

VITATOE, KIRSTIE CHASE. Ed.D. *Physical Activity and Health: An Agrarian Perspective*. (2024) Directed by Dr. Diane Gill and Dr. Adam Berg. 79 pp.

The agrarian lifestyle represents a long-standing way of life, especially for farmers who live and/or work on small farms carry out physically demanding tasks to maintain their livelihood. Few studies have investigated the relationship between farming, physical activity, health, and well-being, though there is a small body of evidence that suggests agriculturally based lifestyles are positively associated with physical activity, as farmers are likely to leverage the human capacity for physical labor in their daily lives. This study employed mixed methods to explore the relationship between farming, physical activity, health, and well-being. Results revealed that farmers engaged in labor-intensive lifestyle practices that promoted their physical activity. Specifically, farmers indicated farm work required continuous movement throughout the day such that farm work provided the greatest contribution to physical activity when compared to transportation or recreational activity. Participants (n=55) averaged  $1447.09 \pm 1013.36$  minutes of occupational physical activity per week, while total weekly physical activity across three domains (work, transportation, and leisure) revealed an average of  $1875.45 \pm 1416.45$  activity minutes per week. Additional insights from this study revealed that farmers experienced unique challenges and benefits to their health. Farmers believed physical injury and psychological stress were among the greatest challenges to their health, while a sense of purpose, access to the outdoors, and ability to consume nutritious foods were believed to be health-promoting benefits of their lifestyle. These results make it possible to conclude that although farming presents certain challenges, farmers clearly indicated that farming promoted their PA, health and well-being. Findings from this study will be shared with farmers and used for continued research into the relationship between lifestyle, physical activity, and health.

PHYSICAL ACTIVITY AND HEALTH: AN AGRARIAN PERSPECTIVE

by

Kirstie Chase Vitatoe

A Dissertation  
Submitted to  
the Faculty of The Graduate School at  
The University of North Carolina at Greensboro  
in Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Education

Greensboro  
2024

Approved by

---

Dr. Diane Gill  
Committee Co-Chair

---

Dr. Adam Berg  
Committee Co-Chair

## DEDICATION

This dissertation is dedicated to Stout Drive, the farm that has always been my home. This work is also dedicated to my husband, Johnny, and our newborn son, Giovanni, in hopes that we may continue to live our dreams and teach our children to do the same.

APPROVAL PAGE

This dissertation written by Kirstie Chase Vitatoe has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Co-Chair

\_\_\_\_\_  
Dr. Diane Gill

Committee Co-Chair

\_\_\_\_\_  
Dr. Adam Berg

Committee Members

\_\_\_\_\_  
Dr. Omari Dyson

May 24, 2024

\_\_\_\_\_  
Date of Acceptance by Committee

April 26, 2024

\_\_\_\_\_  
Date of Final Oral Examination

## ACKNOWLEDGEMENTS

I would like to acknowledge the love and support of my family. I am grateful to my parents, Jim and Lisa, brothers, Zachary and Taylor, and grandparents, Ted and Jean, who have all uniquely inspired me to pursue this journey. I am thankful to my supportive husband, Johnny, who has encouraged me throughout the dissertation process. Special thanks are also to Dr. Ben Webb who has provided guidance and mentorship throughout my education. This project was made possible by the support of my committee members Dr. Diane Gill, Dr. Adam Berg, and Dr. Omari Dyson who have provided insight every step of the way. Lastly, I would like to acknowledge the 2020 cohort, and our journey together.

## TABLE OF CONTENTS

LIST OF TABLES.....	vii
CHAPTER I: PROJECT OVERVIEW.....	1
Physical Activity in the Modern World .....	1
Looking Back Moving Forward .....	2
Physical Activity and the Agrarian Lifestyle .....	4
Purpose and Aims.....	5
Methods.....	7
Setting and Participants .....	7
Measures.....	10
Survey.....	10
Interviews .....	12
Procedures .....	12
Data Analysis.....	13
Results .....	13
Survey Results.....	13
Farming and Physical Activity .....	14
Farming and Health and Well-being.....	15
Interview Results .....	18
Farming and Physical Activity .....	18
Farming and Physical Health.....	19
Farming and Mental Health.....	20
Farming and Well-being .....	21
Discussion .....	22
Conclusion.....	25
CHAPTER II: DISSEMINATION .....	26
CHAPTER III: ACTION PLAN.....	28
REFERENCES .....	31
APPENDIX A: RECRUITMENT EMAIL.....	42

APPENDIX B: INTEREST FLYER .....	43
APPENDIX C: RESEARCH SURVEY .....	44
APPENDIX D: INTERVIEW SCRIPT .....	55
APPENDIX E: SURVEY AND INTERVIEW RESULTS .....	59
APPENDIX F: DISSEMINATION REPORT .....	68

## LIST OF TABLES

Table 1. Survey Demographic Characteristics and Farming Practices (n=62).....	8
Table 2. Interview Demographic Characteristics and Farming Practices (n=8).....	9
Table 3. GPAQ - Self-report Physical Activity in Min/Week (n=55) .....	14
Table 4. Perceived Relationship between Farming and Physical Activity (n=62) .....	14
Table 5. PROMIS Scale v1.2 – Global Health Survey and WHO-5 Well-being Index .....	15
Table 6. Perceived Relationship between Farming and Physical Health (n=62).....	16
Table 7. Perceived Relationship between Farming and Mental Health (n=62).....	16
Table 8. Perceived Relationship between Farming and Overall Well-being (n=62).....	17



## CHAPTER I: PROJECT OVERVIEW

Throughout history, survival has necessitated an active lifestyle and humans have relied on physical activity (PA) for subsistence (Lieberman, 2015; Raichlen et al., 2020; Woessner et al., 2021). PA became a pillar of daily life and humans have come to be well-adapted for a variety of physical capacities (Lieberman, 2015). Today, PA is recognized as a key determinant of health and those who maintain an active lifestyle are more resilient to the physical and cognitive decline associated with inactivity (Centers for Disease Control, 2021; U.S. Department of Health and Human Services [USDHHS] 2018).

Until the last hundred years, PA was tied to daily activity. In contrast, modern environments have made tremendous technological advances, thus preventing people from engaging in difficult and laborious work. Resultantly, this shift has skewed behavioral patterns from active efforts toward sedentary pursuits (Atkinson et al., 2016; Pursell, 2007; Thivel et al., 2018; Woessner et al., 2021). While development has created opportunity for more people to engage in leisure PA, many do not. For example, in the United States it is estimated only 24.2% of adults meet the recommended levels of PA, suggesting many Americans are insufficiently active and at increased risk for the negative health outcomes associated with inactivity (Centers for Disease Control, 2022).

Because physical inactivity increases one's risk for poor health outcomes, it is necessary to review the relationship between lifestyle, PA, and health and well-being. One way to do so is to study a population whose lifestyle is likely to require PA as part of daily life. Today, farming communities are among a shrinking category of lifestyles whose daily endeavors necessitate PA to maintain their livelihood (Bassett, 2008; Regis et al., 2016). Research on traditionally agrarian

lifestyles suggests this way of life often supports PA as farming tends to be a labor-intensive occupation. (Bassett, 2008; Regis et al., 2016).

Currently, little is known about how an agrarian lifestyle influences farmer PA, health, and well-being. (Bassett, 2008; Clealand et al., 2015a; Frost et al., 2010; Gilbert et al., 2019; Liu et al., 2012; Machado-Rodrigues et al., 2014; Moore et al., 2010; Regis et al., 2016). Therefore, this work will investigate this relationship among a sample of Midwestern farmers who live and/or work on small farms. Findings from this study will offer insight about the PA patterns associated with farming and provide a better understanding of farmers' health and well-being.

### **Physical Activity in the Modern World**

PA encompasses all bodily movement brought about by muscular contraction (Caspersen et al., 1985). Broadly, PA can occur as a natural extension of daily activity (Ross & McGuire, 2011), or it can include planned, structured, and repetitive movements, intentionally undertaken for a particular goal (Caspersen et al., 1985; Thivel et al., 2018). Altogether, PA culminates into total daily movement and its importance cannot be overstated. Regardless of the planned or unplanned nature of movement, PA fundamentally represents the interaction between an individual and their social context. Engaging in PA, through work or leisure, or simply the task of everyday life, stimulates a cascade of cellular changes in the human body, leading PA to decisively affect one's health and quality of life (USDHHS, 2018; Warburton et al., 2006).

To reach optimal health, adults are recommended to participate in a minimum dose of PA that includes either 150 minutes of moderate-intensity activity, or 75 minutes of vigorous-intensity aerobic activity, in addition to weekly muscle strengthening exercises (USDHHS, 2018). Those who do not participate in the minimum recommended dose of PA are considered physically inactive (Thivel et al., 2018; USDHHS, 2018). Fortunately, PA simultaneously

reduces disease and promotes health (World Health Organization, 2020). Specifically, PA can reduce the risk of all-cause mortality, cardiovascular disease, stroke, hypertension, type 2 diabetes, adverse blood lipid profiles, musculoskeletal decline, fall-related injuries, certain cancers, depression, anxiety, dementia, and Alzheimer's disease (USDHHS, 2018). The benefits associated with daily movement make PA an important and necessary health behavior.

Fundamentally, one's surroundings present opportunities or barriers to daily movement and it is necessary to consider environmental characteristics as they shape the degree to which someone is active (Cleland et al., 2015a; Cleland et al., 2015b; Day, 2018; Frost et al., 2010; King, 2013; Koohsari et al., 2020; Regis et al., 2016; Suliburska et al., 2012; Zenic et al., 2020). Today, modern environments are defined by technological development and economic productivity (Gordon, 2019; Weimo & Owen, 2017; Woessner et al., 2021). These characteristics have historical roots in the industrial revolution, where mechanization began to substitute physical labor to increase productivity (Gordon, 2019; Woessner et al., 2021). Continued development has given way to today's technological revolution where many rely on intellectual capital rather than physical labor (Yuko, 2021).

Though development has contributed to tremendous innovation, it has reduced the necessity of physical labor, thus reducing the opportunity to be physically active in daily life (Gordon, 2019; Woessner et al., 2021; Yuko, 2021). Today, development is associated with declines in PA across occupation, leisure, and transportation domains (Atkinson et al., 2016; Genin et al., 2019; Huneault et al., 2011; O'Keefe et al., 2011; Woessner et al., 2021). In developed nations, workforce automation has often rendered PA obsolete (Atkinson et al., 2016; Genin et al., 2019; Huneault et al., 2011; O'Keefe et al., 2011; Weimo & Owen, 2017; Woessner et al., 2021). Evidence suggests that since the 1960's on-the-job PA has been on a steady decline

in the U.S. while sedentary work has been on the rise (Cole et al., 2015; Thivel et al., 2018). Further, a review of 47 nations sampling nearly 200,000 people found that workers in secondary (i.e., manufacturing) and tertiary (i.e., service) sector jobs were more likely to be inactive than primary sector (i.e., agriculture) workers (Atkinson et al., 2016).

Development has also transcended the walls of the home where labor saving appliances like the dishwasher further reduce domestic PA (Weimo & Owen, 2017). Moreover, popular devices like televisions and smartphones impact the way people spend their leisure time, and many have traded active pursuits for screen-based activities. This change is evidenced by the fact that Americans average seven hours of screen time each day (Moody, 2022). Additionally, innovation in transportation has led many to rely on automated commuting, thus resulting in greater reductions in PA (Aparicio-Ugarriza, et al., 2022; Jarosz & Cortes, 2014; Raza et al., 2021; Weimo & Owen, 2017). In the U.S., American's commute times have been on a steady rise since 1980 leading to a greater accumulation of sedentary transportation. For instance, today, the average one-way commute has increased to 26 minutes (Jarosz & Cortes, 2014). Altogether, development has led to increased reliance on technology in modern environments which has altered the way people live, and so reduced PA.

### **Looking Back Moving Forward**

An important shift seems to have taken place with advances in available technology. Development provides for greater automation and efficiency, while simultaneously reducing the amount of PA required in daily life. This trend has shifted PA from a matter of necessity to an option of leisure for many. For instance, individuals may choose to engage in leisure PA such as sport and exercise and often experience great benefits to their health and well-being when they do so (USDHHS, 2018; World Health Organization, 2020). Unfortunately, only about 24% of

adults in the United States meet the recommended dose of PA, suggesting many do not choose to participate in PA during their leisure time (Centers for Disease Control, 2022).

Such low participation prompts questions about whether modern environments provide adequate stimulus to encourage health-promoting PA. Throughout history, PA was a vital part of everyday life, integral to survival, daily work, and play. As lifestyles have shifted toward a reliance on the comforts of modernity, the necessity for PA has been reduced and physical inactivity increasingly prevalent (Alotaibi et al., 2020; Atkinson et al., 2016; Genin et al., 2019; Huneault et al., 2011; Ng & Popkin, 2012; O’Keefe et al., 2011; Thivel et al., 2018; Woessner et al., 2021). Despite the trend toward modernization and physical inactivity, there are still areas of life where PA remains vital to one’s livelihood, such as the example of the agrarian lifestyle. Studying these lifestyles will provide a more comprehensive understanding of the impact of labor on overall PA, health, and well-being in the modern world.

### **Physical Activity and the Agrarian Lifestyle**

Today, development has undoubtedly shaped modern lifestyles, subsequently altering PA and health outcomes. Still, there are examples of lifestyles positively associated with PA. One example can be found in the instance of the agrarian lifestyle where agricultural environments are often tied to demanding physical labor (Day, 2018; Gordon, 2019; Mix et al., 2019; Racine et al., 2012). This is especially true for those living and working on small farms, as they are likely to leverage the human capacity for physical work (Gordon, 2019; Racine et al., 2012).

In the U.S., a small farm is considered any place that produces and sells between \$1,000 and \$250,000 of agricultural products annually (i.e., crop yields, livestock, etc.) (Department of Agriculture [USDA], 2019). Farm size is also distinguished by metrics such as reliance on technology, yield capacity, and crop diversity. For instance, small farms produce smaller yields

and greater biodiversity, and therefore require more labor-intensive care (Herrero et al., 2017). In contrast, large farm operations produce greater yields and less crop diversity, which requires greater mechanization (Herrero et al., 2017). When comparing work across small and large farms, larger farms tend to rely more on technology and smaller farms do not (Herrero et al., 2017). This size difference will likely have important implications on the PA, health, and well-being of farmers.

Resultantly, farmers who live and work on small farms are more likely to represent farming as it has been carried out traditionally, and it is thought that small farms are more supportive of PA. For instance, research on the truest representation of traditional agrarian practices can be found in the Old Order Amish and Mennonite communities. These communities carry out daily activity with minimal technology, which would have been typical of agrarian people of the past (Tremblay et al., 2008). Lifestyle factors among these groups tend to support greater PA, steps per day, periods of activity, and levels of muscular strength, compared to modern urbanites (Bassett et al., 2004; Tremblay et al., 2008).

Due to the health benefits associated with PA, one would assume farming communities would experience more adaptive health outcomes. While some evidence suggests farmers who work on small farms experience a reduced risk of disease and mortality (Racine et al., 2012), the relationship between farming, PA, and health is not straightforward. For instance, farming may predispose farmers to unique health challenges such as musculoskeletal injuries and psychological distress that can have undesirable consequences on their overall health (Bjornestad et al., 2021; Yazd et al., 2019).

Altogether, this reveals more research into the lifestyles of farmers is needed to understand how this way of life shapes PA, health, and well-being. While there is interesting and

compelling evidence to suggest this way of life supports PA (Cleland et al., 2015b; Day, 2018; Ding et al., 2011; Racine et al., 2011), it is certain more research is needed to better understand how farming influences PA and overall health and well-being (Bassett, 2008; Cleland et al., 2015a; Frost et al., 2010; Gilbert et al., 2019; Liu et al., 2012; Machado-Rodrigues et al., 2014; Moore et al., 2010; Regis et al., 2016).

### **Purpose and Aims**

The purpose of this study was to explore the influence of the agrarian lifestyle on the PA, health, and well-being of farmers. The following are the specific aims.

*Research Aim 1 - Describe the PA patterns of small-farm farmers in the Midwest United States*

*Research Aim 2 - Explore the relationship of farming to PA among farmers*

*Research Aim 3 - Explore the relationship of farming to physical and mental health.*

*Research Aim 4 - Explore the relationship of farming to well-being.*

### **Methods**

Mixed methods were used to address the research aims and explore how the small farm lifestyle influences the PA, health, and well-being of farmers. To carry out this project, surveys and interviews were conducted to understand the experiences and perceptions of farmers who lived and/or worked on small farms.

### **Setting and Participants**

This study took place in the Midwest of the United States and targeted small farm farmers. Currently, only 31% of farmers who indicate farming to be their primary occupation live and/or work on small farms (USDA, 2019). To maximize participation, this study explored a

broad target region that included farmers from Missouri, Illinois, Kentucky, Iowa, Indiana, and Kansas.

Prospective participants were invited to take part in this study if they met three inclusion criteria. First, participants were required to be 18 or older. Second, participants had to indicate farming as their primary occupation. Finally, participants had to identify as farmers who lived and/or worked on small farms. In total, 84 farmers accessed the survey, 62 farmers (75.6%) completed the survey measures, and eight of the farmers (12.9%) who completed the survey also participated in semi-structured interviews.

Survey participation was roughly split among men (45.1%) and women (51.6%). All participants indicated they were older than 26, with the greatest share between 36-45. Ethnic breakdown included Caucasian (98.4%), African American (8.1%), and Hispanic (3.2%) participants. Most participants indicated they were the owner of their farm operation and that their farm had a diversified product focus. A complete breakdown of survey demographics and farm practices is included in Table 1.

**Table 1. Survey Demographic Characteristics and Farming Practices (n=62)**

<b>Variable</b>	<b>Frequency</b>	<b>Relevant Frequency</b>
<b>Age (years)</b>		
18-25	0	0%
26-35	6	9.7%
36-45	20	32.3%
46-55	11	17.7%
56-65	13	21%
66 and older	12	19.4%
<b>Gender</b>		
Male	28	45.1%
Female	32	51.6%
Non-binary/gender fluid	1	1.6%
<b>Ethnicity</b>		
Black or African American	5	8.1%
Latino/Latina Hispanic	2	3.2%



White or Caucasian	61	98.4%
<b>Role on the Farm</b>		
Owner, co-owner, or partner	58	93.5%
Family (non-owner)	1	1.6%
Employee	2	3.2%
Other	1	1.6%
<b>Employed outside of farming occupation</b>		
No	40	64.5%
Yes, full-time	6	9.7%
Yes, part-time	13	21.0%
Yes, seasonal work	3	4.8%
<b>Farm production focus</b>		
Plant production (fruits and vegetables)	38	61.3%
Plant production (grain)	6	9.7%
Livestock	34	54.8%
Dairy (milk and eggs)	11	17.7%
Other	11	17.7%
<b>Organic farming practices</b>		
Yes	31	50%
Partly	16	25.8%
No	15	24.2%

The interview sub-sample demographic and farm practice characteristics generally reflected the survey sample. Specifically, five of the eight participants identified as male, and all interview participants identified as white or Caucasian. Additionally, all interview participants were owners or co-owners of their farms, and five of the eight farms had a diversified production focus. Details of interview demographics are included in Table 2.

**Table 2. Interview Demographic Characteristics and Farming Practices (n=8)**

<b>Participant</b>	<b>Gender</b>	<b>Ethnicity</b>	<b>Role on the Farm</b>	<b>Employed Outside of Farm Work</b>	<b>Farm Production Pocus</b>
F1	Male	White, Caucasian	Co-Owner	No	Plant Production
F2	Male	White, Caucasian	Owner	No	Plant Production
F3	Female	White, Caucasian	Owner	No	Plant Production, Livestock, Dairy

F4	Male	White, Caucasian	Co-Owner	No	Plant Production, Other
F5	Female	White, Caucasian	Co-Owner	No	Livestock, Other
F6	Male	White, Caucasian	Owner	No	Livestock, Other
F7	Male	White, Caucasian	Owner	No	Grain Production
F8	Female	White, Caucasian	Co-Owner	No	Livestock, Dairy

## Measures

To conduct this work, surveys and interviews were employed. The survey captured information about the lifestyle practices of farmers in relation to PA, health, and well-being. Semi-structured interviews were conducted to provide a deeper exploration into the relationship between farming, and PA, and health.

## Survey

The survey consisted of five subsections including demographics and farming practices, the Global Physical Activity Questionnaire (GPAQ), the WHO-5 Well-being Index, the Patient Reported Outcomes Measurement Information System (PROMIS) Scale v1.2 - Global Health survey, and a section on the relationship of farming to PA, health, and well-being. The complete survey can be found in Appendix C.

*Demographics and Farming Practices* – This section provided basic demographics (gender, age, ethnicity) about farmers who took part in this study. This section also included questions about the role of the farmer (e.g., owner, employee) and their farming practices (e.g., primary products).

*Global Physical Activity Questionnaire (GPAQ)* – The GPAQ captured self-report data on PA across work, transportation, and leisure domains (World Health Organization, n.d.). For this study, the GPAQ was adapted to include additional questions about whether participants

engaged in recreational activities (such as resistance training or Yoga) to account for a broader scope of recreational PA. This GPAQ has been used in multiple populations with low to moderate validity and high reliability (Keating et al., 2019; Metcalf et al., 2018; Sember et al., 2020). Specifically, the GPAQ captures the frequency, intensity, and duration of PA across work, transportation, and leisure activities. From this, it is possible to calculate the volume of vigorous and moderate intensity activity across domains.

*WHO-5 Well-being Index* – The WHO-5 Well-being Index is a measure of psychological well-being (Topp et al., 2015). The WHO-5 has shown high validity and reliability (Phillipp et al., 2020; Topp et al., 2015). This index measures well-being by asking participants to rate how they felt over the last two weeks. Specifically, participants indicate the frequency in which they agree with the five statements outlined by the index. Participants can choose from six responses ranging from “all the time” to “at no time.” Values assigned to each response are then summed to measure well-being.

*Patient Reported Outcomes Measurement Information System (PROMIS) Scale v1.2 - Global Health* – The PROMIS scale prompts participants to report on their physical and psychological health (Elsman et al., 2021). This scale has shown reliability and validity across populations (Pellicciari et al., 2021) and was used to provide a comprehensive understanding of participants’ overall health. This measure asks participants to respond to statements pertaining to their physical and mental health where they are prompted to rank their health on a scale ranging from poor to excellent or indicate the frequency they have experienced health-related obstacles. Response variables are assigned numeric values, ranging from one to five, which are calculated to correspond to physical or mental health outcomes.

*Farming, PA, Health, and Well-being* –This section was developed specifically for this study to assess participants' views on how farming relates to one's PA, health, and well-being. Specifically, participants were asked if farming promoted or detracted from their PA, physical health, mental health, and well-being. Farmers used a 5-item scale to rate the degree to which they agreed or disagreed with statements to indicate if farming promoted or detracted from their well-being. As follow-up, open-ended questions prompted participants to elaborate on their response. These open-ended questions asked farmers to specifically indicate how farming promoted or detracted from their PA, physical health, mental health, and well-being.

### **Interviews**

The final data collection measure was semi-structured interviews, which allowed the researcher to ask questions about participants' lifestyles, PA, health, and well-being. Interview questions were developed to continue the themes in the research survey. Broadly, these questions prompted farmers to discuss the type of farming they practiced, how PA was involved in their farm work, what additional PA they participated in outside of farm work, and how farming impacted their physical health, mental health, and well-being. Follow-up questions encouraged participants to elaborate on their responses. To enhance the credibility and transparency of the interview process, all conversations were recorded and transcribed for detailed analysis. The interview script is provided in Appendix D.

### **Procedures**

Upon approval from the International Review Board, participant recruitment took place and prospective participants' contact information was collected using the online resource Local Harvest. After referencing Local Harvest, the researcher collected email addresses from 1,000

farmers' publicly available websites. Prospective participants were sent an email with study details and a link to the online survey. The invitation materials are in Appendices A and B.

The online survey was administered using Qualtrics. Participation was voluntary and farmers provided informed consent at the time of the survey. After completing the online surveys, participants were invited to take part in semi-structured interviews. Individuals who consented to participate in interviews were invited to meet virtually via Microsoft Teams with the researcher. Interviews were scheduled for 30 minutes and were recorded and transcribed. Upon completion of the interview process, survey and interview data were analyzed.

### **Data Analysis**

Data analysis was carried out in phases. First, the survey data were analyzed using the Statistical Package for the Social Sciences and descriptive statistics. Next, interview and text responses were analyzed using the *Sort and Sift, Think and Shift* approach (Maietta et al., 2021). This was an iterative, back-and-forth process where the investigator engaged with the data repeatedly. Codes were assigned prior to developing themes and sub-themes that represented farmer responses. Finally, a summary of the main conclusions was constructed.

## **Results**

The following sections summarize the key findings from this work. Results include the main findings from the surveys and interviews related to farmers' PA and the relationship of farming to their PA, health, and well-being. Survey results are presented first, followed by the results of the interview analysis.

### **Survey Results**

First, farmers' PA levels and the relationship of farming to PA are presented. Then, results related to the relationship of farming to health and well-being are presented.

### *Farming and Physical Activity*

Farmers reported their weekly PA using an adapted version of the GPAQ, which provided the total weekly minutes of moderate and vigorous PA in work, transportation, and recreational activity. As Table 2 indicates, total weekly PA was reported across the three domains, revealing a mean of  $1875.45 \pm 1416.45$  PA minutes per week, with most of the PA (77%) resulting from work-related activities.

**Table 3. GPAQ - Self-report Physical Activity in Min/Week (n=55)**

Variable	Mean (SD)
<b>Work-Related PA</b>	
Vigorous Intensity PA at Work	479.45 (630.14)
Moderate Intensity PA at Work	967.64 (727.03)
Total PA at Work	1447.09 (1013.36)
Percent of PA from Work-Related Activities	77%
<b>Transport-Related PA</b>	
Total Transport PA	261.27 (519.1)
Percent of PA from Transport-Related Activities	11%
<b>Recreational PA</b>	
Vigorous Intensity Recreational PA	79.27 (239.97)
Moderate Intensity Recreational PA	87.82 (237.56)
Total Recreational PA	167.09 (463.56)
Percent of PA from Recreationally Related Activities	12%
<b>Total PA</b>	1875.45 (1416.45)

Farmers also responded to a set of questions about the degree to which they believed farming promoted or detracted from their PA. Results revealed that most participants agreed that farming promoted their PA, with 64.5% of farmers indicating that farming totally promoted their PA. A full breakdown of responses can be found in Table 3.

**Table 4. Perceived Relationship between Farming and Physical Activity (n=62)**

Promotes	Strongly Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Strongly Agree (5)	Mean (SD)

<b>Frequency</b>	0	2	2	13	45	4.63 (.71)
<b>Percent</b>	0%	3.2%	3.2%	21.0%	72.6%	
<b>Detracts</b>	Strongly Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Strongly Agree (5)	<b>Mean (SD)</b>
<b>Frequency</b>	35	7	8	10	2	2.03 (1.31)
<b>Percent</b>	54.5%	11.3%	12.9%	16.1%	3.2%	
	Mostly Detracts (1)	Somewhat Detracts (2)	Neutral (3)	Somewhat Promotes (4)	Totally Promotes (5)	<b>Mean (SD)</b>
<b>Frequency</b>	0	3	2	17	40	4.52 (.78)
<b>Percent</b>	0%	4.8%	3.2%	27.4%	64.5%	

### ***Farming and Health and Well-being***

To explore the relationship between farming, health, and well-being, participants responded to the PROMIS Scale v1.2 – Global Health survey and WHO-5 Well-being Index. PROMIS employs a T-score as a reference for a study sample. This establishes the T score of 50 as an average while 40 and 60 are one SD below and above the reference population, respectively. T scores in Table 4 reveal that study participants scored near 50 across both mental and physical health. Additional results from the PROMIS Scale v1.2 – Global Health survey can be found in Appendix E.

**Table 5. PROMIS Scale v1.2 – Global Health Survey and WHO-5 Well-being Index**

<b>PROMIS Scale v1.2 – Global Health Survey (n=58)</b>	
<b>Score Name</b>	<b>Mean (SD)</b>
Global Physical Health T-score	49.15 (6.38)
Global Mental Health T-score	48.74 (9.97)
<b>WHO-5 Well-being Index (n=62)</b>	
Total Score	16.53 (4.55)

Additionally, the WHO-5 inventory prompted farmers to report their perceived well-being across five items. The sum of the five items provided the raw score, which can range from 0 to 25. Responses from the survey offered an average total score of about 16.5 (see Table 4). To

further explore this relationship, farmers responded to questions about the degree to which they believed farming promoted or detracted from their physical health, mental health, and well-being. As it pertained to physical health, results revealed farmers generally believed farming had a positive impact, with 50% of farmers indicating that farming totally promoted their physical health. A breakdown of responses can be found in Table 5.

**Table 6. Perceived Relationship between Farming and Physical Health (n=62)**

<b>Promotes</b>	Strongly Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Strongly Agree (5)	<b>Mean (SD)</b>
<b>Frequency</b>	2	0	6	18	35	4.38 (.92)
<b>Percent</b>	3.2%	0%	9.7%	29.0%	56.5%	
<b>Detracts</b>	Strongly Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Strongly Agree (5)	<b>Mean (SD)</b>
<b>Frequency</b>	22	12	12	12	3	2.36 (1.27)
<b>Percent</b>	35.4%	19.4%	19.4%	19.4%	4.8%	
	Mostly Detracts (1)	Somewhat Detracts (2)	Neutral (3)	Somewhat Promotes (4)	Totally Promotes (5)	<b>Mean (SD)</b>
<b>Frequency</b>	0	4	3	23	31	4.33 (.85)
<b>Percent</b>	0%	6.5%	4.8%	37.1%	50.0%	

Participants were also asked to consider the impact farming had on their mental health. Farmers generally reported their lifestyle had a favorable influence on their mental health with roughly 75% of farmers reporting that farming either somewhat or totally promoted their mental health. A breakdown of responses can be found in Table 6.

**Table 7. Perceived Relationship between Farming and Mental Health (n=62)**

<b>Promotes</b>	Strongly Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Strongly Agree (5)	<b>Mean (SD)</b>
<b>Frequency</b>	3	4	5	24	25	4.05 (1.10)
<b>Percent</b>	4.8%	6.5%	8.1%	38.7%	40.3%	



<b>Detracts</b>	Strongly Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Strongly Agree (5)	<b>Mean (SD)</b>
<b>Frequency</b>	20	12	7	15	7	2.62 (1.45)
<b>Percent</b>	32.3%	19.4%	11.3%	24.2%	11.3%	
	Mostly Detracts (1)	Somewhat Detracts (2)	Neutral (3)	Somewhat Promotes (4)	Totally Promotes (5)	<b>Mean (SD)</b>
<b>Frequency</b>	3	4	7	22	25	4.02 (1.12)
<b>Percent</b>	4.8%	6.5%	11.3%	35.5%	40.3%	

Finally, participants indicated the degree to which they believed farming promoted or detracted from their well-being. In these responses, 41.9% of participants indicated that farming totally promoted their well-being, and an additional 38.7% indicated that farming somewhat promoted their well-being. Table 7 provides a breakdown of responses.

**Table 8. Perceived Relationship between Farming and Overall Well-being (n=62)**

<b>Promotes</b>	Strongly Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Strongly Agree (5)	<b>Mean (SD)</b>
<b>Frequency</b>	0	3	2	23	34	4.42 (.78)
<b>Percent</b>	0%	4.8%	3.2%	37.1%	54.8%	
<b>Detracts</b>	Strongly Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Strongly Agree (5)	<b>Mean (SD)</b>
<b>Frequency</b>	23	14	9	14	1	2.28 (1.24)
<b>Percent</b>	37.1%	22.6%	14.5%	23.0%	1.6%	
	Mostly Detracts (1)	Somewhat Detracts (2)	Neutral (3)	Somewhat Promotes (4)	Totally Promotes (5)	<b>Mean (SD)</b>
<b>Frequency</b>	1	4	7	24	26	4.13 (.97)
<b>Percent</b>	1.6%	6.5%	11.3%	38.7%	41.9%	

## Interview Results

Interviews further explored the degree to which farming promoted or detracted from farmer PA, physical health, mental health, and well-being, and nine themes were developed according to these exploratory aims. Because interviews and open-ended survey questions explored similar topics, the open-ended text responses were referenced to provide additional supporting evidence to the established themes.

Interview results are discussed in greater detail in the following sections according to their relationship to PA, physical health, mental health, and well-being. Specifically, themes related to PA include *labor intensive* and an acknowledged *lack of recreational PA*. Themes related to physical health address farmers' access to the *outdoors* and *nutritional foods*, and the *risk of injury* from farm work. *Mental stimulation* and *stress* were two prominent themes that related to mental health. Finally, *stewardship* and *sense of purpose* were two themes discovered relating to farmer well-being. A table detailing the themes, subthemes, definitions, and supporting evidence is included in Appendix E.

### ***Farming and Physical Activity***

*Labor intensive* and an acknowledged *lack of recreational PA* were two themes that emerged relating to farming and PA. References to the labor-intensive nature of farming was the most cited theme as participants perceived their work to be physically demanding. Participants indicated farm work required consistent PA across the day, often necessitating changes in physical posture. This recurrent theme was believed to contribute to overall PA.

Conversely, though farmers believed farming promoted their overall PA, they also indicated how work limited their ability to pursue recreational forms of PA, such as sport, cardiovascular exercise, or weight training. Specifically, farmers reported their work resulted in a

lack of time or energy, which presented a barrier to recreational activities. For instance, participant F5 shared “It’s all the time. It’s 24/7. There’s no time off.” Participant F7 echoed this time constraint by stating “During spring and fall and busy times of the year, it’s seven days a week. The whole day is farm work.” A survey text response underscores this barrier from their comment stating, “I don’t have the extra time or energy to be able to devote to the physical activities I’d like to partake in.” Together, these themes reveal two distinct ways the agrarian lifestyle influenced farmer PA.

### ***Farming and Physical Health***

Pertaining to farming and physical health, three prominent themes emerged. These themes included *access to the outdoors*, *availability of nutritional foods*, and the *risk of injury* associated with farming.

First, farmers indicated much of their work was done outside and supported their PA, and by extension, their physical health. This theme was identified across all interview responses. Participants also shared an appreciation for working in nature and indicated that access to the outdoors was generally supportive of their physical health. For instance, participant F4 shared their work allows them to, “eat well, get fresh air, exercise, and touch the earth.”

Farmers also believed their work provided greater access to nutritious foods. Specifically, participants reported having access to farm fresh goods produced from their farm, which contributed to them having a healthy diet. This is reflective of the survey responses where more than half of participants indicated their farming practices were fully or partly organic. It is worth noting some farmers mentioned the stress of their work also had an impact on their diet. While stress did not reduce their access to nutritious foods, it did impact the food choices they made. For instance, some survey participants indicated they were more likely to eat unhealthy foods if

they had a particularly difficult day of work, and one survey participant noted that, “I work long hours and when I’m done, I’m usually too tired to cook healthy food.”

In contrast to the health-promoting themes identified, farmers believed their lifestyle presented some risks to their physical health and was frequently identified by interview participants. Farmers noted wear and tear was common and their work placed them at risk for health complications due to environmental exposures like chemical radiation or too much sunlight. For instance, participant F3 stated “It’s not all that safe,” and participant F5 shared that “It wears on your joints, it’ll tear you up. Everything tears you up.” Due to the busy nature of their work, some farmers indicated farm work impacted their ability to seek care for their health, and one farmer shared in their survey response that they, “do not have time for routine medical appointments and tend to put off taking care of physical issues until the off season.”

The takeaway relating to farming and physical health is that farming provides benefits to one’s physical health as seen in the examples of access to outdoor work and nutritious foods. However, there are also aspects of farming that can be detrimental to farmer physical health, such as injury, that should not be overlooked.

### ***Farming and Mental Health***

Farmers also identified ways their lifestyle promoted and detracted from their mental health. Here, two themes emerged. First, farmers believed their work was *mentally stimulating*, which was often perceived to be a benefit. More specifically, participants believed their daily tasks were cognitively engaging and required their full attention to complete. Participant F2 shared they are “always learning, and it’s what makes me most happy.”

Though farming offered this cognitive benefit, farmers acknowledged their lifestyle presented many forms of psychological stress which they generally viewed to have a negative

impact on mental health. Farmers consistently shared four types of *perceived stress*, which are outlined as subthemes. These included financial and physical stress, social isolation, and factors outside of one's control.

Participant F5 shared that “There are really miserable moments because you're expected to be all powerful. You created this place, and you chose what goes on, and you're responsible for all of these lives. But then you're also completely at the mercy of nature and the weather and biology and genes and random accidents and things that you cannot control, prevent, or fix.”

Overall, themes related to mental health provide evidence that farming offers health promotion opportunities, such as when work is mentally stimulating. However, even though there are perceived psychological benefits to farming, financial challenges, physical demands, and unpredictable environmental, social, and economical factors cause stress and can detract from farmers' mental health.

### ***Farming and Well-being***

Finally, as it pertains to farming and well-being, two themes were viewed as favorable and were commonly shared by farmers. Specifically, farmers believed their work promoted a sense of *stewardship* and provided a *sense of purpose* in their lives. These themes were identified by all farmer interview responses.

Stewardship represents farmers' sense of responsibility to care for others – be it land, animal, or community. Three subthemes were captured to represent the distinct types of stewardship farmers reported. Specifically, participants believed their work was a form of service whereby they provided goods and services to their local community. Farmers also believed their stewardship extended to animal welfare and land management. When sharing their experiences, participant F8 highlighted these sub-themes by stating, "We really like the type of farming that

we're doing, that it's organic and regenerative and you know, we feel like we're positively contributing to the environment and to our animals and to the meat that we're producing.”

The final theme identified was the sense of purpose derived from farm work. This theme was often expressed as a sense of joy or accomplishment. For instance, participant F3 stated “It just gives you a reason to live.” Additionally, participant F1 shared, “it gives me something to do. It's a set of things that I need to do every day or certainly every week that I can look forward to and do. It makes me tired at night and glad to go to sleep, so I'm going to wake up glad that it's a new day. So yeah, we're really blessed.”

Several of the survey participants also reported a belief that their work provided a spiritual connection to something greater than themselves, such that their work was tied to a higher calling. One survey respondent explicitly stated they believed their work was a connection to God reporting that, “God designed us to be active in stewardship of His creation. Farming is working His creation. This is how things were designed. We mimic nature and when we do that, we have overall well-being. There is no better design.” Together these themes and their associated subthemes represent perceived benefits to farmers' well-being.

Overall, participant interviews provided an open-ended format for farmers to share their experiences. These conversations allowed specific themes to be developed, which offered greater insight into the relationship between farming, PA, health, and well-being.

## **Discussion**

PA has long been tied to activities of daily living. However, with the rise of modern development, the relationship between PA and daily life has shifted, often to the detriment of PA participation, as well as health and well-being. In response, this study explored the relationship between farming, PA, health, and well-being. Overall, the results addressed the purpose and

aims. Broadly, results suggested that farmers who lived and/or worked on small farms led physically active lifestyles and that farmers encountered lifestyle experiences that promoted or detracted from their health and well-being.

The first aims of this study were to describe the PA patterns of farmers and explore the relationship between farming and PA. Results suggested that farmers carried out physically demanding work that contributed to their daily PA. Specifically, farmers indicated most of their PA took place as part of their work, and work was considered a labor-intensive stimulus that required both continuous movement and a variety of movement. Work-related PA was often completed outdoors, which was perceived to be a job benefit. Still, farm work was not without challenges. Participants indicated that even though farming provided the opportunity for PA, risk of injury was associated with the job. Farmers also believed their demanding work detracted from the time and energy they needed to pursue recreational PA. Still, the volume of self-reported PA suggested that farmers led lifestyles that supported PA.

This study also explored the impact of farming on health and well-being and results revealed that farming presented certain challenges and unique benefits to farmers. While farmers indicated their agricultural lifestyle supported their health and well-being, they also reported specific ways farming detracted from their health. For instance, the high volume of physical labor led to injury, sometimes long-lasting. Farmers also noted exposure to risks like too much sunlight and harmful chemicals, which may have deleterious consequences, such as cancer. Together these risks indicate that farming may detract from farmers' physical health.

Psychological stress was another detractor to farmer health. Farmers indicated that stressors, such as financial concerns and problems outside of one's control, took a toll on their

well-being by implicating negative affective states. This is particularly important as things like depression and anxiety serve as risk factors for suicide in farmers (Bjornestad et al., 2021)

While the results revealed some challenges faced by farmers, data suggested the agrarian lifestyle granted benefits to the health and well-being of farmers. For instance, many participants perceived their work to be an active endeavor and indicated their work supported their health by keeping them active throughout the day. Farmers also believed time outdoors and access to green space benefited their well-being. Further, farmers indicated their work gave them access to farm-fresh products that allowed for a nutritious diet that supported their physical health.

Study participants also indicated farming positively impacted their psychological health and well-being. Many farmers shared that their work provided psychological stimulation and an environment that made for mentally engaging work. Additionally, farmers indicated their work brought them a sense of purpose and joy. Farmers revealed they were glad to do their work, and some participants indicated their work was perceived to be a higher calling.

Findings from this study support the small body of work that surrounds farming and farmer health. Previous research revealed that farm work carried out on small farms was tied to demanding physical labor and provided stimulus for PA (Day, 2018; Gordon, 2019; Mix et al., 2019; Racine et al., 2012). Results from this study support this as farmers indicated their work included high volumes of physical labor and PA. Previous work on this subject also showed farming presented health challenges, such as injury and stress (Bjornestad et al., 2021; Yazd et al., 2019), which have also been confirmed by this study.

This study offered new insights about how farming shapes farmer PA, health, and well-being. Specifically, this study explored farmers' perceptions of their lifestyle. In doing so, this study further contributed to current research by including farmers' perceived sense of purpose,



psychological engagement, and lack of recreational PA. These factors expand what is known about the relationships between farming, PA, health, and wellness.

This study was not without limitations. Most notably is the sample size and limited geographic scope. This study only focused on a six Midwestern states which may not reflect the range of small farms in the U.S. Another limitation was the reliance on self-report measures that may not accurately assess PA. Further, this work did not account for seasonal variance that would inevitably shape farmers' work and PA. Future work should include objective measurements of PA, such as trackers or apps, and consider the impact of seasons on farmers. Finally, this study intentionally focused on small farms which account for a fraction of the farming population in the U.S. Future work should include farmers who work on larger-scale operations, as these environments are likely to have different demands and outcomes.

### **Conclusion**

This study investigated the relationship between farming and the PA, health, and well-being of farmers who lived and/or worked on small farms. Results indicated farming was a labor-intensive endeavor that required PA throughout the day. It also revealed that farming presented unique challenges and benefits that contributed to farmers' health and well-being. This work supports the current body of evidence and has added to the knowledge base by providing new insights into farming's impact on PA, health, and well-being.

## CHAPTER II: DISSEMINATION

This study investigated the connection between farming, PA, health, and well-being, and the next step is to disseminate this work to support farmers. To accomplish this goal, this work will be shared with farmers who live and/or work on small farms and those who are considering a career in farming. Sharing this work with these people creates an avenue for impact on the health and well-being of small-farm farmers.

To accomplish the goal of immediate dissemination, a summary report has been developed and can be found in Appendix F. The purpose of this report is to highlight findings related to farmers' PA experiences and generate an awareness of how the farming lifestyle benefits and detracts from health and well-being. This report discusses key background literature, followed by a simplified synopsis of study methodology. Then, the report details the study results, where data is distilled into key takeaways. Finally, the report offers specific recommendations to promote farmer PA, health, and well-being.

This report will first be shared with the participants who took part in this study to provide results specific to their survey and interview responses. The purpose of sharing the results back to the participants is two-fold. The first reason is a gesture of gratitude. The farmers in this study took time to provide insight into their attitudes and behaviors surrounding how farming shapes their PA, health, and well-being. It is therefore the intent of the study author to share the report to this group so they can review the results that were made possible by their contributions.

The second reason this report will be shared back to the study participants is to provide recommendations to promote their health and well-being. Specifically, three recommendations were developed in response to the study results that showed ways farming had a negative impact on the health and well-being of farmers. These recommendations include encouraging farmers to

view their farm work as an avenue to physical activity, to choose recreational activities that are preventative or rehabilitative in nature, and to seek support, either familial or professional, if the stress of farming becomes overwhelming. These recommendations were created because farmers indicated they did not have time to be recreationally active, struggled with physical injuries resulting from their work, and the stress of farming sometimes became too much to handle, respectively. By sharing these recommendations back to the participants, it may support the PA, health, and well-being of this group of farmers.

Beyond sharing this work back to the study participants, the summary report will be submitted to professional publications to reach a broader audience of farmers, as well as those who are considering taking up farming. This work will be shared with this group because it is likely the challenges and stressors shared by the study participants may also be experienced by other small-farm farmers, making this work, and the recommendations, relevant to their lives.

Additionally, this report may provide individuals who intend to become farmers information about how farming may impact their well-being, as well as recommendations to proactively protect their health. To reach a broader audience of farmers, the report will be submitted to select outlets geared towards farmers. Four examples of this include *Growing for Market*, *The Progressive Farmer*, *Small Farmers Journal*, and *Modern Farmer*. These have been selected because they are designed to reach small farm farmers.

It is hoped that by sharing this report directly with famers this work can serve as a resource to promote the PA, health, and well-being of farmers by generating awareness of shared experiences. The full report has been included in Appendix F.

### CHAPTER III: ACTION PLAN

To ensure this work has lasting impact on the PA, health, and well-being of farmers, the author has selected specific short and long-term goals. These goals, both immediate and prolonged, are the basis of the action plans after this project's conclusion.

First, it is the author's plan to share this work with study participants and disseminate the results more broadly among farmers. To do this, a summary report has been developed which describes the study and its findings. The report's intention is to create an impact avenue by generating an awareness of the shared experiences of farmers as these relate to their PA, health, and well-being. This action plan has been fully discussed in Chapter II and the report is in Appendix F.

Following immediate dissemination, this work will be shared with a broader audience of farmers and professionals. One way the author plans to reach farmers is by connecting to farmers through local area farmer's markets. There are several prominent farmer's markets within the author's region that can connect the author with the target population. Examples of these include the Tower Grove Farmer's Market, the U City Farmer's Market, the Edwardsville Farmer's Market, and the Springfield Farmer's Market. To reach these farmers, the author intends to connect with the market organizers to determine how to best share this work. This may include sharing the report with market participants or attending market events to connect with farmers directly.

It is also the goal of the study author to distribute these results to a broader audience of health and fitness professionals to provide information about how professionals can support the PA, health, and well-being of farmers. Professionals across many domains including recreation and rehabilitative care are likely to interact with farmers in their day-to-day work and having this

knowledge can better help them support the farmers. To reach a broader audience, the author also intends to submit this work for professional conference presentation.

Two audiences are being considered, which include an agriculturally based audience and a healthcare/recreation-based audience. Presenting this work to farmers would allow the author to further support the health of farmers, ensuring lasting impact on the study population. Additionally, this work can also be shared with health and fitness professionals who work with farmers because this group is likely to have a hand in supporting the health of farmers in their communities. Examples of conference opportunities include events hosted by the Illinois and Missouri Farm Bureaus, which host regional events for local farmers. Similarly, Illinois and Missouri host regional and statewide conference opportunities for parks and recreation professionals. These events encourage collaboration on and discussion about issues of health and well-being in local communities and would provide a platform to disseminate this work.

An additional action plan is tied to the author's continued scholarly pursuits as it is the responsibility of the author to uphold the teaching, service, and scholarship pillars associated with higher education. Specifically, as a teacher, it is the author's responsibility to share strategies that promote health and well-being. Continued education and practice, such as the experiences garnered during this project, allow the author to grow as an educator to support the next generation of students. One example in which this work can be applied in the classroom is through the Sport and Exercise Psychology for Special Populations course the study author teaches. This course is developed to discuss various populations and the unique experiences they encounter related to their PA, health, and well-being. One way the author may apply this work in this course is to develop a course module on farmers and what is known about their PA patterns. Doing so would generate course content, discussion, and assessments that would challenge

students to consider unique populations, like farmers, and ways in which lifestyle directly impacts PA, health, and well-being.

Second, this research gave the author a deeper understanding of the experiences and health patterns of farmers. This is a foundation for future service to this community and will allow the author to be an advocate and resource to farmers. As mentioned previously, the states of Illinois and Missouri have developed resources to connect consumers and professionals to their local farmers. Using these resources, the study author can develop greater connections within this community which can serve as the basis for future service work.

Finally, this study serves as an introduction to future research projects that allow the author to pursue additional goals in scholarship. Ideas for future work would ideally address some of the limitations of this study for continued understanding of the relationship between farming and health. For instance, future projects would include objective measurements of PA, such as trackers or apps, to provide a more objective measure of farmer PA. Another potential project would evaluate the impact of seasons on farmers' PA for a more comprehensive understanding of the relationship between their lifestyle and their activity levels. Both avenues would advance the knowledge base on what is already known and what was investigated in this work. n

Altogether, the short and long-term plans presented allows this work to be applied in practice. The goal of disseminating this work through these channels is to allow for lasting impact and to serve as a resource to promote the PA, health, and well-being of farmers.

## REFERENCES

- Alotaibi, T., Almuhanha, R., Alhassan, J., Alqadhib, E., Mortada, E., & Alwhaibi, R. (2020). The relationship between technology use and physical activity among typically-developing children. *Healthcare*, 8(4), 488. <https://doi.org/10.3390/healthcare8040488>
- Amireault, S., & Godin, G. (2015). The godin-shephard leisure-time physical activity questionnaire: Validity evidence supporting its use for classifying healthy adults into active and insufficiently active categories. *Perceptual and Motor Skills*, 120(2), 604–22. <https://doi.org/10.2466/03.27.PMS.120v19x7>
- Aparicio-Ugarriza, R., Mielgo-Ayuso, J., Ruiz, E., Ávila, J. M., Aranceta-Bartrina, J., Gil, Á., Ortega, R. M., Serra-Majem, L., Varela-Moreiras, G., & González-Gross, M. (2020). Active commuting, physical activity, and sedentary behaviors in children and adolescents from Spain: Findings from the ANIBES study. *International journal of environmental research and public health*, 17(2), 668. <https://doi.org/10.3390/ijerph17020668>
- Atkinson, K., Lowe, S., & Moore, S. (2016). Human development, occupational structure and physical inactivity among 47 low and middle income countries. *Preventive Medicine Reports*, 3, 40–45. <https://doi.org/10.1016/j.pmedr.2015.11.009>
- Bassett, D. R., Schneider, P. L., & Huntington, G. E. (2004). Physical activity in an old order amish community. *Medicine and Science in Sports and Exercise*, 36(1), 79–85.
- Bassett, D. R. (2008). Physical activity of canadian and american children: A focus on youth in amish, mennonite, and modern cultures. *Applied Physiology, Nutrition, and Metabolism*, 33(4), 831–835. <https://doi.org/10.1139/H08-044>

- Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member checking: A tool to enhance trustworthiness or merely a nod to validation?. *Qualitative health research*, 26(13), 1802–1811. <https://doi.org/10.1177/1049732316654870>
- Bjornestad, A., Cuthbertson, C., & Hendricks, J. (2021). An analysis of suicide risk factors among farmers in the Midwestern United States. *International Journal of Environmental Research and Public Health*, 18(7). <https://doi.org/10.3390/ijerph18073563>
- Centers for disease control (2021, April 5). *Benefits of physical activity*. <https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm>
- Centers for disease control (2022, September 6) *Exercise or physical activity*. <https://www.cdc.gov/nchs/fastats/exercise.htm>
- Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports*, 100(2), 126–131.
- Cleland, V., Hughes, C., Thornton, L., Venn, A., Squibb, K., & Ball, K. (2015). A qualitative study of environmental factors important for physical activity in rural adults. *Plos One*, 10(11), 0140659. <https://doi.org/10.1371/journal.pone.0140659>
- Cleland, V., Sodergren, M., Otahal, P., Timperio, A., Ball, K., Crawford, D., Salmon, J., & McNaughton, S. A. (2015). Associations between the perceived environment and physical activity among adults aged 55-65 years: Does urban-rural area of residence matter?. *Journal of Aging and Physical Activity*, 23(1), 55–63. <https://doi.org/10.1123/japa.2012-0271>
- Cole, J. A., Tully, M. A., & Cupples, M. E. (2015). "They should stay at their desk until the work's done": A qualitative study examining perceptions of sedentary behavior in a desk-



based occupational setting. *BMC Research Notes*, 8, 683. <https://doi.org/10.1186/s13104-015-1670-2>

Cypress, B. S. (2017). Rigor or reliability and validity in qualitative research: Perspectives, strategies, reconceptualization, and recommendations. *Dimensions of Critical Care Nursing*, 36(4), 253–263. <https://doi.org/10.1097/DCC.0000000000000253>

Day, K. (2018). Physical environment correlates of physical activity in developing countries: A review. *Journal of Physical Activity & Health*, 15(4), 303–314. <https://doi.org/10.1123/jpah.2017-0184>

Ding, D., Sallis, J. F., Hovell, M. F., Du, J., Zheng, M., He, H., & Owen, N. (2011). Physical activity and sedentary behaviors among rural adults in Suixi, China: A cross-sectional study. *The International Journal of Behavioral Nutrition and Physical Activity*, 8, 37. <https://doi.org/10.1186/1479-5868-8-37>

Dowd, K. P., Szeklicki, R., Minetto, M. A., Murphy, M. H., Polito, A., Ghigo, E., van der Ploeg, H., Ekelund, U., Maciaszek, J., Stemplewski, R., Tomczak, M., & Donnelly, A. E. (2018). A systematic literature review of reviews on techniques for physical activity measurement in adults: A dedipac study. *International Journal of Behavioral Nutrition and Physical Activity*, 15(1), 1–33. <https://doi.org/10.1186/s12966-017-0636-2>

Dumith, S. C., Hallal, P. C., Reis, R. S., & Kohl, H.W. (2011). Worldwide prevalence of physical inactivity and its association with human development index in 76 countries. *Preventative Medicine*. 53(1) 24-28. DOI: 10.1016/j.ypmed.2011.02.017

Elsman, E.B.M., Roorda, L.D., Crins, M.H.P., Boers, M., & Terwee, C.B. (2021). Dutch reference values for the patient-reported outcomes measurement information system scale

v1.2 - global health (PROMIS-GH). *J Patient Rep Outcomes* 5, 38 (2021).

<https://doi.org/10.1186/s41687-021-00314-0>

Frost, S. S., Goins, R. T., Hunter, R. H., Hooker, S. P., Bryant, L. L., Kruger, J., & Pluto, D.

(2010). Effects of the built environment on physical activity of adults living in rural settings. *American Journal of Health Promotion : Ajhp*, 24(4), 267–83.

<https://doi.org/10.4278/ajhp.08040532>

Genin, P. M., Dutheil Frédéric, Larras, B., Esquirol, Y., Boirie, Y., Tremblay, A., Pereira, B.,

Praznoczy, C., Thivel, D., & Duclos, M. (2019). Promoting physical activity and reducing sedentary time among tertiary workers: Position stand from the french national onaps. *Journal of Physical Activity and Health*, 16(9), 677–678.

<https://doi.org/10.1123/jpah.2019-0154>

Gilbert, A. S., Duncan, D. D., Beck, A. M., Eyeler, A. A., & Brownson, R. C. (2019). A

qualitative study identifying barriers and facilitators of physical activity in rural communities. *Journal of Environmental and Public Health*, 2019.

<https://doi.org/10.1155/2019/7298692>

Gordon, S. E. (2019) Fitting into our genes: Evolutionary theory of the health benefits of physical activity. *Quest*, 71(4), 375-386. DOI: 10.1080/00336297.2019.1656652

Herrero, M., Thornton, P. K., Power, B., Bogard, J. R., Remans, R., Fritz, S., Gerber, J. S.,

Nelson, G., See, L., Waha, K., Watson, R. A., West, P. C., Samberg, L. H., van de Steeg, J., Stephenson, E., van Wijk, M., & Havlík Petr. (2017). Farming and the geography of nutrient production for human use: A transdisciplinary analysis. *The Lancet Planetary Health*, 1(1), 42.

[https://doi.org/10.1016/S2542-5196\(17\)30007-4](https://doi.org/10.1016/S2542-5196(17)30007-4)

- Huneault, L., Mathieu, M.-È., & Tremblay, A. (2011). Globalization and modernization: an obesogenic combination. *Obesity Reviews : An Official Journal of the International Association for the Study of Obesity*, *12*(5), 64–72. <https://doi.org/10.1111/j.1467-789X.2010.00817.x>
- Jarosz, B., & Cortes, R. T. (2014, September 23) *In U.S., new data show longer, more sedentary commutes*. Population Reference Bureau. <https://www.prb.org/resources/in-u-s-new-data-show-longer-more-sedentary-commutes/>
- Keating, X. D., Zhou, K., Liu, X., Hodges, M., Liu, J., Guan, J., Phelps, A., & Castro-Piñero, J. (2019). Reliability and concurrent validity of global physical activity questionnaire (GPAQ): A systematic review. *International Journal of Environmental Research and Public Health*, *16*(21), 4128. <https://doi.org/10.3390/ijerph16214128>
- King B. M. (2013). The modern obesity epidemic, ancestral hunter-gatherers, and the sensory/reward control of food intake. *The American Psychologist*, *68*(2), 88–96. <https://doi.org/10.1037/a0030684>
- Koohsari, M. J., Shibata, A., Ishii, K., Kurosawa, S., Yasunaga, A., Hanibuchi, T., Nakaya, T., Mavoja, S., McCormack, G. R., & Oka, K. (2020). Built environment correlates of objectively-measured sedentary behaviors in densely-populated areas. *Health & Place*, *66*, 102447–102447. <https://doi.org/10.1016/j.healthplace.2020.102447>
- Kraus, W. E., Janz, K. F., Powell, K. E., Campbell, W. W., Jakicic, J. M., Troiano, R. P., Sprow, K., Torres, A., & Piercy, K. L. (2019). Daily step counts for measuring physical activity exposure and its relation to health. *Medicine and Science in Sports and Exercise*, *51*(6), 1206–1212. <https://doi.org/10.1249/MSS.0000000000001932>

- Lieberman, D. E. (2015). Is exercise really medicine? an evolutionary perspective. *Current Sports Medicine Reports*, 14(4), 313–9. <https://doi.org/10.1249/JSR.0000000000000168>
- Liu, J.-H., Jones, S. J., Sun, H., Probst, J. C., Merchant, A. T., & Cavicchia, P. (2012). Diet, physical activity, and sedentary behaviors as risk factors for childhood obesity: An urban and rural comparison. *Childhood Obesity*, 8(5), 440–8. <https://doi.org/10.1089/chi.2012.0090>
- Machado-Rodrigues, A. M., Coelho-E-Silva, M. J., Mota, J., Padez, C., Martins, R. A., Cumming, S. P., Riddoch, C., & Malina, R. M. (2014). Urban-rural contrasts in fitness, physical activity, and sedentary behavior in adolescents. *Health Promotion International*, 29(1), 118–29. <https://doi.org/10.1093/heapro/das054>
- Maietta, R., Mihas, P., Swartout, K., Petruzzelli, J., & Hamilton, A. B. (2021). Sort and sift, think and shift: Let the data be your guide, an applied approach to working with, learning from, and privileging qualitative data. *The Qualitative Report*, 26(6), 2045-2060. <https://doi.org/10.46743/2160-3715/2021.5013>
- Master, H., Annis, J., Huang, S., Beckman, J. A., Ratsimbazafy, F., Marginean, K., Carroll, R., Natarajan, K., Harrell, F. E., Roden, D. M., Harris, P., & Brittain, E. L. (2022). Association of step counts over time with the risk of chronic disease in the all of us research program. *Nature Medicine*, 28(11), 2301–2308. <https://doi.org/10.1038/s41591-022-02012-w>
- McDonald, J. (2021, March 11). *Small farms, big difference*. United States Department of Agriculture. <https://www.usda.gov/media/blog/2010/05/18/small-farms-big-differences>
- Metcalf, K. M., Baquero, B. n., Coronado Garcia, M. L., Francis, S. L., Janz, K. F., Laroche, H. H., & Sewell, D. K. (2018). Calibration of the global physical activity questionnaire to

- accelerometry measured physical activity and sedentary behavior. *Bmc Public Health*, 18.  
<https://doi.org/10.1186/s12889-018-5310-3>
- Mix, J. M., Elon, L., Thein Mac, V. V., Flocks, J., Economos, J., Tovar-Aguilar, A. J., Hertzberg, V. S., & McCauley, L. A. (2019). Physical activity and work activities in florida agricultural workers. *American Journal of Industrial Medicine*, 62(12), 1058–1067. <https://doi.org/10.1002/ajim.23035>
- Moody, R. (2022, March 21). *Screen time statistics: Average screen time in US vs. the rest of the world*. Compaitech. <https://www.comparitech.com/tv-streaming/screen-time-statistics/#:~:text=According%20to%20data%20from%20DataReportal,of%20screen%20time%20per%20day>
- Moore, J. B., Jilcott, S. B., Shores, K. A., Evenson, K. R., Brownson, R. C., & Novick, L. F. (2010). A qualitative examination of perceived barriers and facilitators of physical activity for urban and rural youth. *Health Education Research*, 25(2), 355–67.  
<https://doi.org/10.1093/her/cyq004>
- Ng, S. W., & Popkin, B. M. (2012). Time use and physical activity: A shift away from movement across the globe. *Obesity Reviews*, 13(8), 659–80.  
<https://doi.org/10.1111/j.1467-789X.2011.00982.x>
- O'Keefe, J. H., Vogel, R., Lavie, C. J., & Cordain, L. (2011). Exercise like a hunter-gatherer: A prescription for organic physical fitness. *Progress in Cardiovascular Diseases*, 53(6), 471–9. <https://doi.org/10.1016/j.pcad.2011.03.009>
- Pellicciari, L., Chiarotto, A., Giusti, E., Crins, M. H. P., Roorda, L. D., & Terwee, C. B. (2021). Psychometric properties of the patient-reported outcomes measurement information

- system scale v1.2: global health (promis-gh) in a dutch general population. *Health and Quality of Life Outcomes*, 19(1). <https://doi.org/10.1186/s12955-021-01855-0>
- Philipp, E. S., Andreia, P. C., Georges, S., & Alexander, F. S. (2020). The who-5 well-being index - validation based on item response theory and the analysis of measurement invariance across 35 countries, 1, 100020. <https://doi.org/10.1016/j.jadr.2020.100020>
- Pursell, C. (2007). *The machine in America: A social history of technology (#2)*. John Hopkins University Press.
- Racine, E. F., Laditka, S. B., Dmochowski, J., Alavanja, M. C., Lee, D. C., & Hoppin, J. A. (2012). Farming activities and carrying and lifting: The agricultural health study. *Journal of physical activity & health*, 9(1), 39–47. <https://doi.org/10.1123/jpah.9.1.39>
- Raichlen, D. A., Pontzer, H., Zderic, T. W., Harris, J. A., P Mabulla, A. Z., Hamilton, M. T., & Wood, B. M. (2020). Sitting, squatting, and the evolutionary biology of human inactivity. *Proceedings of the National Academy of Sciences of the United States of America*, 117(13), 7115–7115. <https://doi.org/10.1073/pnas.1911868117>
- Raza, A., Pulakka, A., Magnusson Hanson, L. L., Westerlund, H., & Halonen, J. I. (2021). Commuting distance and behavior-related health: A longitudinal study. *Preventive Medicine*, 150. <https://doi.org/10.1016/j.ypmed.2021.106665>
- Regis, M. F., Tenorio de Oliveira, L. M. F., Mendes Dos Santos, A. R., Leonidio, A. C. R., Dinis, R. R. B., Monteiro de Freitas, C. M. S. (2016). Urban versus rural lifestyle in adolescents: Associations between environment, physical activity levels and sedentary behavior. *Einstein (São Paulo)*, 14(4), 461–467. <https://doi.org/10.1590/s1679-45082016ao3788>

- Ross, R. & McGuire, K. (2011). Incidental physical activity is positively associated with cardiorespiratory fitness. *Medicine & Science in Sports & Exercise*, 43(11), 2189–2194. <https://doi.org/10.1249/MSS.0b013e31821e4ff2>
- Saint-Maurice, P. F., Troiano, R. P., Bassett, D. R., Graubard, B. I., Carlson, S. A., Shiroma, E. J., Fulton, J. E., & Matthews, C. E. (2020). Association of daily step count and step intensity with mortality among us adults. *Journal of the American Medical Association*, 323(12), 1151–1160. <https://doi.org/10.1001/jama.2020.1382>
- Sember, V., Meh, K., Sorić, M., Starc, G., Rocha, P., & Jurak, G. (2020). Validity and reliability of international physical activity questionnaires for adults across EU countries: Systematic review and meta analysis. *International Journal of Environmental Research and Public Health*, 17(19), 7161–7161. <https://doi.org/10.3390/ijerph17197161>
- Suliburska, J., Bogdański, P., Pupek-Musialik, D., Głód-Nawrocka, M., Krauss, H., & Piątek, J. (2012). Analysis of lifestyle of young adults in the rural and urban areas. *Annals of Agricultural and Environmental Medicine*, 19(1), 135–139.
- Sylvia, L. G., Bernstein, E. E., Hubbard, J. L., Keating, L., & Anderson, E. J. (2014). Practical guide to measuring physical activity. *Journal of the Academy of Nutrition and Dietetics*, 114(2), 199–208. <https://doi.org/10.1016/j.jand.2013.09.018>
- Thivel, D., Tremblay, A., Genin, P. M., Panahi, S., Rivière, D., & Duclos, M. (2018). Physical activity, inactivity, and sedentary behaviors: Definitions and implications in occupational health. *Frontiers in Public Health*, 6, 288. <https://doi.org/10.3389/fpubh.2018.00288>
- Topp, C. W., Østergaard, S. D., Søndergaard, S., & Bech, P. (2015). The who-5 well-being index: A systematic review of the literature. *Psychotherapy and Psychosomatics*, 84(3), 167–176. <https://doi.org/10.1159/000376585>

- Tremblay, M. S., Esliger, D. W., Copeland, J. L., Barnes, J. D., & Bassett, D. R. (2008). Moving forward by looking back: Lessons learned from long-lost lifestyles. *Applied Physiology, Nutrition, and Metabolism*, 33(4), 836–842. <https://doi.org/10.1139/H08-045>
- Tudor-Locke, C., Williams, J. E., Reis, J. P., & Pluto, D. (2002). Utility of pedometers for assessing physical activity: Convergent validity. *Sports Medicine* 32(12), 795–808. <https://doi.org/10.2165/00007256-200232120-00004>
- United States Department of Agriculture. (2019). *America's diverse family farms*. <https://www.ers.usda.gov/webdocs/publications/95547/eib-214.pdf?v=7140>
- United States Department of Health and Human Services. (2018). *Physical activity guidelines for Americans: 2nd edition*.
- Wanner, M., Hartmann, C., Pestoni, G., Martin, B. W., Siegrist, M., & Martin-Diener, E. (2017). Validation of the global physical activity questionnaire for self-administration in a European context. *Bmj Open Sport — Exercise Medicine*, 3(1). <https://doi.org/10.1136/bmjsem-2016-000206>
- Warburton, D. E., Nicol, C. W., & Bredin, S. S. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*, 174(6), 801–809. <https://doi.org/10.1503/cmaj.051351>
- Weimo, Z. & Owen, N. (Eds.). (2017). *Sedentary behavior and health*. Human Kinetics.
- Woessner, M. N., Tacey, A., Levinger-Limor, A., Parker, A. G., Levinger, P., & Levinger, I. (2021). The evolution of technology and physical inactivity: the good, the bad, and the way forward. *Frontiers in Public Health*, 9, 655491–655491. <https://doi.org/10.3389/fpubh.2021.655491>



World health organization (n.d.). *Physical activity surveillance*. World health organization.

<https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/physical-activity-surveillance#:~:text=The%20GPAQ%20covers%20several%20components,during%20discretionary%20or%20leisure%20time>

World health organization. (1948, April 7). *Constitution*. World health organization.

<https://www.who.int/about/governance/constitution>

World health organization. (2020, November 26). *Physical activity*. World health organization.

<https://www.who.int/news-room/fact-sheets/detail/physical-activity>

Yazd, S. D., Wheeler, S. A., & Zuo, A. (2019). Key risk factors affecting farmers' mental health:

A systematic review. *International Journal of Environmental Research and Public Health*, *16*(23). <https://doi.org/10.3390/ijerph16234849>

Yuko, E. (2021, November 18). *How the industrial revolution fueled the growth of cities*.

History. <https://www.history.com/news/industrial-revolution-cities>

Zenic, N., Taiar, R., Gilic, B., Blazevic, M., Maric, D., Pojskic, H., & Sekulic, D. (2020). Levels and changes of physical activity in adolescents during the covid-19 pandemic:

Contextualizing urban vs. rural living environment. *Applied Sciences*, *10*(11), 3997–

3997. <https://doi.org/10.3390/app10113997>

## APPENDIX A: RECRUITMENT EMAIL

Dear Farmer,

My name is Kirstie Vitaoe and I am a doctoral candidate at the University of North Carolina Greensboro. I am conducting a research study on the relationship between farming, physical activity, and health. This study aims to better understand the connection between the agrarian lifestyle and its influence on farmers' physical activity, health, and well-being. Your participation in this research will help make this understanding possible.

You are receiving this message as an invitation to participate in the present study. If you meet the following criteria, your participation would be greatly appreciated.

- Be 18 or older.
- Identify farming as your primary occupation.
- Live and/or work on a farm that earns between \$1,000 - \$250,000 annually.

If you meet the above criteria and choose to participate, you will be asked to complete an online survey. Participating in this survey will ask for roughly 15 to 20 minutes of your time. Participation is voluntary and anonymous, and results from this study will allow for a better understanding of the relationship between farming, physical activity, health, and well-being. All aspects of this research will be conducted online and no compensation will be provided.

If you are interested in participating, you can follow the link below to complete the online survey.

[https://uncg.qualtrics.com/jfe/form/SV\\_5cMIJWRD8QsWRLw](https://uncg.qualtrics.com/jfe/form/SV_5cMIJWRD8QsWRLw)

For any questions you may have, I can be reached at [knchase@uncg.edu](mailto:knchase@uncg.edu) or by phone at 217-836-6930.

Thank you,  
Kirstie Vitaoe



# Physical Activity and Health: An Agrarian Perspective

*Investigating the Relationship Between Farming and Health*

## Study for Adult Farmers

This research study seeks adult farmers who live and/or work on small farms and will examine the relationship between farming, physical activity, and health.

Modern lifestyles have led to reduced physical activity. In contrast, farming represents a lifestyle where physical activity is relied upon to maintain one's livelihood. This research seeks to understand the influence farming has on physical activity and overall well-being.

**Participants will be asked to complete one online survey** (estimated time 15-20 min.).

*After the survey, interested participants will be invited to take part in one follow-up interview. No compensation will be provided.*

Revised 9/9/2023

## Location

All research will be conducted through online platforms (i.e., Qualtrics, UNCG Teams).

## Eligibility Criteria:

- Ages 18 and older
- Farming is primary occupation
- Live and/or work on a farm that earns between \$1,000 - \$250,000 annually.

## Primary Investigator

- Kirstie Vitatue
- knchase@uncg.edu
- University of North Carolina Greensboro



## APPENDIX C: RESEARCH SURVEY

Project Title: Physical Activity and Health: An Agrarian Perspective

Principal Investigator: Kirstie Vitatoe

Faculty Advisor: Dr. Diane Gill

### What is this all about?

I am asking you to participate in this research study to better understand the connection between the agrarian lifestyle and its influence on farmers' physical activity, health, and well-being. This will only take about 15-20 minutes and will involve you to complete an online survey. Your participation in this research project is voluntary.

### How will this negatively affect me?

The risks associated with this research are breach of confidentiality and risk of discomfort due to questions regarding mood, depression, and anxiety. The following questions will include questions that will ask about participant health and well-being. Some of these questions will refer to mental health. Individuals who may experience low mood, depression, or anxiety are encouraged to reach out to their primary care provider or Substance Abuse and Mental Health Services Administration's (SAMHSA) National Helpline, 1-800-662-HELP (4357) to discuss pathways for care.

### What do I get out of this research project?

Indirect benefits will result from a better understanding of the relationship between farming, physical activity, health, and well-being.

### Will I get paid for participating?

There is no compensation for this research.

### What about my confidentiality?

We will do everything possible to make sure that your information is kept confidential. All information obtained in this study is strictly confidential unless disclosure is required by law. We will limit the amount of personally identifiable information collected during this study and all data storage will follow University of North Carolina Greensboro approved measures. Absolute confidentiality of data provided through the Internet cannot be guaranteed due to the limited protections of Internet access. Please be sure to close your browser when finished so no one will be able to see what you have been doing.

### Data Storage:

- Survey data will be reviewed to ensure no identifying information was shared. Data will be downloaded from Qualtrics onto an Excel document and SPSS file. The Primary Investigator and Faculty Advisor will have access to the data. We will store all data in UNCG approved data storage locations as outlined in the UNCG Data classification policy. Data will be properly labeled with the UNCG approved security label designation.
- Interviews will be transcribed onto a Word document. The Primary Investigator and Faculty Advisor will have access to the data. We will store all data in UNCG approved data storage locations as outlined in the UNCG Data classification policy. Data will be properly labeled with the UNCG approved security label designation.

- UNCG Teams recordings will be saved on the Primary Investigator's Teams account that is associated with the University of North Carolina Greensboro. The Primary Investigator and Faculty Advisor will have access to the data. We will store all data in UNCG approved data storage locations as outlined in the UNCG Data classification policy. Data will be properly labeled with the UNCG approved security label designation. Recordings will be destroyed after they have been transcribed.

Data Retention Period:

- Data retention will follow the policies outlined by the University of North Carolina Greensboro. Following this policy, research data will be retained for five years after the project is completed.

Data Destruction Plan:

- After the data retention period, electronic data will be destroyed by deleting the data from the documents in which they are saved. All data will be destroyed five years after the study completion.

What if I do not want to be in this research study?

You do not have to be part of this project. This project is voluntary and it is up to you to decide to participate in this research project. If you agree to participate at any time in this project you may stop participating without penalty.

What if I have questions?

You can ask Primary Investigator, Kirstie Vitatoe at [knchase@uncg.edu](mailto:knchase@uncg.edu) or the Faculty Advisor, Dr. Diane Gill at [dlgill@uncg.edu](mailto:dlgill@uncg.edu) for anything about the study. If you have concerns about how you have been treated in this study call the Office of Research Integrity Director at 1-855-251-2351.

Section 1 - Demographics:

The following questions will ask about demographic information.

1. What is your age?
  - a. 18-25 years old
  - b. 26-35 years old
  - c. 36-45 years old
  - d. 46-55 years old
  - e. 56-65 years old
  - f. 66 or older
  - g. Prefer not to answer.
2. What is your gender?
  - a. Male
  - b. Female
  - c. Non-binary/gender fluid
  - d. Other
  - e. Prefer not to answer.
3. What is your ethnicity? Select all that apply.
  - a. American Indian or Alaskan Native
  - b. Asian
  - c. Black or African American

- d. Latino/Latina Hispanic
- e. Native Hawaiian Pacific Islander
- f. White or Caucasian
- g. Other, please specify.
- h. Prefer not to answer.

Section 2 - Farm Practices:

The following questions will ask about your work on the farm.

1. In what state is your farm located?
  - a. \_\_\_\_\_
2. Select the option that best describes your role on the farm:
  - a. Owner, co-owner, or partner
  - b. Family (non-owner)
  - c. Employee
  - d. Other, please specify.
3. Do you currently do any paid work outside of your farming occupation?
  - a. No
  - b. Yes, full time.
  - c. Yes, part-time.
  - d. Yes, seasonal work.
  - e. If yes, please specify the additional work you do.
4. What is the main production focus on your farm?
  - a. Plant production, fruits and vegetables
    - i. If yes, please specify. \_\_\_\_\_
  - b. Plant production, grain (e.g., soybeans, wheat)
    - i. If yes, please specify. \_\_\_\_\_
  - c. Livestock
    - i. If yes, please specify. \_\_\_\_\_
  - d. Dairy (e.g., milk, egg)
    - i. If yes, please specify. \_\_\_\_\_
  - e. Other
    - i. If yes, please specify. \_\_\_\_\_
5. Is your farming organic?
  - a. Yes
  - b. Partly
  - c. No
6. How do you sell your farm products? Select all that apply.
  - a. CSA, co-op, or distributor
  - b. Farmers' market
  - c. Farm stand
  - d. Other, please specify.

Section 3 - Global Physical Activity Measure (GPAQ):

In answering the following questions, 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate; 'moderate-intensity

activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.

The following questions ask about physical activity you do at work on the farm.

*Activity at Work on the Farm*

1. Does your farm work involve vigorous-intensity activity that causes large increases in breathing or heart rate like carrying or lifting heavy loads, digging or construction work for at least 10 minutes continuously?
  - a. Yes
  - b. No
2. In a typical week, on how many days do you do vigorous-intensity activities as part of your farm work?
  - a. \_\_\_\_\_
3. How much time do you spend doing vigorous-intensity activities at work on a typical day?
  - a. Hours: \_\_\_\_\_
  - b. Minutes: \_\_\_\_\_
4. Does your farm work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking or carrying light loads for at least 10 minutes continuously?
  - a. Yes
  - b. No
5. In a typical week, on how many days do you do moderate-intensity activities as part of your farm work?
  - a. \_\_\_\_\_
6. How much time do you spend doing moderate-intensity activities at work on a typical day?
  - a. Hours: \_\_\_\_\_
  - b. Minutes: \_\_\_\_\_

*Travel To and From Places*

The following questions ask about physical activity you do to travel from place to place.

7. Do you walk or use a bicycle for at least 10 minutes continuously to get to and from places?
  - a. Yes
  - b. No
8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?
  - a. \_\_\_\_\_
9. How much time do you spend walking or bicycling for travel on a typical day?
  - a. Hours: \_\_\_\_\_
  - b. Minutes: \_\_\_\_\_

*Recreational Activities*

The following questions ask about recreational physical activity you do.

10. Do you do any vigorous-intensity sports, fitness or recreational activities that cause large increases in breathing or heart rate for at least 10 minutes continuously?
- Yes
  - No
11. In a typical week, on how many days do you do vigorous-intensity sports, fitness, or recreational activities?
- \_\_\_\_\_
12. How much time do you spend doing vigorous-intensity sports, fitness, or recreational activities on a typical day?
- Hours: \_\_\_\_\_
  - Minutes: \_\_\_\_\_
13. Do you do any moderate-intensity sports, fitness or recreational activities that causes a small increase in breathing or heart rate such as brisk walking for at least 10 minutes continuously?
- Yes
  - No
14. In a typical week, on how many days do you do moderate-intensity sports, fitness, or recreational activities?
- \_\_\_\_\_
15. How much time do you spend doing moderate-intensity sports, fitness, or recreational activities on a typical day?
- Hours: \_\_\_\_\_
  - Minutes: \_\_\_\_\_

*Other Physical Activity*

The following questions ask about additional forms of physical activity other than what has been included in the sections above.

16. Do you do any resistance training or weight training for at least 10 minutes continuously?
- Yes
  - No
17. In a typical week, on how many days do you do resistance training or weight training?
- \_\_\_\_\_
18. How much time do you spend doing resistance training or weight training activities on a typical day?
- Hours: \_\_\_\_\_
  - Minutes: \_\_\_\_\_
19. Do you do any activities like Yoga or Pilates for at least 10 minutes continuously?
- Yes
  - No
20. In a typical week, on how many days do you do Yoga or Pilates style activities?
- \_\_\_\_\_



21. How much time do you spend doing Yoga or Pilates style activities on a typical day?
- Hours: \_\_\_\_\_
  - Minutes: \_\_\_\_\_
22. Do you do any other physical activity not covered in the questions above?
- Yes
  - No
  - If yes, please specify.
23. In a typical week, on how many days do you do these activities?
- \_\_\_\_\_
24. How much time do you spend doing these activities on a typical day?
- Hours: \_\_\_\_\_
  - Minutes: \_\_\_\_\_

**Referral Notice:**

The following sections will include questions that will ask about participant health and well-being. Some of these questions will refer to mental health. Individuals who may experience low mood, depression, or anxiety are encouraged to reach out to their primary care provider or Substance Abuse and Mental Health Services Administration's (SAMHSA) National Helpline, 1-800-662-HELP (4357) to discuss pathways for care.

**Section 4 – WHO Five Well-being Index**

The following questions will ask about your overall well-being over the past two weeks.

Q1 Please indicate for each of the five statements which is closest to how you have been feeling over the last two weeks.

	All the time	Most of the time	More than half of the time	Less than half of the time	Some of the time	At no time
I have felt cheerful and in good spirits. (1)	1	2	3	4	5	6
I have felt calm and relaxed. (2)	1	2	3	4	5	6
I have felt active and vigorous. (3)	1	2	3	4	5	6
I woke up feeling fresh and rested. (4)	1	2	3	4	5	6
My daily life has been filled with things that interest me. (5)	1	2	3	4	5	6

Section 5 - Patient Reported Outcomes Measurement Information System (PROMIS) Scale v1.2

- Global Health:

The following questions will ask about your physical and mental health.

Q1 Please respond to each question or statement by marking one box per row.

	Excellent	Very good	Good	Fair	Poor
In general, you would say your health is: (1)	1	2	3	4	5
In general, you would say your quality of life is: (2)	1	2	3	4	5
In general, how would you rate your physical health? (3)	1	2	3	4	5
In general, how would you rate your mental health and ability to think? (4)	1	2	3	4	5
In general, how would you rate your satisfaction with your social activities and relationships? (5)	1	2	3	4	5
In general, please rate how well you carry out your usual social activities and roles. (This includes at home, at work and in your community, and responsibilities as a parent, child, spouse, employee, friend, etc.). (6)	1	2	3	4	5

Q2 Please respond to the question by marking one box.

	Completely	Mostly	Moderately	A little	Never
--	------------	--------	------------	----------	-------

To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries, or moving a chair? (1)	1	2	3	4	5
---	---	---	---	---	---

Q3 Please respond to the question by marking one box.

	Never	Rarely	Sometimes	Often	Always
How often have you been bothered by emotional problems such as feeling anxious, depressed or irritable? (1)	1	2	3	4	5

Q4 Please respond to the question by marking one box.

	None	Mild	Moderate	Severy	Very Severe
How would you rate your fatigue on average? (1)	1	2	3	4	5

Q5 Please respond to the question by marking one box.

	No pain	1	2	3	4	5	6	7	8	9	Worst pain imaginable
How would you rate your pain on average? (1)	0	1	2	3	4	5	6	7	8	9	10

### Section 6 – Farming, Physical Activity, Health and Well-being

The following questions will ask you to indicate how farming affects your physical activity, physical and mental health, and overall well-being.

Two types of questions will be used in this section. First, you will be asked to rate your level of agreement on a statement about farming and physical activity, health, or well-being. After rating your level of agreement, you will be asked to describe the reason for your response.

The following questions will ask about how your farming lifestyle influences your physical activity.

1. My farming lifestyle promotes my physical activity.
  - a. Strongly agree
  - b. Somewhat agree
  - c. Neutral
  - d. Somewhat disagree
  - e. Strongly disagree
2. How does farming promote your physical activity?
  - a. \_\_\_\_\_
3. My farming lifestyle detracts from my physical activity.
  - a. Strongly agree
  - b. Somewhat agree
  - c. Neutral
  - d. Somewhat disagree
  - e. Strongly disagree
4. How does farming detract from your physical activity?
  - a. \_\_\_\_\_
5. Overall, does your farming lifestyle mostly promote or detract from your physical activity?
  - a. Totally promotes
  - b. Mostly promotes
  - c. Neutral
  - d. Mostly detracts
  - e. Totally detracts

The following questions will ask about how your farming lifestyle influences your physical health.

6. My farming lifestyle promotes my physical health.
  - a. Strongly agree
  - b. Somewhat agree
  - c. Neutral
  - d. Somewhat disagree
  - e. Strongly disagree
7. How does farming promote your physical health?
  - a. \_\_\_\_\_
8. My farming lifestyle detracts from my physical health.
  - a. Strongly agree
  - b. Somewhat agree
  - c. Neutral
  - d. Somewhat disagree
  - e. Strongly disagree
9. How does farming detract from your physical health?

- a. \_\_\_\_\_
10. Overall, does your farming lifestyle mostly promote or detract from your physical health?
- a. Totally promotes
  - b. Mostly promotes
  - c. Neutral
  - d. Mostly detracts
  - e. Totally detracts

The following questions will ask about how your farming lifestyle influences your mental health.

11. My farming lifestyle promotes my mental health.
- a. Strongly agree
  - b. Somewhat agree
  - c. Neutral
  - d. Somewhat disagree
  - e. Strongly disagree
12. How does farming promote your mental health?
- a. \_\_\_\_\_
13. My farming lifestyle detracts from my mental health.
- a. Strongly agree
  - b. Somewhat agree
  - c. Neutral
  - d. Somewhat disagree
  - e. Strongly disagree
14. How does farming detract from your mental health?
- a. \_\_\_\_\_
15. Overall, does your farming lifestyle mostly promote or detract from your mental health?
- a. Totally promotes
  - b. Mostly promotes
  - c. Neutral
  - d. Mostly detracts
  - e. Totally detracts

The following questions will ask about how your farming lifestyle influences your overall well-being.

16. My farming lifestyle promotes my overall well-being.
- a. Strongly agree
  - b. Somewhat agree
  - c. Neutral
  - d. Somewhat disagree
  - e. Strongly disagree
17. How does farming promote your overall well-being?

- a. \_\_\_\_\_
18. My farming lifestyle detracts from my overall well-being.
- a. Strongly agree
  - b. Somewhat agree
  - c. Neutral
  - d. Somewhat disagree
  - e. Strongly disagree
19. How does farming detract from your overall well-being?
- a. \_\_\_\_\_
20. Overall, does your farming lifestyle mostly promote or detract from your overall well-being?
- a. Totally promotes
  - b. Mostly promotes
  - c. Neutral
  - d. Mostly detracts
  - e. Totally detracts

#### Section 7 – Invitation for Interview

My name is Kirstie Vitatoe and I am a doctoral candidate at the University of North Carolina Greensboro and I would like to thank you for taking part in this survey. The information you have provided as part of the research survey is valuable and will be used to better understand the connection between farming, physical activity, health, and well-being.

As a follow-up to the research survey, we will be conducting brief online interviews with farmers about their experiences surrounding farming, physical activity, health, and well-being. If you meet the following criteria, your participation would be greatly appreciated.

Be 18 or older.

Identify farming as your primary occupation.

Live and/or work on a farm that earns between \$1,000 - \$250,000 annually.

If you would like to take part in a follow-up interview, please use the link below to provide your contact information. You will be contacted to schedule an online interview using the UNCG Teams platform where interview participants will be asked about their experiences as farmers and how this has shaped their physical activity, health, and well-being. Interviews will last approximately 30 minutes on the online UNCG Teams platform, and will not include compensation, though your time and insight is greatly valued for this research.

[LINK TO INTERVIEW INTEREST FORM – CLICK HERE](#)

For any questions you may have, I can be reached at knchase@uncg.edu or by phone at 217-836-6930. Thank you again for your participation.

## APPENDIX D: INTERVIEW SCRIPT

Project Title: Physical Activity and Health: An Agrarian Perspective

Principal Investigator: Kirstie Vitatoe

Faculty Advisor: Dr. Diane Gill

### What is this all about?

I am asking you to participate in this research interview to better understand the connection between the agrarian lifestyle and its influence on farmers' physical activity, health, and well-being. This will only take about 30 minutes and will involve you to complete an online interview. Your participation in this research project is voluntary.

### How will this negatively affect me?

The risks associated with this research are breach of confidentiality and risk of discomfort due to questions regarding mood, depression, and anxiety. The following questions will include questions that will ask about participant health and well-being. Some of these questions will refer to mental health. Individuals who may experience low mood, depression, or anxiety are encouraged to reach out to their primary care provider or Substance Abuse and Mental Health Services Administration's (SAMHSA) National Helpline, 1-800-662-HELP (4357) to discuss pathways for care.

### What do I get out of this research project?

Indirect benefits will result from a better understanding of the relationship between farming, physical activity, health, and well-being.

### Will I get paid for participating?

There is no compensation for this research.

### What about my confidentiality?

We will do everything possible to make sure that your information is kept confidential. All information obtained in this study is strictly confidential unless disclosure is required by law. We will limit the amount of personally identifiable information collected during this study and all data storage will follow University of North Carolina Greensboro approved measures. Because your voice will be potentially identifiable by anyone who hears the recording, your confidentiality for things you say on the recording cannot be guaranteed although the researcher will try to limit access to the recording as described in this section. Absolute confidentiality of data provided through the Internet cannot be guaranteed due to the limited protections of Internet access.

### Data Storage:

- Survey data will be reviewed to ensure no identifying information was shared. Data will be downloaded from Qualtrics onto an Excel document and SPSS file. The Primary Investigator and Faculty Advisor will have access to the data. We will store all data in UNCG approved data storage locations as outlined in the UNCG Data classification policy. Data will be properly labeled with the UNCG approved security label designation.
- Interviews will be transcribed onto a Word document. The Primary Investigator and Faculty Advisor will have access to the data. We will store all data in UNCG

approved data storage locations as outlined in the UNCG Data classification policy. Data will be properly labeled with the UNCG approved security label designation.

- UNCG Teams recordings will be saved on the Primary Investigator's Teams account that is associated with the University of North Carolina Greensboro. The Primary Investigator and Faculty Advisor will have access to the data. We will store all data in UNCG approved data storage locations as outlined in the UNCG Data classification policy. Data will be properly labeled with the UNCG approved security label designation. Recordings will be destroyed after they have been transcribed.

Data Retention Period:

- Data retention will follow the policies outlined by the University of North Carolina Greensboro. Following this policy, research data will be retained for five years after the project is completed.

Data Destruction Plan:

- After the data retention period, electronic data will be destroyed by deleting the data from the documents in which they are saved. All data will be destroyed five years after the study completion.

What if I do not want to be in this research study?

You do not have to be part of this project. This project is voluntary and it is up to you to decide to participate in this research project. If you agree to participate at any time in this project you may stop participating without penalty.

What if I have questions?

You can ask Primary Investigator, Kirstie Vitatoe at [knchase@uncg.edu](mailto:knchase@uncg.edu) or the Faculty Advisor, Dr. Diane Gill at [dlgill@uncg.edu](mailto:dlgill@uncg.edu) for anything about the study. If you have concerns about how you have been treated in this study call the Office of Research Integrity Director at 1-855-251-2351.

Hello, my name is Kirstie Vitatoe and I will be conducting today's interview. I would like to begin by thanking you for making time to speak with me. Your input is valuable and will help us better understand the link between farming, physical activity, and health. Just to confirm, we'd like to keep this interview to roughly 30 minutes. Does that still work for you? Great. Please let me know if you need a break or need to stop at any time.

To give you an overview, I will start by asking you a few questions about your work. We will continue by discussing the relationship between farming and physical activity and conclude by talking about how farming may influence your health. There are no wrong answers and your perspectives on these questions are valued. Participating in this interview does not present any foreseeable risks. Additionally, the information you share will be kept confidential. All data will be stored electronically and will be password protected. Results of this work will be presented in summary form and no identifying information will be shared.

With your permission, I would like to record this interview. To protect your privacy and identity, you will be asked to turn off your screen so as not to reveal any visually identifying information. Do I have your permission to record this interview? Great.

Finally, Participation in this interview is voluntary. Completing the interview implies your consent to participate in the interview. Should you choose to participate, please answer questions based on your own experience. You may decline to answer any question you do not



feel comfortable answering and you may choose to decline or discontinue your participation at any time during the interview. Your choice to participate, decline participation, or withdraw from this interview at any time will not affect you. I want to confirm that you consent to participating in this interview. Great. Do you have any questions for me at this time? Please note you are welcome to ask questions at any point in time during this interview.

We will begin by discussing the work you do on the farm.

1. What is the main production focus of your farm?
2. Are you an owner or employee on the farm where you work?
3. How much time do you spend per day on farm work?
4. What specific tasks do you do on a typical workday?

We will now transition to some questions about your physical activity.

1. What physical activity do you do on the farm?
2. How often do you do heavy lifting tasks?
  - a. What heavy lifting activities do you do?
  - b. Describe how these activities affect you, either positively or negatively.
3. How often do you do aerobic tasks that increase your heart rate or breathing?
  - a. What are examples of aerobic activities that you do?
  - b. Describe how these activities affect you, either positively or negatively.
4. What other tasks do you do that involve physical activity or movement?
5. Describe other forms of physical activity you do outside of your farm work.
  - a. How often do you participate in these activities?
  - b. Describe how these activities affect you, either positively or negatively.
6. How does the physical activity you do on the farm affect your overall health and well-being?

We will continue our conversation by discussing how farming may positively or negatively influence your overall health and well-being.

1. Overall, how does your farming lifestyle affect your physical health?
  - a. What are specific ways your farming lifestyle promotes your physical health?
  - b. What are specific ways your farming lifestyle detracts from your physical health?
2. Overall, how does your farming lifestyle affect your mental health?
  - a. What are specific ways your farming lifestyle promotes your mental health?
  - b. What are specific ways your farming lifestyle detracts from your mental health?
3. Overall, how does your farming lifestyle affect your well-being?
  - a. What are specific ways your farming lifestyle promotes your well-being?
  - b. What are specific ways your farming lifestyle detracts from your well-being?
4. Based on your experience, what advice would you share with other farmers to help them lead an active and healthy life?

Based on our conversation today, is there anything else you would like to share with me about your experience farming and how this might influence your physical activity, health, or well-being?

Again, I would like to thank you for your time and participation in this study. If you have any questions for me, I can be reached at [knchase@uncg.edu](mailto:knchase@uncg.edu). Have a wonderful day.

APPENDIX E: SURVEY AND INTERVIEW RESULTS

*PROMIS Scale v1.2 – Global Health Survey- Distribution of Responses (%; total n=58)*

Item	Item Content	Frequency (Percent)					Mean (SD)
		Poor (1)	Fair (2)	Good (3)	Very good (4)	Excellent (5)	
Global01	In general, would you say your health is:	0 (0%)	3 (5.2%)	16 (27.6%)	29 (50.0%)	10 (17.2%)	3.79 (.79)
Global02	In general, would you say your quality of life is:	0 (0%)	6 (10.3%)	8 (13.8%)	24 (41.4%)	20 (34.5%)	4 (.96)
Global03	In general, how would you rate your physical health?	0 (0%)	6 (10.3%)	16 (27.6%)	27 (46.6%)	9 (15.5%)	4.67 (.87)
Global04	In general, how would you rate your mental health and ability to think?	4 (6.9%)	5 (8.6%)	9 (15.5%)	22 (37.9%)	18 (31.0%)	3.78 (1.19)
Global05	In general, how would you rate your satisfaction with your social activities and relationships?	7 (12.1%)	10 (17.2%)	17 (29.3%)	14 (24.1%)	10 (17.2%)	3.17 (1.26)
Global06	To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries, or moving a chair?	Not at all (1)	A little (2)	Moderately (3)	Mostly (4)	Completely (5)	
		0 (0%)	0 (0%)	2 (3.5%)	5 (8.6%)	51 (87.9%)	4.84 (.45)
Global07r	In the past 7 days, how would you rate your pain on average?	Worst Pain (1)	2	3	4	No Pain (5)	
		0 (0%)	9 (15.5%)	16 (27.6%)	33 (56.9%)	0 (0%)	3.41 (.75)
		Very severe (1)	Severe (2)	Moderate (3)	Mild (4)	None (5)	

Global08r	How would you rate your fatigue on average?	1 (1.7%)	10 (17.2%)	18 (31.0%)	24 (41.4%)	5 (8.6%)	3.38 (.93)
		Poor (1)	Fair (2)	Good (3)	Very good (4)	Excellent (5)	
Global09r	In general, please rate how well you carry out your usual social activities and roles. (This includes at home, at work and in your community, and responsibilities as a parent, child, spouse, employee, friend, etc.).	5 (8.6%)	8 (13.8%)	14 (24.1%)	24 (41.4%)	7 (12.1%)	3.34 (1.13)
		Always (1)	Often (2)	Sometimes (3)	Rarely (4)	Never (5)	
Global10r	How often have you been bothered by emotional problems such as feeling anxious, depressed or irritable?	7 (12.1%)	5 (8.6%)	23 (39.7%)	21 (36.2%)	2 (3.5%)	3.10 (1.04)

---

*Survey Text and Interview Response Data*

Theme	Subtheme	Definition	Examples
Labor Intensive	Continuous Movement	The requirement of physical activity throughout the day to complete daily work.	<p><i>“It’s all physical labor. And being a small vegetable farm, everything is done by hand.”</i></p> <p><i>“We have no tractors or UTV - we carry, pull, walk, and do most of our farming with hand tools. I know I get more exercise than in my previous profession.”</i></p>
	Variety of Movement	The variety of physical activities required to complete daily work.	<p><i>“Most activities on the farm involve physical activity. I find that the different types of activity I engage in during the day are especially good for health and fitness, because I’m not doing any one activity long enough to sustain an overuse injury.”</i></p> <p><i>“I’m constantly moving on the farm, changing positions, etc., and sometimes it is even moderately intense.”</i></p>
<hr/>			
Lack of Recreational PA	Lack of Time	Perceived lack of time to participate in recreational physical activities for health promotion.	<p><i>“If I had more time, I would exercise more.”</i></p> <p><i>“I don’t have as much time for recreational physical activity during the farm season because I do so much during my workday.”</i></p> <p><i>“I don’t have the extra time or energy to be able to devote to the physical activities I’d like to partake in.”</i></p>
	Lack of Energy	Perceived lack of energy to participate	<p><i>“I am usually farming long hours and tired afterwards, so therefore I don’t actually exercise properly.”</i></p> <p><i>“I would like to get more cardio activity in, but often run out of</i></p>

in recreational physical activities for health promotion.

*energy or time to fit this workout into the day.”*

*“I’m too exhausted to go to gym, though not sure I need to since I’m already active.”*

*“I have little time or energy left for leisure activities. Also, the aches and pains from farm work make leisure activities less appealing.”*

---

Access to Outdoors

Outdoor Activity

The requirement of farm work to be completed outdoors.

*“I do a lot of outside physical work.”*

*“I’m outdoors often and I’m active very regularly.”*

*“Being able to work outside is hugely important for mental health. Much of the work we do here is very gratifying as well – harvesting, planting, even weeding – these are all very tactile and you can clearly see the work you have done.”*

Time in Nature

Farm work allows access to and interaction with natural elements that are perceived as beneficial

*“I get fresh air and vitamin D all day long.”*

*“I get daily movement, fresh air, exposure to natural world, and exposure to peace and quiet.”*

*“There is something about sunshine that lifts mood.”*

---

Nutrition

Eat what you Grow

Farm work provides access to fresh farm products for consumption.

*“I grow vegetables, so I have no real excuse not to eat them.”*

*“I have access to farm fresh, organically grown produce to eat daily.”*

*“We also eat tons of the vegetables we grow here, so with easy access*

---

*to those means I'm doing very well nutritionally."*

*"I eat mostly what we raise so it's organic and grass fed."*

*"We are able to control what our livestock eats, which in turn controls what final products are put into our own bodies. We eat better than most, since we are raising high quality, healthy animals."*

---

Injury

Wear and Tear

The physical demands of farm work lead to injury.

*"I have a lot of joint pain and tendon issues from using my body hard in farming. I've experienced stress fractures due to farming."*

*"There is usually some wear and tear from certain activities, and recovery from such activities usually requires a bit of rest to recover."*

*"I'm fat from stress, worn out, beat up by livestock."*

*"So, it's not all that safe and I have had a couple of accidents."*

*"I had a physical a couple months ago and my doctor flat out told me that farming is killing me."*

Exposure to Health Risks

Exposure to elements, chemicals, and machinery that are risk factors for health.

*"I also need to be safe with how much direct sun I get."*

*"I do have some hearing loss and the hearing loss is more distinct in my right ear, and my audiologist says, well, that's typical of farmers of my age because we mostly drove tractors without cabs."*

Lack of Time

Perceived lack of time to take care of

*"Exposure to chemicals and dust."  
"I do not have time for routine medical appointments and tend to*

---

health due to farm work. *put off taking care of physical issues until the off season.”*

*“Sleep deprivation from spring and fall field work.”*

*“I work long hours and when I’m done, I’m usually too tired to cook healthy food.”*

---

Mental Stimulation

Engagement

The perception that work is cognitively challenging and requires one’s full attention.

*“Keeps me going, keeps me moving, keeps me on my toes, always challenging me...that makes me fulfilled.”*

*“It keeps me busy and engaged.”*

*“Engaging in hard, sometimes complex work.”*

*“You know your mind is engaged all day long.”*

*“Multi-tasking required keeps brain active.”*

---

Stewardship

Community Service

Provision of service and products to community members.

*“Also, a lot of our customers become friends and a few friends become customers.”*

*“Engaging in work that I enjoy and find valuable to my community.”*

*“The satisfaction of providing for myself and others.”*

Animal Welfare

Provision of care to the well-being of animals.

*“We feel good about our farm mission and the work we are doing. We are organic and treat our animals with respect and have a good clean natural living environment.”*

*“Animal welfare is big to us and so working around happy animals makes us happy.”*



Land Management Provision of care to the land through regenerative practices.

*“And I think philosophically, we really like the type of farming that we're doing, that it's organic and regenerative and you know, we feel like we're positively contributing to the environment and to our animals and to the meat that we're producing”*

*“It's our natural state to have the organisms from the soil and the area where we're walking and living in our body, in our digestive system and for us, the fact that we put all this effort into a healthy soil, you know, cover crops and animal rotations and everything, and that's why we grow our vegetables.”*

*“I'm an environmentalist, you know, and I just am interested in the quality of life and environment and water quality.”*

*“Fundamentally our philosophy is treating our animals and our land properly so that we can feed our family and serve our customers and community better.”*

---

Stress

Financial Stress Stress associated with financial aspects of farm operations.

*“Stress and financial insecurity are big detractors.”*

*“It's a lot of work for very little money.”*

*“It can't pay all the bills, so another job is necessary. This can leave me very tired.”*

*“So, it's a constant struggle figuring out how to pay the bills and get all the work done week to week and day to day. This is an enormous mental strain.”*

Physical Stress	Stress associated with physical wear and tear on the body.	<p><i>“Worry about finances is fairly constant.”</i></p> <p><i>“The stresses of farming can be very heavy. Peak season, I am also very tired because of the long days and huge workload.”</i></p>
Factors Outside of One’s Control	Stress associated with factors that impact farm productivity.	<p><i>“I have taken on too much and sometimes my well-being is a victim of my success.”</i></p> <p><i>“I am physically and emotionally pushed past my limits because if I don't do something it won't get done. There is constant stress and worry about the climate, weather, environment, animals, responsibilities, repairs, cash flow, marketing, shipping, etc.”</i></p> <p><i>“Farming is really stressful and has a lot of factors beyond my control.”</i></p> <p><i>“It can be extremely stressful at times, especially when dealing with the consequences of things completely outside my control like severe weather, disrupted markets, changing consumer habits, etc.”</i></p>
Social Isolation	Stress associated with lack of community support.	<p><i>“Less time connecting with people and time to do things that fulfill me outside of farming.”</i></p> <p><i>“No time for social activities.”</i></p> <p><i>“Mainly only because of social isolation due to being tied to a place.”</i></p>

---

Sense of Purpose

Spirituality	Perceived sense of purpose in one’s work that is spiritual in nature.	<p><i>“I love nature. Its fills my soul and I get that every day that I farm.”</i></p> <p><i>“I get to make a difference in the world, I get to be connected to something bigger than myself, and I</i></p>
--------------	---	---

*get to use my body and my mind to help things grow.”*

*“I feel I am doing something for myself and others for a greater good.”*

*“God designed us to be active in stewardship of His creation. Farming is working His creation. This is how things were designed. We mimic nature and when we do that, we have overall well-being. There is no better design.”*

Sense of Accomplishment

Perception that work is worthwhile.

*“It gives me new challenges almost every day and rewards my best efforts.”*

*“I’m productive, have a sense of purpose, and see the fruits of my labor.”*

*“I’m proud of the work that I do, and it gives me hope for the future of farming to promote and talk about the regenerative form of farming that I do.”*

Joy

Sense of enjoyment in one’s work.

*“You have to love what you’re doing and to see things growing that you planted or started plants and seeing them grow from seed, there is something about it really makes you feel good.”*

*“I love my work and am happy when I do it.”*

*“Keeps me moving everyday doing something I’m passionate about.”*

*“This was our choice. So, you know, we did it because we were excited to do it and we like that kind of work.”*



# **Physical Activity and Health: An Agrarian Perspective**

**Kirstie Chase Vitatoe | University of North Carolina Greensboro**

# CONTENTS



---

*03*

PHYSICAL ACTIVITY AND HEALTH

---

*04*

PHYSICAL ACTIVITY IN THE  
MODERN WORLD

---

*05*

FARMING, PHYSICAL ACTIVITY,  
HEALTH, AND WELL-BEING

---

*06*

METHODOLOGY

---

*07*

RESULTS

---

*09*

RECOMMENDATIONS

---

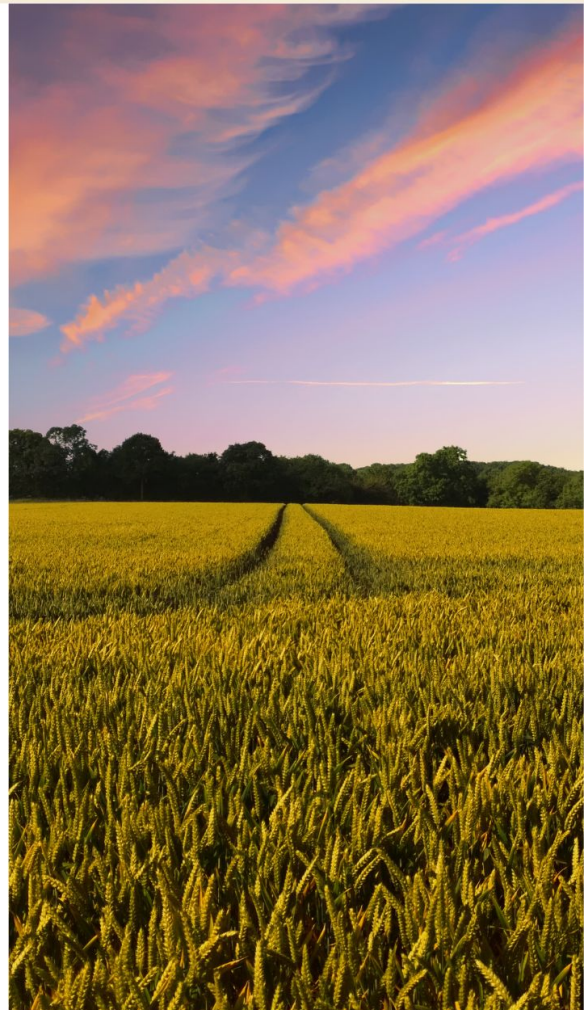
*10*

REFERENCES

# PHYSICAL ACTIVITY AND HEALTH

Throughout history, survival necessitated an active lifestyle and humans relied on physical activity (PA) for subsistence (Lieberman, 2015; Raichlen et al., 2020; Woessner et al., 2021). Today, PA is a key determinant of health and those who maintain an active lifestyle are more resilient to the physical and cognitive decline associated with inactivity (Centers for Disease Control, 2021; U.S. Department of Health and Human Services [USDHHS] 2018).

PA can occur as a natural extension of daily activity (Ross & McGuire, 2011), or it can include planned, structured, and repetitive movements, intentionally undertaken for a particular goal (Caspersen et al., 1985; Thivel et al., 2018). Regardless, PA fundamentally represents the interaction between the individual and their environment. Engaging in PA, either through work or leisure, stimulates a cascade of cellular changes in the body, leading PA to decisively affect one's health and quality of life (USDHHS, 2018; Warburton et al., 2006).





## PHYSICAL ACTIVITY IN THE MODERN WORLD

---

Modern environments are defined by technological development (Gordon, 2019; Weimo & Owen, 2017; Woessner et al., 2021), which provides for automation and efficiency, while simultaneously reducing the PA required for daily life. For many, this has shifted PA from a matter of necessity to an option of leisure. Estimates reveal 45 percent of people in developed environments are physically inactive (Clealand et al., 2015a), and in the U.S., one in five adults are insufficiently active to protect their health (Centers for Disease Control, 2022).

Such low participation prompts questions about whether modern environments provide adequate stimulus to encourage PA. While development has undoubtedly shaped modern lifestyles, there are lifestyles that are positively associated with PA. One such example can be found in agricultural environments (Day, 2018; Gordon, 2019; Mix et al., 2019; Racine et al., 2012). This is especially true for those living and working on small farms, as they are likely to leverage the human capacity for physical work (Gordon, 2019; Racine et al., 2012).



## FARMING, PHYSICAL ACTIVITY, HEALTH, AND WELL-BEING

Agricultural environments are often tied to demanding physical labor, which contributes to PA (Day, 2018), though farm size may have important implications on this. When comparing small and large farms, larger farms tend to rely more on technology, while smaller farms are more inclined to rely on human labor (Herrero et al., 2017). As a result of this, farmers who live and/or work on small farms are more likely to represent farming as it has been carried out traditionally, and it is thought that small farms are more supportive of PA.

To date, research into the lifestyles of farmers is quite limited. While there is interesting and compelling evidence to suggest this way of life supports PA (Cleland et al., 2015b; Day, 2018; Ding et al., 2011; Racine et al., 2011), it is certain more research is needed to understand how farming influences the PA, health, and well-being of farmers (Bassett, 2008; Cleland et al., 2015a; Frost et al., 2010; Gilbert et al., 2019; Liu et al., 2012; Machado-Rodrigues et al., 2014; Moore et al., 2010; Regis et al., 2016). And so, this study assessed the relationship between farming and the degree to which it influenced farmer PA, health, and well-being.



# METHODOLOGY

This study targeted farmers who lived and/or worked on small farms. To maximize participation, this study explored a broad target region including states like Missouri, Illinois, Kentucky, Iowa, Indiana, and Kansas. Prospective participants were invited to take part in this study if they met three criteria: be 18 or older, indicate farming as their primary occupation, and identify as farmers who lived and/or worked on small farms.

In total, 62 farmers participated and completed an online survey that included six sections: demographics, farming practices, the Global Physical Activity Questionnaire (GPAQ), the WHO-5 Well-being Index, the Patient Reported Outcomes Measurement Information System (PROMIS) Scale v1.2 - Global Health survey, and a relational measure about farming, PA, health, and well-being. After the survey, participants were invited to take part in semi-structured interviews that included questions about participants' lifestyles, PA, health, and well-being. In total, eight participants volunteered for interviews.

Following the surveys and interviews, data was compiled and analyzed. Surveys were analyzed using the Statistical Package for the Social Sciences, and descriptive statistics, like frequencies, mean, and standard deviation, were run. Interview responses were analyzed using the Sort and Sift, Think and Shift approach. This was an iterative, back-and-forth process where the investigator engaged with the data repeatedly. Themes and sub-themes were assigned to represent farmer responses. After analysis, a summary of conclusions was constructed.



## RESULTS

This study offered a window into the lifestyles, PA patterns, health, and well-being of farmers who lived and/or worked on small farms. Broadly, results revealed farmers led physically active lifestyles and encountered unique lifestyle-related experiences that promoted or detracted from their health and well-being. A deeper dive into the results revealed specific ways farming shaped the PA, health, and well-being of study participants.

One goal of this study was to describe the relationship between farming and PA. It was revealed that farmers carried out physically demanding work that contributed to their daily PA. Farmers indicated their work was a labor-intensive stimulus that required continuous movement and a variety of movement throughout the day. Additionally, it was revealed that work-related PA was often completed outdoors, which was seen as a job benefit.

Farm work was not without challenges. Participants indicated that even though farming provided the opportunity for PA, the high volume of physical labor inclined farmers to experience injury, sometimes long-lasting. Farmers also believed their demanding work detracted from the time and energy needed to pursue recreational PA and healthcare support needed to maintain overall health. Still, the volume of self-reported PA suggested that farmers led lifestyles that generally supported PA.

This study also aimed to explore the relationship between farming, health, and well-being. Data revealed that farming presented certain challenges and unique benefits to farmers. Farmers noted risks like too much sunlight and exposure to loud noises, harmful chemicals, and dust were perceived to have deleterious consequences. Psychological stress was another detractor to farmer health. Farmers indicated that stressors, such as financial concerns and problems outside of one's control, took a toll on their well-being.

While the results of this study revealed some challenges faced by farmers, data suggested the agrarian lifestyle granted benefits to the health and well-being of farmers. For instance, farmers largely perceived their work to be an active endeavor and indicated their work supported their physical health by keeping them active throughout the day. Farmers also believed time outdoors and access to green space benefited their well-being. Further, farmers indicated their work gave them direct access to farm-fresh products that allowed for a nutritious diet that ultimately supported their physical health.

In addition to physical considerations, study participants indicated farming positively impacted their psychological health and well-being. Farmers shared that their work provided psychological stimulation and an environment that made for mentally engaging work. This was perceived as a psychological benefit by many. Additionally, farmers indicated their work brought them a sense of purpose and joy. Farmers revealed they were glad to do their work, and some participants indicated their work was perceived to be a higher calling.

PAGE 07

Findings from this study support the small body of work that surrounds farming, PA, health, and well-being. Previous research revealed that farm work carried out on small farms was tied to demanding physical labor and provided stimulus for PA (Day, 2018; Gordon, 2019; Mix et al., 2019; Racine et al., 2012). Results from this study support this as farmers indicated their work included high volumes of physical labor and PA. Previous work on this subject also showed farming presented unique health challenges, such as injury and stress (Bjornestad et al., 2021; Yazd et al., 2019), which have also been confirmed by this study.

To the author's knowledge, this study offered new insights about how farming shaped farmer PA, health, and well-being. Specifically, this study gleaned insight on farmers' perceptions of their lifestyle. In doing so, this study uncovered important ideas such as the perceived sense of purpose, psychological engagement, and lack of recreational PA. All of which are believed to be new connections between farming, PA, health, and wellness that lend themselves to future research.





## RECOMMENDATIONS

---

This work highlights some of the key factors related to farmer PA, health and well-being. These results can be used by farmers to enhance their own health. Below are three recommendations for farmers to consider in support of their overall health and well-being:

***View farm work as an avenue for physical activity*** - Many of the participants in this study indicated that farm work required moderate or vigorous PA. While farming may not look like a typical gym workout, it may fulfill the recommended level of PA as outlined by the U.S. Department of Health and Human Services. Specifically, adults are encouraged to participate in a minimum dose of PA that includes either 150 minutes of moderate-intensity activity, or 75 minutes of vigorous-intensity aerobic activity, in addition to weekly muscle strengthening exercises (U.S. Department of Health and Human Services 2018). If farmers find themselves consistently engaging in physically demanding farm work, but not making it to the gym, they can find peace of mind that the activity they are engaging in can have health benefits similar to a more traditional form of exercise.

- ***Select recreational activities that facilitate prevention and rehabilitation*** - While farm work may provide a stimulus for PA, it can also lead to injury or instances where farmers feel physically drained from the workday. Keeping these in mind, farmers can opt to pursue forms of activity that counterbalance stress or help heal injury. Some examples of exercise may include gentle stretching to reduce tension from overworked muscles or strengthening activities to prevent injury, especially when physical imbalances are present.
- ***Seek support to address the challenges associated with farming*** - While study participants shared some of the joys associated with their work, they also alluded to the physical and psychological stressors caused by farming. It is important that farmers seek the care and support needed to maintain their health, be it through their closest loved ones or the professional support of a primary care provider.

PAGE 09

## REFERENCES

- Bassett, D. R., Schneider, P. L., & Huntington, G. E. (2004). Physical activity in an old order amish community. *Medicine and Science in Sports and Exercise*, 36(1), 79–85.
- Bjornestad, A., Cuthbertson, C., & Hendricks, J. (2021). An analysis of suicide risk factors among farmers in the Midwestern United States. *International Journal of Environmental Research and Public Health*, 18(7). <https://doi.org/10.3390/ijerph18073563>
- Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports*, 100(2), 126–131.
- Centers for disease control (2021, April 5). Benefits of physical activity. <https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm>
- Centers for disease control (2022, September 6) Exercise or physical activity. <https://www.cdc.gov/nchs/fastats/exercise.htm>
- Cleland, V., Hughes, C., Thornton, L., Venn, A., Squibb, K., & Ball, K. (2015). A qualitative study of environmental factors important for physical activity in rural adults. *Plos One*, 10(11), 0140659. <https://doi.org/10.1371/journal.pone.0140659>
- Cleland, V., Sodergren, M., Otahal, P., Timperio, A., Ball, K., Crawford, D., Salmon, J., & McNaughton, S. A. (2015). Associations between the perceived environment and physical activity among adults aged 55–65 years: Does urban-rural area of residence matter?. *Journal of Aging and Physical Activity*, 23(1), 55–63. <https://doi.org/10.1123/japa.2012-0271>
- Day, K. (2018). Physical environment correlates of physical activity in developing countries: A review. *Journal of Physical Activity & Health*, 15(4), 303–314. <https://doi.org/10.1123/jpah.2017-0184>
- Ding, D., Sallis, J. F., Hovell, M. F., Du, J., Zheng, M., He, H., & Owen, N. (2011). Physical activity and sedentary behaviors among rural adults in Suixi, China: A cross-sectional study. *The International Journal of Behavioral Nutrition and Physical Activity*, 8, 37. <https://doi.org/10.1186/1479-5868-8-37>
- Frost, S. S., Goins, R. T., Hunter, R. H., Hooker, S. P., Bryant, L. L., Kruger, J., & Pluto, D. (2010). Effects of the built environment on physical activity of adults living in rural settings. *American Journal of Health Promotion : Ajhp*, 24(4), 267–83. <https://doi.org/10.4278/ajhp.08040532>
- Gilbert, A. S., Duncan, D. D., Beck, A. M., Eyeler, A. A., & Brownson, R. C. (2019). A qualitative study identifying barriers and facilitators of physical activity in rural communities. *Journal of Environmental and Public Health*, 2019. <https://doi.org/10.1155/2019/7298692>
- Gordon, S. E. (2019) Fitting into our genes: Evolutionary theory of the health benefits of physical activity. *Quest*, 71(4), 375–386. DOI: [10.1080/00336297.2019.1656652](https://doi.org/10.1080/00336297.2019.1656652)

## REFERENCES

- Herrero, M., Thornton, P. K., Power, B., Bogard, J. R., Remans, R., Fritz, S., Gerber, J. S., Nelson, G., See, L., Waha, K., Watson, R. A., West, P. C., Samberg, L. H., van de Steeg, J., Stephenson, E., van Wijk, M., & Havlík Petr. (2017). Farming and the geography of nutrient production for human use: A transdisciplinary analysis. *The Lancet Planetary Health*, 1(1), 42. [https://doi.org/10.1016/S2542-5196\(17\)30007-4](https://doi.org/10.1016/S2542-5196(17)30007-4)
- Lieberman, D. E. (2015). Is exercise really medicine? an evolutionary perspective. *Current Sports Medicine Reports*, 14(4), 313–9. <https://doi.org/10.1249/JSR.0000000000000168>
- Liu, J.-H., Jones, S. J., Sun, H., Probst, J. C., Merchant, A. T., & Cavicchia, P. (2012). Diet, physical activity, and sedentary behaviors as risk factors for childhood obesity: An urban and rural comparison. *Childhood Obesity*, 8(5), 440–8. <https://doi.org/10.1089/chi.2012.0090>
- Machado-Rodrigues, A. M., Coelho-E-Silva, M. J., Mota, J., Padez, C., Martins, R. A., Cumming, S. P., Riddoch, C., & Malina, R. M. (2014). Urban-rural contrasts in fitness, physical activity, and sedentary behavior in adolescents. *Health Promotion International*, 29(1), 118–29. <https://doi.org/10.1093/heapro/das054>
- Mix, J. M., Elon, L., Thein Mac, V. V., Flocks, J., Economos, J., Tovar-Aguilar, A. J., Hertzberg, V. S., & McCauley, L. A. (2019). Physical activity and work activities in florida agricultural workers. *American Journal of Industrial Medicine*, 62(12), 1058–1067. <https://doi.org/10.1002/ajim.23035>
- Moore, J. B., Jilcott, S. B., Shores, K. A., Evenson, K. R., Brownson, R. C., & Novick, L. F. (2010). A qualitative examination of perceived barriers and facilitators of physical activity for urban and rural youth. *Health Education Research*, 25(2), 355–67. <https://doi.org/10.1093/her/cyq004>
- Racine, E. F., Laditka, S. B., Dmochowski, J., Alavanja, M. C., Lee, D. C., & Hoppin, J. A. (2012). Farming activities and carrying and lifting: The agricultural health study. *Journal of physical activity & health*, 9(1), 39–47. <https://doi.org/10.1123/jpah.9.1.39>
- Raichlen, D. A., Pontzer, H., Zderic, T. W., Harris, J. A., P Mabulla, A. Z., Hamilton, M. T., & Wood, B. M. (2020). Sitting, squatting, and the evolutionary biology of human inactivity. *Proceedings of the National Academy of Sciences of the United States of America*, 117(13), 7115–7115. <https://doi.org/10.1073/pnas.1911868117>
- Regis, M. F., Tenorio de Oliveira, L. M. F., Mendes Dos Santos, A. R., Leonidio, A. C. R., Dinis, R. R. B., Monteiro de Freitas, C. M. S. (2016). Urban versus rural lifestyle in adolescents: Associations between environment, physical activity levels and sedentary behavior. *Einstein (São Paulo)*, 14(4), 461–467. <https://doi.org/10.1590/s1679-45082016ao3788>
- Ross, R. & McGuire, K. (2011). Incidental physical activity is positively associated with cardiorespiratory fitness. *Medicine & Science in Sports & Exercise*, 43(11), 2189–2194. <https://doi.org/10.1249/MSS.0b013e31821e4ff2>

## REFERENCES

Thivel, D., Tremblay, A., Genin, P. M., Panahi, S., Rivière, D., & Duclos, M. (2018). Physical activity, inactivity, and sedentary behaviors: Definitions and implications in occupational health. *Frontiers in Public Health*, 6, 288. <https://doi.org/10.3389/fpubh.2018.00288>

United States Department of Health and Human Services. (2018). *Physical activity guidelines for Americans: 2nd edition*.

Warburton, D. E., Nicol, C. W., & Bredin, S. S. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*, 174(6), 801–809. <https://doi.org/10.1503/cmaj.051351>

Weimo, Z. & Owen, N. (Eds.). (2017). *Sedentary behavior and health*. Human Kinetics.

Woessner, M. N., Tacey, A., Levinger-Limor, A., Parker, A. G., Levinger, P., & Levinger, I. (2021). The evolution of technology and physical inactivity: the good, the bad, and the way forward. *Frontiers in Public Health*, 9, 655491–655491. <https://doi.org/10.3389/fpubh.2021.655491>

Yazd, S. D., Wheeler, S. A., & Zuo, A. (2019). Key risk factors affecting farmers' mental health: A systematic review. *International Journal of Environmental Research and Public Health*, 16(23). <https://doi.org/10.3390/ijerph16234849>