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# The Female Athlete Triad at Pace

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THE FEMALE ATHLETE TRIAD AT PACE

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Advisor Signature Approval Page:

Abstract:

The Female Athlete Triad (Triad) is an interrelationship of energy deficiency, menstrual dysfunction, and decreased bone mineral density. Diagnosis and treatment of the Triad is often complicated or simply unknown. An anonymous, online survey was conducted among current female students enrolled in the Pace University BFA Commercial Dance Program, ages 18-22, measuring for the prevalence of the Triad. Findings from this survey demonstrate a presence of the Triad within the program. Incorporating athletic trainers and pre-participation screenings has been shown to prepare dancers to eat better, lessen the likelihood of injury, and increase the likelihood of career longevity. The incorporation of an athletic trainer who implements screenings would increase the standard of dancer wellness at Pace University.

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### Introduction:

The Female Athlete Triad was first coined by the American College of Sports Medicine in 1992 after many experts in the field noticed a pattern among adolescent and young adult female athlete patients. The pattern consisted of low energy availability, menstrual dysfunction, and decreased bone mineral density. Even though this condition has been described for almost three decades, there is still much debate about how clinicians should manage patients with this complicated condition. Symptoms of the Female Athlete Triad are common among dancers, and the Pace University BFA Commercial Dance students are not excluded.

### Literature Review:

In Taraneh G. Nazem and Kathryn E. Ackerman article “The Female Athlete Triad,” the authors define the Triad as “a constellation of 3 clinical entities: menstrual dysfunction, low energy availability (with or without an eating disorder), and decreased bone mineral density (BMD)” (2012). The *Female Athlete Triad Coalition* is an international consortium whose goal is to prevent the Triad through advocacy, education, international research, public policy, and research. Emily Southmayd of the *Triad Coalition* says that females who are diagnosed with the Triad suffer from one if not all of the following three interrelated conditions: low energy with or without disordered eating or a clinical eating disorder diagnosis, irregular or missing periods, and low bone density or osteoporosis (Southmayd, 2017). Amy Avery and Jane Baas published for The International Association for Dance Medicine and Science (IADMS) that the Triad in young active females can result from disordered eating patterns, therefore causing severe health consequences such as amenorrhea, the loss of menstruations, or osteoporosis, a decrease of bone mineral density. Some of the abnormal dieting behaviors that could trigger the Triad include

restrictive eating, fasting, using diet pills, diuretics, enemas, overeating, bingeing, and purging (Avery & Baas, 2015). These sources were very valuable because of their clarity and thoroughness. The symptoms of the Triad were relayed so transparently that a reader who is unfamiliar with this content could easily understand.

Complications of the Triad are varied and interrelated. Nazem and Ackerman published: “Menstrual dysfunction may lead to infertility due to lack of ovarian follicular development, anovulation, or luteal-phase defects.... Women with the Triad also have decreased immune function and impaired skeletal muscle oxidative metabolism” (2012). The authors assert that many athletes with low bone density and/or menstrual irregularity often suffer from stress fractures; menstrual irregularity can directly increase this risk of injury. Amenorrheic athletes have two to four times greater risk for stress fractures than their counterparts with regular menstruation (p.7). Lastly, decreased energy availability can cause nutritional deficits which can be detrimental to the body’s ability to build bone, maintain muscle mass, repair damaged tissue, and recover from injury (p.8). IADMS states, “Without the proper intervention, the consequences of the Triad can be as simple as the loss of participation in a physical activity or as severe as emaciation or death” (2015, p.2). All researchers can agree that the severe health conditions of the Triad can have devastating life-long effects. These sources indicating the severe risks associated with Triad were also very helpful in conducting this research. Not only did these sources provide insight on questions that could be structured in this survey, but it also emphasized the need for further research in this area. If female athletes are at risk of infertility, decreased immune function, impaired skeletal muscle oxidative metabolism, or even emaciation



or death because of this condition, there must be a greater sense of urgency in researching and preventing the Triad among all female athlete communities.

Despite the resources available in characterizing the Triad, treatment of the condition is still controversial. Most methods are incomplete at this time, but there is a general consensus among experts that the most effective forms of intervention for the Female Athlete Triad are education, prevention, and diet regulation to encourage the resumption of menstruation and increase bone health.

Education has to come first because we simply cannot fix something if we do not know it exists. Avery and Baas agree, being aware of a situation is the first step in changing behavior. In 1998, the American College of Sports Medicine advised that detailed approaches should be established to identify, prevent, and treat the Triad. Some of these strategies included education about the Triad for a wide range of individuals, such as teachers, choreographers, directors, coaches, trainers, administrators, health care providers, parents, and the dancers/athletes themselves (2015). The *Female Athlete Triad Coalition* specifies particular signs to be aware of: “1) preoccupation with weight, food, body image, and avoidance of meals, 2) excessive or compulsive exercise, 3) history of depression, perfectionist and/or obsessive tendencies, 4) recurrent injuries and stress fractures, and 5) extreme fatigue and/or mood changes” (2017, p. 2). These are signs that can be seen by the athlete but more importantly, by those around her if they know what to look for. This source was vital in shaping the content of this survey. Questions in the survey asked about the aforementioned signs directly to indicate the presence or upcoming presence of the Triad at Pace. Current research of the Triad stresses a need for additional

resources, education and information for dancers of all ages. Moreover, these resources should be available not only to the dancers but all those involved in the dance community.

Education can directly help in recognizing early signs of the Female Athlete Triad and therefore, preventing it. Currently, the best approach to the Triad is early detection and prevention. Pre-participation physical screenings are a particularly good time to screen for signs and symptoms, according to Nazem and Ackerman (2012, p.13). Pre-participation screenings are groups of tests or assessments designed to collect information regarding a dancer's unique condition, as described in "Screening in a Dance Wellness Program" (Potter et al., 2007). Screenings for dancers commonly include physical assessments and surveys that collect information about a dancer's nutritional and psychological well-being. Stephanie De'Ath of "Injury Prevention: Screening as a Tool for Education" writes screenings can test and assess "medical history, skeletal structure, alignment, range of motion, strength, cardio-respiratory response, motor skills, stability and mobility, self esteem, motivation, and nutrition" (2015). In the UK National Institute of Dance Medicine and Science (NIDMS) screening program, assessments include: a dancer's health and injury history, current training exposure, anthropometrics (measurements to assess body composition such as BMI or skin-fold test), hypermobility/flexibility, strength, a functional musculoskeletal screen and an aerobic fitness test. In this model, individuals are invited to look at feedback from their assessments to look at the average results for comparable dancers and discuss how their results can impact their training. Information from these sources helped support the idea of implementing screenings at Pace. De'Ath's writing discusses the general benefits of screenings, whereas Nazem and Ackerman relate screenings directly to diagnosing the Triad. De'Ath's also provided a legitimate

example of screenings in the NIDMS program. This concept could easily be translated to Pace University, if not many other dance programs and companies in the states.

The purpose of screening is to gain important information about a dancer that may aid the dancer, teacher, physical therapist, athletic trainer, or other healthcare professionals who work with the dancer to promote ongoing health and well-being. “Screening in a Dance Wellness Program” publishes the aim of pre-participation screenings is to provide a starting profile of the dancer’s baseline physical, medical, and psychological status (Potter et al., 2007). From the dancer’s baseline status, appropriate training and treatment can be applied. This source further supported the practicality of implementing screenings.

In other dance programs, companies, or universities, pre-screenings have often been used as one of the tools for determining acceptance. In current practices, it is more likely that a screening is administered after a dancer or student has been accepted. Therefore, a screening can be used as an educative tool, providing important and useful baseline data.

Karen Potter and Gary Galbraith, directors of the dance program at Case Western Reserve University (Case) designed a leading, collegiate “Dance Wellness” program that focuses on effective injury prevention, treatment and rehabilitation, efficient dance training, optimal levels of conditioning and health, and increased self care among dancers. Generally, Wellness programs include screening protocols and educational components not only in anatomy and kinesiology but also in both nutrition and psychology in the hopes to address a fuller scope of dancer health . The Dance Wellness Program at Case conducts an annual screening, education modules, and seminars or roundtable discussions for the dancers. Kinesiology theory is also integrated in lecture classes to help further educate dancers on their bodies as instruments (Potter

& Galbraith, p.2) . At the heart of the Case University model is the importance of an annual pre-participation screening. Potter, Galbraith, and Baas emphasize that the implementation of dance screening can have both immediate and potentially long term benefits for dancers in “Screening for Improved Dance Function.” Benefits include: the personalization of a dancer’s treatment, conditioning/intervention programs, and cross-training methods, which can encourage a longer, healthier career; screening can help teachers and directors augment dance curriculum to better meet the training needs of their dancers; repeated screenings can help track injuries for individuals and groups, which can be especially helpful in company or university settings; screening results may contribute to the greater body of dance science and knowledge and therefore could be made useful in research efforts which could ultimately impact dancers and their teachers around the world (Potter, Galbraith & Avery, 2011, p.16). These sources proved to be very significant to this study. The researcher’s goal is to incorporate a trainer and screenings at Pace; the Dance Wellness model at Case demonstrates a clear, reasonable example of that. Unlike the NIDMS program in the UK, though successful, the Case model shows that these goals can and have been achieved here in the United States. This model could easily be implemented at Pace; the success at Case demonstrates this unambiguously.

The work done by Potter and Galbraith at Case dominates in the fields of dance education, dancer care, and dancer health. Again, at the heart of the Case Dance Wellness model is the importance of pre-participation screenings. This model indicates primary weaknesses which can be applied back into a dancer’s training in a corrective manner (De’Ath, 2015). Screenings can play a role in enhancing a dancer’s ability and may help them change movement patterns to result in stronger bodies and better dancing.

Sources acknowledge that at present, screenings have not been scientifically proven to be able to predict dance injuries; the relationship between screenings and health outcomes at present is not well understood. Therefore, there is a need for educators and healthcare providers to undertake research aimed at understanding how performance and wellness can be optimized and how injury and illness can be prevented. (Potter et al., 2007, p.4). This source was insightful because it brought forward the imperfect nature of this area of research. The limited scientific knowledge of the relationship between screenings and healthcare or injuries illustrates the need for more research. The researcher views this as hopeful rather than discouraging.

The goal of this study is twofold: measure for the prevalence of the Triad at Pace, and support that prevalence by suggesting the incorporation of an athletic trainer who conducts pre-participation screenings. Other college programs in New York City have access to trainers and screenings, whereas Pace does not. In a competitive market, it would prove highly beneficial for Pace University to incorporate trainers and screenings to benefit current students and all of the future students searching for a college that fits all of their needs. Technical training is of paramount importance in a collegiate dance program, and so is proper care, treatment, and conditioning to support such intense training. This review of current literature supports this suggestion.

#### Research Question:

Are symptoms of the Female Athlete Triad prevalent in the Pace Commercial Dance Program? Would a pre-participation screening performed on Pace Commercial dancers by a

certified athletic trainer to determine symptoms of the Triad prevent injury and detect nutritional deficiencies? Would the findings promote healthier graduating dancers and career longevity?

#### Hypothesis:

Symptoms of the Triad do exist within the Commercial Dance program. At present, dancers in the program are injured and uneducated on the matter. Incorporating an athletic trainer who implements pre-participation screenings would help Pace Commercial Dance students be less vulnerable to certain injuries while in school, and it would promote healthier BFA graduate dancers with a greater likelihood of career longevity.

#### Methodology:

To measure the prevalence of symptoms of the Female Athlete Triad in the current female student body (ages 18-22) at the Pace University Commercial Dance Program, I conducted an anonymous, online survey. The online survey was distributed via the private Pace School of Performing Arts BFA Commercial Dance Facebook group. The Facebook group members include all current students in the Commercial Dance Program, as well as the director, assistant director, and adjunct faculty members. A link to the survey was posted with the following instructions:

*“Hi everyone! For my Honors Thesis, I’m conducting a quick, anonymous survey about symptoms of the Female Athlete Triad at Pace. With the information I’m gathering (again – it’s anonymous!) I’m hoping to use that data to demonstrate a need for an athletic trainer at Pace! If this interests you, you must be a currently enrolled female Commercial Dance major, ages 18-22, to participate. The survey*

*is designed to take 10-15 minutes to complete. I would really appreciate your participation!”*

The post informed the targeted audience: the survey is relevant only for female Commercial Dance students between the ages of 18 and 22, the survey is intended for research purposes, and the information collected is assured to be completely anonymous and unidentifiable. The questions in the online survey were designed to indicate if participants demonstrate symptoms of the Female Athlete Triad, which are energy deficiency, menstrual irregularities and amenorrhea, and low bone mass density or osteoporosis.

Established research shows that nutrition is one of the first factors in the chain of developing the Female Athlete Triad. The survey questions about nutrition asked:

Table 1.

- How many complete meals do you eat per day?
- Are those meals “nutrient dense” in that they cover the five food groups (as recommended by the US Department of Health)?
- How many snacks do you have per day?
- Are those snacks “healthy” snacks?
- If you know, how many calories do you consume per day?

Along with poor nutritional health, a lack of sleep and/or too much exercise can lead to the hallmark energy deficiency of the Female Athlete Triad. If one sleeps too little or exercises in a way that they exert more energy than they consume, that leads to an energy deficit. The survey questions about sleep and exercise asked:

Table 2.

- How many hours of sleep do you get in one night?
- How many hours do you dance per week -
  - in class at Pace?
  - in rehearsal at Pace?
  - supplemental to your Pace schedule?

The *Female Athlete Triad Coalition* says energy deficiency is the *main cause* of the Female Athlete Triad (2017). The questions above, concerning nutritional intake, sleep, and exercise, are designed to demonstrate if an energy deficiency is prevalent among the current female Pace Commercial Dance student body.

Another clear indicator of the Female Athlete Triad is menstrual irregularity or amenorrhea. Amenorrhea is the medical term for the absence of menstrual periods, either on a permanent or temporary basis. The condition can be classified as primary or secondary. In primary amenorrhea, menstrual periods have not begun by age 16. In secondary amenorrhea, menstrual periods are absent for three consecutive cycles or a time period of more than six months in a woman who was previously menstruating (Stöppler, n.d.). To measure this, the survey questions about menstrual irregularity or amenorrhea asked:

Table 3.

- How old were you when you started to menstruate (your period)?
- After you began menstruating, did you ever skip a period for more than three cycles or for more than six months?



If a woman is suffering from menstrual irregularity or amenorrhea, this strongly indicates that the ovaries are malfunctioning. If the ovaries are malfunctioning, this will negatively affect the ovaries' production of estrogen. Without the production of estrogen, bone health can be compromised, which increases the risk of injury. To find the relation of menstrual irregularity or amenorrhea and poor bone health or osteoporosis, the survey questions about bone health asked:

Table 4.

- If you started your period after you were 16 years old, have you ever suffered any bone-related injuries?
- If your period has ever been absent for more than three cycles or for more than six months, have you ever suffered any bone-related injuries?
- Have you ever been diagnosed with any bone density issues?
- If yes, please explain briefly:
- Have you ever been diagnosed with osteoporosis or osteopenia?

In reality, the Female Athlete Triad is just one condition that could exist within the Commercial Dance program. The dancers at Pace University, both male *and* female, can be affected by a variety of injuries, illnesses, etc. To garner a greater sense of injury frequency in the Pace Commercial Dance program, the survey questions about injury at Pace asked:

Table 5.

- Did you enter the Pace Commercial Dance Program with an injury?
- During your time at Pace, have you ever experienced any injury?

- If yes, did the injury occur during class or rehearsal?
- Did Pace Commercial Dance provide a list of doctors, chiropractors, or similar resources upon your entrance to the program?

I strongly believe that if the Pace Commercial Dance Program were to have access to an athletic trainer on campus, the dancers' health and wellness at Pace University could be vastly improved. In reference to the dancers' health and wellness, this is including but not limited to the prevalence of the Female Athlete Triad within Pace Commercial Dance. To measure interest in having an athletic trainer at Pace, the survey asked:

Table 6.

- Do you believe it would benefit the Pace Commercial Dance program if an athletic trainer were present on campus?

Data collection was conducted through the use of an online survey because it was estimated to be the most accessible, the most user-friendly, and the most anonymous for the targeted audience. Current female BFA Commercial Dance students could easily access the link to the Google Forms survey via private Facebook group. The link was posted once with the message listed above, and then posted again about one week later to encourage more participation. A link to a slideshow that defined the Female Athlete Triad was also provided in the second wave of posting in yet another attempt to encourage participation.

I chose to use Google Forms as compared to other online survey services such as Survey Monkey or Qualtrics due to the user-friendliness of the website. Google Forms proved to be the

most simple to navigate and did not limit the number of questions or types of questions that could be utilized in the survey. Other survey providers did not offer the same versatility.

Above all, I chose to conduct this survey online because it provided the target audience the most assured form of anonymity. The questions in the survey did not ask for identifiable information; moving the survey from an in-person interview to an online platform protected the participants' anonymity. In assuring the participants' anonymity through an online service, I expected this opportunity to have elicited more honest and open answers than what could have been collected in-person. The anonymous nature of the survey meant that this study was considered low-risk. Upon submission to the International Review Board (IRB), this study was approved for exemption as per the fourth category of Social and Behavioral Sciences exemption, which states:

Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

The IRB submission of this study was completed and fully approved before the survey link was ever posted or made available to others. After leaving the survey "open" for just under two weeks, and making three recruitment attempts, I closed the study. Of the 45 responses received online, one individual's response had to be removed because it was determined to be ineligible when the participant noted in a short answer question that they had already graduated

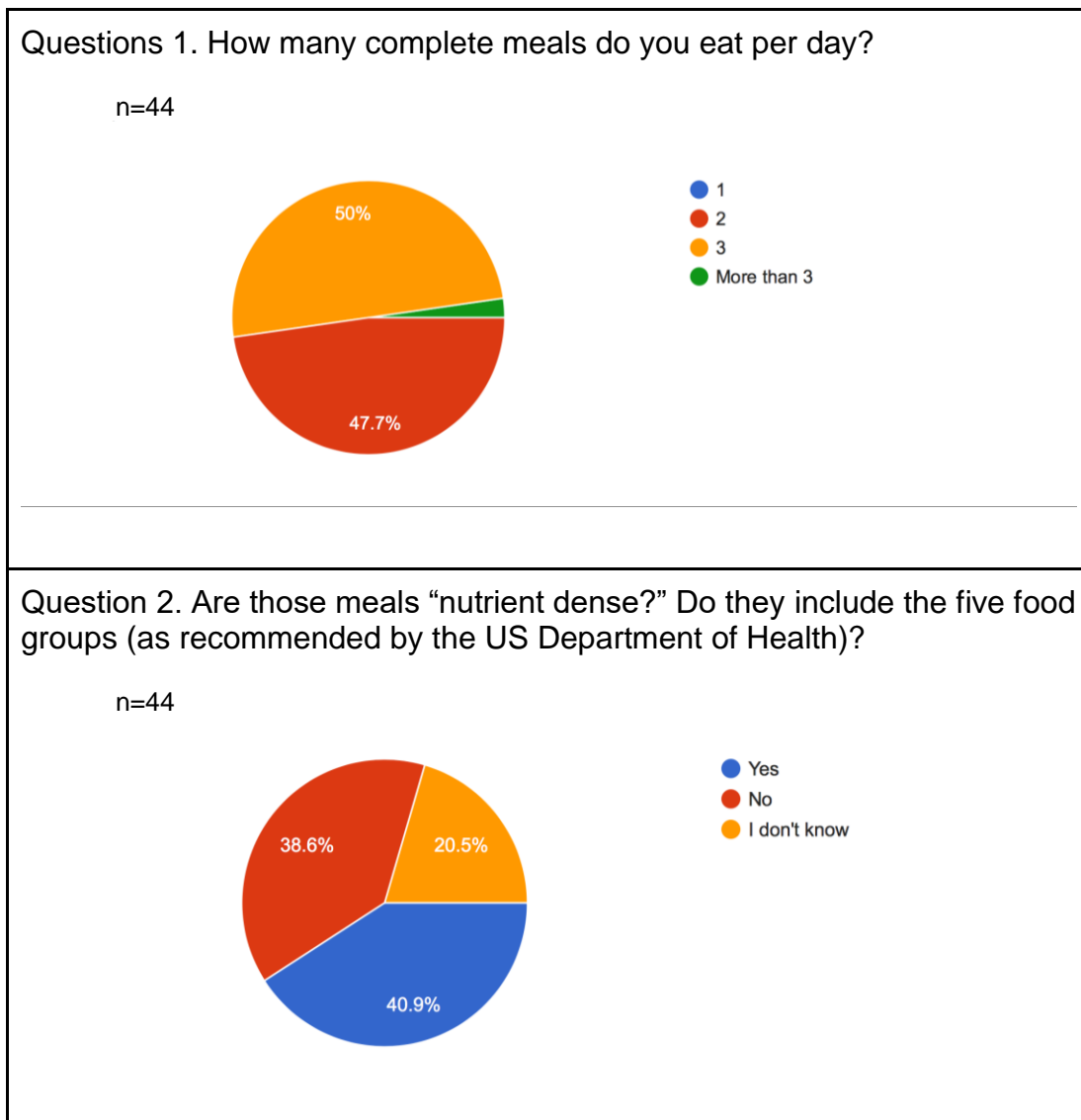
from Pace University. This study concentrated on current female Commercial Dance majors between the ages of 18 and 22.

A summary of all of the responses was automatically created by Google Forms. For each multiple choice question, the results were displayed in a pie chart showing the percentage of the total answers to each question. For the short answer questions, these had to be manually accounted by the researcher to bypass the graph chart created by the Google Forms algorithm. All questions were studied based on the summary of answers from the whole group's responses. Some questions didn't require responses if they were structured as a follow-up to the previous question ("If yes..."). The survey results are as follows.

## Results:

## Part I. Measuring for Energy Deficiency

The first tenet of the Female Athlete Triad is energy deficiency. The following series of questions were designed to measure this among the body of participants.

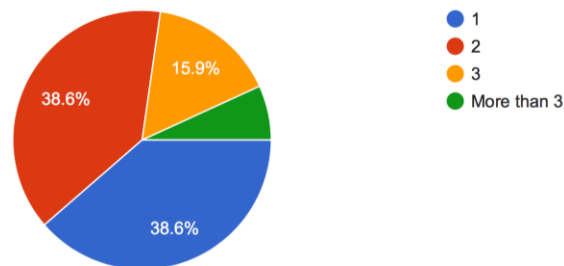


Here, we see that most participants eat two to three complete meals per day. More than half of the participants report that those meals are not “nutrient-dense” or that they simply don’t

know. In the U.S. Department of Health's 2015-2020 Dietary Guidelines for Americans, the top two guidelines are 1) Follow a healthy eating pattern across the lifespan, and 2) Focus on variety, nutrient density, and amount. According to these survey results, the majority of participants are eating two to three meals a day that most likely are *not* nutrient dense. It is also unlikely that two to three meals a day are simply not enough to support the students' caloric needs.

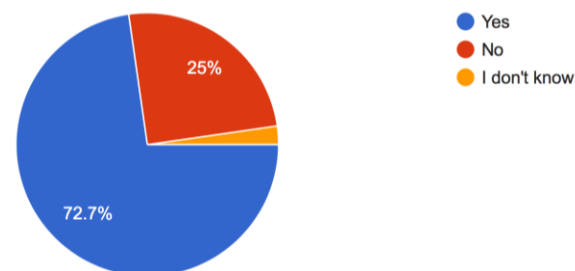
Question 3. How many snacks do you have per day?

n=44



Question 4. Are those snacks "healthy" snacks?

n=44



These results show that the participants choose healthy snacks, usually one or two per day. This is ideal. Perhaps this is because healthy snacks can be much easier to prepare than full

meals. Pairing one or two healthy snacks during the day with two to three meals is desirable for these participants because they are young, active females. By this measure, the participants could be successfully avoiding energy deficiencies caused by diet. Of course, there could be room for error in this section because the “healthiness” is being determined by the student. Not all participants may have the same standard. It is difficult to ask this question in reference to the U.S. Dietary Guidelines, but an attempt was made nonetheless to gather as much information as possible. To further explore this area, we must also measure the participants’ caloric intake.

#### Questions 5.

**If you know, how many calories do you consume per day?**

19 responses

1600	1200
1900	1600 ish
Around 2000 or just under	3000
Unknown	Around 1800
1500	I am not sure.
1800-2100	n/a
I don't know but I think not enough calories overall	1500-2000 depending on my activity level
but maybe too much cause it's unhealthy food	Approx 1600-1800
1700-2100	Over 2000
I don't know	Roughly 1500?

This data proves the most concerning. Below is an abbreviated chart from the U.S. Department of Health’s 2015-2020 Guidelines for Americans - **Estimated Calorie Needs per Day, by Age, Sex, and Physical Activity Level.**

Table 7.

FEMALES <sup>[d]</sup>			
AGE	Sedentary <sup>[a]</sup>	Moderately active <sup>[b]</sup>	Active <sup>[c]</sup>
18	1,800	2,000	2,400
19-20	2,000	2,200	2,400
21-25	2,000	2,200	2,400

Note. Adapted from *2015 – 2020 Dietary Guidelines for Americans*, by U.S. Department of Health and Human Services and U.S. Department of Agriculture. Retrieved from <https://health.gov/dietaryguidelines/2015/guidelines/> Copyright 2015 by U.S. DOH.

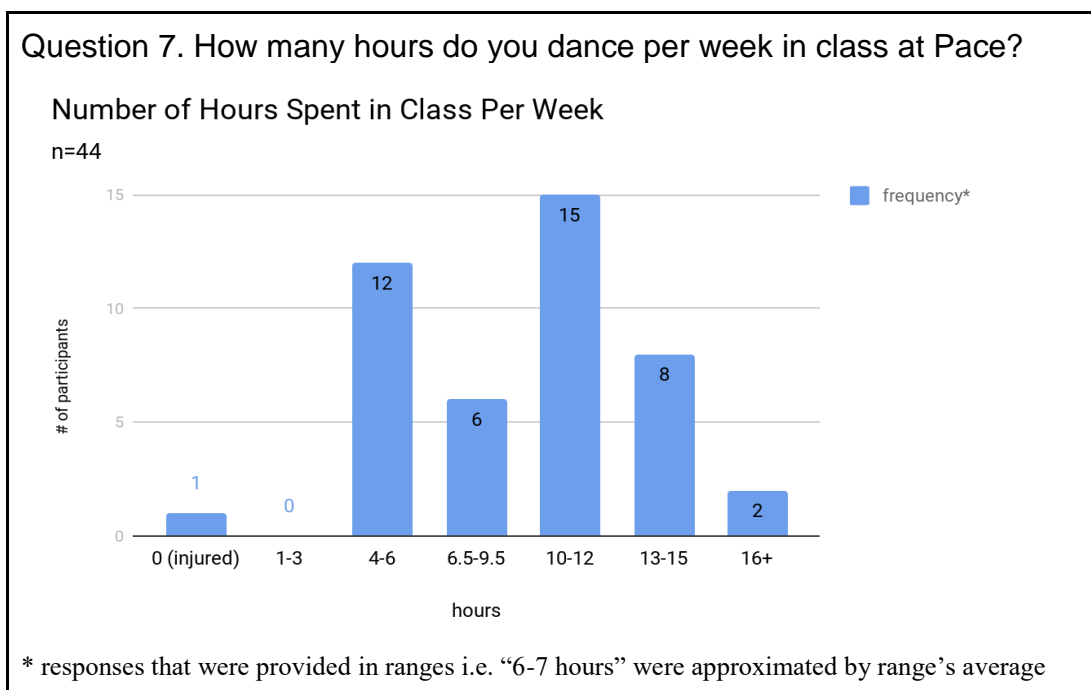
- Active = a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living.
- Moderately active = a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living.
- Sedentary = a lifestyle that includes only the physical activity of independent living.

Active females ages 18-25 are estimated to need 2,400 calories per day. With the rigour of the dance training in the Pace Commercial Dance program, there is no doubt that the students are asked to exercise with an intensity equivalent to the “active” lifestyle as described above. In this study of active females ages 18-22, only 19 of 44 participants answered the question, “If you know, how many calories do you consume per day?” Average answers ranged from 1600-2000 calories. This is clearly below the estimated caloric need as outlined by the U.S. Department of Health. It is also concerning that the majority did not answer this question. It is unsure if the



participants did not answer because they did not want to relay that information, or if they did not know.

Energy deficiency is considered by experts to be the main cause of the Triad. When a female has low energy availability, this can affect the brain's regulation of the ovaries, which then affects menstruation cycles. If the ovaries are malfunctioning, this can negatively affect the ovaries' production of estrogen. Without the production of estrogen, bone health can be compromised which increases risk of injury. All that to say, energy deficiencies caused by diet or disordered eating are often the root of the Female Athlete Triad. According to Nazem and Ackerman, "Athletes may have disordered eating simply by unknowingly failing to attain their energy requirements secondary to time constraints or lack of nutritional knowledge" (2012). Having measured the amount of energy consumed by participants, or at least by those participants who were able to answer this question, the amount of energy participants expend during exercise needs to be examined as well.

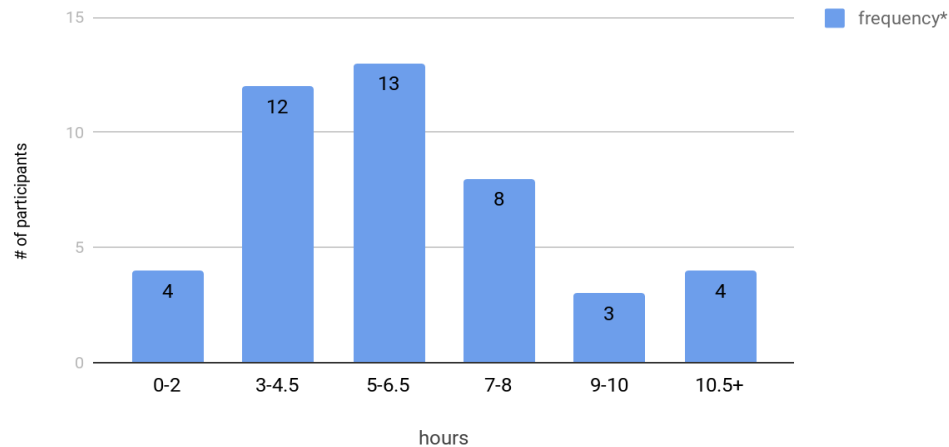


The chart above shows that the majority of participants spend between 4-6 or 10-12 hours per week in dance classes at Pace. The difference is suspected to be representative of the grade level of the participants. In the design of the Pace Commercial Dance Program, underclassmen have a heavy dance *and* academic schedule. Upperclassmen, on the other hand, get to wean off of their intense dance class schedule at Pace in an attempt to make the transition out of school and into the professional dance world easier for students. Upperclassmen take fewer dance classes at Pace to allow more time for auditions, workshops, etc. It is likely that the majority of students who answered between 4-6 hours are upperclassmen, and those who answered between 10-12 hours are underclassmen.

In one particular participant's response, she answered that she spent "zero hours" in dance class at Pace because she is currently injured. This outlier still seemed pertinent to the nature of this study. Injury within the Commercial Dance Program, especially those potentially related to the Triad, will be discussed later. It should be noted that this participant's response did not affect the results of the caloric intake section of this study because this participant did not enter a response to that question.

**Question 8. How many hours do you spend in rehearsal at Pace?****Number of Hours Spent In Rehearsal**

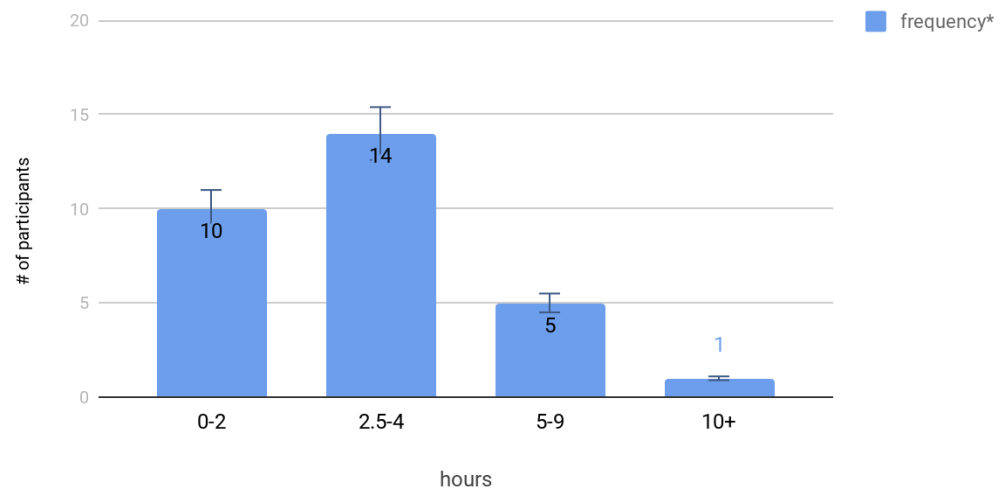
n=44



\* responses that were provided in ranges i.e. “4-6 hours” were approximated by range’s average

**Question 9. How many hours do you spend exercising supplemental to your Pace schedule?****Number of Hours Spent Exercising Supplemental to Pace**

n=34



\* responses that were provided in ranges i.e. “3-4” were approximated by range’s average

\*\* 4 responses along the lines of “no consistent” or “n/a” were not included in this graph because they held no value

The majority of participants also note spending between 3-6.5 extra hours dancing in rehearsals at Pace. On top of that, of the 44 participants total, 30 responded saying they spent even more time dancing/exercising outside of school. The majority of those 30 participants said they spent up to 4 hours supplemental to their required Pace schedule.

This data shows that on average, a female student in the Pace Commercial Dance Program is spending around 10 hours a week in dance class at Pace, around 6 hours a week in rehearsal at Pace, and around 4 hours a week exercising outside of their Pace schedule. This brings our estimated average to about 20 hours of intense exercise a week. This does not include, as described by the U.S. Department of Health, the “activities of independent living.” We have already seen that the participants’ average caloric intake is below the estimated need of active females ages 18-22. At this point, it is appropriate to examine how the participants’ sleeping patterns could be affecting their energy input and output.



The most common response to the question “How many hours of sleep do you get per night?” among participants was between 5-7 hours. For younger adults ages 18-25, the

recommended sleep range is between 7-9 hours (National Sleep Foundation). 13 of 44 participants hit this goal, 1 participant surpassed by reporting over 9 hours of sleep per night, but the 30 majority fall shy by reporting between 5-7 hours.

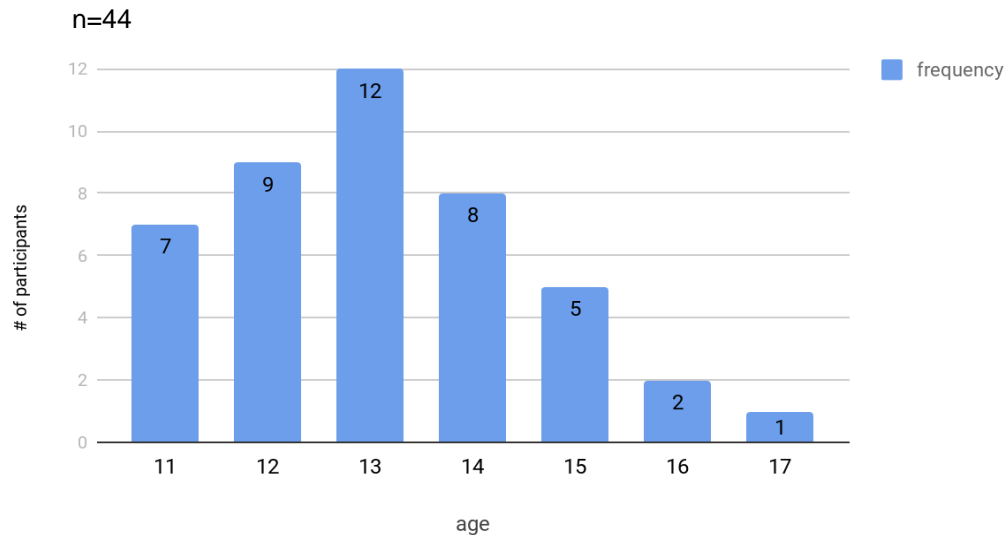
Based on these reports, the majority of these active female students are falling short on their recommended sleep range, falling far below their recommended caloric intake, and expending intense energy in about 20 hours of dance or exercise per week. This shows that on average, the participants' energy intake is not adding up to their energy expenditure. The imbalance of the amount of energy consumed (nutrient-dense meals, calories consumed) and the amount of energy expended during exercise (hours spent in class, rehearsal, and supplemental to Pace) create an energy deficiency, which is often the first step to lead to menstrual disturbances or amenorrhea, and bone loss or osteoporosis. Simply put, these factors do not add up to healthy habits or healthy dancers.

## Part II. Measuring for Amenorrhea and Bone Loss:

The second tenet of the Female Athlete Triad is amenorrhea, which has two forms: primary and secondary. Primary amenorrhea is when the menstruation cycles never start, or do not start until after 16 years old. Secondary amenorrhea occurs when there is either an absence of three or more consecutive menstrual cycles or no menses for six months. When the ovaries malfunction, they cannot produce estrogen correctly. Without the production of estrogen, bone health can be compromised which increases risk of injury. The following questions measured the prevalence of amenorrhea in either form among participants, as well as the relationship between amenorrheic participants and their bone health.

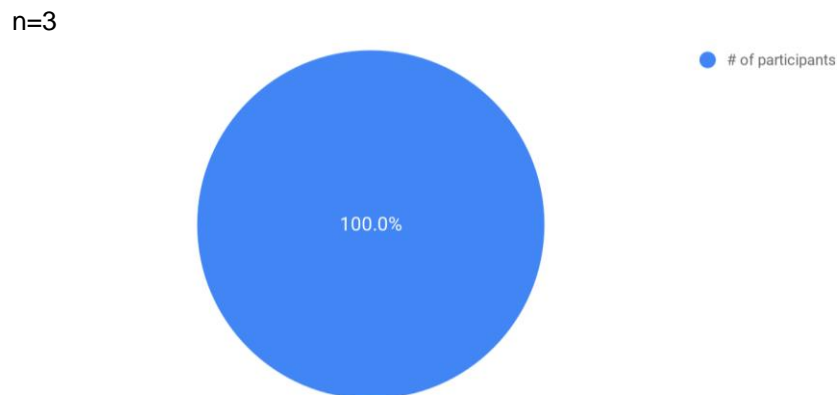
## Question 10.

How old were you when you started to menstruate (your period)?



3 out of 44, or about 7% of participants responded that they started to menstruate after 16 years old. This indicates primary amenorrhea.

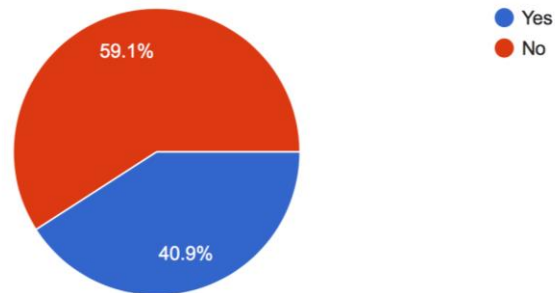
Question 11. If you started your period after you were 16 years old, have you ever suffered any bone-related injuries?



3 out of 3, or 100% of participants who started menstruating after 16 years old, indicating primary amenorrhea, have suffered bone-related injuries.

Question 12. After you began menstruating, did you ever skip a period for more than three cycles or for more than six months?

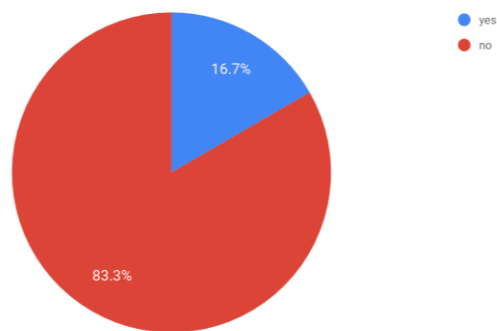
n=44



18 out of 44, or about 41% of participants responded that they had skipped a period for more than three cycles or for more than six months after they began menstruating. This indicates secondary amenorrhea.

Question 13. If your period has ever been absent for more than three cycles or for more than six months, have you ever suffered any bone related injuries?

n=18



3 out of 18, or about 17% of participants whose period has been absent for more than three cycles or for more than six months, indicating secondary amenorrhea, have suffered bone-related injuries.

44 out of 44, or 100% of participants responded that they have not be diagnosed with any bone density issues, osteoporosis, or osteopenia. One participant, however, chose to expand in question 15 which asked, “If yes [you have been diagnosed with bone density issues], please explain briefly.” The short answer response fell along the lines of:

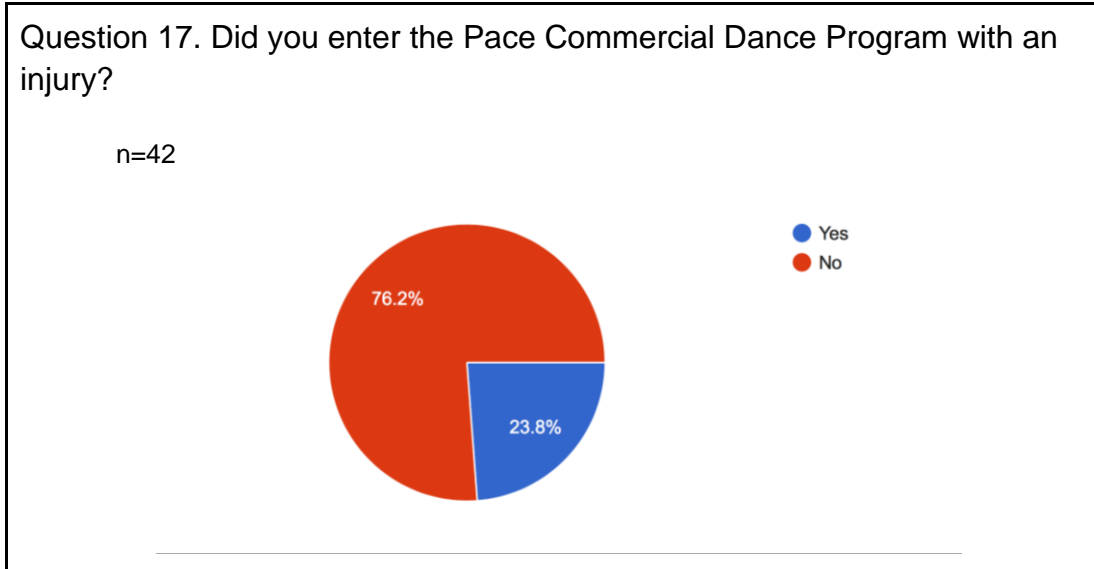
*“I have not been officially diagnosed with bone density issues, but because of several severe hormone imbalances stemming from what I believe to have been the Female Athlete Triad, my bones are at high risk of bone density depletion. In the past two years of my recovery, my estrogen and vitamin D levels still have not returned to the healthy base levels for a normal female my age. I take daily vitamin supplements and try to add foods to my diet that can help fulfill my vitamin deficiencies. I also have not menstruated in almost 3 years. I have consulted with many doctors and try to educate myself on the matter as much as possible because if I can’t get my body to normal, healthy levels soon, there could be permanent consequences in my future.”\**

*\* this response has been paraphrased to protect the participant’s anonymity.*

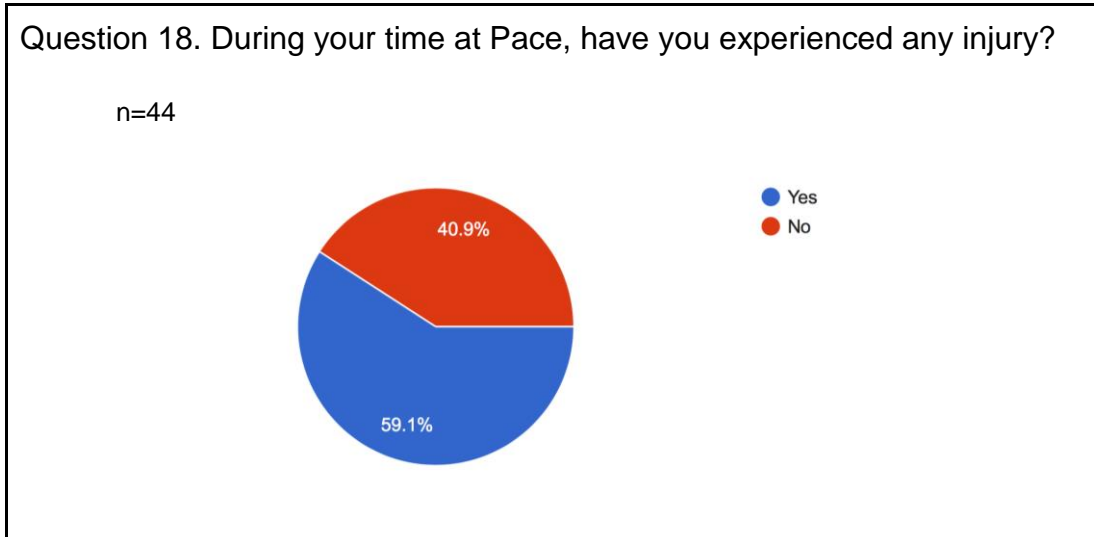
### Part III. Measuring Injury at Pace.

Of course, injuries related to the Female Athlete Triad are only one branch of many sources of injury within the Pace Commercial Dance Program. The researcher took interest in injuries that occurred before a student enters the Program as well as injuries that occurred during a student’s enrollment in the Program, and what the Program does to prevent or care for such injuries.





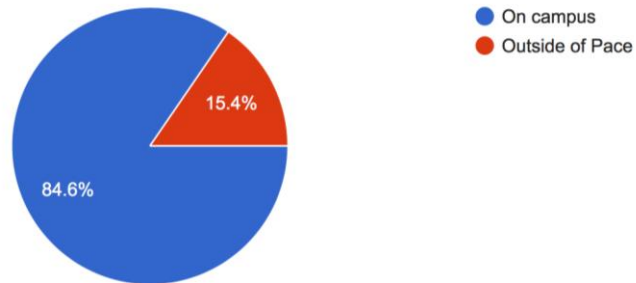
Out of 42 responses, 32 participants, about 76%, report *NO* they did not enter the program with a pre-existing injury. 10 participants, about 24%, report *YES* they did enter the program with a pre-existing injury.



Here, the responses present the near inverse. Out of 44 responses, 26 participants, about 59%, report *YES* they have been injured during their time at Pace. 18 participants, about 41%, report *NO* they have not been injured during their time at Pace.

Question 19. If yes, did the injury occur during class or rehearsal?

n=26

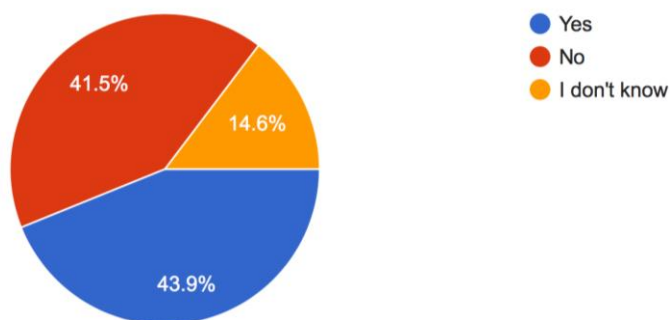


Of the 26 participants who reported injuries *during* their time at Pace, 22 out of 26, about **85%**, report that their injuries occurred **on campus** at Pace. 4 out of 26, about 15%, report that their injuries occurred outside of Pace.

The next questions concern what the Pace Commercial Dance Program does to treat or prevent students' injuries, regardless whether they are pre-existing, or occur on or off campus.

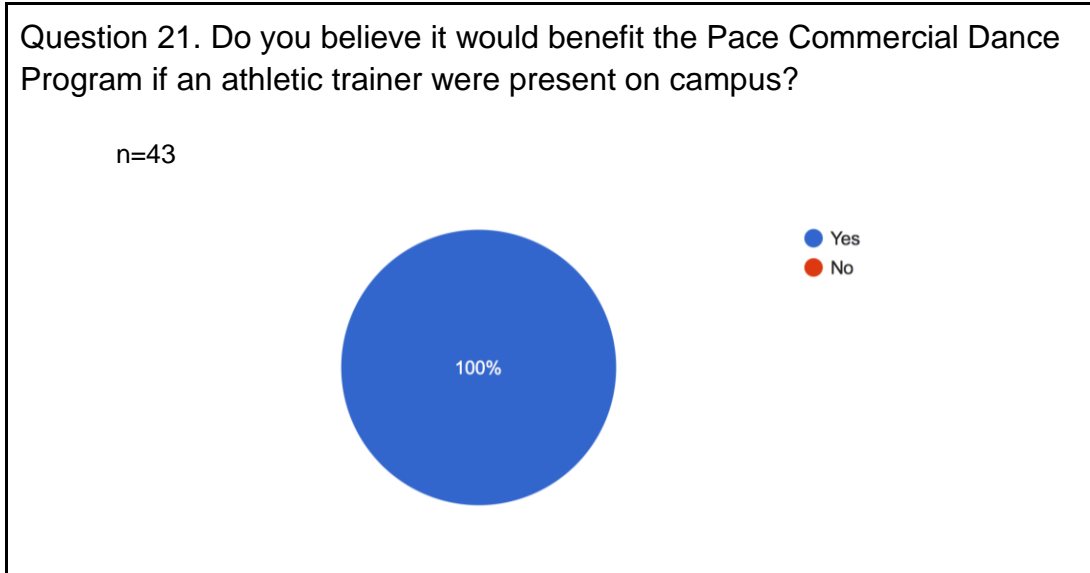
Question 20. Did Pace Commercial Dance provide a list of doctors, chiropractors, or similar resources upon your entrance to the program?

n=41



Out of 41 responses, 18 participants, about 44%, report *YES* that they were provided a list of medical resources they could reach out to in case of injury. 17 out of 41, about 41%, report *NO* that they were not provided a list of resources. 6 out of 41, about 15%, report *I DON'T KNOW*. These results illustrate an inconsistency. A total of 56% of participants either did not receive any or do not know if they received a list of medical resources upon their entrance to the Commercial Dance Program.

Pace University's BFA Commercial Dance Program currently does **not** have medical help meant specifically for the dance program. There are no medical professionals at Pace who specialize in Dance Medicine. At the New York City campus, there is a University Health Center in the main academic building, One Pace Plaza. The medical professionals at the University Health Center do not have a focus in dance medicine and are unable to provide adequate care for our highly specialized BFA Commercial Dance majors. In a specialized collegiate program like Commercial Dance, it is both reasonable and necessary to have access to equally specialized health care on campus. Such specialized dance medicine providers could include (but are not limited to) physical therapists, chiropractors, or athletic trainers. While any or all of these types of medical professionals would be advantageous, it is the researcher's belief that incorporating an athletic trainer into the Pace Commercial Dance Program would highly benefit the students. To measure the students' interest in having an athletic trainer on campus, the following question was asked:



100% of 43 responses unanimously reported *YES*, the participants *do* believe that the Pace Commercial Dance Program would benefit if an athletic trainer were present on campus.

#### Discussion:

The survey's results are extremely informative. Since the questions were organized in three parts, the following discussion will reflect that format. For section one, the questions relating to measuring energy intake and expenditure, the results were disheartening.

#### Part I: Measuring for Energy Deficiency

Energy availability is the amount of dietary energy available after accounting for energy expenditure from exercise. In "The Female Athlete Triad: Special Considerations for Adolescent Female Athletes," decreased energy availability is described as "the primary disorder driving the pathophysiology of the rest of the triad" (Brown et al., 2017). Low energy availability or energy deficiency may be the result of an eating disorder or disordered eating patterns. Disordered

eating is different from eating disorders because eating disorders fit an established diagnosis such as anorexia nervosa or bulimia nervosa, whereas disordered eating is used as a descriptive phrase for irregular eating patterns that do not meet nutritional needs. The main thing differentiating disordered eating from an eating disorder is the level of severity and frequency of behaviors. Because of this, disordered eating can often be the stepping stone to a fully developed eating disorder. Avery and Baas note,

“Historically, having a thin physique has been essential for consideration in the dance world . Unfortunately, this can encourage eating disorders that are associated with the Triad.... It is a common occurrence for dancers to limit their food intake to meet the demands of professional expectations of body image. Weight control is influenced by aesthetic considerations and body image” (2015, p. 2).

In this survey, most participants reported eating between 2 to 3 complete meals per day paired with 2 to 3 healthy snacks. Objectively, this seems appropriate for a young active female. Looking at the participants’ self-reported caloric intake, however, raises concern. The participants’ responses (average of around 1600-2000 calories per day) fall *far below* the estimated daily caloric need of young active females (2400 calories per day) according to the U.S. Department of Health’s 2015-2020 Guidelines for Americans. This shows that these young women are operating at a 17-33% deficit of their optimal caloric intake. It is also concerning that only 19 of 44 participants were able to answer this question. This could be because most of the participants either did not want to disclose this information, or simply do not know the nutritional value of what they are consuming on a daily basis. Awareness could be increased if

the students were to have access to nutritional/dietary education. Nazem and Ackerman write, “Athletes may have disordered eating simply by *unknowingly failing* to attain their energy requirements secondary to time constraints or *lack of nutritional knowledge*” (2012, p.5). An interesting question to have added to the survey could have asked if participants currently work with or have ever worked with a nutritionist or dietician before.

This dangerously low caloric intake paired with vigorous exercise on and off campus and little sleep undoubtedly creates an energy deficiency. The survey results show that on average, a female student in the Pace Commercial Dance Program is spending approximately 10 hours a week in dance class at Pace, 6 hours a week in rehearsal at Pace, and 4 hours a week exercising outside of their Pace schedule. This is an estimated average of about 20 hours of intense exercise a week, not including the “activities of independent living.” The U.S. Department of Health describes an “active” lifestyle as having the physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living. Walking 3 miles per day at 3 to 4 miles per hour equals around 1 hour of physical activity every day. Our students are exceeding that standard at an average of 20 hours of exercise per week. On top of that, the majority of participants, around 68%, reported getting between 5-7 hours of sleep per night when the recommended sleep range for young active females is between 7-9 hours. Again, these factors among current female students in the Pace Commercial Dance Program consistently create the formula for energy deficiencies.

One participant proved to be an interesting outlier in this section of the survey. Said participant reported consuming 3000 calories in 2 meals and 2 snacks per day, getting 5-7 hours of sleep per night, and exercising around 22 hours per week. It appears as though this participant

could be looking to gain weight from their self-reported caloric intake, which is contrary to the typical, societal standard among dancers. This participant's response prompts another question that could have been added to the survey: Are you looking to lose, maintain, or gain weight? Body mass is an interesting factor in each participant's response that could not be easily measured via online survey. For this participant in particular, being able to account for body mass could be crucial in supporting this student's caloric intake, exercise workload, and sleep range, and making sure that she is working in a healthy manner.

In the early stages of developing this survey, the researcher considered including questions to calculate participants' Body Mass Index (BMI). BMI is a commonly accepted anthropometric study; BMI takes one's body mass divided by the square of one's body height to measure body fat. Upon further research, the researcher found a *Sports Health* article entitled "Body Mass Index and Percentage of Body Fat as Indicators for Obesity in an Adolescent Athletic Population," published in May 2011 by The Hughston Clinic in Columbus, Georgia. This study said that BMI is a measurement of relative body *weight*, not an accurate measurement of body *composition*. "Because lean mass weighs far more than fat," the study reads, "many adolescent athletes are incorrectly classified as obese based on BMI" (2011). The Hughston Clinic's study suggests skinfold testing as a more accurate body assessment than BMI in adolescent athletes. It is believed that this same principle could carry over to the young active females in this researcher's study of the Female Athlete Triad at Pace. Dancers strive for long, lean muscles for both functional and aesthetic purposes. Based on this research, a skinfold test would be a better indicator of the participants' body composition than BMI testing. Skinfold testing, however, is not possible to conduct online. For these reasons, the survey did not explore

body weight, height, or composition. That is not to say that body composition is unimportant in the training of young, active, collegiate dancers. Correct body composition data can help to provide better diet and activity guidelines for all dancers, not just young active females at Pace.

## Part II: Measuring for Amenorrhea and Bone Loss

Amenorrhea can be caused by energy deficiency, a variety of diseases or genetic abnormalities, and even stress (Nazem & Ackerman, 2012, p.4). This survey chose to explore the prevalence of Primary and Secondary amenorrhea among participants. There is another type of amenorrhea that results from changes in energy availability; this is called functional hypothalamic amenorrhea (FHA). It is commonly associated with exercising and stress, which leads to association with the Female Athlete Triad (Brown et al., 2017). This survey chose to measure for prevalence of primary and secondary amenorrhea because primary and secondary amenorrhea was easier to test for via online survey than trying to measure changes in participants' energy availability, and therefore the prevalence of FHA. This survey also chose to focus on primary and secondary amenorrhea because of its relevance in the world of dance. Statistics show, "in women who participate in sports that emphasize aesthetics or leanness, such as ballet or running, the prevalence of secondary amenorrhea can be as high as 69%, compared with 2% to 5% in the general population" (Nazem & Ackerman, 2012, p.2).

When there are menstrual changes or dysfunctions, the ovaries struggle to produce estrogen correctly. Estrogen plays an important role in the physiology of bone mass density (BMD) and bone formation; amenorrhea of any type can compromise bone health which in turn



increases risk of injury (Brown et al., 2017). Major risks of compromised bone health include osteoporosis or osteopenia.

Osteoporosis is a disease characterized by low bone mass and microarchitectural deterioration which leads to bone fragility, and therefore, increased risk of nontraumatic fractures. Although this disease is commonly thought of as a disease striking postmenopausal women, it is seen in young amenorrheic women as well. Osteoporosis in the female athlete specifically refers to inadequate bone formation and premature bone loss. Premature osteoporosis in the short run may cause amenorrheic athletes to have higher rates of injury, particularly stress fractures. In the long run the consequences are more severe, as those with premature osteoporosis are at increased risk for osteoporotic fractures.

Average peak bone mass occurs between ages 18 to 25, precisely the age category of the participants in this survey. By the age of 18, approximately 90% of peak bone mass is gained through puberty (Brown et al., 2017). When normal menstrual process are interrupted (i.e. amenorrhea), an athlete's bones may become weaker with decreased BMD and more prone to injury and risk of fracture. The BMD in amenorrheic athletes is significantly lower than in their peers with normal menstrual cycles. Studies suggest that the BMD lost as a result of amenorrhea may be *completely or at least partly irreversible*, even with calcium supplementation, resumption of menses, and estrogen replacement therapy (Nazem & Ackerman, 2012, p. 7). Depending on the duration of the Triad, a young active female with the Triad may never return to normal age appropriate BMD (Brown et al., 2017). Clearly, menstrual disturbances and decreased bone health as a result of the Female Athlete Triad can have lifelong effects.

In this survey, 3 out of 44 participants reported starting their periods after turning 16 years old, indicating primary amenorrhea. Of those participants, all 3 reported suffering bone-related injuries. On the other hand, 18 out of 44 participants reported that they had skipped a period for more than three cycles or for more than six months after they began menstruating, indicating secondary amenorrhea. Of those participants, 3 out of 18 reported suffering bone-related injuries. These results are unnerving. In this study, there was a 100% success rate in the relationship between symptoms of primary amenorrhea and symptoms of low BMD, as demonstrated by reports of bone-related injuries. When looking at the relationship between symptoms of secondary amenorrhea and symptoms of low BMD, the statistics aren't quite so drastic. Secondary amenorrhea in this study was definitely more common (18 showing secondary vs. 3 showing primary), but only 3 of 18 had suffered bone-related injuries. It is important to note that this does not mean that these participants are not at risk of low BMD. Perhaps consequences of low BMD in those who demonstrate symptoms of secondary amenorrhea will not present for years to come.

In general, it is difficult to assess the pervasiveness of the Triad when considered separately. One study described in Nazem and Ackerman's *Sports Health* article found that in a study of female athletes, the prevalence of all 3 components of the Triad was 4.3%, which is not far off from the 3.4% found among healthy controls. However, the prevalence of 2 components of the Triad ranged from 5.4% to 26.6% (2012, p.3). Nazem and Ackerman publish, "It is important to realize that not all components of the Triad need to be present concurrently for a female athlete to suffer negative health sequelae of the Triad, as the 3 components may have different time sequences of presentation." If this study of the Female Athlete Triad at Pace were

to be continued, following these participants outside of their education at Pace and later in life would provide interesting data and perspective.

This survey also asked participants if they had ever been formally diagnosed with bone density issues, osteoporosis, or osteopenia. 100% of the 44 responses reported *no* to these questions. This raises more questions: Have any of the participants ever checked their risk of low BMD with a medical professional before? Are they answering “no” because they have a doctor’s confirmation that they are not at risk of low BMD, osteoporosis, or osteopenia, or are they answering “no” because they are just assuming that they are not? Most young women do not believe they are at risk for osteoporosis or osteopenia because it is a disease most commonly thought to affect postmenopausal women. As we have learned, amenorrheic athletes are not excluded from the risk of low BMD. In young female athletes with the Triad, a compromise in bone strength, ranging from low BMD and stress fractures to osteoporosis, can occur at a much younger age (Nazem & Ackerman, 2012). Healthy bones are important for all women, and they hold special significance for athletes.

### Part III: Measuring Injury at Pace

Complications of the Female Athlete Triad are plentiful. Decreased energy availability or energy deficiency may affect the body’s ability to build bone, maintain muscle mass, repair damaged tissue, and recover from injury. Menstrual dysfunction may lead to infertility; alternatively, in young women recovering from the Triad, while regular menstruation cycles are being restored, “premature ovulation may occur and result in unexpected pregnancy in the absence of contraception” (Nazem & Ackerman, 2012, p.7). For young women with low BMD

caused by the Triad, they may never “catch up” to normal, age-appropriate BMD. Estrogen deficiency can even cause endothelial dysfunction, resulting in cardiovascular disease. Of course, injuries related to the Female Athlete Triad are just one area of concern. Within the Pace Commercial Dance Program, injuries of all types happen all the time to students of all genders. With this in mind, the third section of this survey aimed to measure how Pace treats student injuries whether they are pre-existing, or happen on or off campus.

Out of 42 responses, 10 participants report YES they did enter the program with a pre-existing injury. Out of 44 responses, 26 participants report YES they have been injured during their time at Pace. Of the 26 participants who reported injuries during their time at Pace, 22 out of 26, about **85%**, report that their injuries occurred **on campus** at Pace. When asked if the students were provided with medical resources, there was major inconsistency. About 44% of participants report that they were provided a list of resources, whereas the majority, at 56%, report that they either did not or did not know. In a specialized collegiate program like Pace Commercial Dance, it is both reasonable and necessary to have access to equally specialized, dance medicine-focused health care on campus. It is the researcher’s strong belief that having an athletic trainer on campus could be the answer to providing specialized health care to dancers at Pace University. Participants in the survey unanimously voted yes, that they too believed that the Pace Commercial Dance Program would benefit if an athletic trainer were present on campus.

#### Part IV: Potential Treatment - Incorporating an Athletic Trainer and Pre-Season Screenings

Current research reveals that there are three universally accepted methods to treating the Female Athlete Triad: education and prevention, early recognition, and a multidisciplinary treatment plan.

Prevention can be implemented through education. The responsibility of education, however, should not rest solely on the shoulders of the students themselves. The Pace Commercial Dance Program can educate their female students about the Female Athlete Triad in the following ways:

- Encourage positive attitudes and healthy bodies
- Provide information regarding calorie consumption and energy expenditure
- Raise awareness regarding adequate nutrition and bone health
- Advise vulnerable dancers to seek proper assistance
- Be mindful of early signs of the female athlete triad
- Insist on regular medical check-ups
- Create strategies to develop ideal health and wellness resources for dancers

The steps mentioned above create a workload that is not only far beyond the overwhelming responsibilities of the program director, co-directors, adjunct faculty, etc., but also outside of their areas of expertise. An **athletic trainer** at Pace University would be the appropriate resource in educating dancers within the Commercial Dance Program.

In recent years, athletic trainers have become crucial cast members in many dance companies and collegiate programs. In the past, athletic training was exclusive to sports, but Marijeanne Liederbach served as a pioneer in crossing that boundary and bringing athletic

training to dancers. Liederbach is the current director at NYU Langone's Harkness Center for Dance Injuries, a facility dedicated to enhancing the health and well-being of dancers and dance companies. Liederbach's work as an athletic trainer for dancers has helped revolutionize care for entertainers and artists. Others who helped forge the path include Radio City's Elaine Winslow; The Cincinnati Ballet's Jacqui Haas; Las Vegas performing arts' Steve MCAuley; Harkness Center's Megan Richardson and Alison Deleget. Richardson said in an interview for NATA News' "Athletic Trainer: Key Member of the Cast" that treating performers presents a unique challenge. Dancers are equal parts athlete and artist. "You have to treat them based on both their cultural upbringing within the performing arts world as well as their athleticism... You have to understand where they're coming from emotionally, and you have to realize that many times, their directors don't take into account physical challenges the way a coach would," explains Richardson (2007). Athletic trainers for dancers are just that: *for dancers*. They offer insight that a regular medical practitioner simply doesn't understand. In "Dance Dance Revolution: How ATs are Making a Difference for Athletes in the World of Dance Medicine," Deleget speaks again:

"Traditionally, a sports doctor unfamiliar with the nuances of the dance world may give advice such as, 'take two weeks off'... But there's immense fear associated with not being able to dance, so you just can't tell a dancer that; *you need to understand the biopsychosocial aspects of the dancer's mindset and workplace.*" (NATA News, 2014).

Being able to understand dancers is crucial to educating them and giving them treatment. Athletic trainers are able to assess the "full picture" for dancers to get to the root of a problem,

whether it's the function of a dancer's technique or poor nutritional habits, rather than treating symptoms or injuries at surface level. An athletic trainer at Pace Commercial Dance could bring this unrivaled knowledge and perspective to the Program. Through injury surveillance, an athletic trainer would be able to detect signs of the Triad in the Pace Commercial Dance Program and therefore, prevent and educate students about the risks of the Female Athlete Triad.

The greatest challenge in treating young female athletes with the Triad is often the initial diagnosis of the condition. Experts agree early recognition of the Triad can be conducted through preparticipation screenings. Currently, the best approach to treating the Triad is early detection and prevention. Pre-participation physical examinations are a particularly good time to screen for signs and symptoms according to Nazem and Ackerman. The Triad is a complex condition that can affect female dancers' bodies and minds. Physical, nutritional, and psychological information collected in preparticipation screenings can lead athletic trainers directly to signs or symptoms of the Triad in dancers. Screening for other injuries or conditions in a pre-participation screening, such as pre-existing injury, and nutritional education, could prepare students in the Pace Commercial Dance program to be less vulnerable to certain injuries throughout their career at Pace, and it could also promote healthier BFA graduate dancers with a greater likelihood of career longevity.

There is much debate on the best method of treatment for young female athletes with the Triad, but a multidisciplinary approach is usually necessary for recovery. Support from a sports physician or athletic trainer, as well as a nutritionist or dietitian, psychiatrist or therapist, teachers or directors, and family members is extremely important throughout the rehabilitation process. The bottom line is that treatment of the Female Athlete Triad must address the

underlying cause of the Triad: low energy availability. Energy status must be normalized primarily through modifications of diet and exercise training. Restoration or normalization of body weight is the best strategy for successful resumption of menses and improved bone health. An athletic trainer is a vital element of this process.

Incorporating an athletic trainer and preparticipation screenings would be the best method to treat and prevent the Female Athlete Triad at Pace University's BFA Commercial Dance Program. Education has to come first, because being aware of the Triad is the first step in changing behavior. An athletic trainer at Pace can easily educate students about the risks of the Triad. Educating dancers also leads to teaching them methods of prevention, which can protect the longevity of their dance careers. Early recognition of the Triad can be conducted through the use of preparticipation screenings; athletic trainers can conduct such screenings. Finally, overall treatment of the Triad must be multidisciplinary. Athletic trainers play a vital role in the treatment and recovery process.

The Dancer Wellness Project (DWP) is a "consortium of organizations [such as professional dance organizations, universities, schools, and medical clinics] that promote dancer health, wellness, education, and research through the implementation of dance screening, exposure tracking, and injury surveillance" (DWP 2019). The DWP's online system creates profiles for individual dancers and in those profiles, one can store and access data from screenings, exposure tracking, and injury surveillance. More information about these three components are listed below from the DWP's website:

- A screening is the collection of data about a particular dancer including information such as a dancer's strength, flexibility, and technique. This information is often used as teaching tools for the dancer, though it may also be



used for research projects, or part of a medical inventory used by medical professionals working with dancers.

- Exposure data provides information about how often the dancer is actively involved in dance related activities and what risk factors are involved with that activity. The exposure tracking module allows users to not only collect information on how long and how many times a dancer is involved with dance related activities, but also data related to other factors such as equipment and environment.
- Unlike screenings and exposure tracking, which are typically a single event, injuries have a 'life span' (onset through resolution). The DWP allows for the monitoring of injuries through the duration of the injury cycle and supports multiple definitions of injury, e.g. time loss (how much time a dancer is unable to participate in dance activities), function loss (how much impairment to motion they experience), financial loss (how much financial impact is involved).

The main goal of the DWP is to provide the technological resources needed to facilitate, support, and promote injury prevention, career longevity, effective and efficient training, and assist dancers, dance educators, and medical professionals who work with dancers. The DWP programming is customizable with up to 200 components, and it is even smart-phone friendly. Affiliates of the DWP include well-established ballet companies (New York City Ballet, Boston Ballet, Joffrey Ballet, San Francisco Ballet), other collegiate dance programs (Point Park University, Montclair State University, Chapman University), the Alvin Ailey Dance Theater, and various dance companies and programs outside of the country (Trinity Laban, London, UK; Royal New Zealand Ballet, Wellington, NZ; Hochschule für Musik und Theater München, Munich, Germany). Pace University's Commercial Dance Program could easily enroll as an

affiliate of the DWP and use their online services, in conjunction with a certified athletic trainer, to better screen, track, train, and protect current and future students.

#### Conclusion:

This survey shows that symptoms of the Female Athlete Triad are undoubtedly prevalent in the Pace Commercial Dance Program. Incorporating pre-participation screenings by a certified athletic trainer for symptoms of the Female Athlete Triad, pre-existing injury, and nutritional education, could better prepare current Commercial Dance students to be less vulnerable to certain injuries throughout their career at Pace, and it could also promote healthier BFA graduate dancers with a greater likelihood of career longevity. Further research is needed to explore more sophisticated options for treating symptoms of the Triad at Pace. For now, incorporating an athletic trainer and pre-participations screenings, as well as the various screening services from the Dancer Wellness Program, would be the best method to better train, prepare, and protect current and future students.

## References:

- Avery, A., BFA, MS, & Baas, J., MA, MFA. (2015, August 24). *The female athlete triad in college dance students: Video from the 2014 Annual Meeting*(Rep.). Retrieved <https://www.iadms.org/blogpost/1177934/225016/The-female-athlete-triad-in-college-dance-students-Video-from-the-2014-Annual-Meeting>
- Berz, K., & McCambridge, T. (n.d.). *Amenorrhea in the Female Athlete: What to Do and When to Worry*(Vol. 45, Ser. 3, Rep.). Thorofare, NJ: Pediatric Annals.  
doi:10.3928/00904481-20160210-03
- Brown, K. A., Dewoolkar, A. V., Baker, N., & Dodich, C. (2017). *The female athlete triad: Special considerations for adolescent female athletes*(3rd ed., Vol. 6, Rep.).  
doi:10.21037/tp.2017.04.04
- De'Ath, S. (2015, July 7). *Injury Prevention: Screening as a tool for education*(Rep.). Retrieved February 11, 2019, from International Association for Dance Medicine & Science website.
- Galbraith, G. (n.d.). What is the Dancer Wellness Project? Retrieved March 23, 2019, from <http://www.dancerwellnessproject.com/Information/Summary.aspx>
- Hunt, V. (n.d.). Athletic Trainer: Key Member of the Cast. *NATA News*, 7(7), 12-15.
- Keeping Dancers Dancing: The Inside Story on Working with Performing Artists. (2014, April). *NATA News*, 36-36. Retrieved February 11, 2019, from <https://www.nata.org/professional-interests/emerging-settings/performing-arts>

- National Sleep Foundation. (n.d.). How Much Sleep Do We Really Need? Retrieved March 23, 2019, from <https://www.sleepfoundation.org/excessive-sleepiness/support/how-much-sleep-do-we-really-need>
- Nazem, T. G., BA, & Ackerman, K. E., MD, MPH. (2012). *The Female Athlete Triad*(4th ed., Vol. 4, Rep.). doi:10.1177/1941738112439685
- Potter, K., MFA, Galbraith, G., MFA, & Baas, J., MFA. (2011). *Screening for Improved Dance Function*(1st ed., Vol. 3, pp. 14-16, Rep.). The IADMS Bulletin for Teachers.
- Potter, K., MFA, & Galbraith, G., MFA. (n.d.). *Dance Wellness: Why, How and The Future; A Model at Case Western Reserve University*(pp. 1-8, Rep.). Dancer Wellness Project.
- Potter, K., Kimmerle, M., Grossman, G., Rijven, M., Liederbach, M., & Wilmerding, V. (2007, August). *Resource Paper: Screening in a Dance Wellness Program*(Rep.). Retrieved February 11, 2019, from International Association for Dance Medicine & Science website: <https://www.iadms.org/page/174>
- Siegle, J. (2014, January). Dance Dance Revolution: How ATs are Making a Difference for Athletes in the World of Dance Medicine. *NATA News*, 11-12. Retrieved February 11, 2019, from <https://www.nata.org/sites/default/files/professional-interests-dance-injuries-nata-news.pdf>
- Southmayd, E. (2017, November 2). IDENTIFYING THE TRIAD. Retrieved February 11, 2019, from <http://www.femaleathletetriad.org/identifying-the-triad-in-your-athlete/>
- Stöppler, M. C. (n.d.). Secondary and Primary Amenorrhea Definition, Causes, Treatment. Retrieved February 11, 2019, from <https://www.medicinenet.com/amenorrhea/article.htm>

- U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 *Dietary Guidelines for Americans*. 8th Edition. December 2015. Available at <https://health.gov/dietaryguidelines/2015/guidelines/>.
- Zar, R. (2015, March). When Your Period Disappears. *Dance Spirit*, 19(3), 34-36.