Differences in physical activity behaviors of university women from rural, micropolitan, and metropolitan areas

by

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Abstract

Background: Significantly fewer rural adults than urban adults meet physical activity (PA) guidelines, making rural adults one of the most physically inactive populations (only 19.4% meet PA guidelines). Women are also less physically active than men (20.1% versus 28.8% meet PA guidelines). Rural women identify numerous PA barriers in adulthood, many of which are community-related. In childhood, rural girls are less active than both their male and urban counterparts, and overall, PA declines from adolescence into adulthood. Many past studies have examined how PA behaviors change in college-aged populations, though few have shown how a student's past environment may relate to their current behavior. Because barriers for rural women are rooted in their community, the social ecological model (SEM - based on the idea that the environment shapes behaviors) may be useful to categorize barriers and facilitators to PA. **Purpose:** To test for differences in current self-reported PA levels among university women from metropolitan, micropolitan, and rural areas, as well as gather insight into barriers and facilitators for PA within the first four levels of the SEM (both in high school and in the university setting). Women from rural areas were hypothesized to report less PA and more barriers to PA than those from metropolitan and micropolitan areas both in high school and in the university setting. **Methods:** Inclusion criteria were women age 18-24, attended in-person classes at a US university, and were not collegiate athletes or had an injury/disability that hindered the ability to do PA. Women respondents (n=371) provided demographic information, self-report PA via the international physical activity questionnaire (IPAQ, long form), and both scaled (scale: 1 – strongly disagree to 5 – strongly agree) and summed responses for barriers and facilitators to PA. Data were analyzed by Kruskal-Wallis H tests and Mann-Whitney U tests to examine differences between Rural Urban Commuting Area (RUCA) groups – metropolitan,

micropolitan, and rural. **Results:** Respondents were a mean age of 20.0 years (SD = 1.2 years), mostly white (84.5%), not Hispanic or Latino (91.1%), and were categorized into a RUCA group [metropolitan (n = 258), micropolitan (n = 41), and rural (n = 65)] based on high school ZIP codes. No significant differences were found between groups for total PA (Median: 2007.5 MET-min, IQR: 568.9-5035.5 MET-min) or intensity-specific PA. Recreational vigorous activity was statistically significantly different by Mann-Whitney U test (U = 224.5, p = 0.012), in which participants from rural areas reported significantly more recreational vigorous activity than participants from micropolitan areas. A statistically significant difference was found for recreational walking, in which micropolitan participants did less recreational walking than rural participants (KW: $\chi 2(2) = 7.525$, p = 0.023; U=394.0, p = 0.006). Statistically significant differences for access to resources (KW: $\chi 2(2) = 17.543$, $p < 0.001$) and perceived PA resources in the high school community (KW: $\chi 2(2) = 23.138$, $p < 0.001$) were found, in which rural participants reported less access to resources than both micropolitan (U = 621.5, p = 0.001) and metropolitan (U = 4328.5, $p < 0.001$) participants and fewer perceived resources than both micropolitan (U = 539.0, $p < 0.001$) and metropolitan (U = 3600.5, $p < 0.001$) participants. **Discussion:** The hypothesis that rural women would report less PA was not supported in this study. Women from rural areas identified as having less access to PA resources in their high school setting, which is consistent with previous literature among adult rural women. Yet, they reported significantly greater recreational PA than those from micropolitan areas. Future research should investigate whether PA is more influenced by past PA behaviors and environments or the current environment in which participants live.

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Chapter 1 - Literature Review and Introduction

Physical Activity & Health

Physical activity is "any bodily movement produced by skeletal muscles that requires energy expenditure" (World Health Organization, 2018). It includes activities such as walking, doing housework, occupation-related movement, and recreational movement (World Health Organization, 2018). Physical activity has a positive impact on health outcomes such as functional capacity and physical fitness (U.S. Department of Health and Human Services, 2018) and an inverse relationship with chronic diseases like obesity and cardiovascular disease (Haskell et al., 2009). To gain health benefits and reduce health risk, it is recommended for adults to do 150-300 minutes of moderate-intensity activity or 75 minutes of vigorous activity per week (U.S. Department of Health and Human Services, 2018). The guidelines for physical activity (150-300 minutes of moderate activity) are equivalent to 500-1,000 MET-min (MET: metabolic equivalent, the rate at which the body expends energy), which is commonly used to measure physical activity in science (2018 Physical Activity Guidelines Advisory Committee, 2018).

Rural & Women's Health

Data from the United States National Health Interview Survey show that significantly fewer rural adults meet the physical activity guidelines than their urban counterparts (Whitfield et al., 2019). Specifically, rural adults are among the least physically active populations (only 19.6% met physical activity guidelines in 2017) (Trust for America's Health, 2019). Additionally, research from the 2016 Behavioral Risk Factor Surveillance System showed rural adult obesity rates were 19% higher than urban adults (Trust for America's Health, 2019). Women are also less physically active (i.e., 20.1% meeting physical activity guidelines) and more likely to be obese (41.1% obese nationally) than men (28.8% meeting physical activity

guidelines and 37.9% obese) (Trust for America's Health, 2019). Thus, it could be inferred that being a woman from a rural area puts one at greater risk for not meeting physical activity guidelines and having obesity.

A focus group examining physical activity behaviors in rural women from ages 18 to 70+ found that across all age groups, lack of awareness about the importance of physical activity was a barrier to participating in it (Zimmerman et al., 2016). Two of those subgroups, encompassing ages 18-50, identified physical inactivity as the norm for their age (Zimmerman et al., 2016). Rural women identify multiple barriers to participating in physical activity. Individual factors including a lack of time and energy (Osuji et al., 2008), lack of motivation, lack of knowledge of the benefits of physical activity for health, and lack of understanding of how to properly use exercise equipment were barriers to physical activity (Gilbert et al., 2019). In terms of social support, a lack of childcare was identified as a barrier (Wilcox et al., 2000). Lack of infrastructure supporting physical activity within their communities was also a barrier to participate in physical activity (Bove & Olsen, 2006; Kegler et al., 2008; Wilcox et al., 2000).

Adolescence into Adulthood

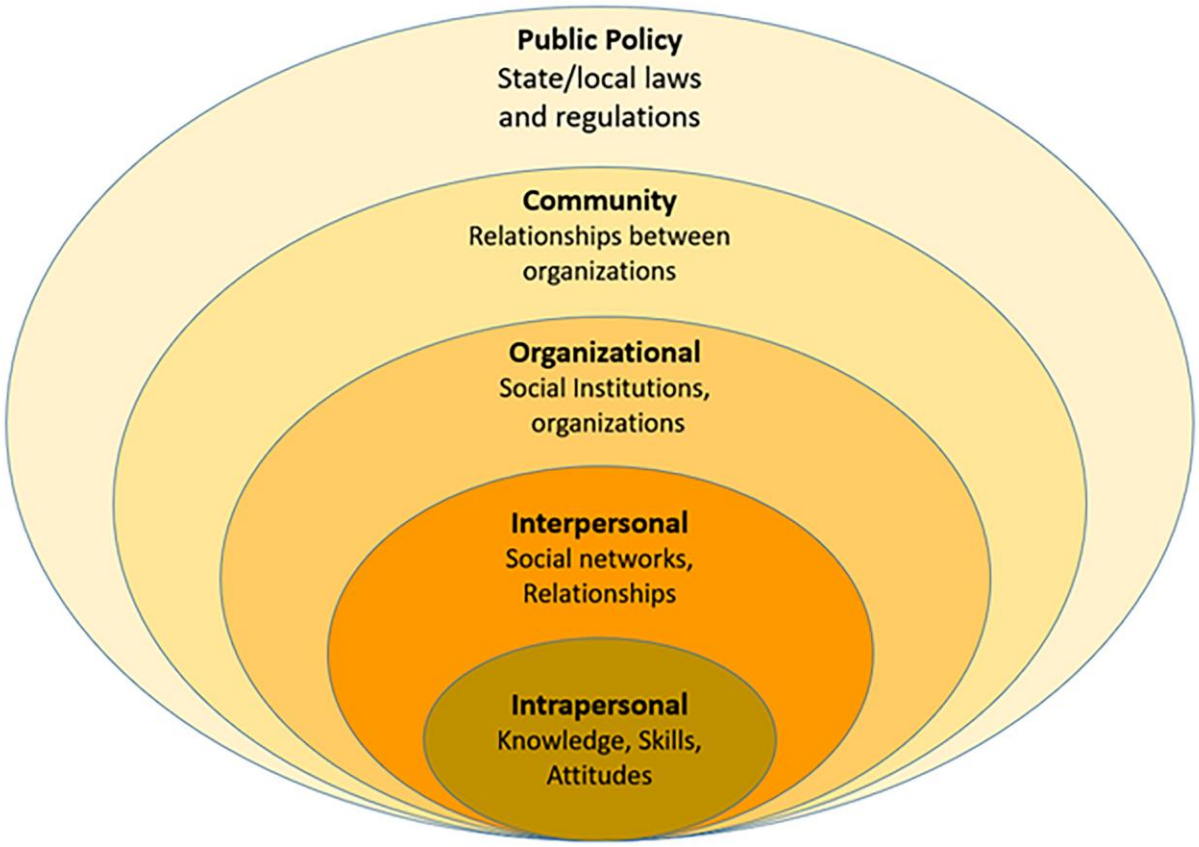
Though some studies have shown that rural adolescents engage in more physical activity per week than urban adolescents (Kasehagen et al., 2012), young rural girls have been found to engage in significantly less physical activity than their rural male and urban male and female counterparts (Collins et al., 2012). Additionally, Wells et al. (2017) identified that physical inactivity is more common among adolescent girls than boys, and adolescent physical inactivity was associated with physical inactivity in young adulthood. Only one-fifth (20.0%) of adolescents (high school age) were categorized as meeting both aerobic and muscle-strengthening physical activity guidelines in 2017 (Centers for Disease Control and Prevention,

2019). Barriers to participate in physical activity are described as “intrapersonal” and included lack of motivation and/or skill to do physical activity by young women in grades 11-12 (Gyurcsik et al., 2006). Interestingly, first-year university freshmen women reported more barriers than high school participants (Gyurcsik et al., 2006). Perceived barriers at the university level have been shown to predict future health behaviors (Lovell et al., 2010). Among non-exercising university females in the United Kingdom, common barriers included spatial barriers “places for me to exercise are too far away” and personal barriers, “exercise is hard work for me” (Lovell et al., 2010). Physical inactivity appears to be a trend in rural women beginning at a young age and continuing into adulthood. Unsurprisingly, physical activity declines from adolescence into adulthood (Corder et al., 2016), making college-aged women an optimal population to target for gathering information about current and past behaviors.

Social Ecological Model (SEM)

Figure 1.1.

Social Ecological Model



Ecological models (e.g.., social ecological model [SEM] – see Figure 1.1.), are often used when examining physical activity behavior across populations and are informed by the idea that adaptations are made by individuals in response to the resources one has available to them (Spence & Lee, 2003; King & Gonzalez, 2018). Ecological models are useful in that they provide purpose and describe the places/environments in which physical activity takes place, which supports the objectively measured data often reported (Sallis et al., 2006). Specifically, an individual's personal beliefs, knowledge, and demographic characteristics are the root of this model (individual/intrapersonal), followed by the relationships they have with friends, family,

and other social networks around them (interpersonal). The intrapersonal level is heavily researched in physical activity behavior research, as constructs including self-efficacy, motivation, self-regulation, and similar comprise many of the physical activity behavior theories (Zhang & Shilko, 2020). The interpersonal level, which includes the social aspect of physical activity, is also frequently researched. Both perceived social support and the social norms of an area's impact on activity preferences and participation (Zhang & Shilko, 2020). Universities, schools, and workplaces are common examples at the organizational level. Organizations that individuals are exposed to can have an impact on their physical activities by providing or limiting resources that make physical activity more or less accessible (Zhang & Shilko, 2020). The cities, towns, or general area in which smaller interacting groups are located (e.g., place of residence, etc.) compose the community level of the model. Resources for physical activity are also a crucial part of this level in the SEM, such as accessibility to recreation centers, public transportation, and other physical activity facilitators (Zhang & Shilko, 2020). The ecological model assumes that individuals change their behaviors in response to resources available to them in their environments (Spence & Lee, 2003). The importance in understanding how the environment impact physical activities calls for research of various areas of living.

Defining "Rural"

In physical activity research, no one definition of rural is identified as the "gold standard." Merriam-Webster (2020) defines rural as "in, relating to, or characteristic of the countryside rather than the town," which is broad and provides no quantitative value. The U.S. Census Bureau is also fairly vague, "'Rural' encompasses all population, housing, and territory not included within an urban area" but adds quantification by defining urbanized areas (50,000+ people) and urban clusters (at least 2,500 and less than 50,000 people) (U.S. Census Bureau,

2020). Zimmerman et al. (2016) used Rural Urban Continuum Codes (RUCC) to stratify groups of women, which "classifies counties as metropolitan or non-metropolitan by degree of urbanization based on population size and proximity to an urban area." These codes provide more specificity: 1-3 are metropolitan counties, with populations ranging from <250,000-1,000,000 or more. Rural-urban continuum codes 4-9 are non-metropolitan counties defined by both population size (<2,500-20,000+) and adjacency to a metropolitan area (adjacent or not adjacent) (National Cancer Institute: Surveillance, Epidemiology, and End Results Program, 2014). While this is much more specific and quantifiable than using Merriam-Webster or the U.S. Census Bureau, discrepancies lie at the county level. Rural-Urban Commuting Area (RUCA) codes, though like RUCC, effectively distinguish rural areas for purpose of health-related research through ZIP codes, which helps identify rural portions of metropolitan counties (Hart et al., 2005). RUCA codes were created using U.S. census tract data for population density, urbanization, and daily commuting within an area (USDA: Economic Research Service, 2020). Rural RUCA codes are numbered 7-10 (small town core -- rural), micropolitan RUCA codes are 4-6 (micropolitan area core – micropolitan low commuting), and metropolitan RUCA codes are 1-3 (metropolitan area core – metropolitan low commuting). Table 1.1 provides the RUCA codes in detail.

Table 1.1.

Primary RUCA Codes, 2010

1	Metropolitan area core: primary flow within an urbanized area (UA)
2	Metropolitan area high commuting: primary flow 30% or more to a UA
3	Metropolitan area low commuting: primary flow 10% to 30% to a UA
4	Micropolitan area core: primary flow within an Urban Cluster of 10,000 to 49,999 (large UC)
5	Micropolitan high commuting: primary flow 30% or more to a large UC
6	Micropolitan low commuting: primary flow 10% to 30% to a large UC
7	Small town core: primary flow within an Urban Cluster of 2,500 to 9,999 (small UC)
8	Small town high commuting: primary flow 30% or more to a small UC

9 Small town low commuting: primary flow 10% to 30% to a small UC
10 Rural areas: primary flow to a tract outside a UA or UC

Using RUCA codes to test for differences in physical activity between metropolitan, micropolitan, and rural women is novel, though many studies have looked at the relationship between urban and rural adults. Data from the National Health Interview Survey showed urban adults to be more active by almost six percent in 2017 (25.3% urban adults vs 19.6% rural adults meeting physical activity guidelines) (Trust for America's Health, 2019). The Behavioral Risk Factor Surveillance System (BRFSS) stratifies adults by residence into six groups ranging from large metropolitan center to noncore (rural); data collected in 2013 by this system showed that only 46.7% of rural adults were meeting aerobic physical activity guidelines, whereas more than 50% of metropolitan county adults were meeting physical activity guidelines (range: 50.7 - 51.4%) (Matthews et al., 2017). However, one study to date analyzed differences in both objective and subjective physical activity levels of adults across the RUCA classifications of metropolitan, micropolitan, and rural (Fan et al., 2014). Though objectively measured data indicated that rural adults were less active than micropolitan and metropolitan counterparts, subjective data (which incorporated measures of household and transportation physical activity) showed rural residents to be more active than metropolitan residents (Fan et al., 2014).

The purpose of this study was to test for differences in current self-reported physical activity levels among university women from metropolitan, micropolitan, and rural areas, as well as gather insight into barriers and facilitators for physical activity within the first four levels of the SEM (both in high school and in the university setting). It was hypothesized that women from rural areas would report less physical activity and more barriers to physical activity than those from metropolitan and micropolitan areas for both settings.

Chapter 2 - Methods

Study Design

This study used a cross-sectional survey design and was approved by the Kansas State University Institutional Review Board (approval #10180). Respondents provided informed consent upon entrance to the survey, where they answered a series of screening and demographic questions. Women were classified as rural, micropolitan, or metropolitan by their ZIP code and corresponding rural-urban commuting area (RUCA) code based on where they lived during high school. The ZIP code for their university and where they currently reside was also recorded. Rural RUCA codes were 7-10 (small town core – rural), micropolitan RUCA codes were 4-6 (micropolitan area core – micropolitan low commuting), and metropolitan RUCA codes were 1-3 (metropolitan area core – metropolitan low commuting).

Participants

Inclusion criteria required participants to be between ages 18-24, identify as female, not be or never have been pregnant, and be a full-time student who attended classes in person at a university prior to COVID-19. Exclusion criteria were those who were under 18 or above 24 years of age, identified as male, had been or were pregnant, collegiate athletes, did not attend a university full-time or take in person classes, did not attend a university in the United States, were obtaining a degree above a bachelors, or had experienced an injury in either high school or college that continued to hindered their ability (long-term) to be physically active.

Measures

Demographics including age, height and weight, race, ethnicity, area of study, financial aid (federal or as a result of military service), job status, and high school graduation class size and year were asked of participants. Frequencies were recorded for all descriptive measures aside

from age and body mass index (BMI; height (kg)/weight $(m)^2$), which were reported as M ± SD. ZIP codes for high school residence and university location were re-coded into RUCA codes and grouped as metropolitan, micropolitan, and rural.

Assessments of current physical activity behaviors were quantitatively assessed by the International Physical Activity Questionnaire (IPAQ), which is a widely accepted assessment of self-report physical activity (Craig et al., 2003). In the long form of this questionnaire, the participant reported (in minutes) moderate and vigorous physical activity across five domains: job-related, transportation-related, home-oriented, and recreational/leisure time-related physical activity, and sitting time. Values were first truncated by domain at 180 minutes, then intensity values were truncated at 180 minutes. Activities were measured in metabolic equivalents (METs), which are multiples of resting metabolic rate, or the rate at which the body expends energy and are dependent upon activity intensity (Forde, n.d.). The researchers calculated MET-min as a continuous measure by the equation ([MET-value multiplied by the number of minutes per day at that MET-value] x [number of days/week activity was performed]) (Forde, n.d.).

Additional open-ended, scaled, and multi-response questions were incorporated into the survey to gather information about barriers and facilitators to physical activity. These questions were informed by the socio-ecological model, to include the first four levels: individual, interpersonal, organizational, and community. All non-IPAQ questions were developed by the researcher for the purposes of this study and were not formerly used or validated. Scaled questions were answered on a scale of 1-5, with one being “not true at all” and five being “very true for me.” All questions were phrased in past tense when asking about the high school setting and present tense when asking about the university setting. For simplicity in this document, all questions are phrased in the past tense.

SEM Informed Questions - Intrapersonal Factors

Individual-level factors included motivation, personal beliefs, and knowledge about physical activity for this study. Questions for this level were answered on a scale of 1-5 including: “I believed physical activity was good for my physical and mental health,” “I felt I had the knowledge to be physically active,” “I felt that being physically active was a privilege I did not have because gyms and activity facilities were too expensive,” “I enjoy being physically active,” “I didn’t have time to be physically active due to academic demands,” and “I was comfortable utilizing the recreation centers for physical activity.” One open-ended question asked of participants was about their motivation: “What motivated you to be to physically active in high school?”

SEM-Informed Questions - Interpersonal Factors

Interpersonal factors were incorporated by asking questions about how relationships with others have an impact on physical activity habits. Scaled-responses questions were “Physical activity was a way for me to spend time with my peers.” One free-text response question was asked of participants: “How did those you have close relationships with (parents, friends, etc.) support you in being physically active in high school?”

SEM-Informed Questions - Organizational

Organization-level factors included the schools (both high school and university) the respondents attended, as well as any club sports and teams in which they took part. For open-ended response, respondents were asked to detail what sports or physically active groups (including but not limited to marching band, show choir, etc.) they were a part of in high school. For the university setting, the question was phrased as “What clubs/organizations are you

involved in now that have frequent physical activity opportunities (i.e., intramural teams, jogging/walking groups, etc.)?"

SEM-Informed Questions - Community

For the purposes of this study, the "communities" were the town where the participant grew up, the university grounds, and the town the university was located in. Community-level factors were the aspects of these that either hindered or were conducive to physical activity. For scaled response, participants were asked "There were a lot of resources available (recreation centers, pools, trails) to participate in physical activity." The following questions were multi-response, and prompted respondents to identify as many community resources as they had access to from a list of twelve items, which included: indoor courts, outdoor courts, indoor fields, outdoor fields, indoor pools, outdoor pools, weight rooms, gyms, running tracks, walking paths, cycling paths, and cycling lanes. They were also asked to indicate access to natural resources out of a list of six items, which included: dirt/gravel trails, nature trails, national parks, state parks, national forests, and nature centers. These multi-response questions provided a space to write in any other resources not otherwise listed.

Qualitative Analysis

Open-ended response questions were asked of each respondent to gather further insight into their physical activity barriers and facilitators, both in high school and at their university. Data were grouped together, rather than stratifying by high school or university RUCA code. A single question was asked for participants to detail what "motivated" them to be physically active; responses were coded as facilitators within the first four levels of the SEM (i.e., intrapersonal, interpersonal, organizational, and community), and direct quotes were taken from the dataset to describe both common, and sometimes unique, themes. Questions about

relationships with others, as in "who" influenced or had an impact on their physical activity, were open-coded, to determine frequency variables that emerged from the data. The researcher highlighted key themes upon a first read-through, determined common themes, and then counted the number of responses for each theme after the second read of the data. Finally, aspects of both the high school and university communities which hindered or facilitated physical activity were coded.

Recruitment and Procedures

Participants self-identified by clicking on the survey link. Aside from providing both a current RUCA code (where they are now a resident at their university) and a RUCA code from where they grew up (or where they spent most of their time growing up), responses were recorded anonymously. Participants were recruited through Kansas State University (through student listservs and the daily newsletter, K-State Today), social media advertisement, and through connections with faculty members at other universities. Once utilization of free recruitment methods was exhausted, funding was used to pay for Facebook ads to target the intended audience and increase survey response. The survey remained open for a total of 10 weeks and three days. Participants who completed the survey were redirected to another link to provide their email for a chance to win one of 20 gift cards, with values ranging from $20-$100. Data were downloaded from Qualtrics and stored on a password-protected computer.

Statistical & Power Analyses

We aimed to recruit 150 responses per group (rural, micropolitan, and metropolitan), for a total of 450 responses. Power was calculated based upon a previous study (Moore et al., 2014) that used objectively measured physical activity data and classed participants into rural, suburban, and urban categories, and had a small effect size (ES=0.11, n=254/group). A moderate

effect size estimation was calculated as well (ES=0.25, n=53/group). Thus, the intent was to recruit 150 responses for each classification.

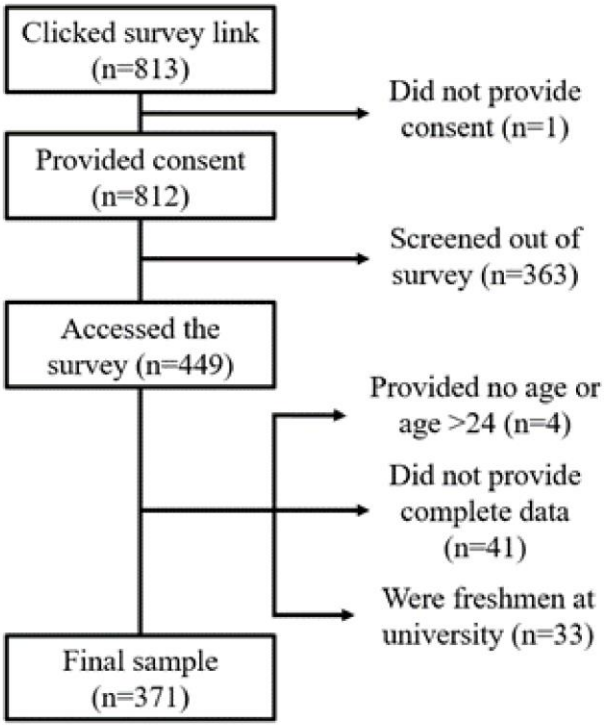
Descriptive statistics were run to characterize the respondents to the survey, which included the means and standard deviations for age and body mass index (BMI), as well as frequencies for race, ethnicity, and area of study. During university, participants were also asked to indicate whether they qualified for financial aid or worked a job. Both IPAQ and scaled-response data failed the assumption for normal distribution using the Shapiro-Wilks test. Thus, Kruskal-Wallis H tests were run to determine differences between metropolitan, micropolitan, and rural RUCA groups for self-report total physical activity, vigorous, moderate and walking activity, and domain-specific physical activity, as well as for rated barriers and facilitators to physical activity and perceived resources. To further differentiate between groups, Mann-Whitney U pair-wise comparisons determined which groups differed, and pairs were as follows: metropolitan-micropolitan, metropolitan-rural, and micropolitan-rural. Open-ended response data was coded into themes that emerged from the data, and varied dependent upon the question (e.g., for physical activity relationships, data were coded into parents, friends, coaches, etc. for individuals who had impact on physical activity). One exception to the coding procedure was made for a question regarding motivation (high school and university), in which participants were asked, "What motivated(s) you to be physically active?" This question was coded into SEM constructs. Frequencies and/or key direct quotes were reported from the open-response portion of the survey.

Chapter 3 - Results

A total of 813 individuals clicked on the survey link. Of those, 812 consented to participate in the survey. A total of 6 respondents answered no further questions upon entrance to the screening questions. Respondents were ineligible based on the following criteria: identification as a man (n = 29), having been pregnant or were pregnant (n = 61), outside the ages of 18-24 (n = 37), having an injury or disability that hinders the ability to do physical activity (n = 106), attending a university not in the United States (n = 21), not pursuing a bachelor's degree (n = 30), or were a university athlete for paid or unpaid participation (n = 41). Thirty-two respondents dropped out during the screening questions. Thus, a total of 449 respondents were allowed entrance into the survey. Further responses were removed from the survey by the researcher for the following reasons: a text response of age greater than 24 (n = 1) or no age provided (n = 3), no survey answers past the screening questions (n = 4), no attempt to answer IPAQ questions (n = 37), and having graduated high school in 2020 (n = 33). A total of 371 responses were used for analysis (Figure 3.1).

Figure 3.1.

Flow Diagram Illustrating Participants Excluded from the Study



Characteristics of Respondents

Respondents were women, age 20.3 ± 1.2 years, and of normal weight (BMI = 24.2 ± 5.4). Most respondents were white (n = 331, 84.5%) and identified as non-Hispanic (n = 338, 91.1%). One-fourth of respondents studied exercise & health sciences or athletic training (n = 93, 25.1%), but the remainder were dispersed across many major areas of study (see Table 3.1). Most respondents attended some of or all university classes in person before COVID-19 (n = 364, 98.1%.

As seen in Table 3.2, the majority of the respondents did not qualify for federal financial aid (n = 219, 59.2%), military service financial aid (n = 364, 98.1%) or federal work study financial aid (n = 260, 70.1%). Almost two-thirds of women worked a job to pay for school (n = 223, 60.1%).

Table 3.1.

Descriptive Characteristics of Respondents

Characteristic	**M(SD)**	**Range**
Age	20.3(1.2)	18-24
Body Mass Index	24.2(5.4)	11.9-53.2
	n	**%**
Gender		
Woman	371	100
Race		
White	331	84.5
Black/African American	11	3
American Indian/Alaska Native	11	3
Asian Indian	2	0.5
Japanese	2	0.5
Chinese	16	4.3
Korean	3	0.8
Filipino	6	1.6
Vietnamese	3	0.8
Other Asian	4	1
More than 1 race	23	6.3
Missing	3	-
Ethnicity		
Mexican, Mexican American, Chicano	25	6.7
Cuban	2	0.6
Other	6	1.6
None	338	91.1
Area of study		

Accounting/Finance	12	3.2
Agriculture/Animal Science	33	8.9
Architecture/Design	11	3
Business/Economics	22	6
Communications/Political Science	18	4.9
Computer/Technology	6	1.6
Criminal Science/Justice	4	1.1
Education	19	5.1
Engineering	29	7.8
Exercise & Health Sciences/Athletic Training	93	25.1
Fine Arts/Languages	11	3
Life Sciences	36	9.7
Math/Physics	4	1.1
Psych/Social Sciences	24	6.5
Double Major	48	13
Missing	1	-

Table 3.2.

Financial Characteristics of Respondents

	n	%
Federal financial aid		
Yes, I qualified	134	36.2
No, I did not qualify	219	59.2
Prefer not to say	17	4.6
Missing	1	-
Military service financial aid		
Yes, I qualified	5	1.3
No, I did not qualify	364	98.1
Prefer not to say	2	0.5
Federal work study fin. aid		
Yes, I qualified	87	23.4
No, I did not qualify	260	70.1
Prefer not to say	24	6.5
Works a job to pay for school		
Yes	223	60.1
No	129	34.8
Prefer not to say	19	5.1

A majority of women attended high school in a metropolitan area (n = 258, 70.9%), while fewer were from rural (n = 65, 17.9%) and micropolitan (n = 41, 11.2%) areas. Just over one-fourth of respondents considered themselves to "definitely" be from a rural area (n = 94, 25.3%), while 36.7% answered as being "definitely not" from a rural area (n = 136). Women attended universities in primarily metropolitan areas (n = 341, 92.4%) but were located in micropolitan (n = 22, 6.0%) and rural (n = 6, 1.6%) areas, as well. A more thorough breakdown of the RUCA distribution across the respondents can be seen in Table 3.3. Table 3.4 shows more descriptive data about high school residence and graduation year, while Table 3.5 shows average high school graduation class size.

Table 3.3.

RUCA Frequencies

	High School		University	
	n	%	n	%
RUCA code				
1: Metropolitan area core	217	59.6	340	92.1
2: Metro high commuting	39	10.7	1	0.3
3: Metro low commuting	2	0.6	-	-
4: Micropolitan area core	29	8.0	22	6.0
5: Micro high commuting	11	3.0	-	-
6: Micro low commuting	1	0.3	-	-
7: Small town core	-	-	5	1.3
8: Small t. high commuting	30	8.2	-	-
9: Small t. low commuting	6	1.6	-	-
10: Rural areas	29	8.0	1	0.3
Missing	7	-	2	-
RUCA classification				
1: Metropolitan (1-3)	258	70.9	341	92.4
2: Micropolitan (4-6)	41	11.2	22	6.0
3: Rural (7-10)	65	17.9	6	1.6
Missing	7	-	2	-

Figure 3.2.

High School Response Distribution

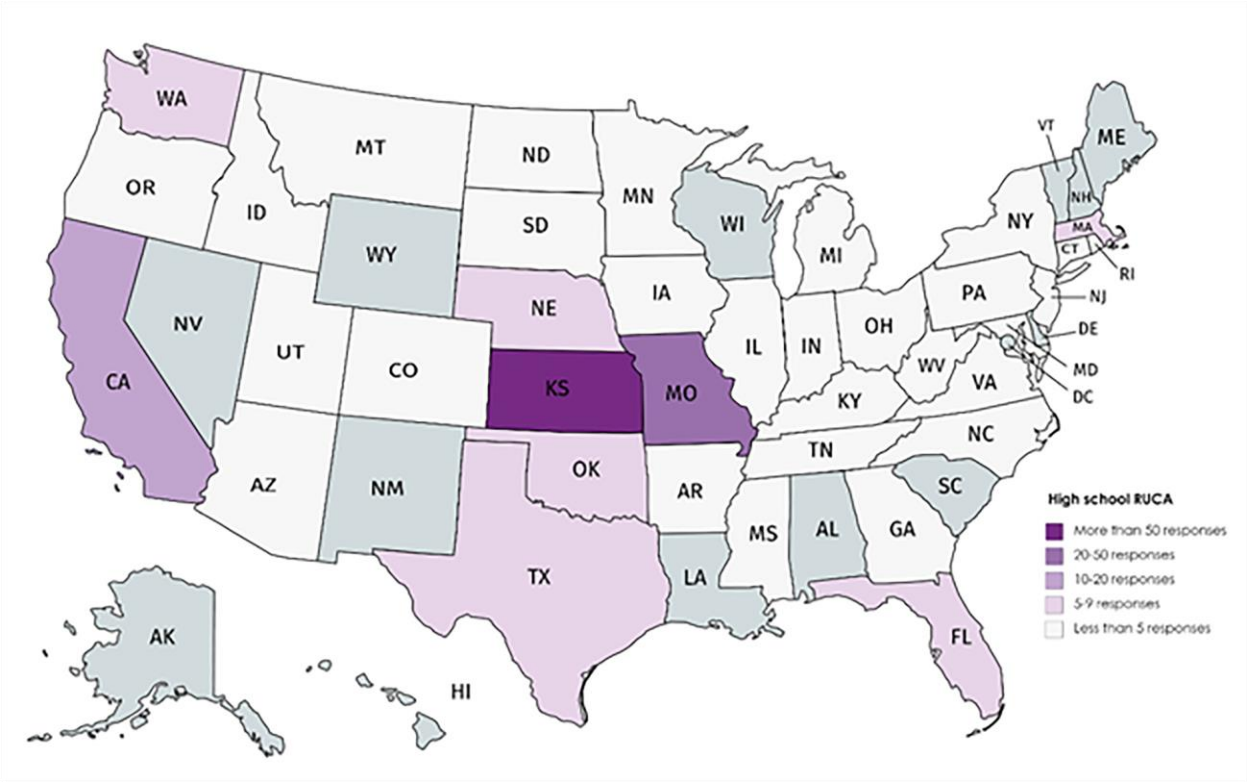


Figure 3.3.

University Response Distribution

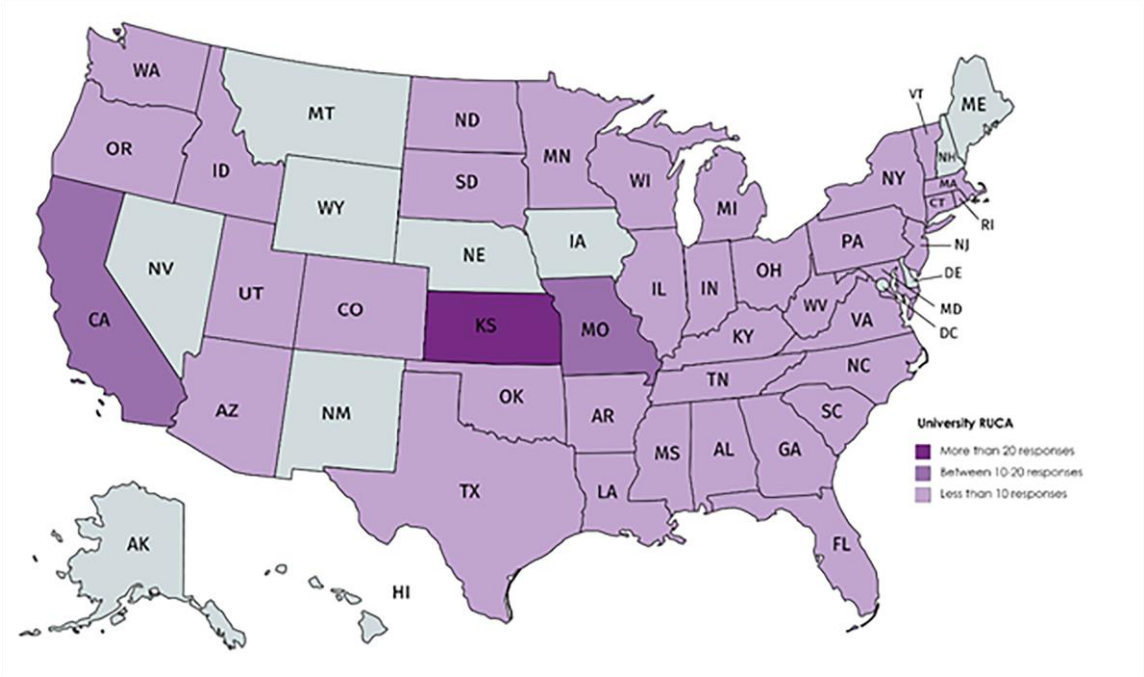


Table 3.4.

High School Descriptive Characteristics

	n	%
Are you from a rural area?		
Definitely yes	94	25.3
Probably yes	45	12.1
Might or might not	24	6.5
Probably not	72	19.4

Definitely not	136	36.7
High school graduation year		
2019	104	28.9
2018	113	31.4
2017	101	28.1
2016 & before	42	11.6
Missing	7	-

Table 3.5.

High School Descriptive Characteristics

Characteristic	**Median (IQR)**	**Range**
High school graduating class size	800 (300-1500)	1-8000

Self-Report Physical Activity (IPAQ)

As shown in Table 3.6, physical activity was analyzed by the following categories: total vigorous, total moderate, total walking activities, and total MET-min (vigorous + moderate + walking activities) across the four domains found in the IPAQ. Median total activity for metropolitan, micropolitan, and rural university women across all domains and intensities was 2007.5 MET-min (IQR: 568.9 - 5035.5 MET-min). Total walking activity was the highest median (683.3 MET-min) and largest IQR (198.0 - 2376.0), while vigorous activity had both the lowest median (480.0 MET-min) and smallest IQR (0.0 - 1530.0 MET-min). Kruskal-Wallis H tests showed no significant difference in mean ranks for any total activity variables between metropolitan, micropolitan, and rural respondents.

Table 3.6.

Descriptive Total Activity (MET-min)

Activity Type	Median (IQR)	Sig.
Total Vigorous MET-min	480.0 (0.0 - 1530.0)	0.791
Total Moderate MET-min	525.0 (120.0 - 2085.0)	0.187
Total Walking MET-min	683.3 (198.0 - 2376.0)	0.169
Total MET-min (Walk+Mod+Vig)	2007.5 (568.9-5035.5)	0.186

Vigorous physical activity was analyzed by intensity across the following domains: job-related, home-related, and recreational (Table 3.7). The median value for recreational vigorous activity was the highest value of the three domains, at 240.0 MET-min (IQR: 0.0 – 960.0 MET-min). The median values for both job-related and home-related vigorous activities were 0.0, though job-related vigorous activity had a higher 75th percentile value (1120.0 MET-min).

Table 3.7.

Descriptive Domain-Specific Vigorous Activity (MET-min)

Activity domain	Median (IQR)	Sig.
Job-related	0.0 (0.0 - 1120.0)	0.262
Home-related	0.0 (0.0 - 640.0)	0.730
Recreational	240.0 (0.0 - 960.0)	0.050

No statistically significant differences were found for job-related or home-related vigorous physical activity between metropolitan, micropolitan, and rural women by Kruskal-Wallis H tests. However, vigorous recreational activity was statistically significantly different by

Mann-Whitney U test (U = 224.5, p = 0.012), in which respondents from rural areas did more recreational vigorous activity than respondents from micropolitan areas.

Table 3.8 shows moderate activities, which were stratified into job-related, transportation by bicycle, home-outdoors, home-indoors, and recreational. The greatest moderate physical activity was reported for job-related (median = 360.0, IQR = 0.0 - 2400.0 MET-min), followed by home: indoors (median = 90.0, IQR = 0.0 - 336.0 MET-min). No significant differences were found in mean ranks for any domain of moderate activity variables between metropolitan, micropolitan, and rural respondents by Kruskal-Wallis H tests.

Table 3.8.

Descriptive Domain-Specific Moderate Activity (MET-min)

Activity domain	Median (IQR)	Sig.
Job-related	360.0 (0.0 - 2400.0)	0.121
Transportation: Cycle	0.0 (0.0 - 162.0)	0.822
Home: Outdoors	80.0 (0.0 - 240.0)	0.965
Home: Indoors	90.0 (0.0 - 336.0)	0.176
Recreational	0.0 (0.0 - 240.0)	0.228

Walking activity (Table 3.9) was analyzed by job-related, transportation, and recreational walking. The greatest walking activity was job-related (median = 792.0, IQR = 0.0 - 2376.0 MET-min). Although recreational walking had the lowest median value (132.0 MET-min, IQR = 0.0 - 396.0), a statistically significant difference was found between mean ranks for recreational walking activity by RUCA codes, $\chi^2(2) = 7.525$, p = 0.023, with a mean rank of 119.4 for metropolitan respondents (n = 167), 96.8 for micropolitan respondents (n = 27), and 140.7 for

rural respondents (n = 47). Mann-Whitney pair-wise comparisons indicated micropolitan respondents' mean rank significantly lower than rural respondents (U=394.0, p = 0.006).

Table 3.9.

Descriptive Domain-Specific Walking Activity (MET-min)

Activity domain	Median (IQR)	Sig.
Job-related	792.0 (0.0 - 2376.0)	0.096
Transportation	198.0 (0.0 - 495.0)	0.981
Recreational	132.0 (0.0 - 396.0)	**0.023**

Facilitators and Barriers to Physical Activity

In Table 3.10, respondents rated barriers and facilitators to physical activity in high school on a scale of 1-5 by across various SEM categories. Differences between means were analyzed using the high school RUCA classification grouping variable. The top facilitator to physical activity for this sample was "I believed physical activity was important for my physical and mental health" (M = 4.4. SD = 0.8), while the top barrier was "I didn't have time to do physical activity" (M = 2.9, SD = 1.3).

Statistically significant differences between mean ranks were found by Kruskal-Wallis H tests for sports and outdoor court participation by RUCA codes, $\chi 2(2) = 8.694$, p = 0.013, with a mean rank of 147.9 for metropolitan respondents (n = 219), 179.3 for micropolitan respondents (n = 37), and 179.9 for rural respondents (n = 59). Mann-Whitney pair-wise comparisons indicated metropolitan respondents' mean rank was significantly lower than both micropolitan respondents (U = 3228.5, p = 0.042) and rural respondents (U = 5065.0, p = 0.014). A statistically significant difference was also found between mean ranks for physical activity as a

way to spend time with peers, $\chi 2(2) = 14.767$, $p = 0.001$, with mean ranks of 146.9 for metropolitan respondents (n = 220), 201.6 for micropolitan respondents (n = 37), and 172.5 for rural respondents (n = 58). Mann-Whitney pair-wise comparisons indicated metropolitan respondents' mean rank was significantly lower than both micropolitan respondents ($U = 2678.5$, $p < 0.001$) and rural respondents ($U = 5318.0$, $p = 0.040$). A statistically significant difference was also found for access to resources to be physically active $\chi 2(2) = 17.543$, $p < 0.001$, with a mean rank of 163.9 for metropolitan respondents (n = 220), 183.6 for micropolitan respondents (n = 37), and 115.8 for rural respondents (n = 57). Mann-Whitney pair-wise comparisons indicated rural respondents' mean rank was significantly lower than both micropolitan respondents ($U = 621.5$, $p = 0.001$) and metropolitan respondents ($U = 4328.5$, $p < 0.001$).

Table 3.10.

Facilitators & Barriers in High School

***Facilitators*/Barriers**	**Total Mean(sd)**	**Sig.**
PA Importance for health	4.4(0.8)	0.628
PA Knowledge	4.2(1.0)	0.993
PA spend time with peers	3.8(1.3)	**0.001**
Comfortability utilizing resources	3.1(1.4)	0.112
PA resource availability	3.5(1.2)	**<0.001**
Sports/outdoor court participation	3.4(1.5)	**0.013**

PA enjoyment	4.1(1.0)	0.477
Didn't have time to do PA - academics	2.9(1.3)	0.275
PA privilege	2.4(1.7)	0.255

Respondents also rated facilitators and barriers to physical activity in the university setting (Table 3.11). The highest rated facilitator for physical activity was "I believe physical activity is important for my physical and mental health" (M = 4.7, SD = 0.5), while the highest rated barrier was "I don't have time to be physically active due to academic demands" (M = 3.4, SD = 1.2). Differences between means were analyzed using the high school RUCA classification. No significant differences in mean ranks were found for any university barrier or facilitator variables for physical activity between metropolitan, micropolitan, and rural respondents.

Table 3.11.

Facilitators & Barriers in University

***Facilitators/*Barriers**	**Total Mean(sd)**	**Sig.**
PA Importance for health	4.7(0.5)	0.390
PA Knowledge	4.4(0.8)	0.627
PA spend time with peers	3.4(1.2)	0.134
Comfortability utilizing resources	3.3(1.3)	0.382
PA resource availability	4.2(0.9)	0.370
PA enjoyment	4.3(0.9)	0.771

Don't have time to do PA - academics	3.4(1.2)	0.069
PA privilege	2.0(0.9)	0.215

Availability of Physical Activity Resources

The availability of physical activity resources was broken down into two sections for high school, to include hometown community resources and hometown natural resources, and three sections for university, to include resources available from the university, resources within the community in which the university is located, and natural resources within the community in which the university is located. Respondents were asked to indicate availability for a total of 12 community and six natural resources variables. Resources were tallied into a single variable for each section. Table 3.12 shows that participants identified the most resources on their university campus (M = 9.0, SD = 2.0), while the least number of resources were high school natural resources (M = 2.0, SD = 1.0).

Table 3.12.

Sum of Resources in High School and University Settings

Types of resources	**Total Mean(sd)**	**Sig.**
High school community resources	8.0(2.9)	**0.001**
High school natural resources	2.0(1.0)	**0.001**
University-campus resources	9.2(2.0)	**0.001**
University-town community resources	6.6(3.3)	**0.001**
University natural resources	2.4(1.0)	0.264

A statistically significant difference between mean ranks was found for high school community resources by RUCA codes, $\chi 2(2) = 23.138$, $p < 0.001$, with a mean rank of 165.1 for metropolitan respondents (n = 213), 164.2 for micropolitan respondents (n = 37), and 102.4 for

rural respondents (n = 56). Mann-Whitney pair-wise comparisons indicated rural respondents' mean rank was significantly lower than both micropolitan respondents (U = 539.0, p < 0.001) and metropolitan respondents (U = 3600.5, p < 0.001). A statistically significant difference was also found between mean ranks for natural resources within the high school community $\chi 2(2) = 22.143$, p = 0.000, with a mean rank of 159.2 for metropolitan respondents (n = 207), 142.7 for micropolitan respondents (n = 36), and 99.5 for rural respondents (n = 50). Mann-Whitney pair-wise comparisons indicated rural respondents' mean rank was significantly lower than both micropolitan respondents (U = 636.5, p = 0.014) and metropolitan respondents (U = 3061.0, p < 0.001). A statistically significant difference between mean ranks was also found for university community resources for different high school RUCA codes, $\chi 2(2) = 19.092$, p = 0.000, with a mean rank of 137.5 for metropolitan respondents (n = 211), 176.6 for micropolitan respondents (n = 35), and 188.7 for rural respondents (n = 56). Mann-Whitney pair-wise comparisons indicated metropolitan respondents' mean rank was significantly lower than both micropolitan respondents (U = 2709.5, p = 0.011) and rural respondents (U = 3929.0, p < 0.001). A statistically significant difference was also found between mean ranks for resources within the university-town community $\chi 2(2) = 13.274$, p = 0.001, with a mean rank of 134.8 for metropolitan respondents (n = 202), 170.5 for micropolitan respondents (n = 33), and 174.9 for rural respondents (n = 57). Mann-Whitney pair-wise comparisons indicated metropolitan respondents' mean rank was significantly lower than both micropolitan respondents (U = 2530.0, p = 0.026) and rural respondents (U = 4149.5, p = 0.001).

Barriers and Facilitators – Qualitative Analysis

Motivation – High School

Respondents were asked, “What motivated you to be physically active in high school?” Table 3.13 shows high school motivation was mostly driven by organizational influences, with 52.1% (n = 52.1) of respondents identifying sports or physically active clubs as their primary form of motivation. Respondents commonly answered, “Being in an active class like marching band,” and “I played sports and had to stay active to stay healthy and in shape for sports.” Motivation was also influenced by intrapersonal factors (28.0%, n = 80), such as personal beliefs about physical activity, enjoyment, and the knowledge to do physical activity. Though many participants identified positive motivations like the following respondent, “I truly enjoy working out. I love the feeling of setting goals and working hard to achieve them. The sense of success motivated me to be physically active,” some responses were negatively-framed, such as “Honestly personal image-I just didn't want to get picked on for being unhealthy.” Relationships with peers and parents also impacted physical activity motivation, with almost a quarter of respondents (24.8%, n = 71) identifying the behaviors of others influencing their own physical activity participation. Some common responses included elements such as “It gave me more time with my friends,” or “I was mainly motivated by my parents, who always encouraged physical activity.” Least frequently, respondents found the community as a motivation to be active, with only 1% (n = 3) naming any community factor. The three responses were as follows: “My town. If the people that are physically capable of playing sports didn't then the school teams would struggle from not having enough players,” “I lived on a farm and had to be,” and “It was pretty much the only thing to do in such a small place.”

Table 3.13.

High School Motivation Response Frequencies Coded by SEM Levels (n = 286)

SEM Level	n	%
Intrapersonal	80	28.0
Interpersonal	71	24.8
Organizational	149	52.1
Community	3	1.0

Motivation – University

Respondents were asked, "What motivates you to be physically active?" Responses were coded into the first four levels of the socio-ecological model (intrapersonal, interpersonal, organizational, and community) and are reported in Table 3.14. Answers overwhelmingly included intrapersonal factors (78.4%, n = 221), such as health, staying healthy, and stress management. Respondents commonly responded with phrases such as, "My personal well-being. I feel a lot better when I stay active," and "I want to be healthy and build a strong, toned body. I also believe it helps with my mental health and helps me feel in control. It makes me feel fulfilled, happy, and healthy." Peers and significant others were mentioned more than parents for physical activity motivation, though interpersonal factors were mentioned far less than when respondents answered for motivational factors in high school (6.7%, n = 19). While in the university, fewer organizational factors were reported, due to a lack of sports-playing and organized activity within a school or recreational department setting (3.9%, n = 11). Only one respondent (0.4%) gave an indication that their community had an impact on their motivation, "The knowledge I have learned about physical activity, as well as the great design of our town for activity."

Table 3.14.

University Motivation Response Frequencies Coded by SEM Levels (n = 282)

SEM Level	n	%
Intrapersonal	221	78.4
Interpersonal	19	6.7
Organizational	11	3.9
Community	1	0.4
Other	17	6

Impact of Relationships on Physical Activity – High School

When respondents were asked, "How did those you have close relationships with (parents, friends, teachers, etc.) support you in being physically active in high school?" respondents most frequently used the word "they," which was coded into a perceived "general support" (38.6%, n = 119) (see Table 3.15). Respondents often said things like, "They supported me greatly. Enjoyed the fact that I played sports and wanted me to be healthy," or "They were always proud of my accomplishments and supported my decisions in staying physically active." Conversely, a few respondents provided that they received "no support" in being physically active (9.1%, n = 28), and stated things like, "They didn't[.] Grades were everything" and "They didn't, they were indifferent." Frequently, parents were identified (30.2%, n = 93) as big supporters of physically activity, as well as role models. One participant said, "My mom loves to be physically active, and she coached almost every sport I played. So she is my biggest role model/motivation." Many times, fathers and mothers both were singled out as inspirations separately, as well as supportive of activity as a unit. Friends and teammates were influential for respondents in high school (19.8%, n = 93). Significant others (1.0%, n = 3) and others (1.3%, n = 4) were less frequently identified as influencers of activity.

Table 3.15.

Relationships that Influenced Physical Activity in High School (n = 308)

	n	%
Parents	93	30.2
Friends/teammates	61	19.8
Coaches	14	4.5
Significant others	3	1.0
Other	4	1.3
No support	28	9.1
General support	119	38.6

Impact of Relationships on Physical Activity - University

Respondents were also asked, “How do those you have close relationships with (parents, friends, professors, etc.) support you in being physically active while in a university setting?” As seen in Table 3.16, one-third of respondents identified friends as people who influenced physical activity (33.4%, n = 98) at the university level. Commonly it was stated, “Friends go to the gym with me,” or “Friends will go on walks with me.” One participant elaborated further, “My parents don't really have an influence on this matter anymore, but my friends do. My friends as [I] mentioned above are active and like to do activities outdoors. They play games together and encourage community within it.” Though parents were discussed less, 13.3% (n = 39) of respondents said that their parents do still influence their physical activity. Parental influence on physical activity was often related to finances, “My parents pay for me to use the rec” or verbal encouragement, “My parents are still very supportive even if I am not being physically active, but they still say positive things when I tell them I was at the gym,” which differs from the actionable support seen in high school. General support was described frequently (27.3%, n = 80), while few respondents answered as having no support from others (14.7%, n = 43).

Significant others (4.8%, n = 14) and coaches from high school sports or current professors (2.4%, n = 7) were less common responses.

Table 3.16.

Relationships that Influenced Physical Activity at University (n = 293)

	n	%
Parents	39	13.3
Friends/roommates	98	33.4
Coaches/professors	7	2.4
Significant others	14	4.8
Other	0	0.0
No support	43	14.7
General support	80	27.3

Physical Activity Resources in High School

Resources for physical activity in high school were most commonly sidewalks, parks, recreation centers, and outdoor courts. Many participants indicated positive associations for the resources they had available and perceived themselves to have adequate access to them. One respondent said, “My neighbourhood has sidewalks everywhere and people are constantly walking. There is a park if you go through the neighbourhood next to mine and across the street from that is a lake with bike lanes and a pedestrian lane.” Another participant who lived outside of town stated, “The town nearest has sidewalks that are well lit at night, a park, tennis courts, pickleball courts, and a ballpark.” However, many respondents reported fewer resources, such as inaccessibility of physical activity-facilitating infrastructure. Some examples of these responses were:

“Coming from a small town, we didn’t really have many facilities that encouraged activity per say [per se]. But the town was super friendly and people were constantly riding their bikes or walking to school regardless of no bike lanes and very poor infrastructure for sidewalks and roads.”

"My school was regional and I lived in a town that was not the same town I went to school in. The town I was from was rural and did not have many sidewalks. The town my high school is in has a lot of sidewalks and also is more conducive for biking."

"No, it was the middle of the city in Wichita [KS]. Although there were neighborhoods near, it was mostly a business district. There were some sidewalks, but they were close to the road. No parks or bicycle lanes in the area."

"There were no sidewalks or bicycle lanes. I lived in a "bad" area so I wasn't allowed to be outside by myself. They have recently added a bike lane on the Main Street in my neighborhood though I still don't use it because I'm scared to be alone outside now."

Physical Activity Resources at the University Level

Resources for physical activity at the university level also included sidewalks, parks, outdoor courts, and recreation centers. Respondents also mentioned nature trails, cycling lanes, and paths specifically designed for walking. Some participants named these resources as a facilitator. For example, one participant answered, "Sidewalks and bicycle lanes. Pretty river side running path. Biggest motivator to physical activity are the exorbitant parking fees so no students bring cars and everyone therefore walks/bikes on a normal basis." Other respondents answered that while resources were available, aspects such as the quality of the sidewalks or on-going construction was often a barrier.

"Normally there are a lot of sidewalks where I live, but currently the construction has taken away from where I live and has forced me to only walk on the road unfortunately."

"The parts I mainly live in there are some main sidewalks, but they are closed down right now due to major construction that has been happening. There are bike lanes, but construction has shut those down too."

"It is very difficult to bike/walk due to lack of bike lanes, sidewalks in poor condition, heavy traffic, and frequent road construction."

"There are many parks. However it is an urban setting, so there are some areas that aren't conducive to walking / biking / jogging for exercise."

"Bad bike lanes, ok sidewalks. Okay parks but it's Seattle."

Chapter 4 - Discussion

Principal Findings

The purpose of this study was to determine differences in current self-reported physical activity levels among university women from metropolitan, micropolitan, and rural areas, as well as gather insight into barriers and facilitators for physical activity within the first four levels of the SEM (both in high school and in the university setting). It was hypothesized that women from rural areas would report less physical activity than their metropolitan and micropolitan counterparts; this hypothesis was not supported. Micropolitan women ranked significantly lower than rural women for recreational vigorous activity and recreational walking activity, which were the only statistically significant differences between RUCA groups for physical activity. The second hypothesis, in which rural women would report more barriers to physical activity than those from metropolitan and micropolitan areas for both settings, was also not supported. However, when stratified by high school RUCA groups, women from rural areas ranked availability to physical activity resources significantly lower than metropolitan and micropolitan women. Specifically, rural respondents reported significantly fewer perceived physical activity resources for their high school community and natural resources. Conversely, metropolitan women identified significantly fewer resources in their university communities and in the town in which their university was located within when stratified by high school RUCA groups. Additionally, metropolitan women ranked significantly lower than both micropolitan and rural women for playing sports and using outdoor courts for activity in high school, as well as using physical activity as a way to spend time with peers in high school.

Physical Activity

Respondents to this survey were much more physically active than what is recommended for health benefits and risk reduction for physical activity (median total MET-min/week of this sample: 2007.5 MET-min/week vs. recommended: 500-1000 MET-min/week). These extremely high values are not uncommon in previous literature among college-aged populations. One study analyzed differences between physical activity of off-campus vs. on-campus college students using the IPAQ and found that the median total MET-min of activity per week was 5,003 MET-min/week for off-campus students and 5,654 MET-min for on-campus students (Peachey & Baller, 2015). These MET-min values are much higher than what this study reported, and higher still than what is recommended for health benefits and risk reduction. The population for this study may have been more physically active due to the recruiting methods used, in which many recruitment resources were kinesiology listservs and faculty connections. Thus, these findings may not be generalizable to all college-age populations.

Resources

Rural respondents reported significantly fewer resources than their metropolitan and micropolitan counterparts in high school. Gilbert et al. (2019) discussed a similar finding, in which stakeholders (i.e., those who worked for local agencies) from smaller towns identified fewer available resources in their communities than those from larger towns. Additionally, rural respondents rated significantly lower than metropolitan and micropolitan respondents for availability of physical activity resources, which was a perceived barrier. This parallels previous literature, in which rural adults identify many barriers to being physically active. In one focus group study, participants discussed that while resources were available, they did not perceive them to be accessible (Cleland et al., 2015). Interestingly, respondents from metropolitan areas

identified fewer resources at the university level in their university community and university town. One study that examined health-related resources from a spatial perspective in metropolitan areas found that resources were not randomly dispersed across the three cities examined but were significantly spatially clustered across sites (Smiley et al., 2010). Specifically, resource densities of recreational facility activities were lower in places where blacks and Hispanics lived (Smiley et al., 2010). If respondents from metropolitan areas grew up in a larger and perhaps more privileged area but attended a university in a more disadvantaged or smaller metropolitan area, they may perceive fewer activity opportunities. One review analyzed agreement between perceived and objective neighborhood environment measures and how these may have an impact on physical activity; the authors found that in approximately 60% of studies, neither perceived or objective environment had a relationship with physical activity (Orstad et al., 2017). Further, authors concluded that change in physical aspects of the environment may not be enough to impact recreational physical activity (Orstad et al., 2017).

High School Motivation and Relationships

Motivation for physical activity in high school was driven predominantly by sports participation. Previous literature notes that intrinsic motivation for participation in physical activity later in life was rooted in a history of sports participation in rural women (Nazaruk et al., 2016). Additionally, sports provide social outlets for young women. Respondents identified perceived social support (from peers, teammates, parents, and coaches) as a factor for motivation to be physically active. In high school, relationships with parents were also discussed often as positive influences on physical activity participation. Previously, Eime et al. (2010) found that Australian girls from rural areas, and those ages 16-17, greatly esteemed the support from their

parents, who would watch games, show interest in, and encourage the girls to play sports or be active.

University Motivation and Relationships

Motivation was driven primarily by intrapersonal factors at the university level. Improved health was identified most often by participants, which parallels research by Kilpatrick and colleagues (2005) about motivational factors for exercise participation. They aimed to determine what factors influenced exercise participation motives for male and female college students, which were then ranked. Positive health was ranked number one in their inventory of motivational factors, while weight management ranked second and appearance ranked third, all of which were intrapersonal factors (Kilpatrick et al., 2005). Additionally, friends/roommates were commonly identified as having a positive impact on physical activity at the university level, which is partially supported by Greaney et al. (2009) who conducted focus groups among college students to determine what impacted healthful eating and physical activity. They found females reported social support as both a barrier and facilitator to being physically active (Greaney et al., 2009). Interestingly, Eime et al. (2014) also found that interpersonal factors, such as support from family and peers, trended downward from middle school to upon leaving high school. This was similar to the current study, where familial support was mentioned far less for impactful relationships at the university level opposed to high school.

Study Considerations – Strengths and Limitations

One strength in this study was use of a validated self-report physical activity measure. The IPAQ-long form has an acceptable repeatability coefficient ($p = 0.81$ (95% CI 0.79–0.82)) and fair to moderate agreement (pooled $p = 0.33$, 95% CI 0.26–0.39) with Computer Science and Applications, Inc. accelerometers (Craig et al., 2003). To the best of my knowledge, this was the

first study to analyze physical activity levels and barriers and facilitators of university women by RUCA groups. One limitation of this research was the sole use of self-report data, in which participants may have over-reported their physical activity participation. The IPAQ asks participants to report physical activity in bouts greater than 10 minutes; so, if a participant's walk to class (i.e., transportation-related walking activity) is only 8 minutes, they may round up to 10 when reporting for the IPAQ. The sampling frame could also be a limitation. Participants were largely from Midwestern universities and went to high school in the Midwest. Additionally, this sample was very physically active, which may not be representative of college-aged populations. Both of these limitations could have been mitigated by more diverse recruitment strategies. Another limitation of this research was the data were underpowered for moderate effect size (n = 53/group), in which micropolitan respondents (n = 41) were under the desired group size using high school RUCA groups. Thus, confidence in the statistically significant results is lessened. Data were also analyzed by only high school RUCA groups, though researchers collected data for university RUCA groups. However, university groups would have been much more underpowered (i.e., both micropolitan (n = 22) and rural (n = 6) below desired group size) than the high school RUCA groups. As determined by Shapiro-Wilks normality tests, these data were not normally distributed, requiring alternative statistical tests to be conducted to determine differences between groups. When asking respondents to recall information about their physical activity behaviors in high school, the information may not be complete or accurate, resulting in a recall bias. Depending on where they lived at the time of the survey, recall bias may have also impacted their reports of physical activity behaviors during college, as the respondent would have to think back to being in the university setting. Last, analysis of qualitative data was only conducted by one individual, which may have resulted in an observer bias. Including at least one

other individual to assist with coding and determining an agreement percentage would have mitigated this issue.

Future Directions

With many limitations to improve upon, future study opportunities are vast. Some inclusion of objectively measured data, such as an accelerometer or similar device, would improve construct validity. Inclusion of objectively measured data, as well as multiple timepoints to analyze activity levels both in high school and at the university would be novel, especially when stratified by RUCA groups. Additionally, determining differences between women who leave their rural hometowns and attend a university and those who do not leave may provide insight into how a change in resource availability may impact physical activity. If differences are present between those who leave and those who do not, identifying what resources the women from rural settings were drawn to and used most frequently may shed light on resources that would be beneficial to implement in rural areas for physical activity. Ideally, the increase in physical activity resource availability would increase physical activity among rural adult women. Another direction for future research may be analyzing physical activity among university populations in different RUCA codes. Comparing physical activity of young adults, and determining what resources are available to them, may encourage more rural universities to 1) provide more physical active resources or 2) make students aware of the resources they do have available to them to be active.

Conclusions

In the current study, only recreational vigorous and recreational walking activity differed between women from rural and micropolitan areas, in which women from rural areas reported more activity for both categories. However, respondents from rural areas did identify fewer

resources in their high school communities than respondents from micropolitan and metropolitan areas, though this did not seem to impact their physical activity in the university setting. Additionally, respondents from metropolitan areas identified fewer physical activity resources in their university settings than respondents from micropolitan and rural areas. This research suggests that physical activity behaviors may be impacted more by the university environment rather than where one went to high school.

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