Obstructive Sleep Apnea: Capstone Screening Project

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Sufficient sleep should be considered a “vital sign” of good health and should not be considered a luxury. Over 25 percent of the U.S. population report that they occasionally do not have enough sleep. However the CDC reports that there are new methods for assessing and treating sleep disorders that will bring hope to the millions suffering from insufficient sleep. Sleep apnea is one of the most common sleep disorders causing insufficient sleep. One of the main signs of sleep apnea is snoring and people who have sleep apnea characteristically make a gasping or snorting noise during their sleep and their sleep is momentarily interrupted. They may experience excessive daytime sleepiness, as their sleep is commonly interrupted (CDC, 2012).

The most common form of sleep apnea is obstructive sleep apnea (OSA). This is a potentially serious sleep disorder in which breathing repeatedly stops and starts during sleep. This occurs when the throat muscles intermittently relax and block the airway during sleep. The most noticeable sign of OSA is snoring. Anyone can develop this disorder although it is most common in middle-aged and older adults and those who are overweight (Mayo Clinic, 2012). Symptoms should be taken seriously, as an interruption of regular breathing or obstruction of the airway during sleep can pose serious health complications. Treatment should be sought from a healthcare provider (CDC, 2012).

The treatment for sleep apnea depends on its cause. If other medical problems are present, such as congestive heart failure or nasal obstruction, sleep apnea may resolve with treatment of the condition. Treatment for OSA includes the use of gentle air pressure administered during sleep (typically in the form of a nasal continuous positive airway pressure device referred to as a c-pap). Others may undergo a procedure to change the structure of their nose, mouth, or throat in order to treat this disorder (Mayo Clinic, 2012). OSA is estimated to have an incidence of 24 percent in men and 9 percent in women. There is also a belief by
researchers that there is a correlation between sleep disordered breathing and hypertension. This is believed to be due to sleep fragmentation, intermittent hypoxemia, and increased sympathetic tone resulting in a higher mortality and morbidity rate. Therefore it is desirable to attempt to diagnose all patients with OSA to institute early treatment intervention, and to prevent the development of further complications. The current and most accurate method for diagnosing OSA is the level I polysomnogram, but due to limited resources, including the number of recording beds, high cost, long waiting lists, and labor requirements, screening tools such as clinical predictors or questionnaires that may help to identify higher-risk individuals are frequently used. Other screening devices in the form of single or multiple channel monitoring systems have also been introduced and may represent an alternative method to diagnose OSA (Pang and Terris, 2006).

Clinical predictive models generally target the symptoms of OSA both at night and during the day. The symptoms frequently reviewed at night include snoring, choking at night, witnessed apneic episodes, nocturia (need to get up at night to urinate), and frequent arousals. Those that generally manifest during the day include excessive daytime drowsiness, poor concentration, poor memory, mood changes, and irritability (Pang and Terris, 2006). Research of those who snore who underwent an attended, hospital-based overnight polysomnogram found that 87.5 percent of loud habitual snorers have OSA with 72 percent of those complaining of excessive daytime sleepiness (Puvanendran and Goh, 1999). Other studies suggest that between 41 and 37 percent of patients with OSA will have excessive daytime sleepiness. However, when snoring is combined with other apneic events, such as those described above, the likelihood of finding OSA is higher (Pang and Terris, 2006).
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Given this, there have been several questionnaires and prediction models used to differentiate the OSA patients from snorers. Current research suggests that the most promising models used to screen for OSA include the respiratory disturbance index (RDI), which uses portable monitors to record and quantitate respiratory disturbances (Flemons and Littner, 2003); the Berlin Questionnaire, an 11-item questionnaire that asks questions about snoring, behavior, wake time sleepiness or fatigue, obesity, and hypertension (Reyes and Clark, 2010) and uses a risk grouping system to predict the likelihood of the patient to have OSA (Netzer et al., 1999); the Epworth sleepiness scale that considers snoring, gasping at night, witnessed apneas, age, sex and BMI (Maslin et al. 1995); and the apnea risk evaluation system (ARES) that combines features of other established screens including the Berlin and Epworth (Reyes and Clark, 2010). Other predictive models or screening methods used include the physical examination model that considers snoring, body mass index (BMI), age, and sex (Viner et al., 1991); the use of artificial neural nets (i.e., a computational simulation of a biological neural network) designed to assess 23 clinical variables including patient biomedical data, sleepiness, smoking, alcohol history, and physical examination (Kirby et al., 1999); and the Kushida Index that uses of a predictive formula of quantitative measurement to look at BMI, neck circumference, oral cavity measurements, palatal height, maxillary intermolar distance, mandibular intermolar distance, and overjet measurement (Pang and Terris, 2006).

Ideally, the screening device should be cheap, readily accessible, and easily used with minimal instructions, have no risk or side effects to the patient, and be safe and accurate (Pang and Terris, 2006). Specificity and sensitivity, as well as the positive and negative predictive values can be used to help determine which of the most promising screening mechanisms/predictive models are best to be used with at-risk populations. These can be
considered with regards to the four most promising listed above i.e., the RDI, Berlin, Epworth, and ARES.

The RDI has a sensitivity of 90 percent, a specificity of 88 percent, a positive predictive value (PPV) of 83.3 percent and a negative predictive value (NPV) of 93.0 percent. This means that patients testing positive with a false-positive result were 16.7 percent and those testing negative with a false-negative result were 7.0 percent (Flemons and Littner, 2003). The Berlin Questionnaire has a sensitivity of 67.9 percent, a specificity of 54.8 percent, a PPV of 72 percent and a NPV of 50 percent. This means that patients testing positive with a false-positive result were 28 percent and those testing negative with a false-negative result were 50 percent (Reyes and Clark, 2010). The Epworth sleepiness scale has a sensitivity of 60 percent, a specificity of 82 percent, a PPV of 85 percent and a NPV of 52 percent. This means that patients testing positive with a false-positive result were 15 percent and those testing negative with a false-negative result were 48 percent (Echevarria et al., 2000). The ARES questionnaire has a sensitivity of 90.6 percent, a specificity of 43.2 percent, a PPV of 73.8 percent and a NPV of 73.7 percent. This means that patients testing positive with a false-positive result were 26.2 percent and those testing negative with a false-negative result were 26.3 percent (Reyes and Clark, 2010). These are reflected in Figure 1 below.

Figure 1. Specificity, Sensitivity, PPV, NPV, and false positive and negative percentages for predictive models of OSA

<table>
<thead>
<tr>
<th>Predictive Model</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>PPN</th>
<th>False +</th>
<th>False -</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDI</td>
<td>90.0%</td>
<td>88.0%</td>
<td>83.3%</td>
<td>93.0%</td>
<td>16.7%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Berlin</td>
<td>67.9%</td>
<td>54.8%</td>
<td>72.0%</td>
<td>50.0%</td>
<td>28.0%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Epworth</td>
<td>60.0%</td>
<td>82.0%</td>
<td>85.0%</td>
<td>52.0%</td>
<td>15.0%</td>
<td>48.0%</td>
</tr>
<tr>
<td>ARES</td>
<td>90.6%</td>
<td>43.2%</td>
<td>73.8%</td>
<td>73.7%</td>
<td>26.2%</td>
<td>26.3%</td>
</tr>
</tbody>
</table>
Currently, the target population to be screened for OSA is those who have been identified to snore. It is also administered to those who are at risk for sleep apnea. These include persons who are overweight or obese, male (as men are more likely than women to have OSA), are older (generally over 60), have high blood pressure, smoke, have a metabolic syndrome, and/or have a family history of sleep apnea, or diabetes. Additionally, those who have small airways in their noses, throats, or mouths or enlarged tonsil tissues, or meet the risk factors for stroke or heart failure (National Heart, Lung, and Blood Institute, 2012). Screening tests are generally used to determine who may need to be referred to a sleep lab for a polysomnogram to determine if the person actually has OSA (Pang and Terris, 2006).

Sleep is something generally taken for granted, and is usually considered to be a passive activity. However, it is now increasingly being recognized as a source of public health concern and is essential for health promotion and chronic disease prevention. According to the Centers for Disease Control and Prevention (CDC), insufficient sleep and OSA is associated with a number of chronic disease, obesity, and depression making it a threat to the health of the nation. They explain that insufficient sleep and OSA is associated with the onset of these diseases and also poses important implication for their management and outcome. Additionally, insufficient sleep is responsible for motor vehicle and machinery-related crashes, causing substantial injury and disability every year. Comparatively, “a driver who is tired can be just as dangerous and preventable as one who is intoxicated” (CDC, 2012). Ethically, the public health field is responsible to try to identify those who may require treatment and address this issue for the safety and well being of the nation.

Base on the information written in this report, it is recommended that New Mexico initiate a screening campaign to educate, identify, and treat those who suffer from OSA. It is
recommended that the screening campaign to start with Albuquerque, NM. Albuquerque is the most populous city having over one fourth of the entire population of the state (26.6 percent) (U.S. Census Bureau, 2013). The target population of the campaign should be men 60 years and older (as men are more like to have the OSA than women and those who are older are more likely to have OSA as well) (National Heart, Lung, and Blood Institute, 2012).

The screening campaign that would include the following: a three tier screening system that incorporates the Berlin questionnaire, the RDI, and the polysomnogram. The first tier would require that all primary care, internal medicine, and geriatric physicians administer the Berlin questionnaire to all men annually starting at age 60 during their annual physical examination. Next, it would be indicated that the Berlin questionnaire also be administered to women 60 years and older at the recommendation of the physician.

The Berlin is recommended in lieu of the ARES because the test can be administered at no cost to either the provider or patient. Because of this, there is a higher chance of compliance with the requirement ensuring that it will be administered by providers/physicians if they do not have to purchase, order, or have it administered on a proprietary form. The Berlin questionnaire also has a 72 percent PPV with a 28 percent chance that those with a positive result will have a false positive (Reyes and Clark, 2010) this should yield results with enough accuracy to initially identify those who may require further screening and or testing.

The second tier of the campaign would include a secondary test for that those who tested positive for OSA on the Berlin questionnaire. The second tier of testing is the RDI. This test can be administered at the patient’s home with a portable monitor that records and quantitates respiratory disturbances. This test has an 83.3 percent PPV and a 93.3 percent NPV. The chance of a false negative is 7 percent (Flemons and Littner, 2003). This test should be able to rule out
most of the people who do not have OSA. Finally the third tier of testing should include an overnight trip to the sleep lab for a polysomnogram for all those who did not test negative for OSA using the RDI. This test will be able to provide the most accurate information for diagnosing OSA.

Implementing this three tier system should effectively assist providers to more accurately assess those who require comprehensive testing. By first identifying those who may display the symptoms to place them at a higher risk for OSA, the providers/physicians are able to place more emphasis on the associated health risk of these individuals, sending them for further testing. Having the second tier allows for an initial rule out diagnosis of OSA for with the RDI. This method is more readily available and accessible and can be used to effectively separate those who do not have the diagnosis from those who may need the more costly evaluation. The third tier of the campaign allows for a comprehensive evaluation of those who have been identified as being high risk for OSA. Using this three tier should ideally reduce the number of persons waiting to have comprehensive testing, allowing those who are at higher risk to have better access to services. This should also reduce incidental costs, as those who may not require the more comprehensive testing for OSA i.e., the third tier will be ruled out through the other processes.

Participation in the screen would be encouraged through the development of a strategic plan based on the ecological model. The plan would be developed by first conducting a gap analysis of the provider system as well as the current processes for OSA education, screening, diagnostics, and treatment in the Albuquerque area. Next, the plan would allow for “buy-in” from the community, proving an opportunity for internal and external stakeholders to provide recommendations and comments to the Department of Health. This would be accomplished by
inviting participants from differing areas to participate in a summit to assist with the development of the ecological model. The participants would include persons with OSA, persons without OSA, persons 60 and over, persons under 60, providers (to include physicians, nurses, specialists), those who operate the sleep labs, the public health regional offices, Indian health services, the local health plans, Albuquerque hospitals coalition, medical and nursing boards, the office of epidemiology, and other interested parties. Equal representation would be expected from all areas.

The goal of the summit would be to develop the ecological model promotion and participation strategic plan designed to educate and encourage participation at all levels addressing the 1) individual, 2) interpersonal, 3) organizational, 4) community, and 5) public policy aspects of participation (Schneider, 2011). Once the recommendations are developed by the summit of stakeholders, they would then be sent to a smaller steering committee consisting of membership from all of the areas invited to the summit. The steering committee would review the recommendations and develop a strategic plan for education, promotion, and participation in the campaign. After completion, the plan would be submitted for public comment, reviewed by the legislative relations departments and rule writers, and any policy or rule changes would be initiated. Finally, any staff needed to carry out the plan would be advertised and hired, and/or reassign to initiate and monitor the implementation of the campaign and strategic plan.
References


