**Review:**

Effects of Music on Health: The Plight of the Piper.

Authors:

Oluwaseyitan Adesegun, Department of Internal Medicine, Babcock University Teaching Hospital, Ilishan-Remo, Ogun State,

Olusegun Ojuola, Department of Music, School of Education and Humanities, Babcock University, Ilishan-Remo, Ogun State,

Ayokunle Osonuga, Department of Internal Medicine, Babcock University Teaching Hospital, Ilishan-Remo, Ogun State,

Akolade O. Idowu, Department of Internal Medicine, Babcock University Teaching Hospital, Ilishan-Remo, Ogun State, Benjamin S. Carson School of Medicine, Babcock University, Ilishan-Remo, Ogun State.

Address for Correspondence

Oluwaseyitan Adesegun,
Department of Internal Medicine, Babcock University Teaching Hospital, Ilishan-Remo, Ogun State.

E-mail: oluwaseyitanaadesegun@gmail.com.

Citation


Submitted: June 22, 2019; Accepted: Oct 10, 2019; Published: Oct 30, 2019

**Abstract:** Music, an important tool of social and cultural value, has found relevance in healthcare and is being harnessed for therapeutic purposes. However, the art of producing music with musical instruments, has potential health benefits and hazards, which are often ignored. In this article, we review literature, and expound on the effects of playing wind instruments on the health of the player. Some authors have documented superior lung function and a lower risk of obstructive sleep apnea amongst wind instrumentalists. However, the list of health hazards associated with playing wind instruments exceed the potential benefits, with myriad cases of adverse events documented following wind instrument playing. Many of these adverse events are as a result of increased pressures (intra-thoracic, intra-abdominal, intra-ocular, intra-cranial etc.), especially with high resistance instruments, when delivering high pitches and volumes. It is recommended that wind instrument players be aware of the potential health benefits and risks associated with playing their instruments, avoid prolonged playing, ensure adequate rest intervals between playing, and avail themselves of regular (at least annual) medical fitness checks, with special attention paid to their otolaryngologic, cardiovascular, respiratory and ocular health.

**Key Words:** Music, Health, Wind instrumentalists, Wind instruments

**Introduction:**

Health, as obviated by the World Health Organisation is a term that indicates wholeness, which goes beyond the physical, to include the mental and social wellbeing of an individual[1]. Music on the other hand has been defined by many, as the science or art of ordering sounds into meaningful combinations that can be perceived and appreciated by people in their social context. There is growing interest in the utilization of the arts as therapy for the ill, in providing psychological and physiological therapeutic benefits. Music has been reported to have cardiovascular benefits of reducing heart rate and blood pressure, as well as dropping cortisol levels, a hormone that rises in moments of stress[2]. Researchers have used music to reduce the perception of pain by patients undergoing hemodialysis, while some others have found lower degrees of anxiety, and better attention and memory in those who listened to music[3–6]. Music does have beneficial effects on health but seldom do we consider the effects of being a musician on health. Children that play musical instruments have been demonstrated to have higher intelligence quotients(IQs)[7,8], as well as neurocognitive development and preserved cognitive functioning in old age[9,10]. However, there are some unfavourable health outcomes, occupational hazards, that could result from playing certain music instruments, ranging from musculoskeletal disorders in violinists, to disorders of the ears, larynx and lungs in horn players.

In this article, we attempt to detail the effects of musicianship on health, with a focus on wind instrument players. We discuss the benefits, as well as the health challenges that result from playing wind instruments, and make recommendations to help the musician make the best of the art, while being a potential source of restoration through the music he/she produces.

**Wind Instruments in Music**

Wind Instruments generally belong to the family of Aerophones, instruments in which a fluctuating airflow generates sound[11]. However, wind instruments are conventionally divided into two large classes, namely “woodwind” and “brass”, according to the method by which sound is generated[12].

Woodwind Instruments comprise of these families of instruments; Flute family (piccolo, flute, and recorder), Clarinet family (clarinet and bass clarinet), Oboe family (oboe and cor anglais), Bassoon family (bassoon and contra-bassoon), and Saxophone family (soprano, alto, tenor, baritone, and bass saxophones). Woodwinds produce vibrations of air within a tube that was traditionally made of wood, although some are made of metal, such as flutes, piccolos, and saxophone family. The unique tone colour of woodwinds can be felt in concert with other orchestral instruments. For example, the piccolo and the flute have high pitch range that is extremely agile, shrilling, and whistle-like. Conversely, the oboe and bassoon have nasal, intense, and
expressive tone. The clarinet can produce tones very rapidly while the saxophone is rich, husky, and speech-like[13]. Brass instruments on the other hand, comprise of the trumpet, cornet, French horn, bugle, trombone, euphonium, and tuba. Brasses are actually made of brass. They produce vibrations through the manipulative control of the player’s lips as he or she blows into a cup or funnel shaped mouthpiece. The vibrations are amplified and coloured in a tube that is coiled, and flared at the end to form a bell. Brasses are powerful instruments, often used at climaxes and for bold heroic statements. They can also play rapid solo passages[13]. Brasses are common features of the symphonic orchestra, military bands, jazz, and other traditional dance bands. The techniques of playing brass instruments generally consist in the way and manner the player controls the tension of the lip muscles, and directing the stream of air through the lips into the mouthpiece. However, pressing the mouthpiece hard against the lips to produce higher notes can result in the reduction of blood supply to the lips[11].

Moreover, the volume of tone produced depends on the flow rate of air through the instrument, and is controlled by the player’s lungs. A note can be initiated simply by blowing, while the diaphragm is tightened to give a sharp puff of air. The player’s control of tone requires a great skill, and also depends on many factors, principally the shape of the air column inside the player’s mouth, larynx, trachea, and lungs. Hence, brass players are generally advised to “adopt an upright body posture, relax the muscles of the throat, and think in terms of producing tone by diaphragm support”[11].

Relevant Anatomy and Physiology of the Airway and Auditory Tract

Anatomy and Physiology of the Airway

The pathway for air to reach the lungs from the exterior, though long and convoluted, is the essential route for success in breathing, olfaction and phonation. Air, while passing through the nasal cavities to the nasopharynx is warmed, humidified and filtered of particulate matter by the action of the pseudostratified ciliated columnar epithelium and goblet cells. The air subsequently passes to the oropharynx and hypopharynx which serves as a common pathway for air inhaled nasally and orally. The oral cavity serves as an alternate pathway for air to reach in and out of the lungs. It is lined by stratified squamous epithelium and the tongue is continuous posteriorly with the epiglottis. The larynx, which is the organ of phonation, lies below the hypopharynx and protects the lower airway from contents of the gastrointestinal tract through the valve-like action of the epiglottis, a fibrous cartilaginous structure which overhangs the laryngeal inlet[14]. The larynx then leads to the trachea which branches into smaller units (bronchi and bronchioles) before terminating at the alveolar sacs, the primary units of the respiratory system responsible for gas exchange. For air to move into the lungs (inspiration), the alveolar pressure must drop below the atmospheric pressure, thereby producing a pressure gradient for which air would flow into the lungs actively, with the aid of the diaphragm, intercostal muscles and neck muscles. Expiration however, is achieved when alveolar pressure exceeds the atmospheric pressure, forcing air out of the lungs by elastic recoil of the lungs and chest wall[15].

For the purpose of future reference, Vital capacity (VC) is the total volume of air that can be exhaled after a maximum inhalation[16].

Anatomy and physiology of the Ear

The ear subserves the special sense of hearing, which is the conscious appreciation of vibrations perceived as sound. The ears are designed to trap sound waves and conduct them to the brain for interpretation. Without an intact sense of hearing, appreciating music would be physically impossible. The young human ear can detect sound ranging from 20-20,000Hz, though frequencies of 1000-4000Hz are more easily appreciated[17]. The pinnae are bilaterally symmetrical and are shaped to focus sound to reach the tympanic membrane via the external auditory canal. The sound waves, such as may be transmitted to the ossicles (malleus, incus and stapes) located in the air-filled space called the middle ear, to the cochlea’s inner hair cells, which transduces the sound waves into electrical impulses sent to the higher centres. The listener becomes aware of sound only when it has gone through the above pathway and has been processed by the primary auditory cortex[18].

The Eustachian tube connects the middle ear to the nasopharynx. It functions to equilibrate atmospheric pressure with pressure in the middle ear, drains the mucus from the middle ear and protects it from unwanted pressure fluctuations and loud sounds[19]. The Eustachian tube normally opens periodically for a short duration, especially during yawning, swallowing and during some mouth or neck manoeuvres; it remains closed otherwise[20].

Health Benefits of Playing Wind Instruments

Aside from the numerous health benefits of playing musical instruments in general, wind instrument players have been reported to enjoy certain benefits, such as having a larger vital capacity than expected for age and height[21]. This implies that a larger volume of oxygen can be taken in and exchanged for carbon dioxide over longer periods of time in wind instrumentalists. This may be so because the musician will need to develop the art of observing deep inspiratory and expiratory cycles in order to execute a musical passage seamlessly. Another study noted that the longer the wind instrumentalist had been in employment, the better the lung function[22]. Studies have shown that asthmatic teenagers and school children who played wind instruments not only had better control of their asthma, but also had better lung function than non-wind instrumentalists, which may be attributable to them practicing their instruments regularly[23],[24]. Some researchers have demonstrated a reduced risk of developing obstructive sleep apnoea syndrome (OSAS) in wind instrumentalists due to a supposed strengthening of the oropharyngeal wall[25]. However this has been disputed by other researchers[26].

Hearing and Ear Related Disorders in Wind Instrument Players

Instruments like the trumpet and saxophone are known to be able to generate very high decibels (dB) of sound. However, a single exposure to loud sounds is not as dangerous to the hearing as repeated and prolonged exposure, such as may be seen in musicians that play in big bands or orchestras[27], who are often exposed to noise in excess of the recommended 85dB[28]. The highest sound exposure levels within the orchestra were found to be among percussionists and flute/piccolo players (95 dB), and brass players(92-94 dB) in a particular study[27]. Kahari et al confirms that brass instrumentalists have slightly worse hearing thresholds when compared to other musicians; other features could include ear fatigue, ear-aches, noise intolerance, tinnitus and sleep disturbance[29].

Another rarely mentioned disorder related to the auditory system, that could be seen in wind instrumentalists is a patulous Eustachian tube. This is when the Eustachian tube remains abnormally open, and is due to dysfunction of the tensor veli palatine muscle from constant pressure on the Eustachian tube leading to loss of muscle tone. Individuals with this disorder have an abnormal sensation of their own voice as echoes, loud and low-pitched. It can be distressing to the musician, but is relieved by lying down, which causes the Eustachian tube to close[20].

Airway Disorders in Wind Instrument Players

Airway disorders have been found to be more prevalent among wind instrumentalists than their counterparts who play other musical instruments, including disorders such as sinustis,
nasal catarrh and hoarseness[22]. The relationship between asthma and wind instrument players remains unclear, like the camouflage mystery of which came first “the chicken or the egg”. While wind instruments playing has been shown to have therapeutic benefits on individuals with asthma[23], asthma has also been shown to impair lung function in wind instrumentalists[30,31]. Another possible but rare complication of playing wind instruments is hemoptysis[32] due to the shear force/barotrauma from playing these instruments, which may cause micro-injuries to the delicate respiratory lining.

A laryngocoele can be a direct complication of prolonged positive pressure in the airway. It is an abnormal dilation of the laryngeal saccule, a membranous sac between the false vocal cords and the inner surface of the thyroid cartilage. It often presents with a “harmless” bulge in the neck made prominent when blowing through the instrument (increasing intralaryngeal pressure), but regresses afterwards. It could present with hoarseness and airway obstruction[33]. Potential hazards exist in the sharing of instrument mouthpieces which often harbours myriad pathogenic microbes, ranging from simple bacteria, moulds and yeasts to mycobacterium tuberculosis which can last up to 13 days on a clarinet’s reed. This microbial contamination has been documented to be more severe in reed instruments[34]. An immune mediated allergic reaction called hypersensitivity pneumonitis has been reported in some professional wind instrumentalists, who had features of interstitial lung disease. Certain moulds and mycobacteria were isolated from their instruments (the trombone and bassoon)[35,36]. Wind instrument playing has been suggested as a possible risk factor in the development of lung cancer, as 2 out of 132 cases of lung cancer played wind instruments[37]. However a past history of smoking in both patients serves as a confounder, hence higher levels of evidence is needed to prove this hypothesis, and possible pathophysiologic mechanisms need to be propounded.

Other Health Concerns

Several other health concerns have been raised amongst wind instrument players, as a consequence of playing such instruments. Musculoskeletal disorders are common among musicians[38] and result from prolonged and repetitive overload of the muscle-tendon unit in awkward positions, otherwise termed overuse syndrome[39], especially affecting the forearms, wrist and hands[40]. This often results in chronic pain, with no other identifiable etiology, and loss of function. A study on upper extremity problems associated with instrument playing revealed that the tendon-lens dressing was most common. The proportion of flutists and other woodwind instrumentalists who had strains was 25% and 68.2% respectively[40]. Inflammatory conditions such as De quervain’s tenosynovitis have been reported amongst wind instrument players as well[40]. Embouchure problems have also been reported amongst wind instrument players. An embouchure is “the position and use of the lips, tongue, and teeth in playing a wind instrument”. One study that reviewed 81 brass instrumentalists over a 16-year period found that slightly over half (53%) of the study participants had embouchure problems including dystonia, overuse phenomena, soft tissue injuries, sensory and motor disturbances of the lip. These myriad conditions resulted in impairment in lip control, problems of articulation or tone quality, loss of seal, pain, swelling and discolouration[42], all of which would impact instrument playing negatively. Due to increased intra-thoracic and intra-abdominal pressures associated with blowing wind instruments, several disorders associated with increased pressures may result.

The normal physiological response to the Valsalva manoeuvre is an initial decrease in blood pressure, as the rise in intra-thoracic pressure causes a drop in venous return and stroke volume. However there is a counteractive baroreflex that causes an increase in sympathetic output which consequently increases the blood pressure towards normal[43]. Whether there sustained increase in mean arterial pressure could result in significant morbidity in the wind instrumentalist, is subject to research. Changes in cerebral blood flow correspond with the hemodynamic changes observed during the Valsalva manoeuvre. The mean cerebral blood flow velocity can rise greater than 50% above baseline in stage IV, where a corresponding increase in mean arterial blood pressure is observed[44]. Cerebrovascular events, both ischemic and hemorrhagic, are documented aftermarts of wind instrument playing. A healthy 49 year old man was reported to have awoken with lateralisigns (left arm hemianaesthesia and weakness) with upper motor neuron features, which developed after he had practiced the shofar (a high resistance instrument) for an hour a night before, in preparation for an event. Confounders such as a history of high blood pressure were absent and the funduscopic examination, chest radiograph, electrocardiogram, carotid duplex, and all blood tests were normal. Computed tomography (CT) scan confirmed a hyperdensity in the right temporal lobe, consistent with a bleed[46]. Other cerebrovascular events that could occur in wind instrument players, including syncope, carotid artery dissection, transient ischemic attack due to paradoxical embolism (in a patient with a coexisting patent foramen ovale), spinal epidural hematoma, and cerebral venous thrombosis, which have been reported to occur howbeit rarely[47].

Ingual hernia has been described to occur in a 65-year old bag-piper who developed symptoms of inguinal hernia while playing his instrument, and had been playing for 10 years. Sharp rises in intracranial pressure (IOP) have been recorded in wind instrumentalists, when high resistance instruments were played normally and forcefully (to achieve higher volumes and pitches), as high as 42mmHg. Lower rises in IOP were also noted in low-resistance instrument players, and IOPs were noted to drop to normal values when playing was stopped[48]. Interestingly, IOP rises were smaller in professional players than in lay players[48], alluding to the role that technique plays in producing sound from wind instruments, without incurring deleterious effects on the player. Other researchers have also reported increases in IOP after playing wind instruments[49], however one study reported that the differences in prevalence of glaucoma in wind versus non-wind orchestra instrumentalists was not significant. It can be therefore surmised that, when increased, the increased risk of glaucomatous change in the optic nerve of wind instrument players, but establishing a direct causal link would require more evidence[50].

Implications for the Wind Instrumentalist

Wind instruments in their various forms, shapes and sizes do affect the health of the player, perhaps more than they do the listener. Players may benefit from improved respiratory health and improvement in symptoms for those who have chronic lung diseases such as asthma. However, the increased pressure (intra-thoracic, intra-abdominal, intra-ocular, intra-cranial etc.) can lead to detrimental outcomes on the player. This is particularly true for those who play high-resistance instruments. We, however, are not against playing wind instruments, instead, we recommend that wind instrumentalists be aware that such hazards exist. We also recommend that wind instrumentalists refrain from prolonged playing, for long stretches of time, especially when high pitches and volumes are required in executing a passage of music. It is advised that intervals of rest be observed between plays. It would also benefit the player to observe at least, annual check-ups with their physician, with particular attention paid to otolaryngologic, cardiovascular, respiratory and ocular health.
Conclusion
We have reviewed literature to expound on the effects of musicianship on health, particularly as regards wind instrument players. Health benefits exist for those who play wind instruments, including those with respiratory pathologies like asthma. However some adverse health events, though rare, have been documented amongst wind instrument players. It is therefore imperative that these individuals be aware of such occupational hazards, and avail themselves of regular health checks to avoid sudden, unexpected deterioration in health. There is need for higher levels of evidence (e.g. case control or cohort studies) to establish a stronger case for causality between wind instrument playing and the various hazards discussed.

Conflict of Interest
The authors have no conflicts of interest to disclose.

PS – Authors Oluwaseyitan Aidesgun and Olusegun Ojuela are musicians in their own right. OA plays the piano and trumpet, with particular interest in jazz and classical music, while OO plays the piano, with interest in Musicology and Choral conducting, and also teaches music professionally.

Funding
No funding, in any form, was received for this research work.

References


