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Process of Science

An Exploratory Survey of Self-Reported Joint Pain Among College Students

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ABSTRACT

Topics in Exercise Science and Kinesiology Volume 4: Issue 1, Article 13, 2023. Prior research has shown that college students are a unique subset of our global population that commonly experience stresses and strains to their musculoskeletal system as they complete their traditional coursework. Most of this population is viewed as healthy since their joints and skeletal systems have yet to be subjected to the levels of wear and tear of their elder constituents. However, there are still individuals within this population that often report experiencing some level of joint pain or discomfort that would not fall underneath the classic diagnoses of arthritis or other severe joint-related pathologies. The purpose of this descriptive study was to examine joint pain in non-clinical college students and some of the potential contributions to that pain. An email was sent to the entire current student population at a southeastern university in the United States inviting them to complete an online questionnaire about joint pain. Prior to its distribution, a pilot version of the questionnaire was distributed and tested to ensure readability and to establish content validity. The final version of the questionnaire was distributed twice during the fall 2021 semester. From the total number of students who may have received the email invitation (n = 18,985), 211 students completed the survey for a response rate of 1.11%. Of the 116 respondents who had never seen a healthcare professional for a joint injury or joint surgery, 72 reported current joint pain (62%). Thirty participants (47.6%) reported that the duration of their pain has lasted longer than three months. Participants reported cervical pain (76%), lumbar spine pain (84.8%), knee pain (65.1%), and hip or pelvis pain (76.2%) as the most frequent joints being affected. While typically considered healthy, college students are experiencing joint health-related pain and discomfort. Due to lack of past and current research on joint health in college students, the results of this exploratory study may begin to shed light on the need to implement and fund more proactive methods to best address this emerging issue.

KEY WORDS: Joint health, joint pain, arthritis, joint discomfort, post-secondary students

INTRODUCTION

Research within the field of kinesiology and exercise physiology has established the holistic and multilayered benefits of regular exercise and physical activity among communal, societal, and global populations (23, 30). These benefits expand beyond the confines of physiological adaptations and consistent physical activity has been correlated with added benefits encompassing the psychological and overall well-being of all individuals who adhere to recommendations provided within the Physical Activity Guidelines for Americans (30). Conversely, epidemiological studies have examined the indirect effects of physical inactivity due to its potential negative impact on energy level, aerobic fitness, cognitive, and musculoskeletal decline (5). Concerns also exist when considering the mental health of the students as it relates to possible joint pathologies. Physical activity has been shown to be beneficial for both physical and psychological health (2) Across the United States, utilization of mental health services has increased over the last couple of decades (18) and students reported increased anxiety, loneliness, and depression during the Covid 19 pandemic (17). While these indicators of poor mental health continue to rise, addressing the physical concerns of college students may have long withstanding effects for their quality of life and mental health (11). Physical inactivity has an estimated annual healthcare cost of $117 billion per year in the United States (23). Moreover, according to the Center for Disease Control and Prevention (CDC), more than half of adults living in the US with arthritic joint changes, which might include injury to the bones within the joint or to the soft tissue structures around the joint, are between the ages of 18 - 64. The annual medical costs associated with joint health are over $300 billion (6). Related to and sometimes existing as a precursor to arthritis are various joint health issues (25). Specifically, lower back and knee pain are two of the most common joint health issues clinicians treat (13). While there are many variables to consider, many joint health issues do not have a defined mechanism of injury (MOI). Therefore, it is not fully understood the origin or cause of these joint related issues. Another concern of these joint issues is that a majority of both current and past research suggests that being more active equates to being healthier overall although there is evidence that exercise activity in early adult life is a risk factor for arthritic changes in the knee (25).

College students, although viewed as being some of the healthiest members of our society, often experience some level of joint dysfunction or pain (10). These individuals may initially be overlooked when trying to account for the number of active arthritic cases in the United States (US) although nearly 60% of patients with arthritic changes in their joints are of working age between 18 and 60 years (6). Most of the college-aged population's musculoskeletal complaints are viewed as transient in nature and more often associated with situational factors as opposed to formally diagnosed chronic medical pathologies (15). Menéndez and colleagues (19) highlighted a common transient situational factor associated with musculoskeletal complaints that was detected and reported in individuals with poor computing postures observed in the workplace. It was speculated that these poor postural behaviors observed in adult populations may have originated during extensive computer use in these individuals as students. As a result, an unhealthy motor behavior pattern and suboptimal level of global postural awareness manifested among active working adults (19). Since the risk of musculoskeletal pain to the upper

extremity doubles with four or more continuous hours of computer usage and since many college students and workers exceed that threshold as a consistent aspect of their daily routines, examination of this population has been deemed prudent (15, 28, 33). Earlier studies that centered on college students focused more on postural loads during extended periods of sitting or inactivity in front of a computer while doing work associated with classes or employment as opposed to contextual factors which may also have a direct impact on joint health amongst this population (23, 10). Computer usage of approximately three hours each day or 21 hours each week is associated with neck, upper back, and lower back pain possibly due to forward head posture (4, 9, 12). Over 40% of students surveyed between two universities in the northeastern and southwestern US reported upper extremity pain while computing in the previous two weeks. Furthermore, more than half of that sample reported that upper extremity pain limited their role as a student to stationary behavior during college-level coursework may reasonably lead to maladaptive movements (e.g., rounded shoulders, forward head posture, decreased range of motion and movement capabilities with the upper extremity) in response to musculoskeletal pain (14). The impacts of experiencing persistent joint pain as a result increased stationary time in front of computer screens and other educational technologies has become a more common demand for today's students. This increased static postural loading and strain may be significant as Vega and colleagues noted of cases of knee pain presented at an orthopedic surgery practice, patients who were recommended to undergo surgery were younger than those who were not recommended surgical intervention at 32.4 ± 14.7 years (31). The timing of these invasive procedures used in attempts to address joint pain among younger populations may present added complications and significantly increase the need for these individuals to undergo future revisions of these replaced joints when compared to other joint pain surgical cases where surgical intervention was performed in individuals older than 60 years (3). Utilizing movement screening may be a more practical primary option to address musculoskeletal concerns before irreversible progression into significant clinical pathologies such as arthritis occur. The Functional Movement Screen (FMS), a specific movement-based screen developed by Gray Cook & Lee Burton in the 1990s, has been researched previously most often with athletic populations and tactical/public service occupations (21). The FMS could uncover postural malalignment faults in addition to the presence of pain throughout the various testing movements utilized within the screening tool. With this information, an appropriate non-invasive intervention plan utilizing corrective exercises could be implemented as a therapeutic intervention plan to address non-clinical populations suffering from joint paint (20, 21). Though not currently accepted as a clinical tool for the formal diagnosis of maladaptive clinical joint pathologies, employing an early movement-based screening analysis among the general population could help reduce ongoing pain and discomfort for many individuals, including college students (20, 21, 29). The benefits of implementing these primary interventions are magnified when implementing the FMS screen only requires the functional anatomy of the screened participant and the portable FMS screening kit.

The purpose of this descriptive study was to examine joint pain in nonclinical college students and investigate some of the potential mechanical and ergonomic-related contributions to that pain. Building upon the previous research conducted on the potential negative long-term ramifications and increased costs/risks of early aggressive surgical interventions (3), the study

aimed to provide more insight on how joint pain may be better detected and addressed within this unique global population. While some college students are viewed as some of the healthiest members of our society, they too appear to be suffering from an increase in joint-related pain. Early detection of joint dysfunction could be an opportunity for universities and faculty to make a conscious effort in supporting student-centered health initiatives on their respective campuses that have the potential to be delivered at little to no cost for their respective student populations while these individuals are actively enrolled and reporting to their respective campus/university grounds.

METHODS

This research was carried out fully in accordance to the ethical standards of the *International Journal of Exercise Science* (22).

Participants

University officials emailed the study invitation including the link to the online survey to all students enrolled at a multi-campus university in the southeastern United States during the fall 2021 academic semester. From the total number of students who may have received the email invitation (n = 18,985), 211 students completed the survey for a response rate of 1.11%. The researchers accepted a low response rate for this exploratory investigation because survey research among college students often experiences historically low response rates (32); furthermore, the sample size of the present study is comparable to previous surveys of pain with computing among college students (14, 19). Additionally, by surveying the entire population, sampling bias was reduced since all enrolled students were invited to take part in the study (27). Exclusion criteria included being under 18 years of age, reporting a history of musculoskeletal injury to a joint including injuries that were not evaluated by a healthcare provider, reporting a history of surgery in or around a joint, or having been diagnosed by a doctor with a medical illness that might result in joint pain such as systemic inflammatory conditions.

Instrumentation

The research team developed the Joint Health Survey – College Population Questionnaire for this study. Observations from the researchers' professional interactions as certified athletic trainers, sports performance professionals, and college educators prompted a review of literature in sports medicine, orthopedics, and strength and conditioning which served as the foundation for survey item development. The process was collaborative and required consensus from each member of the research team before an item was added to the final survey.

The questionnaire contains questions in five participant-reported categories: demographic information, items regarding former and current participation in various levels and types of activities, questions regarding current joint pain or discomfort, questions about current joint stiffness or tightness, and a section asking about daily experiences during movement. With the exception of the optional free-response item presented to respondents who indicated

previous joint dislocation or surgery, all items present dichotomous options. Table 1 is a summary of the demographic items on the instrument.

Participants were excluded if they have received a formal diagnosis by a doctor of a medical condition that affects joints such as osteoarthritis, rheumatoid arthritis, fibromyalgia, or other similar conditions or if they have been treated by a doctor or other healthcare professional, which could be interpreted as an athletic trainer, physical therapist, chiropractor, nurse, or any other provider with musculoskeletal training, for a joint dislocation or joint surgery. If participants reported a history of joint dislocation or surgery, they were invited to describe in their own words which joint was affected and what happened; this additional context may have allowed researchers to avoid excluding participants as several respondents provided history of ligamentous sprains and bony fractures. Lastly, respondents indicated if they currently experience joint pain and were asked to categorize the duration of their pain.

Table 1. Demographic Items on Joint Health Questionnaire – College Population

Item Prompt	Item Response Options
Has a doctor ever told you that you have a medical condition that affects your joints?	Yes/No
Sex assigned at birth	Options with non-specific and non-response choices
Current student status	Options of full-time, part-time, and degree level with non-specific and non-response choices
Current employment status	Options of full-time, part-time, unemployed but seeking, unemployed and not seeking, and non-response choices
Age	Age ranges presented in 2-year increments
Have you seen a doctor or healthcare professional for a joint dislocation or joint surgery?	Yes/No
Current joint pain or discomfort	Yes/No
Duration of joint pain*	Options for less than 6 weeks, 6 weeks – 3 months, more than 3 months, and unknown

* Presented only if respondents indicate "yes" to the item regarding current joint pain or discomfort

Table 2. Activity Items on Joint Health Questionnaire – College Population

Item Prompt	Item Response Options
Previous involvement with sport and recreation activities	10 multiple selection items with a variety of activities
Time seated or reclining during a work or classroom day	Options in 2-hour increments
Percentage of time active during a typical work or classroom day	Options in increments of 25%
Percentage of time seated or reclining during day off	Options in increments of 25%
Percentage of time active during a day off	Options in increments of 25%

For respondents who indicated current joint pain, the next section captured participants' previous and current activity. Respondents were presented items regarding previous involvement with sport and recreational activities followed by items estimating time seated, reclining, and active during typical classroom and workdays and during typical off days. Table 2 is a summary of the items that assessed participants' level of activity. These items provided a point of reference for determining the relatively sedentary nature of classroom and work engagement.

Participants who indicated joint pain proceeded to indicate which of the following joints were painful:

- cervical spine/neck
- thoracic spine/middle back
- lumbar spine/low back
- shoulder
- elbow
- wrist/hand
- hip/pelvis
- knee
- ankle
- foot/toes

For each joint, respondents had the option to indicate if the pain was present on the left side, right side, or bilaterally. A dropdown item collected severity of pain on a 0 – 10 scale with instructions to indicate "0" for "no pain" and 10 for "most severe pain". Respondents were asked if they experienced stiffness or tightness in any of their joints; if they indicated stiffness or tightness, the survey presented the same joint options with prompt to select joints that felt stiff. Respondents also indicated if pain or discomfort has increased recently.

Lastly, respondents who felt painful joints were asked additional questions about their experiences of joint pain including when pain occurs, how joint pain affects activities of daily living (ADLs), and how the pain has affected their movement. The instrument presents five questions inquiring when during the day pain or discomfort is experienced. Each of the following items include forced-choice options for 0 days/week, 1-2 days/week, 3-4 days/week, 5-6 days/week, or 7 days/week:

- How often do you experience pain or discomfort in your joints when you are not physically active?
- How often do you experience pain or discomfort in your joints between the hours of 7 a.m. and 11 a.m.?
- How often do you experience pain or discomfort in your joints between noon and 5 p.m.?
- How often do you experience pain or discomfort in your joints between the hours of 6 p.m. and 10 p.m.?
- How often do you experience pain or discomfort in your joints between the hours of 10 p.m. and 6 a.m.?

Two additional items ask the frequency with which joint pain affects their activities of daily living and their ability to perform academic or work-related tasks: always, most of the time, about half of the time, sometimes, or never.

Participants are finally asked if they have noticed any noises or sensations in their joints with movement. If they reply "yes", then they are presented with five more "yes or no" items:

- Do you experience pain or discomfort with these sensations?
- Have you experienced weakness in any of your joints?
- Do you feel that your posture has changed because of your joint health?
- Do you feel that your balance or coordination has changed because of your joint health?
- Do you feel your overall level of function has changed because of your joint health?

With approval from the IRB, the researchers distributed the survey to a convenience sample for pilot testing. Respondents were asked to supply feedback to improve item clarity, survey appearance, and survey flow. The research team reviewed the pilot test data to ensure the instrument performed as expected and edited a few items. The item asking for sex assigned at birth originally used the language "gender identity." The order of the demographic items was rearranged to capture exclusionary criteria earlier in the survey. The presentation of the items asking respondents to indicate pain on the left, right, or bilateral joints was changed from one large table to several smaller tables that are organized by region - spine, upper extremity, lower extremity - for easier viewing on mobile devices. Also, the word "perform" was misspelled in one of the questions as "preform" and was corrected. The researchers determined that the edits promoted readability without altering item constructs, so the instrument was finalized.

Study Protocol

University officials distributed an email with the study invitation including the link to the finalized survey to all students (n = 18,985) enrolled in classes at a multi-campus university in the southeastern United States during the fall 2021 academic semester. Two weeks after the distribution of the first survey invitation, university officials issued a reminder email. Four weeks after the first invitation, the questionnaire closed, and the researchers exported the data from Qualtrics for import into SPSS.

Statistical Analysis

For this descriptive study, the researchers reported frequencies. Analyses were performed using SPSS version 29 (IBM Corps, Armonk, N.Y.). The Joint Health Questionnaire – College Population uses display logic to decide which survey items are presented to respondents, so the statistical analyses are based on responses of participants who could engage with each item.

RESULTS

After excluding ineligible responses, the researchers completed data analysis for 116 responses. Table 3 is demographic data for the respondents included in the study.

Most of the respondents to the survey were 18 – 23 years of age and were pursuing undergraduate degrees.

Table 3. Respondents' Demographic Information (N=116)

Demographic	*n*
Degree level of academic program	
Baccalaureate	99 (85.3%)
Post-baccalaureate	17 (14.7%)
Gender identity	
Male	28 (24.1%)
Female	87 (75%)
Nonbinary/Prefer not to respond	1 (0.9%)
Age in years	
18 – 19	43 (37%)
20 – 23	53 (45.7%)
24 – 25	5 (4.3%)
>26	15 (12.9%)

Table 4. Characteristics of Respondents' Self-reported Joint Pain

Characteristic	*n*
Pain without diagnosed injury or illness	*N = 116*
Yes	72 (62.1%)
No	44 (37.9%)
Pain affects school	*n = 63*
Always	1 (1.6%)
Most of the time	3 (4.8%)
About half of the time	4 (6.3%)
Sometimes	27 (42.9%)
Never	28 (44.4%)
Pain affects ADLs	*n = 63*
Always	1 (1.6%)
Most of the time	1 (1.6%)
About half of the time	4 (6.3%)
Sometimes	18 (28.6%)
Never	39 (61.9%)
Duration of pain	*n = 63*
Acute (<6 weeks)	17 (27.0%)
Subacute (6 weeks to 3 months)	5 (7.9%)
Chronic (>3 months)	30 (47.6%)
Unsure of duration	11 (17.5%)

The present study assumed that post-secondary students who have not experienced an illness or musculoskeletal injury to their joints should have intact joints with no regularly occurring pain. To this end, the researchers excluded from data analysis respondents who self-reported having been evaluated by a healthcare provider for joint injury. Despite no known joint illness or injury, 62% (n = 72) of respondents reported experiencing some level of joint pain. The pain experienced by nine respondents did not align with the joint locations included in the survey and were not included in analyses. Of note, 55% (n = 35) of our sample with pain replied that joint pain has affected their educational experience and 38% (n = 24) of the same sample reported that joint pain has affected their Activities of Daily Living (ADLs). Table 4 is the frequencies of pain descriptors offered by otherwise healthy respondents who experience joint pain.

Follow-up questions after establishing the impact of joint pain in the otherwise healthy sample looked to explore the severity of the pain especially since participants replied that their ADLs and academic work are affected. On a scale from zero to ten, with zero standing for no pain and ten standing for the worst pain imaginable, 85% (n = 56) of our participants reported that their current level of pain was between three and seven. Additionally, 47% (n = 31) of respondents self-reported that their current level of pain has increased recently. Figure 1 represents the frequencies of responses to the pain quantification questions on the Joint Health Questionnaire – College Population. The reader should note that the traditional anchor of zero on the pain scale was removed from the table because zero is synonymous with being pain-free and because respondents who replied that they are not currently experiencing joint pain were not presented with this item; anyone who had the opportunity to respond to this question, therefore, had pain.

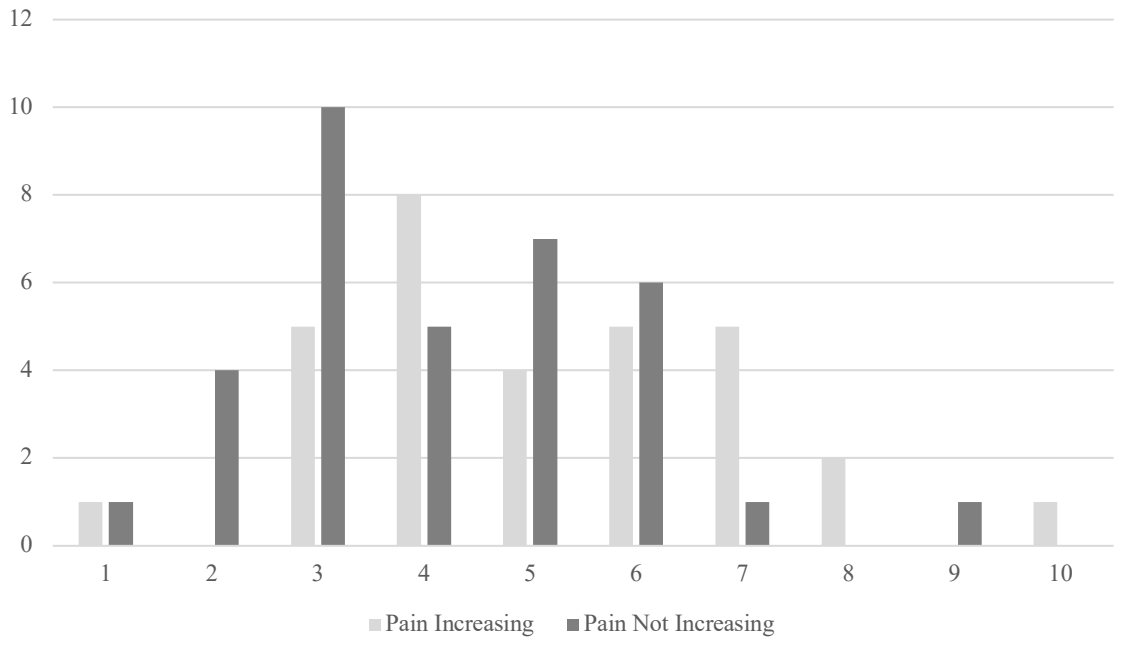

Figure 1. Quantification of respondents' joint pain (N = 66). Respondents indicated current joint pain on a scale from 0 – 10 with 0 being "no pain" and 10 being "the worst pain imaginable." Of the 66 respondents, 85% indicated a current level of pain between three and seven. Thirty-one respondents (47%) indicated that their current level of pain was increasing.

Students who spend more of their time with academic classwork seemed to experience joint pain more often than students with lesser course demands. Table 5 is the frequencies of student and employment statuses reported by the 66 nonclinical participants in the present study who reported joint pain.

Table 5. Frequencies of pain[a] based on student and employment status

Student and Employment Status	Number of respondents experiencing pain (n = 66)
Full-time student with full-time job	6 (9.1%)
Full-time student with part-time job	28 (42.4%)
Part-time student with full-time job	7 (10.6%)
Part-time student with part-time job	4 (6.1%)
Full-time student, not employed	17 (25.8%)
Part-time student, not employed	4 (6.1%)

[a]Table 5 is the frequencies of pain reported by students with various academic and employment statuses. Of the 66 respondents who indicated they experienced joint pain without known cause, full-time students with part-time jobs (n = 28) and full-time students without jobs (n = 17) reported pain more than students with other academic and employment statuses. The reader should note that this information does not address the degree of pain, on a scale from 0 – 10.

The researchers wondered if the amount of time spent in class and at work may be associated with increased sedentary behaviors such as sitting, reclining, or lying down. Tables 6 and 7 highlight potential concerns of these sedentary behaviors. Table 6 represents the percentage of time students were active during a typical day of class and work. Of the 66 respondents who reported pain in the absence of known injury, 77% (n = 51) indicated that they were active less than 50% of the time when present for class or work.

Table 6. Percent time active during class or work

Student and Employment Status	25% of time or less	25-50% of time	50-75% of time	More than 75% of time
Full-time student, full-time job	1	2	1	2
Full-time student, part-time job	10	11	5	2
Part-time student, full-time job	2	3	1	1
Part-time student, full-time job	1	1	1	1
Full-time student, not employed	4	12	1	0
Part-time student, not employed	4	0	0	0

Table 7. Percent time sedentary on day off from class and work

Student and Employment Status	25% of time or less	25-50% of time	50-75% of time	More than 75% of time
Full-time student, full-time job	0	1	5	0
Full-time student, part-time job	5	11	12	0
Part-time student, full-time job	0	3	4	0
Part-time student, full-time job	1	1	1	1
Full-time student, not employed	0	9	8	0
Part-time student, not employed	0	2	1	1

Table 8. Frequency of joints affected by pain

Joint	*n*
Cervical spine pain	*N = 25* (37.9%) [a]
Unilateral	6 (24%)
Bilateral	19 (76%)
Thoracic spine pain	*N = 23* (34.8%)
Unilateral	4 (17.4%)
Bilateral	19 (82.6%)
Lumbar spine pain	*N = 33* (50%)
Unilateral	5 (15.2%)
Bilateral	28 (84.8%)
Shoulder pain	*N = 28* (42.4%)
Unilateral	19 (67.9%)
Bilateral	9 (32.1%)
Elbow pain	*N = 5* (7.6%)
Unilateral	3 (60.0%)
Bilateral	2 (40.0%)
Wrist or hand pain	*N = 13* (19.7%)
Unilateral	10 (76.9%)
Bilateral	3 (23.1%)
Hip or pelvis pain	*N = 21* (31.8%)
Unilateral	5 (23.8%)
Bilateral	16 (76.2%)
Knee pain	*N = 43* (65.2%)
Unilateral	15 (34.9%)
Bilateral	28 (65.1%)
Ankle pain	*N = 16* (24.2%)
Unilateral	9 (56.3%)
Bilateral	7 (43.8%)
Foot or toes pain	*N = 10* (15.2%)
Unilateral	4 (40.0%)
Bilateral	6 (60.0%)

[a]Table 8 is the frequencies of pain reported in various joints. Sum of all reported painful joints will exceed the number of respondents who reported pain (*n* = 66) because respondents indicated experiencing pain in multiple joints.

While Table 6 shows the percentage of time students engaged in activity during a typical day of class or work, the argument of potentially concerning inactivity must consider the amount of time students are inactive during a typical day off. Fifty-eight respondents out of 66, accounting for 88% of the students who are experiencing joint pain without a known cause, reported spending 25 – 75% of their time off in a seated position. Table 7 represents the percentage of time respondents were sedentary on a typical day off according to their student-employment status.

Non-clinical college students self-reported higher levels of pain within their postural joints as opposed to other areas in the body. From a mechanical standpoint, postural joints, such as the knee, spine, and hip are often subjected to more strenuous and consistent internal loading throughout the day as opposed to non-postural joints like the wrist, hand, and fingers whose primary tasks are more associated with dexterity and the execution of tasks of daily living. The most prevalent painful joints in this sample were knees ($n = 43$), lumbar spine ($n = 33$), shoulders ($n = 28$), cervical spine ($n = 25$), thoracic spine ($n = 23$), and hips or pelvis ($n = 21$). Except for shoulders, our respondents reported pain bilaterally more commonly than unilaterally. Table 8 is the frequencies of pain by joint.

More respondents indicated bilateral than unilateral pain of the lower extremity and spine. In the upper extremity, more respondents reported unilateral pain than pain affecting both sides.

DISCUSSION

The exploratory study's scope focused on the self-identification of physiological and mechanical factors that may be associated with joint pain among college students. The self-reported levels of joint pain and dysfunction by participants in the study may not have been related solely to physiological and mechanical factors. With added time now often spent in a low-energy and low-activity state in the classroom, a student's inability to adhere to the recommendations of weekly physical activity may be a unique situational barrier that is beyond the direct control of students. The authors of this exploratory study used a post-secondary population as a starting point for examining the prevalence of joint health related issues among non-clinical populations. To date, most studies on joint health have focused on the athletic or older populations while little to no research has been conducted on the general post-secondary population (29).

Preliminary data from this joint health study showed that of the 211 respondents, 116 that self-reported some aspect of joint pain also reported having never visited a healthcare professional for a joint injury or joint surgery and therefore not having been formally diagnosed with an illness that affects their joints; we researchers considered this population to fall within the non-clinical designation. Seventy-two of the 116 respondents (62%) reported current joint pain, less than what was reported by nursing students (79%), although most of these complaints associated with the nursing student population were related to the physiological activity and strain required as part of their clinical rotations (16). The students most affected by pain reported being current full-time students with a part-time job. Added findings of the study found almost half (47.6%) of the participants who reported pain self-reported that their pain was chronic in nature, which appears to contrast with what was reported by Katz et al. highlighting that for

this population most musculoskeletal complaints were transient (15). Moreover, 85% of participants reported their level of pain to be between three and seven out of a scale of ten; 47% reported their pain was becoming worse. Furthermore, 38% reported that their joint pain affected ADLs; 44% reported their pain affected their academics. The respondents most often reported pain in their cervical, lumbar, hip, and knee joints, similar to what was previously reported (13). Perhaps the reason over 60% of painful respondents to the survey experience joint health concerns was attributed to self-reported inactivity. The researchers speculated that the amount of time spent in class and at work may decrease the amount of time available for exercise or recreational activities. Much of these students' reported pain and discomfort could be secondary to positions that they support for extended lengths of time (1, 28). Specifically, these positions can lead to upper crossed syndrome or lower crossed syndromes which can create a cascade of issues if not properly treated. Upper crossed syndrome, commonly secondary to sedentary work including computer use for coursework or employment, can lead to forward head, rounded shoulders, and kyphosis (1). Another concern, related to being seated for prolonged periods of time, can be characterized by anterior pelvic tilting, lumbar lordosis, and weakened abdominal musculature (28).

Even though the sample size is small, there was still value in the findings. A large majority of college students surveyed reported a joint health issue in a population that most would consider too young to have pain without a known cause. Given that 62% of the population sampled reported one or more joint health issues, further research in this area appears necessary. Resources dedicated to the assessment and treatment of joint pathologies are typically more focused on the rehabilitation side of joint health issues after a reported trauma as opposed to being focused on more proactive and prevention-based strategies. Universities may be able to use resources on their respective campuses to help examine and address joint-related problems in this population. Helping college students find potential causes or triggers of joint pain, stiffness, or dysfunction may lead to more primary or preventative approaches that could be implemented while these individuals have direct access to campus resources unavailable to the public. A formal movement screen like the Functional Movement Screen (FMS) could be a starting point for some institutions. The FMS has its roots as a continuation of the pre-participation examination for sport and examines a person's functional capacity (7). The FMS uncovers the presence of pain and joint dysfunction throughout its 7 movements and clearing tests, the presence of which should lead a participant to seek medical attention for a more appropriate examination or assessment (7, 8). While FMS screening has mostly been used in the athletic and tactical populations (fire, police, and military), the general population may gain a greater benefit from an FMS screen. The overarching goal is to find ways to be more proactive with this population and to potentially alleviate some of the costs associated with rehabilitation, prescription drugs, and time lost due to joint health issues. Moreover, the lack of past and current research on joint health in college students may begin to shed light on the need to implement and fund more proactive methods to best address this emerging issue.

Because of the small sample, the present study should be interpreted as exploratory and should not be expected to be generalizable. While the authors accept that sampling bias was reduced by sampling all students enrolled at the university at the time of distribution, the sample is

limited to students who engaged with the emailed study invitation during the study window and the authors acknowledge that students from a multicampus university in the southeastern United States may not represent students from other universities. Standard limitations of survey research also apply - the researchers did not directly supervise participants while they were responding to the survey instrument so participants answered survey items based on their interpretation of the item prompts and recall bias may have affected responses.

Recommendations for future research would include the addition or expansion of the survey to include a targeted series of questions to better explore and account for the potential influence of psychological and social factors on the manifestation of non-clinical joint pain among students. Future research should also consider more ways to implement multiple sampling strategies in order to increase response rates among the college population. Demographic information collected from the pilot study can assist in the identification of comparable student populations and institutions where the survey instrument could be issued. Another recommendation would be to implement the survey of joint health in a longitudinal manner as opposed to the cross-sectional design implemented as part of this descriptive exploratory study. If a shift to a longitudinal/cohort study model were to be adapted, additional contact information from participants may need to be collected to ensure an adequate number of repeated responses were collected. This would require an amendment to data collection and storage procedures to ensure data security across the duration of the new study design. Additionally, future research should consider pairing the joint health questionnaire with a formal movement screen such as the FMS. Comparing the response of each participant's joint health questionnaire with the results of their FMS screen may provide better insight into the root cause of participant's joint pain.

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