sleep-away sports camp for four consecutive weeks. These participants will be recruited by placing advertisements online on sleepwalking websites and discussions and by leaving information with pediatricians and sleep specialists. Advertisements will also be placed in local elementary, middle, and high schools to aid recruitment.

Measures

Each participant entering the camp will fill out an initial survey (see Appendix A) with demographic questions. Before each participant goes to sleep an additional survey will be administered (see Appendix B) questioning his/her physical and emotional stress level. This will give us an insight into the sleepwalker's mood when they are stressed out. Their feelings can have a correlation with how stressed out they become resulting in sleepwalking violence. Upon awakening each participant will fill out a survey (see Appendix C) answering if he/she had any episodes or dreams the night before and stating if and what he/she remembers. Every night, each participant will be monitored to see if any episodes occur. By having the participants fill out these surveys, researchers can gain an idea of participant's awareness to his/her sleepwalking. The reason researchers will ask about the topic of their dream is to see if there is a relationship to when/why sleepwalking occurs. For instance, if their dreams relate to someone chasing them, there could be a correlation of why that participant is acting out in their sleep.

Procedure

There will be two sleep-away summer sports camp sessions consisting of 100 participants each. The camp will last for four weeks. Each participant must have experienced three to four sleepwalking episodes in the last eight weeks. The participants will be separated into two groups equally dispersing boys and girls. The participants will have free time during the day to do arts/crafts/music/movies and more. Aside from their free time they will participate in sports activities such as bowling, baseball, tennis and soccer. They will practice 3-4 hours a day for every day of the week. The first hour of practice they will do stretches and run. The remaining 2-3 hours they will actually be playing the sports. This will all take place between 2:00 p.m. and 6:00 p.m. at night. All participants will complete the series of activities to enable natural stress levels exhibited in the chart below. For the first week both groups will be exposed to the same activity (bowling) at the same level (level one) of stress being induced. Week two, both groups will be increased to level two; the activity will be baseball. At this week, the control group will remain at level two for the rest of the study, while the experimental group will advance weekly to level four. The experimental group will be participating in tennis during week three and then soccer for week four. The assumption made here is that bowling and baseball are least physically stressful, followed by tennis, and lastly soccer. Additionally, changing sports causes a stress as well, whereas the comparison camp maintains the same activity for three weeks. Each night after the participant completes an activity, he/she must complete a survey before bed (see Appendix B). Upon bedtime, participants

will be monitored by a portable device to measure their mental and physical activity. Researchers will be able to specifically identify when the participant is active and their brain is stimulated throughout the night. Each individual will be provided with their own room and security guard, in order to prevent injuries caused by sleepwalking. Upon awakening each participant will fill out another survey (see Appendix C) answering if they had any episodes or dreams the night before and stating if and what they remember.

After all of the data is collected, the researcher will determine if there is a correlation between three different components: physical stress and sleepwalking violence, emotional stress and sleepwalking violence, and dreams and sleepwalking violence. If the participants have high ratings for physical and/or emotional stress and had sleepwalking episodes then there could be a relationship. Additionally, there could be a correlation found between participant's dreams and their sleepwalking habits.

	Stress Level		Activity	
	Experimental Group	Control Group	Experimental Group	Control Group
Week 1	Level 1		Bowling	
Week 2	Level 2		Baseball	
Week 3	Level 3	Level 2	Tennis	Baseball
Week 4	Level 4	Level 2	Soccer	Baseball

CONCLUDING REMARKS

Limitations

There are several limitations for this research. One ethical concern is that some individuals may feel the effects of the exercise lingering after the camp is over. Parental permission may limit the participants in this study, limiting the data. Another concern could also be that the parents may not like the methods being used. Participants may be more comfortable in their natural environment rather than the sleep-away camp setting. Therefore, the results could be different if this was done in a setting more comfortable to the participant. Finally, participants may inaccurately complete the surveys, falsifying the results from the exertion exercises.

Significance

This study will allow for testing the effects of violence on sleepwalking and to see if physical stress plays a part in this role. Compared to the experimental group, I believe that participants in the control group will experience little to no violence but may experience disturbances throughout their sleep. If the results support my hypothesis, this study may lead to the encouragement of developing stress reducing techniques to limit sleepwalking violence.

Determining whether stress (coming from physical activity during the day) contributes to sleepwalking violence is important. If physical exercise during the day is more exerting and causes more sleepwalking and/or sleepwalking violence, we have an insight into prevention.

The significance of the study is to determine if there is a correlation between physical stress and someone who sleepwalks. If we can find a relationship between the two, we can begin to develop treatments or therapies that could reduce the amount of sleepwalking in people all around the world. Reducing stress could cause less injury to the sleepwalkers themselves as well as people around them.

APPENDIX A

Please fill in the blanks and circle when needed:

Name: _____

Age: _____

Gender: Male Female

How many sleepwalking episodes have you had in the last eight weeks?

3 4-5 6 or more

On a scale of 1 to 10, what do you feel your stress level is on a daily basis?

1= least stressful

10= most stressful

APPENDIX B

Please fill in a number on the line provided below:

On a scale of 1 to 10, what is the physical stress level you feel you have experienced today?

1= least stressful

10= most stressful

Before your sports activity how were you feeling? (Please check all that apply)

___Excited ___Happy ___Neutral ___Exhausted/Tired
 ___Sad ___Mad/Angry

After your sports activity how were you feeling? (Please check all that apply)

___Excited ___Happy ___Neutral ___Exhausted/Tired
 ___Sad ___Mad/Angry

APPENDIX C

Please circle and fill in the blank if necessary: (if you need more room to write, feel free to write on the back of this paper).

Do you think you had a sleepwalking episode last night?

Yes No

If yes, do you think you encountered a violent act within your episode?

Yes No

Do you remember having a sleepwalking episode? Yes No

If yes, please write in the space provided anything that you remember:

Did you remember having any dreams last night? Yes No

If yes, please write in the space provided anything that you remember: (example: scary, happy, sad, etc; being chased, sitting on the couch, etc):

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