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Physical Activity Patterns of School-going Adolescents in Rural India: An Examination of Gender Differences

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By

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Bachelor of Arts, Integrative Physiology

University of Colorado at Boulder

2010

Thesis Committee Chair: Delia Lang, PhD

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Abstract

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An Examination of Gender Differences

By Sharanya Thummalapally

Objective: To characterize physical activity patterns of school-going adolescents in rural India by duration, frequency and participation. Total, activity-specific and domain-specific physical activity was assessed, as well as gender differences, to understand how adolescents in rural India engage in physical activity and what differences exist between girls and boys. **Study Design:** A total of 395 adolescents aged 13 to 16 participated in this study, including 198 girls and 197 boys, from 6 schools (3 public and 3 private) in the city of Bijapur, India. Data from 24-hour time-use surveys were used to assess adolescents' physical activity. **Methods:** Twenty activities from the 24-hour time-use recall were determined to be physical activities, and were grouped into activity domains. Mean duration and percent participation were calculated for each activity and activity domain. Gender comparisons were made for duration using t-tests, and for participation using chi2 tests. **Results:** Adolescents engaged in 124 minutes of daily physical activity and 68% engaged in at least 60 minutes of physical activity. Adolescents completed an average of 3 physical activities over the course of the 24-hour recall period. Compared to boys, girls exhibited higher participation and spent more time in indoor cleaning, meal cleanup, laundry, preparing food, and serving food. Compared to girls, boys exhibited higher participation and spent more time in active play outdoors and biking. By domain, girls reported higher participation and spent more time in the household chores domain (51%; 41min) than boys (19%; 13min). Boys reported higher participation in the travel domain (50%) than girls (27%). Girls from households with domestic help exhibited lower physical activity than girls from households without domestic help, though the same difference was not observed for boys. **Conclusions:** Cultural gender norms seem to influence physical activity behaviors. Though boys and girls did not differ in overall duration of physical activity, gender differences exist in types of physical activities engaged in, where girls engage in more household activity indoors while boys engage in more active play and biking outdoors.

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ABSTRACT

Objective: To characterize physical activity patterns of school-going adolescents in rural India by duration, frequency and participation. Total, activity-specific and domain-specific physical activity was assessed, as well as gender differences, to understand how adolescents in rural India engage in physical activity and what differences exist between girls and boys. **Study Design:** A total of 395 adolescents aged 13 to 16 participated in this study, including 198 girls and 197 boys, from 6 schools (3 public and 3 private) in the city of Bijapur, India. Data from 24-hour time-use surveys were used to assess adolescents' physical activity. **Methods:** Twenty activities from the 24-hour time-use recall were determined to be physical activities, and were grouped into activity domains. Mean duration and percent participation were calculated for each activity and activity domain. Gender comparisons were made for duration using t-tests, and for participation using chi2 tests. **Results:** Adolescents engaged in 124 minutes of daily physical activity and 68% engaged in at least 60 minutes of physical activity. Adolescents completed an average of 3 physical activities over the course of the 24-hour recall period. Compared to boys, girls exhibited higher participation and spent more time in indoor cleaning, meal cleanup, laundry, preparing food, and serving food. Compared to girls, boys exhibited higher participation and spent more time in active play outdoors and biking. By domain, girls reported higher participation and spent more time in the household chores domain (51%; 41min) than boys (19%; 13min). Boys reported higher participation in the travel domain (50%) than girls (27%). Girls from households with domestic help exhibited lower physical activity than girls from households without domestic help, though the same difference was not observed for boys. **Conclusions:** Cultural gender norms seem to influence physical activity behaviors. Though boys and girls did not differ in overall duration of physical activity, gender differences exist in types of physical activities engaged in, where girls engage in more household activity indoors while boys engage in more active play and biking outdoors.

INTRODUCTION

Physical activity is associated with many health benefits, including weight maintenance, lowered risk factors for non-communicable diseases (NCDs), cardiovascular fitness, improved skeletal health, and psychological health (Kahn et al., 2005; Dept of Health, 2004; Jago et al., 2005; Parfitt & Eston, 2005; Jago et al., 2004). Yet, researchers estimate that around 31% of adults and 80% of adolescents (aged 13-15) do not engage in enough physical activity (Hallal et al., 2012a), defined as 150 min per week of moderate intensity physical activity for adults and 60 minutes and moderate to vigorous physical activity for children and adolescents (U.S. HHS, 2008; WHO, 2011b). Special attentions should be paid to physical activity in adolescence, when many disease risk factors first begin to develop and life-long physical activity behaviors are most modifiable. The global decline in adolescent physical activity is a serious public health issue (Biddle et al., 2004; Jago et al., 2008; Marcus et al., 2000, Swaminathan et al., 2011), that is associated with rising rates of NCDs and globalization. This decline is more pronounced in girls compared to boys (Livingstone et al., 2003; Sallis et al., 1993), just one of many indications that gender differences exist in adolescent physical activity.

In developing countries, like India, where the effects of globalization are rapidly taking effect, the risk of physical inactivity for adolescents is quickly growing as secular changes in the home reduce the need for everyday physical activity. In countries like India, where gender norms largely dictate male and female roles in the family and in society (Desai, 1995), gender differences in physical activity are likely to be the most pronounced. This has both short-term and long-term health implications that differ for

boys and girls. Therefore, the study of adolescent physical activity in India, and associated gender differences, is needed.

Study Purpose and Framework

The purpose of this study was to characterize the physical activity patterns of school-going adolescent boys and girls, aged 13 to 16, in a rural city of southern India. Gender differences in physical activity were examined to determine if girls and boys spent similar or different amounts of time in physical activity and if they engaged in different types of physical activity. How boys and girls choose to engage in physical activity may be influenced by their gender-specific role in society, in terms of responsibilities, family expectations, and what resources they have available. Additionally, associations between gender-specific home environment factors and physical activity were examined to investigate family influence on physical activity behaviors.

LITERATURE REVIEW

1. Physical Activity

The term physical activity describes any bodily movement produced by contraction of skeletal muscle and resulting in energy expenditure (Caspersen, Powell, & Christensen, 1985). Physical activity is required of everyday life, but the amount that people engage in can vary greatly from person to person, and can vary over time for an individual (Caspersen et al., 1985). Physical activity has historically been measured as daily or weekly energy expenditure, in kilocalories (kcal) or kilojoules (kJ) (Caspersen et al., 1985).

In relation to health, physical activity has often been expressed in terms of duration, frequency and intensity, which combined make up the total volume of activity (Corder et al., 2008). Duration refers to the time spent performing a physical activity in relation to a given time period, such as 60 minutes of physical activity in a day. Frequency refers to the number of times a physical activity is performed over a set period of time, such as 3 times in a week. Intensity reflects the amount of effort or energy required of an activity. Other important dimensions of physical activity include the type or mode of activity, such as walking or biking, and the setting of an activity, such as indoors or outdoors, (Corder et al., 2008) both of which can offer important contextual information.

Intensity of physical activity is determined based on metabolic equivalents (METs). MET is the ratio of a person's working metabolic rate relative to their resting metabolic rate. Physical activity intensity is often expressed as low, less than 3 METs, moderate, between 3 and 6 METs, and high or vigorous, more than 6 METs (WHO, 2013b). Examples of moderate-intensity physical activity include brisk walking, gardening, housework and domestic chores, and active involvement in games and sports (WHO, 2013b). Examples of vigorous-intensity physical activity include running, fast cycling, competitive sports and games, and walking or climbing briskly up a hill. To maintain good health, it is recommended that adults engage in 150 minutes of moderate intensity aerobic physical activity, such as brisk walking (U.S. HHS, 2008). For children and adolescents, the recommendation is for 60 minutes of moderate to vigorous physical activity (MVPA) (Haskell et al., 2007; WHO, 2011b).

Physical activity can be categorized in many different fashions, such as by weekday or weekend activities (Swaminathan et al., 2011), or by domain (Vaz et al., 2011; Laxmaiah et al., 2007), such as activity for leisure, occupation, household, or travel purposes (Caspersen et al., 1985). The method of categorization ultimately depends on the purpose of study and the population of interest. For example, studies in children and adolescents have examined physical activity in terms of time spent outdoors (Puri et al., 2008), because outdoor time is associated with higher physical activity in youth (Dunton et al., 2010).

Past physical activity studies have mainly been conducted in high-income countries, where physical activity occurs most in leisure-time (Hallal et al., 2012), through activities like running, biking, and playing sports In developed and less-developed settings alike, modes of "active transport", like biking, walking, or running, have been considered physical activities in past research (Bauman et al., 2012; Hallal et al., 2012). Though often overlooked by studies assessing physical activity, household chores may be considered physical activity, as they may account for significant daily energy expenditure (Shepard et al., 2003; Hallal et al., 2012; WHO, 2013b).

2. Health Implications

Physical activity has many implications for health. Lack of adequate physical activity is rapidly becoming a major risk factor for non-communicable diseases (WHO, 2011a). In the last twenty years, the focus on exercise for health has shifted to moderate intensity lifestyle physical activity. While the prior aims to develop physical fitness and maintain good health, the latter is focused solely on improving health outcomes and disease prevention (Biddle et al., 2004; Dunn et al., 1998; U.S. HHS, 2000). The

literature demonstrates that significant health benefits are associated with activity of moderate intensity that can be accumulated throughout the day (Church et al., 2007; U.S. HHS, 1996). Physical activity is associated with numerous life-long health benefits, such as weight maintenance and lowered cardiometabolic risk factors (Kahn et al., 2005). With the prevalence of obesity and other non-communicable diseases (NCDs), like cardiovascular disease (CVD), on the rise worldwide, public health efforts recently have focused on understanding the role that physical activity can play in halting and reversing this epidemic. In addition to reducing the risk of NCDs, being physically active is also thought to maintain bone mineral density and improve mental health (Dept of Health, 2004; Jago et al., 2005; Parfitt & Eston, 2005; Jago et al., 2004).

3. Physical Activity in Adolescence

Though most NCDs occur in adulthood, the precursors of NCDs, as well as other health problems associated with inadequate physical activity, often begin early in childhood and adolescence (Hallal et al., 2006; Sternby et al., 1999). As such, special attention should be paid to physical activity in children and adolescents. Physical activity has been shown to decline during adolescence globally (Biddle et al., 2004; Jago et al., 2008; Marcus et al., 2000, Swaminathan et al., 2011). This is worrying because this decline is associated with a rise in childhood overweight and obesity (Janssen et al., 2004; Yang et al., 2006). In addition to poor health outcomes in childhood, being overweight or obese in childhood tends to continue into adulthood, resulting in poor health outcomes in adulthood. In a review examining the positive effect of physical activity in childhood and physical activity guidelines set for children (Loprinzi et al., 2012), short-term benefits associated with physical activity included improved skeletal

health, psychological health, cardiorespiratory fitness, and decreased adiposity. Physical activity in childhood was also found to improve motor skill development, which has both short- and long-term benefits, and health outcomes in adulthood (Loprinzi et al., 2012).

In addition to preventing early development of disease risk factors, there are several other reasons to focus on adolescent physical activity, as identified in a review by Swaminathan & Vaz (2013). Barriers and motivations for health behaviors in adolescence can be very different from adulthood. For example, individuals are more affected by peer influence (Finnerty et al., 2010) in adolescence than in adulthood. As children transition to adolescence their physical activity patterns involve less active play and more structured sports, which require muscular strength, cardiorespiratory fitness, and endurance (Boreham et al., 2001). Puberty may play a role in the observed decline of physical activity in adolescence, affecting boys and girls differently (Finne et al., 2011). Additionally, various social issues arise around puberty, which differently affect boys and girls in terms of their roles and responsibilities, as well as the negotiation of power (Swaminathan & Vaz, 2013). The observed secular decline in adolescent physical activity worldwide warrants further investigation (Must & Tybor 2005; U.S. HHS, 1996). Modifiable high risk behaviors in childhood, such as not engaging in adequate levels of physical activity, are correlated behaviors in adulthood (Lytle & Roski, 1997). Therefore, intervening on physical activity behaviors in adolescence has greater potential to impact adult health behaviors as well as reduce the burden of NCDs, than doing so in adulthood (Swaminathan & Vaz, 2013).

According to the American Heart Association and the WHO, children and adolescents should take part in at least 60 minutes of moderate to vigorous physical

activity (MVPA) every day, or at least 20 minutes of MVPA three times weekly (Haskell et al., 2007; Strong et al., 2005; WHO, 2011b). In the United States, less than 10% of adolescents (ages 12-19), obtain the recommended one hour per day of MVPA (Troiano et al., 2008). Globally, a striking 80.3% of adolescents do not meet this recommendation for daily physical activity (Hallal et al., 2012a).

4. Factors Thought to Influence Adolescent Physical Activity

Many studies have examined individual factors that influence youth physical activity behaviors. Child care, active commuting to and from school, school recess and physical education, after-school programs, churches, medical settings and the home environment, have all been shown to influence children's physical activity behavior (Loprinzi et al., 2012). Considering children spend a significant amount of time at home, children's physical activity is thought to be largely influenced by the home environment. In past research on physical activity, home environment has referred to factors such as parental monitoring, parenting style and rules, family behavioral modeling, household socio-economic status (SES), screen time (computer/TV), and neighborhood characteristics (Gruber et al., 2010; Shileds et al., 2008; Eyler et al., 2002; Cousins et al., 1992; Lox et al., 2006; US Census, 2000; Miller et al., 2012; Jiminez-Pavon et al., 2012; Johnson et al., 2012; Byrne et al., 2011; Huffman et al., 2007; Strauss et al., 1999; Quarmby et al., 2010). Factors most relevant to this study will be discussed.

Family Rules for Outdoor Play

In Western settings, where physical activity consists mostly of leisure activities, social and interpersonal support from family has consistently been shown to be associated with physical activity levels (Shields et al., 2008; Eyler et al., 2002; Cousins et al., 1992;

Gruber et al., 2010; Sallis et al., 1988), especially in terms of participation in sports, structured exercise and active leisure, both inside and outside the home (Lox et al., 2006). Also, in terms of children's physical activity, permissive parenting has been found to be positively associated with physical activity (Berge et al., 2010; Hennessy et al., 2010; Jago et al., 2011). In developing countries, family may influence adolescent physical activity patterns in different ways. In rural settings specifically, where household activities play a larger role in overall physical activity (Hallal et al., 2012a), adolescents may be required or expected to do a certain amount of domestic work. This is especially relevant for girls in India, as females in the household are responsible for the majority of domestic work (Govt of India, 1999). Parenting styles and parent rules about children's physical activity, such as those regarding outdoor play, have yet to be examined in India.

Domestic Workload

More than half of the unpaid work in India, mainly domestic work, is performed by women (Govt of India, 1999). As such, domestic work may account for a large portion of daily activities for females in India. While in European countries and other developed settings, SES is positively associated with physical activity, whereby higher SES groups tend to be more physically active (Seabra et al., 2012), the opposite has been observed in developing countries (Alves et al., 2012), and one reason may be that higher SES households can afford domestic help. Presence of domestic help in the household may be associated with lower levels of physical activity for children in the household because children engage in fewer household chores and therefore less overall physical activity. Or perhaps domestic help in a household is merely an indicator of higher SES, and children living in the household have lower physical activity levels due to other risk factors

associated with SES (such as having a car, and driving to school rather than walking or biking). However, if children are expected to do less household work (when domestic help is present in the household), they may have additional time to engage in other types of physical activity, like active play outdoors/indoors, resulting in higher levels of physical activity.

5. Gender Differences

Gender differences in adolescent physical activity levels have been observed, whereby boys are more active than girls (Dunton et al., 2010; Swaminathan et al., 2011; Goyal et al., 2010; Jain et al., 2010; Guthold et al., 2010; Singh et al., 2006; Thakor et al., 2004). Figure 1 visually illustrates the significant difference in activity level of boys and girls globally, where girls are less active than boys (Hallal, 2012a). Hallal et al. (2012a) show that among adolescents aged 15-18 in India, 70-80% of girls and 60-70% of boys do not get adequate physical activity. Additionally, the phenomenon of children becoming less physically active as they age is more pronounced in girls than boys (Livingstone et al., 2003; Sallis et al., 1993; Swaminathan et al., 2011).

Research reveals gender differences in physical activity in terms of setting and company. A U.S. study found that girls were more likely to do physical activity with family, while boys were more likely to do so with friends, acquaintances or others (Dunton et al., 2010). Boys were also more likely to engage in physical activity outdoors (Dunton et al., 2010). A study in India showed that only 32% of girls engaged in outdoor play of more than 1 hour, compared to 83% of boys (Thakor et al., 2004). The difference between girls and boys was even larger for more than 2 hours of outdoor play—only 3% of girls compared to 49% of boys.

One explanation for these gender differences is that girls enjoy physical activity less than boys and are less confident in their ability to participate in these activities. U.S. studies indicate that boys report greater modeling by friends, more social support from friends, fewer perceived barriers, greater enjoyment of games and sports participation, and greater self-efficacy than girls (Sallis et al., 1996; Seabra et al.,2012). Additionally, girls are more likely to dislike physical activity (Sallis et al., 1996). Another reason may be that resources available to girls and boys, in terms of physical activity, are different. For example, the built environment, specifically proximity of a child's home to recreational park space, is associated with physical activity for boys, but not for girls (Roemmich et al., 2007). This implies that the outdoor environment may not be as important for girls' physical activity levels compared to those of boys.

6. Globalization and Physical Activity

Increased urbanization around the world has resulted in several environmental factors which may discourage participation in physical activity, including: violence, high-density traffic, low air quality, pollution, lack of parks, sidewalks and sports/recreation facilities (WHO, 2013a). In addition to insufficient participation in physical activity during leisure time, an increase in sedentary behavior during occupational and domestic activities is thought to explain the declining levels of physical activity (WHO, 2013a). With advancements in technology and increased use of labor-saving devices, such as motor vehicles and other transportation aids, the minimum daily energy expenditure necessary for living has decreased globally (Hallal et al., 2012b; WHO, 2013a). In Asian countries, migration from rural to urban areas and rapid socio-economic transition are associated with lifestyle changes that result in decreased levels of physical activity

(Ramachandran et al., 2012). This is especially true of countries undergoing substantial social and physical transitions, namely those with low-to-middle incomes. However, little data on physical activity patterns exist for low- and middle-income countries; the majority of research on physical activity has been conducted in high-income countries (Hallal et al., 2012b). Additionally, low- and middle-income countries have the fewest surveillance measures of physical activity in place (Hallal et al., 2012b). Therefore, there is a need for research and increased surveillance of physical activity in low- and middle-income countries.

Differences in types of physical activity exist for different countries, namely by income level. People living in lower-income countries exhibit more occupational, household, and transportation-related physical activity compared to those living in higher-income countries, who exhibit more leisure-time physical activity (Dunton et al., 2010; Scheers et al., 2012; Hallal et al., 2012). Leisure time physical activity has been found to be a predictor of longevity in a U.S. population (Moore et al., 2012). However, this finding may only apply to high-income countries. More research is needed to examine time spent in various activity domains in low- and middle-income countries, another justification for research on physical activity in India.

7. Physical Activity in India

In India, physical inactivity is thought to account for 2.6% of coronary heart disease cases, 3.2% of type 2 diabetes cases, 4.8% of breast cancer cases, 4.6% of colon cancer cases, and 4.2% of all-cause mortality (Lee et al., 2012). Asian populations experience increased risk of type 2 diabetes (T2D) at lower BMI values compared to other racial/ethnic groups (Ramachandran et al., 2012), and, compared to other

populations worldwide, the Indian population experiences first myocardial infarction earlier in life. Therefore, more research on physical activity is warranted in the Indian population.

Several studies have examined physical activity patterns in Indian youth (Dongre et al., 2011; Swaminathan et al., 2011; Vaz et al., 2011; Goyal et al., 2010; Jain et al., 2010; Guthold et al., 2010; Puri et al., 2008; Kuriyan et al., 2007; Laxmaiah et al., 2007; Singh et al., 2006; Thakor et al., 2004), all of which were included in a review by Swaminathan & Vaz (2013). Four studies examined physical activity duration by domain (Kuriyan et al., 2007; Laxmaiah et al., 2007; Swaminathan et al., 2011; Vaz et al., 2011). A study conducted in Hyderabad (Laxmaiah et al., 2007) found that non-participation in activity domains varied, where 18% of adolescents did not participate in household activities and 44% did not participate in outdoor games. One study reported that around 57% of adolescents walked or biked to school (Guthold et al., 2010). Vaz et al. (2011) reported a mean of 62 minutes of MVPA per day for all participants, indicating that adolescents, on average, met the recommended daily physical activity. Swaminathan et al. (2011) found that MVPA decreased in adolescence in as little as 1 year. In an urban study, a much higher percentage of girls exhibited low outdoor play compared to boys (Thakor et al., 2004). Across all studies, girls were found to exhibit lower physical activity than boys (Swaminathan & Vaz, 2013), which is consistent with international literature. Girls exhibited much lower participation in outdoor games and in sports than boys (Swaminathan & Vaz, 2013).

Though these studies provide a foundation of research on physical activity in Indian youth and gender differences therein, varying methods, sample sizes and outcome

parameters leave much in question (Swaminathan & Vaz, 2013). Findings are difficult to compare between studies because common methodologies and instruments were not employed. Nine of the 11 studies included in this review (Swaminathan & Vaz, 2013) were conducted in urban settings, leaving a gap in the literature regarding rural settings. More information is needed to understand physical activity across its multiple domains, as well as the determinants of physical activity at the individual, family and community levels (Swaminathan & Vaz, 2013).

In India, cultural preference for boys over girls indicates that gender-based preferential treatment occurs. In terms of the home environment and family influences, this preference for boys plays into family resource allocation (Sharma et al., 2011; Jatrana et al., 2003). Girls are thought to be devalued in the Indian family, and often carry a heavy domestic workload (Desai, 1995). In terms of physical activity, this could mean less restrictive rules for boys than for girls, creating disparity between boys and girls' physical activity behaviors. More attention should be paid to gender differences regarding physical activity, especially in the context of non-Western countries where gender norms differ.

8. Measurement of Physical Activity

Physical activity has been measured in children and adolescents in several ways, most commonly using motion-sensing devices and self-report surveys/questionnaires (Corder et al., 2008). Pedometers, motion-sensing devices, record the number of steps taken, distance covered, and duration of an activity, and are practical for large study populations, as they tend to be less expensive than other objective tools (e.g. accelerometers and heart rate monitors). Though pedometer data can be used to estimate

energy expenditure, higher accuracy can be attained using accelerometers, which record velocity through movement counts, and can be used to estimate physical activity intensity (Corder et al., 2008.

Two common self-report measures are physical activity questionnaires and time-use recalls. Physical activity questionnaires, like the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003) has allowed researchers to estimate overall physical activity levels of adolescents around the world (Hallal et al., 2012a), as seen in Figure 1. In the IPAQ, respondents are asked a series of questions regarding their weekly physical activity behavior. For example, respondents are asked to report how many times per week they engage in moderate to vigorous physical activity. Respondents are also asked to report how much time they spend in certain physical activities over the course of the week. The IPAQ has served as a standard measure of physical activity with which comparisons can be made across different populations and countries around the world, both in adult and adolescent populations. One drawback of this questionnaire is that the energy expenditure values (Ainsworth et al., 2000) that are assigned to self-reported activities are derived from adult energy costs (Corder et al., 2008). Therefore no measure of physical activity is currently as accurate for adolescents as instruments that exist for adult populations.

For time-use recalls, respondents typically report what activities they engaged in and when the activities started and ended, over a given period of time, such as the past 24 hours, or past 7 days (Corder et al., 2008). In a study utilizing American Time Use Survey data from 2003 to 2006, researchers examined physical activity behaviors of adolescents aged 15-18 years (Dunton et al., 2010). Participants were interviewed by

telephone and asked to sequentially recall each of their activities and its duration during the previous 24 hours. Where and with whom each bout of physical activity occurred was reported, as well as the setting–options included outdoors, at home, or at work. Participants reported if they engaged in each physical activity bout alone, with family, with friends or acquaintances, or with others (meaning family and friends/acquaintances).

Objective motion-sensing devices, such as pedometers and accelerometers, are advantageous over subjective measures of physical activity in that subjective measures are vulnerable to recall bias (Corder et al., 2008). However, subjective measures, namely time-use surveys, can provide a wealth of contextual information that is not possible with objective measures. Though often more difficult to conduct, some studies have employed both subjective and objective measures of physical activity, employing strengths of both measure types. Miller et al. (2012) conducted a study of youth physical activity using both accelerometers and activity diaries. To understand how children spend their time in relation to adult supervision, researchers examined the physical activity patterns and social environment of US middle school children after school, when children were likely to be unsupervised (Miller et al., 2012). Participants wore Actical accelerometers, which detect both low- and high-energy movements, and were instructed to wear the devices from 3pm until they went to sleep, when accelerometers were removed. Participants were also asked to keep a diary of their activities from 3pm to 12am for 4 days. The activity diary was based off of the Bouchard 3-day physical activity diary, a validated and reliable estimate of daily energy expenditure for ages 10-50 years (Eisenmann et al., 2003; Bouchard, 1983), but adapted for 4 days of data collection. While the Bouchard diary splits up time into 15-minute intervals, Miller et al. (2012) chose 20-minute intervals

based on previous research indicating that this would help with compliance in completing the diary (WCM, unpublished, 2010). To match these activity diary intervals, accelerometer data were split into 20-minute intervals as well. A high and significant correlation between these two measures of physical activity was reported. Location of activities, recorded in diaries, was coded as indoors at home, indoors out of home or outdoors. With whom the activities were completed, also recorded in diaries, was coded as with a family member, with a friend, or alone. Activities were categorized as active or sedentary, where sedentary was defined as anything done sitting or lying down, including napping. This study demonstrates how subjective measures of physical activity can provide validation, when used in combination with objective measures, as well as contextual information.

In our study, a time-use survey was used. Though difficult with large populations, time-use surveys have several advantages over other physical activity measurement tools. Time-use surveys are non-restrictive in that they allow respondents to record when activities actually began and ended, rather than tailoring the start and end times of activities to pre-determined periods of time, as is customary with activity diaries. For youth, this is especially important in that physical activity bouts are often unplanned and short-term (Corder et al., 2008). Time-use surveys are comprehensive measures in that they measure what activities are performed and how long the activities lasted, as well as where the activities took place and with whom they were completed. This is especially important in understudied populations where physical activities may differ significantly from other (more-studied) populations, due to various factors, like SES or cultural factors. This measure of physical activity is also advantageous in that it may capture

physical activities of girls that have previously been overlooked.

Studies of physical activity patterns in adults worldwide suggest that men engage in more physical activity than women; however, this difference is usually observed in the context of participation in sports and other leisure activities, especially those that are vigorous intensity (Livingstone et al., 2003). Though physical activity encompasses many activities, including household tasks and care-giving tasks that are more commonly performed by women, not all activities are given equal importance and are adequately measured in national surveys (Livingstone et al., 2003). Therefore, physical activity in females may be underestimated. By using a time-use survey, rather than a questionnaire, we may be able to more accurately capture physical activity patterns of girls in this study.

CONCEPTUAL FRAMEWORK

Given the observed differences in physical activity by gender, a conceptual framework was developed for this study, guided by ideas from the Theory of Gender and Power (Connell et al., 1987; Diclemente et al., 2002). This theory is comprised of three main structures: Sexual division of labor, sexual division of power, and cathexis. For our conceptual model, the first and third structures apply. At the societal level, sexual division of labor refers to the allocation of women and men to certain occupations; women are often assigned different and unequal positions relative to men. At the institutional level, examples of this division can be seen in the segregation of unpaid nurturing work for women – namely child care, caring for the sick and elderly, and housework. Cathexis refers to social norms and affective attachments. This structure includes family, biological, and cultural influences. Family values, which are often viewed as protective factors in health, are an example of family influence (Diclemente et

al., 2002). Onset of menstruation is an example of biological influence. Gender norms regarding domestic responsibilities are an example of cultural influence. In relation to physical activity, social norms define what activities are socially appropriate or expected of the different genders. For example, the majority of household work and caretaking in Indian households falls on females in the household (Desai, 1995; Govt of India, 1999), indicating a cultural expectation that females are responsible for these domestic activities.

In our model, shown in Figure 2, we hypothesize that parents protect their daughters by keeping them from playing outside, perhaps for reasons of safety or fear of injury. This leads to lower outdoor physical activity for girls, compared to boys. According to the sexual division of labor, women are responsible for a much greater proportion of the unpaid work, namely domestic work, which occurs in India (Govt of India, 1999). Cultural gender norms in India dictate that women are more responsible for domestic work, namely household chores and nurturing (taking care of family members or siblings) than are boys (Desai, 1995). As such, we expect that girls spend more time indoors, in housework and nurturing activities, than boys, as they will one day have to take on the responsibility of being the primary caretaker of a family. Boys, on the other hand, may have more freedom to play outside, as well as less responsibility of housework.

Though past studies of Indian adolescent physical activity have examined active play or sports, physical education, active transport (biking/walking) and household work as indicators of physical activity level (Swaminathan & Vaz, 2013), gender differences in these various types of activity were often not examined. Though girls were found to be less physically active than boys in terms of overall duration of physical activity

(Swaminathan et al., 2011; Goyal et al., 2010; Jain et al., 2010; Guthold et al., 2010; Singh et al., 2006; Thakor et al., 2004), this has only been observed in respect to sports and exercise (Goyal et al., 2010; Swaminathan et al., 2011). If activities such as household work and travel are taken into account, we expect that the difference in physical activity levels between boys and girls will be less pronounced, or even insignificant.

We believe that boys and girls may engage in similar amounts of physical activity, in terms of duration (minutes per day), but that they engage in different sorts of activities. Based on our conceptual framework, we expect girls to engage in more household physical activity than boys, and boys to engage in more outdoor physical activity than girls. Additionally, if girls engage in lower intensity activities than boys (household chores versus active play outdoors) but for similar amounts of time, girls will expend less energy throughout the day than boys. In order to determine if this potential difference in energy expenditure relates to downstream health risks such as obesity and heart disease, dietary information would need to be taken into account. Energy expenditure and diet are beyond the scope of this study and are not measured.

Research Questions

Our conceptual framework informed the creation of our research questions, which are as follows:

Main Research Question: What are the physical activity patterns of adolescents aged13 to 16 in rural India and the associated gender differences?

Research Question 1: What level of physical activity do adolescents engage in?

1a. How much time do adolescents spend in physical activities daily?

1b. What proportion of adolescents engage in these activities?

1c. How many times do adolescents engage in physical activities daily?

Research Question 2: What is the role of gender in adolescents' physical activity?

2a. Do boys and girls spend different amounts of time in physical activities?

2b. Do boys and girls engage in different types of physical activity?

2c. Arehome environment factors associated with physical activity of boys and girls differently ?

Research Question 3: What are the domains of physical activity?

3a. How much time do adolescents engage in different domains?

3b. What proportion of adolescents engage in these domains?

DATA & METHODS

1. Study Setting

Data used for this study were collected in the city of Bijapur in the spring of 2012. Home to approximately 326,360 people, the city of Bijapur is located within Bijapur District, in the state of Karnataka, India (Census, 2011). The population of the district has grown drastically over the last decade, from 1,806,918 in 2001 to 2,175,102 in 2011—an increase of over 20% (Census, 2011). Though Bijapur is considered a rural city, with 77% of the population residing in rural areas, and 23% in urban areas (Census, 2011), it is becoming increasingly urbanized given ongoing population growth.

2. Sample Selection & Interviews

Participants were male and female children between the ages of 13 and 16, who were attending schools, both private and public, in the city of Bijapur. From 32 secondary schools in Bijapur, three private and three public schools were randomly selected. From

the selected schools' rosters, 407 adolescents were selected, 201 from public schools (102 boys, 99 girls) and 206 from private schools (105 boys, and 101 girls), using simple random sampling. The mothers or primary caregivers of these adolescents were also sampled. Nine adolescents did not have data from both the 24-hour recall and the caregiver interview. These participants with incomplete data were not included in analysis, yielding a final sample of 395 participants.

3. Survey Instruments

A 24-hour time-use survey (see Figure 3), adapted from the Panel Study of Income Dynamics (PSID) Child Supplement Weekday Time Diary (PSID, 2007), was used to record all activities that adolescents engaged in over a 24-hour period. The coding scheme for the adapted time-use survey was created by Emory researchers, in collaboration with the Bijapur team, and can be seen in Table 1. Additionally, a questionnaire for the mother/primary caregiver was used to assess the home environment of each adolescent; questions used from this instrument are described in the measures section.

4. Data Collection

Data were collected by a team of 8 interviewers and 2 supervisors. Data collection took place during the months of February, March and April, 2012. Adolescents were asked to fill out the 24-hour time-use survey at school, with the assistance of interviewers. Participants also received a home visit, during which interviewers collected demographic and home environment information from adolescents' mothers or primary caregivers using the caregiver questionnaire. A few items were chosen from this interview to include in our study, which are discussed further in the measures section.

5. Data Setup and Management

Creating the 24-hour Recall Dataset

Data collected by the Bijapur team were de-identified and made available to us on a secured server at Emory University, in an electronic database, accessible through Microsoft Excel. Each participant had a unique identifier, by which the 24-hour data was organized. Information for the 24-hour recall was provided as an Excel workbook, comprised of six spreadsheets, one for each school. Each school's spreadsheet was imported into STATA (v.12) statistical analysis software, to create an individual dataset. Before datasets could be appended, the variable type (typically numeric or string) for each variable was standardized in each dataset. By appending the six separate datasets (one for each school), a single 24-hour recall dataset was created.

In the 24-hour dataset, each participant had multiple observations, where each observation represented an activity reported during the 24-hour period of recall. Observations were grouped by the respondent's unique identifier, known as the Respondent ID. The Respondent ID included the character "M" or "F", depending on the respondent's gender, where M = male and F = female. A new variable called "gender" was created and coded as 1 if the respondent was female and 0 if the respondent was male (as indicated by the 3rd character in the Respondent ID).

Each observation was given an activity code shown in the coding scheme (Table 1); the number of observations per participant varied, depending on how many activities were completed. For each observation, the start time and end time were provided, each as separate variables. In addition, with whom the activity was done (if anyone) and where the activity was done, were provided.

Creating the Caregiver Dataset

In order to obtain demographic and home environment information, caregiver interview data were merged with 24-hour recall data. Information from the caregiver interview, which was also organized by respondent ID, was imported into STATA separate from the 24-hour recall data. While the 24-hour recall data had multiple observations per respondent, the caregiver interview data had only one observation per respondent. In order to merge the two datasets, we collapsed the 24-hour recall dataset by respondent ID, gender, and duration of physical activity, resulting in one observation per person, with a value for gender and physical activity duration. Once in a format where each respondent had only one observation, the 24-hour recall dataset was merged with the dataset from the caregiver interview to create the caregiver dataset.

Coding the Time Variables

In the 24-hour dataset, start time and end time values had been recorded in 12-hour clock time. These values did not have AM or PM recorded, and had a decimal separating the hours and minutes. For example, "12.15" was recorded as a start time of an activity, though from this value we cannot determine if the time was 12:15PM or 12:15AM. Therefore, several steps were taken to recode these time variables into 24-hour clock time. The first step taken was to determine which values occurred after noon.

The order of observations for all participants had been recorded chronologically, where the first observation occurred at the earliest point in the day, and the last observation, at the latest point in the day. Adolescents were instructed to report all activities that they engaged in throughout the day, beginning at 12am and ending at 12am (see Figure 3). A variable was created to number the observations for each participant, so

that the chronological order of activities could be restored if needed and so that the first and last observations for each participant could be identified. Next, two variables, called *pm_start* and *pm_end,* were created to indicate which times occurred after 12pm. As the names indicate, pm_start was used as an indicator of start time values occurring after noon, and pm_end was used as an indicator for end time values occurring after noon. For both pm_end and pm_start, a value of 1 indicated that the time was a PM value, whereas, a value of 0 indicated that the time was not a PM value (or that it was an AM value).

The following details how time values were chose to be marked as PM or not. The assumption was made that if an activity was coded as "sleep" and the time value (start or end) included the number "12" before the decimal (indicating the hour), this was a 12AM value. Likewise, if a time value included the number "12" and the activity was not coded as "sleep", this was systematically marked as PM. This step served as a marker for the "PM switch", the point at which the time values in a recall should switch to PM. However, this did provide a PM switch for respondents who did not have any activities starting or ending with a time value including a "12". Therefore, two flag variables were created, one defined as the sum of the pm_start variable for each respondent, and the other, the sum of the pm_end variable for each respondent. For both flag variables, a 1 indicated that the respondent now had a PM switch, while a 0 indicated no PM switch. Respondents who had no PM switch were looked at individually. The recall (i.e. all observations for a respondent) for each of these respondents was examined individually. Given the chronological order of observations, we were able to determine where the PM switch occurred, and individually marked each one of these PM switches. Once each respondent had a PM switch, the values after this PM switch were marked as PM, for all

following pm_start and pm_end values. Once all PM time values were identified, we added 12 hours to all time values marked as PM, to recode time values as 24 –hour clock time. For example, a value of "3.00", which was marked as a PM value, would now become "15.00".

Considering the recall period was from 12am to 12am, the start time was systematically set to "0.00" (in 24-hour time). Similarly, the last observation of every recall was set to end at "24.00". For recalls where the first observation started after 12am and was coded as a "waking up/going to bed" activity, the time unaccounted for—between 12am and waking up—was coded as a "sleep" activity, assuming that the respondent was sleeping before waking up. The same was done for recalls where the last observation was a "waking up/going to bed" activity and ended before 12am, assuming that the respondent was sleeping after going to bed. Less than 2% of recalls were dealt with in this way. For recalls that started after 12am, or ended before 12am, and did not start or end, respectively, with a "waking up" activity, the time unaccounted for could not be coded as any specific activity. Therefore, these recalls do not add up to 24 hours exactly, though this has little bearing on our study, as we did not examine physical activity as a proportion of the day.

Once all times were coded in 24-hour time, time variables were converted from numeric type to string type, in order to change the decimal separating the hours and minutes to a colon, and then converted back into numeric type. As a decimal, times like "2.45" were being read as 2 hours and 45/100 minutes. Converting this time to read "2:45" allowed for STATA to read the time value correctly as 2 hours and 45 minutes. After each step in the process of coding the time variables, several recalls (one recall

represents all observations for a single respondent) were examined to ensure that correct recoding took place.

6. Developing Measures

In order to characterize physical activity patterns in the sample, physical activities first had to be identified. Based on the literature, the following activities were identified as physical activities: active play outdoors, active play indoors, biking to a destination or for fun, walking or running to a destination or for fun, shopping for household items, shopping for clothes or games, shopping for snacks or tobacco or drinks, errands, preparing food, serving food, meal cleanup, indoor cleaning, laundry, home repairs and outdoor chores, other indoor things around the house, other outdoor chores, vehicle care, work outside the home, gardening, and playing with younger child. Though listed as a single activity, work outside the home referred to a variety of paid jobs, like working in a garage, polishing shoes, and distributing newspapers on a bike, all of which can be considered moderate to high physical labor. Physical activities were organized into the following physical activity domains: *sleeping and passive activities*, *shopping and errands*, *self-care*, *eating*, *household chores*, *work outside the home*, *school*, *active play*, *travel*, *child and plant care*. A domain variable was created to indicate what domain each activity corresponded to. All physical activities and their corresponding domains are highlighted in Table 2.

In order to examine gender differences in physical activity, we first had to establish what the levels of physical activity were among this population, by looking at total duration of physical activity, duration of individual activities, and duration of activity within specific domains. We also looked at how many adolescents engaged in

any physical activity, how many engaged in individual activities, and how many engaged in specific domains. Then gender differences in physical activity were examined, for all of these measures. As an additional step, two gender-specific home environment factors were examined as potential correlated of any gender differences observed in physical activity. The following details what measures were used and how they were developed.

Total Duration of Physical Activity

To determine how much time was spent for each activity, or duration of physical activity, a variable called "duration" was created. Values for this variable were calculated by taking the difference between the start and end time for each observation (each activity reported). Observations where negative duration values were generated were examined individually and recoded if appropriate, or excluded from analysis. For example, if an adolescent reported that an activity started at 4:45pm and ended at 4:00pm, this would have generated a negative duration value of 45 minutes. If the preceding activity ended at 4:00pm and the successive activity started at 4:45pm, we assumed that the start time and end time had been switched, and these times were recoded. In most cases, however, the error was not as straightforward, and observations were excluded from analysis, which we discuss further in the Missing and Impossible Values section. Duration was represented as minutes of physical activity per day. Duration values for all physical activities were summed, yielding a value of total duration of physical activity.

Duration by Activity

Duration by activity, a measure of how much time was spent in each physical activity, was determined by summing duration values for each activity, by respondent. For example, if an adolescent spent 20 minutes walking to school in the morning, 20

minutes walking home from school in the afternoon, and 10 minutes walking to a friend's house in the evening, duration for the walking/running activity would be 50 minutes.

Duration by Domain

Duration by domain, a measure of how much time was spent in each physical activity domain, was determined by summing duration values for each domain, by respondent.

Frequency of Physical Activity

To determine the number of physical activity bouts (instances) reported by each respondent, a variable called "frequency" was created. For this variable, a value of 1 was assigned to each physical activity. The frequency variable was summed by respondent, yielding the total number of physical activity bouts completed by each person, or frequency.

Participation in Any Physical Activity

Participation in any physical activity, defined as completing at least one physical activity bout, was calculated using the frequency variable previously described. The frequency variable was summed by respondent, yielding a frequency for each respondent (i.e. the total number of physical activity bouts completed for each respondent). If the frequency value was greater than 0, a respondent participated in at least one physical activity.

Participation by Activity

Participation by activity, defined as engaging in a specific physical activity at least one time, was calculated using the frequency variable. The frequency variable was summed by activity and by respondent, yielding a frequency for each activity, for each

respondent. If the frequency value was greater than 0, a respondent engaged in that activity at least once. From this, the number of adolescents who participated in each activity was calculated.

Participation by Domain

Participation by domain, defined as engaging in a specific activity domain at least once, was calculated using the frequency variable. The frequency variable was summed by domain and by respondent, yielding a frequency for each domain, for each respondent. If the frequency value was greater than 0, a respondent engaged in that activity domain at least once. From this, the number of adolescents who participated in each activity domain was calculated.

Home Environment – Parent rule on outdoor play

A question from the caregiver interview was used to assess parental rules for outdoor play, and the potential influence of this home environment factor on girls' and boys physical activity levels. Caregivers were asked if they allowed their children to play outside. Answer options included: (1) only boys, (2) only girls, (3) both boys and girls, and (4) neither boys nor girls. To determine potential gender differences, this variable was recoded into two new variables called "allowedgirls" and "allowedboys" were created. "Allowedgirls" was coded as 0 or 1 , where 0 means girls are not allowed to play outside (codes 1 and 4 from the previous question) and 1 means girls are allowed to play outside (codes 2 and 3 from the previous question). "Allowedboys" was coded as 0 or 1 where 0 means boys are not allowed to play outside (codes 2 and 4 from the original question) and 1 means boys are allowed to play outside (codes 1 and 3 from the original question).

Home Environment – Household domestic help

To measure the association between domestic work and adolescent physical activity, specifically for girls, domestic help in the household was examined. In the caregiver interview, caregivers reported if their household had domestic help, with answer options being yes (=1) and no (=2).

Demographic Characteristics

Demographic characteristics of the sample included: school type, caste, household education level, and monthly household income. School type was recorded as public (=0) or private (=1). Caste, a measure of socio-economic status (SES), was recorded as "general," "other backward classes," "scheduled caste," or "scheduled tribe," in order from highest to lowest SES group. Household education level was based on the education level of the head of the household, which in most cases was the father (69%) or the mother (12%). This was recorded during the caregiver interview as part of the household roster. Education levels included: not educated, primary, high school, pre-university course, degree, and professional. Household income, measured in Indian rupees (R), was represented as the following five categories: less than 5,000R (~$93); 5,000 to 10,000R (~$93-$186); 10,000R to 20,000R (~$186-$372); 20,000-30,000 (~$372-$558); and greater than 30,000R ($558).

Missing and Impossible Values

Three respondents, who had time values but no activities reported for their entire 24-hour recalls, were excluded from analysis. Nine other respondents who were missing all data from either the 24-hour recall or the caregiver interview were excluded from analysis. Observations, meaning single activities, that generated negative duration

values, were also excluded from analysis (n=16). For example, if an adolescent reported that an activity started at 4:45pm and ended at 4:00pm, this would have generated a negative duration value of 45 minutes. If the preceding activity ended at 4:45pm and the successive activity started at 5:00pm, then the error lies in the end time, which was most likely meant to be 5:00pm (instead of 4:00pm). However, if the preceding activity ended at 4:30pm and the successive activity started at 6:30pm, we could not make any assumptions about where the error was made. Because we could not determine what the actual error was, observations like this, that generated negative duration values, were not included in analysis.

7. Data Analysis

STATA software (v.12) was used for data management and analysis. Descriptive statistics were run to check the distribution of all variables and to characterize participant demographics, including gender, school type, caste, education level, and household income.

Research Question 1: What level of physical activity do adolescents engage in?

To address sub-question 1a, (*how much time do adolescents spend in physical activities daily?*), mean duration of physical activity was calculated. To address sub-question 1b (*what proportion of adolescents engage in these activities*?), frequencies were calculated using descriptive statistics to determine how many adolescents took part in each activity. To address sub-question 1c, (*how many times do adolescents engage in physical activities daily?*), mean frequency of physical activity was calculated using descriptive statistics.

Research Question 2: What is the role of gender in adolescents' physical activity?

To address sub-question2a (*do boys and girls spend different amounts of physical activities?*), independent t-tests were run to determine if differences in total physical activity duration existed between males and females. Independent t-tests were also run to determine if differences in duration by activity existed between males and females, and if differences in duration by activity domain existed between males and females. Significance level was set at $p<.05$ for all tests.

To address sub-question 2b (*do boys and girls engage in different types of physical activity?*), Pearson's chi2 test was used to determine if differences existed between males and females in terms of participation in each activity. Also, Pearson's chi2 test was used to determine if differences existed between males and females in terms of participation in each activity domain. Significance level was set at $p<.05$ for all tests.

To address sub-question 2c (*do home environment factors influence boys and girls differently in terms of physical activity*), an independent t-test was used to determine if, among girls, parent rule on outdoor play was associated with mean duration of physical activity. Likewise, an independent t-test was used to determine if, among boys, parent rule on outdoor play was associated with mean duration of physical activity. An independent t-tests was also used to determine if, among girls, having domestic help in the household was associated with mean duration of physical activity. Likewise, an independent t-tests was used to determine if, among boys, having domestic help in the household was associated with mean duration of physical activity.

Research Question 3: What are the domains of physical activity?

To address sub-question 3a (*how much time do adolescents engage in different domains?)*, descriptive statistics were used to calculate mean duration of physical activity

by domain. To address sub-question 3b (*what proportion of adolescents engage in these domains*?), descriptive statistics were used to determine how many adolescents participated in each domain (meaning they participated in at least one activity in that domain).

RESULTS

1. Demographics

Of the original 404 adolescents sampled, 2% (n=9) were not analyzed in this study, as they were missing data from the either the 24-hour recall or the caregiver interview. The final sample for this study was 395 adolescents, of which about half were male (n=197), and the other half female (n=198). All adolescents were between the ages of 13 and 16 years old. Half of the sample attended public schools (n=197, 50%), with the other half attending private schools (n=198, 50%). Among the adolescents' primary caregivers, about 18% were not formally educated (n=70). Of those who were educated, 14% completed primary school (n=55), 18% completed high school (n=72), 11% completed Pre University Course (PUC) (n=42), 34% completed a degree (n=133), and less than 10% had completed a professional degree (n=23, 6%). In terms of income, 14% of adolescents came from a household with a monthly income of less than 5,000R (n=55). Around a third of households had a monthly income of 5,000-10,000R (n=124, 31%), and the remaining 53% had a monthly income of more than 10,000R (n=211). In terms of caste, 55% of families were of other backward classes. A quarter of families were of general caste (n=99, 25%), and around 20% of families were of scheduled caste or scheduled tribe (n=74, 19%; n=6, 2%, respectively). Demographics can be seen in Table 3.

2. Physical Activity

Majority of the sample (92%) took part in one or more physical activities during the day, with no significant differences seen between males and females. Adolescents reported taking part in anywhere from 0 to 690 minutes of physical activity per day, with the average being 124 minutes (sd=109), about 2 hours, of physical activity. Average duration of physical activity was similar among males, at 131 minutes, and females, at 117 min. Adolescents reported from 0 to 16 physical activity bouts per day, with 3 physical activity bouts per day being the average. Males and females did not significantly differ in terms of frequency of physical activity, both averaging 3 bouts of activity per day. Over 90% of adolescents participated in at least one physical activity, with no significant differences seen between male participation (92%) and female participation (91%). Approximately 68% of adolescents completed at least 60 minutes of physical activity (n=268), with no significant differences between males (69%) and females (66%). Refer to Table 4.

Duration by Activity

Among physical activities, adolescents spent the most time walking or running (mean=39min, sd=60), in active play outdoors (mean=27min, sd=51), and biking (mean=10min, sd=25). In general, the same amount of time was spent shopping for household items (mean=5min, sd=24), doing errands (mean=4min, sd=23), cleaning indoors (mean=5min, sd=17), doing paid work (mean=4min, sd=36), and taking part in active play indoors (mean=5min, sd=22). Girls spent significantly more time performing many chores compared to boys. Girls spent more time preparing food (mean=5min, sd=19) than did boys (mean=0min, sd=2) ($t= -3.6$, $df=393$, $p<0.001$) and serving food

(mean=3min, sd=16) than did boys (mean=0min, sd=3) (t= -2.3, df=393, p=0.020). Girls spent more time performing meal cleanup (mean=7min, sd=21) than did boys (mean=0min, sd=0) (t= -4.9, df=393, p<0.001). Girls spent more time cleaning indoors (mean=9min, sd=20) than did boys (mean=1min, sd=11) (t= -5.1, df=393, p<0.001). Girls spent more time doing laundry (mean=10min, sd=27) than did boys (mean=0min, sd=3) (t= -4.9, df=393, p<0.001). In contrast, boys spent significantly more time in active play outdoors (mean=42min, sd=59) than did girls (mean=13min, sd=36) (t=5.7, df=393, p<0.001). Boys also reported more time biking (mean=17min, sd=32) than did girls (mean=4min, sd=13) (t= 5.5, df=393, p<0.001). Mean duration values (in minutes) for every physical activities, overall and by gender, can be found in Table 5.

Duration by Domain

The physical activity domains included: *shopping and errands, household chores, work outside the home, active play, travel,* and *child and plant care* (Table 2). Among these domains, adolescents spent the most time in *travel* (mean=92min, sd=85), *active play* (mean=176min, sd=135), and *household chores* (mean=27min, sd=54). On average, adolescents spent 10 minutes (sd=35) in *shopping and errands*, 4 minutes (sd=36) in *work outside the home*, and 2 minutes (sd=11) in *child and plant care*. Girls spent more time in the *household chores* domain (mean=41, sd=60) than did boys (mean=13min, sd=44) (t= -5.3, df=393, p<0.001). Mean duration of time spent in each activity domain, overall and by gender, can be seen in Table 6.

Participation by Activity

The majority of adolescents reported engaging in walking or running at least once (n=265, 67%). The next most popular activity was active play outdoors, reported one or

more times by 33% of the sample (n=130). About 21% of adolescents reported biking (n=81); 15% reported cleaning indoors (61), and 12% reported doing home repairs and outdoor chores (47). Nearly 10% of adolescents reported doing laundry (9%, n=37), and all other activities were reported by less than 10% of the sample. Compared to boys, more girls reported preparing food (n=0, 0%; n=8, 2%) (p=0.007), serving food (n=1, 1%; n=13, 7%) (p=0.002), meal cleanup (n=0, 0%; n=33, 17%) (Fisher's exact p<0.001), indoor cleaning(x^2=49.52, df=393, p<0.001), and laundry (n=3, 2%; n=34, 17%) (p<0.001). Vehicle care was reported by more boys (n=7, 4%) than girls (n=1, 1%) (p=0.036). More boys than girls reported active play outdoors (n=92, 47%; n=38, 19%, respectively) (x^2=34.67, df=393, p<0.001). Similarly, more boys than girls reported biking (n=63, 32%; n=18, 9%, respectively) (x^2=32.33, df=393, p<0.001). The number of adolescents who participated in each activity one or more times is shown in Table 7.

Participation by Domain

More than three quarters of adolescents reported one or more activities in the travel domain (n=305, 77%). Over a third of adolescents reported one or more activities in the play and social activities domain (n=152, 38%) and the household chores domain (n=139, 35%). More boys reported activities in the play and social activities domain (n=99, 51%) than did girls (n=53, 27%) (x^2=23.78, df=393, p<0.001). In contrast, more girls reported activities in the household chores domain (n=36, 18%; n=103, 52%, respectively) (x^2=48.28, df=393, p<0.001). The number of adolescents who participated in one or more activities for each domain is shown in Table 8.

Home Environment

Among girls, those whose parents allowed girls to play outside (n=131) had lower mean duration of physical activity (106min, sd=94), compared to those whose parents did not allow girls to play outside (n=67)(137min, sd=116) ($t=1.98$, $p<0.05$). See Table 9. Among boys, those whose parents allowed boys to play outside (n=170) did not differ significantly in mean duration of physical activity (131min, sd=115) compared to those whose parents did not allow boys to play outside (n=22) (133min, sd=128). See Table 10.

Among girls, those living in a household with domestic help (n=48) had lower mean duration of physical activity (71min, sd=93), compared to those living in a household without domestic help (n=150) (131min, sd=102) ($t=3.61$, $p<0.001$). See Table 11. Among boys, those living in a household with domestic help (n=48), did not differ significantly in mean duration of physical activity (108min, sd=126) compared to those living in a household without domestic help (n=149) (137min, sd=111). See Table 12.

DISCUSSION

The purpose of this study was to characterize physical activity patterns of adolescent boys and girls in Bijapur, India. To determine how much physical activity this population engages in, duration and frequency of physical activity and participation in physical activity were examined. Gender differences were examined to determine if differences existed between boys and girls in physical activity levels. Types or domains of physical activity were examined to determine in which domains adolescents spent more of their time, and in which domains most adolescents participated. Lastly, two home environment factors, parent rule for outdoor play and household domestic help, were examined with regard to gender-specific differences in physical activity.

1. Summary of Findings

We found that adolescents, on average, reported 124 minutes of physical activity, which did not differ significantly between girls and boys, and completed an average of 3 physical activity bouts in a day. Over 90% of adolescents participated in at least one physical activity and over 67% participated in at least 60 minutes of physical activity. Among all physical activities, the most time was spent walking or running (mean=39min) in active play outdoors (mean=27min) and biking (mean=10min)

Regarding gender differences, boys and girls did not differ in terms of total duration of physical activity. Compared to boys, girls spent significantly more time performing the following household chores: food preparation, serving food, meal cleanup, indoor cleaning, and laundry. Moreover, more girls participated in these household chores. Compared to girls, boys spent significantly more time in active play outdoors and biking, and more boys reported these activities. No boys reported shopping for snacks/tobacco/drinks, gardening, or playing with younger child. However, this is not alarming as these activities were generally unpopular, with only 2 girls reporting shopping for snacks, 1 girl gardening, and 2 girls playing with a younger child.

The only significant difference seen in duration of physical activity by domain was that girls spent more time in the household chores domain than boys. More girls participated in the household chores domain compared to boys, who had higher participation in the active play domain.

Among girls, those whose parents allowed girls to play outside had lower mean duration of physical activity compared to those whose parents did not allow girls to play outside. Among girls, those living in a household with domestic help had lower mean

duration of physical activity compared to those living in a household without domestic help.

Highest participation was seen in the active play, travel, and household chores domains, in order of higher to lower participation. A smaller percentage took part in the shopping and errands domain, and a very small percentage participated in the work outside the home domain and the child and plant care domain.

2. Comparing Findings to Expectations and Existing Literature

Several of our findings were consistent with the existing literature. We hypothesized that that girls and boys take part in different activities and that overall girls and boys take part in similar amounts of daily physical activity. We found that girls and boys engaged in similar amounts of physical activity, which was consistent with our hypothesis as well as international and Indian literature (Swaminathan & Vaz, 2013; Hallal et al., 2012a). Also consistent with our hypothesis was the fact that girls and boys engaged in different types of activities, in terms of individual activities and in terms of activity domains. International literature supports this observation, finding that boys engage in more outdoor activities than girls (Dunton et al., 2010). Indian literature supports the finding that girls engage in less sports activity and MVPA (Swaminathan et al., 2011), much like the active play in this study. One strong finding was that none of the 197 boys reported meal cleanup, while 33 girls did. This is a clear indication of differing roles of boys and girls in the household. This may also be an effect of parental modeling, whereby girls model their behavior after their mother, who is often the primary caregiver and is responsible for the most housework in a household in India (Govt. of India, 1999).

In terms of the home environment, we assumed that a large part of girls' physical activity comes from household work, as girls in India are thought to be responsible for a large portion of the domestic work in a home (Desai, 1995). Therefore, our expectation that girls living in a household with domestic help had lower physical activity than those in a household without domestic help was supported by our findings. Additionally, this implies that a lack of household work does not translate into physical activity of another sort. Perhaps, even if girls have less of a family responsibility to stay indoors to do household work, they will not necessarily engage in more outdoor activities and active play. This association warrants further exploration.

Not all findings were consistent with the existing literature. Compared to studies on Indian populations our estimates of overall physical activity (Table 2) are higher than past estimates in the literature. Guthold et al. (2007) found that 37% of Indian girls aged 13 to 15 engaged in sufficient activity (60min of activity at least 5 days/week), while we found that 66% of girls engaged in at least 60 minutes of activity in a day. Though we cannot assume that our estimate applies to all days of the week, the difference between our estimate and that of Guthold et al. is still worth noting. Closer to our estimate were the findings of Singh et al. (2006), who found that 78% of girls participated in 60min of physical activity at least 3 days/week. Guthold et al. also found that 57% of adolescents participated in active transport, defined as walking or biking, while our findings indicate that 77% of adolescents took part in biking, walking, or running (the travel domain). This difference may be explained by the fact that adolescents in rural places have farther to travel to destinations, and also less means of motorized transport, than the average adolescent in India.

Hallal et al. (2012a) estimated that 60-70% of adolescent boys and 70-80% of adolescent girls in India do not engage in the recommended 60 minutes of MVPA daily. Though we cannot say that the physical activity measured in our study is MVPA, we found that 32% of all adolescents did not complete at least 60 minutes of physical activity. This difference in findings may be because past estimates were averaged with or came directly from urban Indian populations, which are thought to have lower levels of physical inactivity compared to rural Indian populations (Yadav & Krishnan, 2008).

Physical activity, in terms of duration and participation did not differ significantly between boys and girls. This is not consistent with existing literature, which indicates that males in engage in higher levels of physical activity both in India and globally (Swaminathan & Vaz, 2013; Hallal et al., 2012a). This may be a result of the fact that many studies have not looked at household chores as physical activity, especially in adolescent populations. Though it may be less relevant in developed countries, where physical activity consists mostly of leisure-time activities, greater attention should be paid to domestic work as a means of physical activity in developing countries (Shepard et al., 2003).

Given that outdoor play and time spent outdoors has been found to be associated with physical activity (Sallis et al., 2000), we were surprised to find that girls who were allowed to play outside had lower mean duration of physical activity compared to girls who were allowed to play outside. Considering girls exhibited low outdoor play in past research (Thakor et al., 2004), it may be that girls choose to not play outdoors, regardless of parent rules. Therefore unless they are engaging in physical activity indoors (such as

through household chores), girls engage in low levels of physical activity. Whether this choice is influenced by peers or other social influences has yet to be determined.

3. Limitations

We cannot say that the physical activities measured in our study qualify as MVPA, as physical activity intensity was not calculated or objectively measured; however, future assignment of MET values to each activity can lend support in this respect. This can be done using the Compendium of Ainsworth (Ridley, 2008), which assigns MET values for many different daily activities, including sedentary and sleep activities. Using this compendium could help quantify how much energy adolescents in this study expended in physical activities, as well as total energy expended over the course of the entire day, considering that we have data on all activities completed over a 24-hour period. However, because the compendium is highly specific, we would need to work with the Bijapur study staff in India to better characterize certain activities, such as work outside the home, in order to determine what degree of physical activity was required for those activities. Considering this compendium has been used with the IPAQ, quantifying physical activity in this way would allow for comparison with existing and future studies that have used the IPAQ.

One specific coding issue that arose during analysis was the fact that running and walking, though they may have very different intensity levels, were grouped together. Given the unstructured and intermittent patterns of youth physical activity (Corder et al., 2008), the Emory research team assumed it would be difficult for youth to recall duration of running (unless in a structured sport), as opposed to walking. Though we ideally would like to differentiate between these two activities in the future, this may be difficult and

only accomplished through use of accelerometers, or other real-time objective measures in the future.

Though we originally assumed that household chores were lower intensity activities, as can be seen in the conceptual framework, this is an assumption. It may be that housework and chores in this setting, a rural city in India, are fairly labor intensive compared to Western settings. As such, perhaps many of the household chores in our study could be considered MVPA. Considering women in rural India exhibit several times as much physical activity as women in urban settings (Yadav et al., 2008), and that women are responsible for most of the household work in Indian households (Govt of India, 2004), it is likely that household chores may have different physical requirements for rural compared to urban households. Therefore, future research should collect data on urban/rural dwelling and stratify analysis by setting. By working with the study team in Bijapur, we hope to characterize what constitutes household chores, and if differences exist by setting. Assigning MET values to activities, as previously suggested, will help us better understand the contribution of household chores to physical activity. Future analysis with this data should also examine potential differences by SES – as indicated by household income and caste. Puri et al. (2008) demonstrated that a greater percentage of lower SES adolescents participate in outdoor activities, and spend more time in these activities, compared to their upper SES counterparts. Potential SES differences, as well as how SES is related to household chores, should be examined in the future.

One limitation of this study is the cross-sectional design. Employing a longitudinal design would allow for examination of age effects and secular changes in physical activity, as Bijapur becomes increasingly urbanized and secular changes in the

household occur. It is possible that follow-up data will be collected from this population or that future studies will employ a longitudinal design. Though our sample's age range of 13 to 16 years old was fairly restrictive, literature indicates that physical activity significantly declines in adolescence, even in the span of a single year (Swaminathan et al., 2011); therefore, available age data should be used in the future to examine age effects in our sample.

Another design limitation of this study was the use of only subjective data. Though objective pedometer data were also collected, pedometer data were not available for use at the time of analysis and will be examined to compare with subjective data in the future. Considering this study used only subjective data, our results are somewhat vulnerable to recall bias. Literature shows that individuals tend to report greater physical activity than they actually engage in, often due to social desirability. However, we would argue that asking an adolescent to recall their activities in the past day—including sleep, and meals—is likely less subject to recall bias regarding physical activities than many existing physical activity questionnaires. With a time-use recall, researchers can code activities as physical activities when appropriate. Additionally, activities can be coded by intensity level; often physical activity intensity is coded as low, moderate and high. Whereas, with many physical activity questionnaires (such as the IPAQ) participants are asked what physical activities they engage in and how much time they spend in certain types (based on intensity) of physical activity (Craig et al., 2003). Not only is this latter method more subject to recall bias than our time-use survey, but it may also result in greater measurement error. Respondents may not be able to accurately recall how much physical activity they engaged in over the past week or month (as opposed to a 24-hour

period). Different respondents may have different interpretations of physical activity intensity levels. These measurement concerns are especially relevant to adolescent populations, who tend to have unstructured, short-duration and sporadic physical activity bouts. Though, accelerometers are typically more expensive than pedometers and their use less feasible with large populations, future research may benefit from using real-time accelerometers as an objective measure (to complement the subjective recall data), as these can capture relatively short periods of activity.

Another potential limitation of this study is the fact that activity recall data were collected only for a single 24-hour period. Researchers have used activity diaries in the past suggest that using activity diaries for 4 days, and collecting data on the 4th day as the most accurate method (Miller et al., 2012). From a public health perspective, weekly physical activity is more important and indicative of long-term physical activity behavior than activities from a single day. Data from this study could be used to calculate weekly physical activity values; however, the possibility of variation by day of the week must be taken into account. Though physical activities for an individual may differ for different days of the week, all adolescents were attending school and therefore had similarly structured weekdays. Also, because all data were collected on weekdays, and none collected on weekends, there is less risk of variation by day of the week. In the future, though, questions regarding weekly physical activity habits could be included in the adolescent interview to account for any variation across the week.

4. Strengths and Contributions

Though several other cross-sectional studies on adolescent physical activity in India have already been conducted, this study provides a much more comprehensive

understanding of physical activity patterns of adolescents in India, revealing activity- and domain-specific patterns and gender differences therein. The Bijapur Study is unique in that researchers not only collected several types of data from adolescents (24-hour recall data; home and school environment data; anthropometric data), but also collected data from adolescents' caregivers and opposite-sex siblings. Though data from the opposite-sex sibling interview was not used in our analysis, incorporating this data in the future will be an interesting next step and will hopefully provide additional context for observed gender differences in physical activity. This study contributes to the growing body of literature on physical activity patterns of children and adolescents in India. We were able to characterize physical activity of adolescents in rural India, in terms of overall, activity-specific, and domain-specific duration and participation. In doing so, we found that girls spent more active time indoors and doing household chores, while boys spent more time outdoors and in active play.

We were able to measure two elements of the home environment; however, the caregiver interview from which these measures were taken includes many other measures of the home environment that would be interesting to examine—in relation to physical activity—in the future. A better understanding of family influence on gender-specific physical activity behaviors can be gleaned using these measures. Family and peer support were not examined in this study, but can be examined in the future, given the data provided in the 24-hour recall; adolescents reported if and who else took part in activities with them. Another variable for future consideration is the location of physical activities. This information was also collected in the 24-hour recall and may reveal institutional and environmental influences of physical activity, as well as mechanisms by which societal

gender norms influence physical activity. Generally, there is a need for a better understanding of what physical activity really means for this population, taking into account the cultural context and rural setting.

Continued research using the Bijapur Study data will be valuable, using linear and logistic modeling to test associations observed while controlling for demographic variables, like household income, primary caregiver's education, caste, and school type. Another valuable next step will be to incorporate dietary information and anthropometric data, collected during the adolescent and the caregiver interviews, in order to better understand the pathways by which physical activity and diet influence adolescent weight status.

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FIGURES

Figure 1. Proportion of 13-15-year-old boys (A) and girls (B) not achieving 60 min per day of moderate to vigorous physical activity (Hallal (a), 2012).

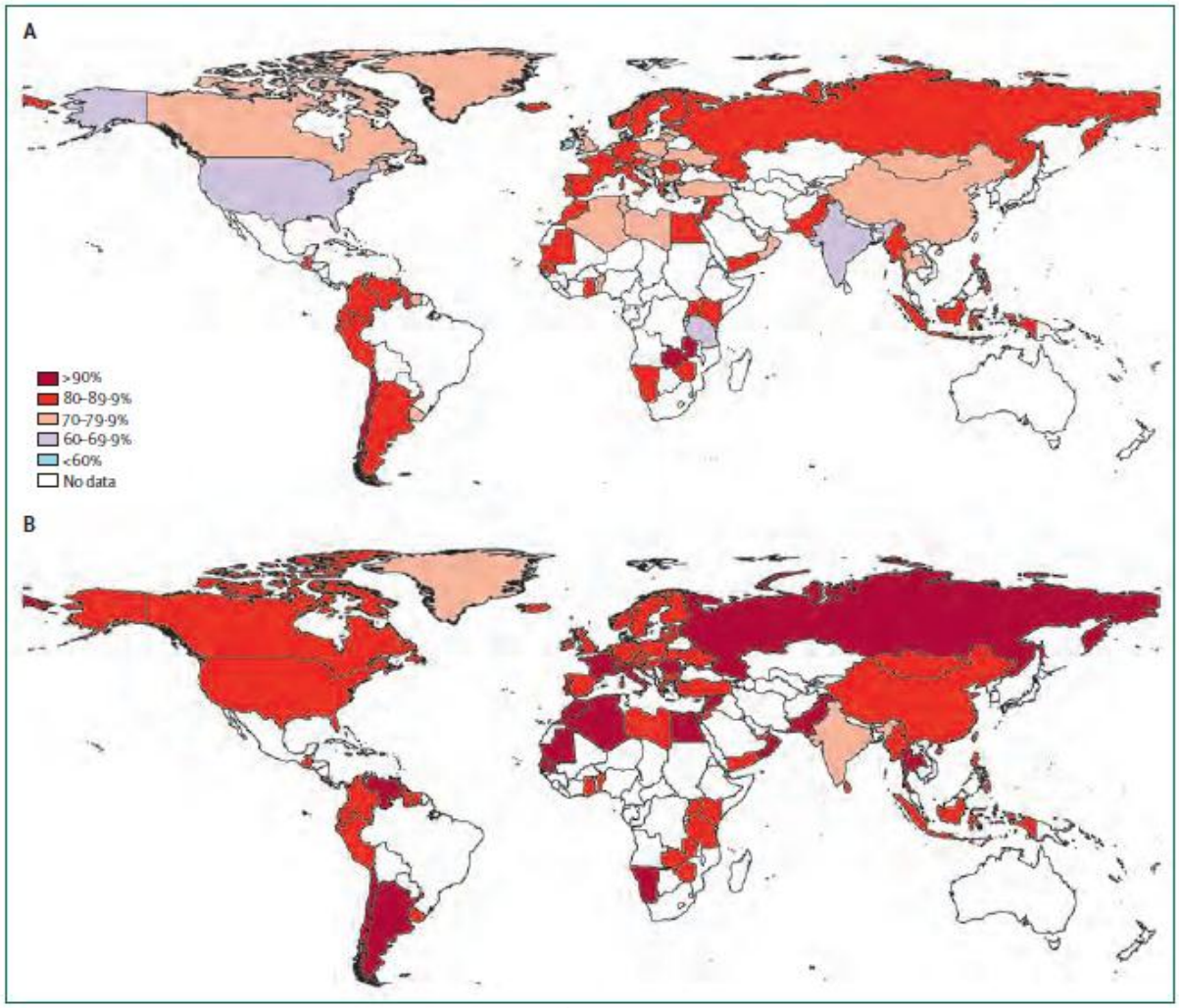

Figure 2. Conceptual Framework: How gender norms, through family influence, affect physical activity patterns of adolescent boys and girls in rural India.

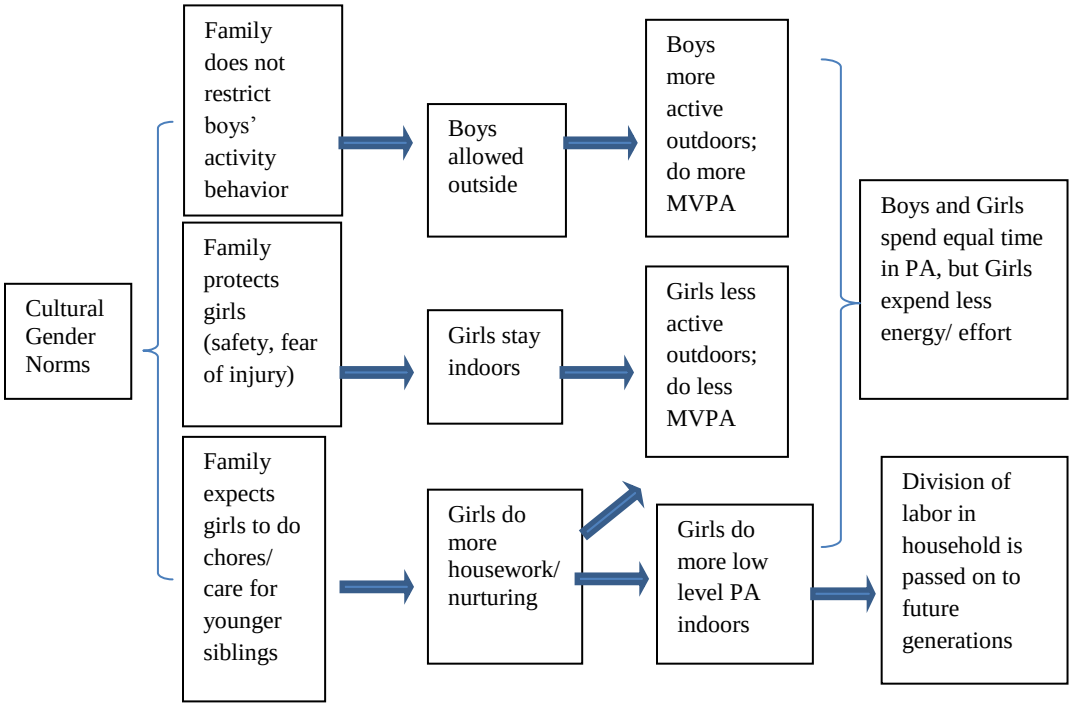

Figure 3. The 24-hour Time-Use Recall.

24-hour Time-Use Recall

We would like to know about what you do during a day. Let us talk about yesterday. Please tell me everything you did from the time you woke up in the morning to the time you went to sleep at night. I would also like to know how long each activity took, where you were when you did it, who you were with, and what else you were doing at the same time.

Here is an example of a day given by someone your age.

TIME	A	B	C	D	E	F	G
Midnight	*What did you do?*	*Time Began*	*Time Ended*	*Where were you?*	*Who was doing this with you?*	*Who else was in the same room but not doing the same thing?*	*What else were you doing at the same time?*
	1. Sleeping	12:00	7:10	At home	----------	----------	----------
	Trying to wake up	7:10	7:20	At home	----------	----------	----------
	Showering	7:20	7:35	At home	----------	----------	----------
	Getting dressed	7:35	7:40	At home	----------	----------	----------
	2. Eating breakfast	7:40	7:55	At home	Mother, sister	X	Talking, watching TV
	3. Driving to school	7:55	8:05	In car	X	X	Listening to CDs
	4. At school	8:05	2:35	At school	----------	----------	----------

TABLES

Table 1. Coding sheet for time-use surveys; all activities organized by activity domain; physical activities highlighted in gray.

Activity Domain	Code	Activity	Description	Justification for including as Physical Activity
Sleeping and passive activities	0	Going to bed or waking up	Lying in bed not yet asleep or trying to get up	
	1	Sleeping		
	2	Private	Don't want to say	
	3	Watching someone work or do tasks	Passive watching without helping	
Shopping and errands	10	Shopping for household items	Food for the home, cleaning products, household items	May involve walking and other light physical activity (our choice)
	11	Shopping for clothes or games	For self or other, selecting items, clothes measurements	May involve walking and other light physical activity (our choice)
	12	Shopping for snacks, tobacco, drinks	For self	
	13	Errands	Running errands for family member, such as taking messages, taking brother to school, shopping for items for family members, going to borrow goods from others	May involve walking and other light physical activity (our choice)
Self-care	20	Personal care	Bathing, brushing, makeup, toilet, picking clothes	
	21	Medical care	Going to the doctor, pharmacist, fixing remedy	
	22	Washing self	Bathing, showering, washing	
	23	Hobbies	Singing , drawing, playing with toys, painting, other non-sports	

Activity Domain	Code	Activity	Description	Justification for including as Physical Activity
			activities done for fun or dance lesson	
	26	Family interaction	Receiving instructions from adult or older sibling, being disciplined, being praised, discussing, planning, complaining, telling about day	
	27	Doing nothing	Doing nothing, thinking, waiting	
Eating	30	Lunch at school		
	31	Lunch at home		
	32	Lunch at restaurant, snack bar, street.		
	33	Eating breakfast at home	Including drinking tea or coffee with milk or juice	
	34	Eating breakfast away from home	Including drinking tea/coffee with milk or juice; including friend's house, school, restaurant, snack bar, street	
	35	Eating dinner at home		
	36	Eating dinner away from home	Friend's house, school, restaurant, snack bar, street	
	37	Snack at home	Food taken between meals, including drinking	
	38	Snack away from home	Eating or drinking at friend's house, school, restaurant, snack bar, street	

Activity Domain	Code	Activity	Description	Justification for including as Physical Activity
	39	Eating/ drinking while doing something else	Only for "what else were you doing"	
Household chores	40	Preparing food	Preparing meals, fixing lunch, packing school lunch ,baking	Household chores are often overlooked in PA studies (Shepard 2003). For low and middle income countries, PA mainly comes from occupational, transport and household activities (Bauman, 2012; Hallal, 2012)
	41	Serving food	Setting table, putting groceries away, serving food	Household chores are often overlooked in PA studies (Shepard, 2003). For low and middle income countries, PA mainly comes from occupational, transport and household activities (Bauman, 2012; Hallal, 2012)
	42	Meal cleanup	Cleaning table, cleaning dishes/utensils	
	43	Indoor cleaning	Picking up items, dusting, sweeping floor , mopping floor	
	44	Laundry	Washing laundry, ironing, hanging clothes to dry, sorting, folding, repairing clothes	
	45	Home repairs and Outdoor chores	Fixing broken plumbing, furnace, furniture, painting Cutting wood, removing garbage, cleaning outside of house or yard, building additions to house	
	46	Other indoor things around the house	Unspecified	
	47	Other outdoor chores	Unspecified	
	48	Vehicle care	Fixing car, bike, two-wheeler, washing vehicle	
Work outside the	50	Paid work	Activities at the job including work brought home, travel that is	These all are moderate to heavy physical labor

Activity Domain	Code	Activity	Description	Justification for including as Physical Activity
home			part of the job, overtime; "working," "at work."	according to study team in Bijapur. (our choice)
	51	Volunteer work	Doing work outside the home for free, to be helpful, promote a cause, or for religion	
School	60	Sitting in class at school		
	61	Tutoring	Receiving tuition	
	62	Homework	Studying at home or elsewhere outside of class time, doing research, reviewing homework with parent	
	63	Training	Being taught other than school (e.g. apprenticeship)	
	64	Meetings	Attended meeting or assembly in school, youth group, other	
Play and social activities (7)	70	Playing on computer or mobile	Includes games, chatting, texting, Facebook	
	71	Reading and writing	For pleasure or for school work	
	72	Party	Attending party or social event	
	72	Religious activity	Attending religious service or training, praying	
(called Active Play in our study)	73	Active play outdoors	Ball, running, skipping	This is leisure-time activity, which has been consistently seen to be a large contributor to PA for adolescents everywhere. (Dunton, 2010; Scheers 2012; Hallal, 2012a)
	74	Active play indoors	Running, skipping, climbing	This is leisure-time activity, which has been consistently seen to be a large contributor to PA for adolescents

Activity Domain	Code	Activity	Description	Justification for including as Physical Activity
				everywhere. (Dunton, 2010; Scheers 2012; Hallal, 2012)
	75	Non-active game	Chess, Carrom ,card games, guessing games	
	76	Socializing	chatting with friends gossiping, discussing	
	77	Watching games	Watching others play or an organized game, or parade, fair, not on TV	
	78	Watching TV	Watching TV or movies	
	79	Visiting	Paying a visit or receiving a visit from a friend or relative	
Travel (8)	80	Travel to and from school or job	Traveling by car or other non-active mode	
	81	Sitting or standing while traveling	Waiting for bus, sitting in car or on bus	
	82	Biking	To a destination or for fun, not on a two-wheeler	For low and middle income countries, PA mainly comes from occupational, transport and household activities (Bauman, 2012; Hallal, 2012)
	83	Walking or running	To a destination or for fun	For low and middle income countries, PA mainly comes from occupational, transport and household activities (Bauman, 2012; Hallal, 2012)
Child, adult, pet, and plant care	90	Gardening	Caring for flowers or vegetables, weeding, working with plants	Similar to household chores, may account for significant daily EE, especially for females
(called Child and Plant care in our	91	Animal care	Taking care of animal that is a pet or used for work or food - walking, cleaning, feeding,	No one reported doing this

Activity Domain	Code	Activity	Description	Justification for including as Physical Activity
study)			bathing pet	
	92	Playing with younger child	Indoor or outdoor	Similar to household chores, may account for significant daily EE, especially for females
	93	Helping child learn	Teaching child how to do things or helping with homework	Perhaps should be considered if activities above are being included?
	94	Helping with child sleeping, care	Putting child to sleep, getting them dressed or undressed, bathing them	Perhaps should be considered if activities above are being included?
	95	Adult care	Providing care for someone who is not a child, such as a sick father or an elderly grandmother	Perhaps should be considered if activities above are being included?
	999	**Undefined activities**	Any activity that cannot be classified above	

Table 2. Physical Activities listed by Domain

Domain	**Physical Activity**
Shopping and errands	Shopping for household items Shopping for clothes or games Shopping for snacks, tobacco, drinks Errands
Household chores	Preparing food Serving food Meal cleanup Indoor cleaning Laundry Home repairs and outdoor chores Other indoor things around the house Other outdoor chores Vehicle care
Paid work	Work outside the home
Active play	Active play outdoors Active play indoors
Travel	Biking Walking or running
Child and Plant care	Gardening Playing with younger child

Table 3. Demographic characteristics for adolescents aged 13-16, from public and private schools in Bijapur city, India do not differ between boys and girls (n=395).

Characteristics	Overall %	Male %	Female %	chi2
Total	100	49.87	50.13	
School Type				0.00
Public	49.87	49.75	50.00	
Private	50.13	50.25	50.00	
Caste				4.42
General	25.06	22.34	27.78	
Other Backward Classes	54.68	59.9	49.49	
Scheduled Caste	18.73	16.24	21.21	
Scheduled Tribe	1.52	1.52	1.52	
Primary Caregiver's Education				7.45
Not Educated	17.72	19.29	16.16	
Primary	13.92	16.75	11.11	
Secondary	18.23	17.77	18.69	
Pre University Course	10.63	12.18	9.09	
Degree	33.67	29.95	37.37	
Professional	5.82	4.06	7.58	
Monthly household income, in INR, (USD) (n=390)				5.01
<5,000 ($93)	13.92	17.44	10.77	
5,000-10,000 ($93-$186)	31.39	31.79	31.79	
10,000- 20,000 ($186-$372)	24.3	24.62	24.62	
20,000-30,000 ($372-$558)	16.46	13.85	19.49	
>30,000 ($558)	12.66	12.31	13.33	

INR = Indian Rupee; USD = US Dollar
*p<0.05,** p<0.01, ***p<0.001

Table 4. Duration, Frequency, Participation and Met 60min of Physical Activity.

	Total (n=395)				Male (n=197)				Female (n=198)					
Measure of PA	mean or %	SD or N	min	max	mean or %	SD or N	min	max	mean or %	SD or N	min	max	t-value or chi2	p-value
Duration (min/day)	123.6	109.3	0	690	130.6	115.3	0	690	116.7	102.8	0	480	1.27	0.206
Frequency (bouts/day)	3.2	2.3	0	16	3.2	2.09	0	10	3.2	2.4	0	16	-0.24	0.810
Reported ≥1 PA (%)	91.90	363			92.39	182			91.41	181			0.13	0.723
Met 60min PA (%)	67.85	268			69.54	137			66.16	131			0.52	0.472

PA = physical activity

*p<0.05,** p<0.01, ***p<0.001

Table 5. Duration of physical activity (min/day) for school-going adolescents (aged 13-16) in Bijapur, India, by activity.

	Total (n=395)		Male (n=197)		Female (n=198)			
Activity	mean	SD	mean	SD	mean	SD	t-value	p-value
Shopping for household items	4.94	24.48	6.12	31.42	3.76	14.61	0.96	0.340
Shopping for clothes or games	0.19	3.11	0.08	1.07	0.30	4.26	-0.72	0.469
Shopping for snacks, tobacco, drinks	0.16	3.03	0.00	0.00	0.33	4.28	-1.08	0.282
Errands	4.48	22.97	5.51	28.50	3.46	15.65	0.89	0.375
Preparing food	2.71	14.03	0.23	2.39	5.18	19.38	-3.56***	<0.001
Serving food	1.54	11.41	0.20	2.85	2.88	15.76	-2.34*	0.020
Meal cleanup	3.62	14.98	0.00	0.00	7.22	20.55	-4.93***	<0.001
Indoor cleaning	5.41	16.62	1.29	11.26	9.49	19.82	-5.05***	<0.001
Laundry	5.06	19.77	0.33	2.73	9.77	27.01	-4.88***	<0.001
Home repairs and outdoor chores	7.07	31.05	9.11	41.37	5.03	14.75	1.31	0.192
Other indoor things around the house	0.71	4.55	0.89	5.19	0.53	3.82	0.78	0.435
Other outdoor chores	0.72	6.28	0.30	4.27	1.14	7.76	-1.32	0.188
Vehicle care	0.51	4.58	0.94	6.37	0.08	1.07	1.88	0.061
Paid work	4.44	35.60	6.55	43.18	2.35	25.92	1.17	0.242
Active play outdoors	27.34	51.07	41.50	59.49	13.26	35.99	5.71***	<0.001
Active play indoors	5.00	22.26	4.54	23.91	5.46	20.53	-0.41	0.683
Biking	10.49	25.36	17.31	32.15	3.71	12.85	5.52***	<0.001
Walking or running	38.98	60.11	35.68	54.63	42.26	65.08	-0.09	0.277
Gardening	0.05	1.01	0.00	0.00	0.10	1.42	-1.00	0.319
Playing with younger child	0.18	3.52	0.00	0.00	0.35	4.97	-1.00	0.319

*p<0.05,** p<0.01, ***p<0.001

Table 6. Duration of physical activity (min/day) for school-going adolescents (aged 13-16) in Bijapur, India, by activity domain.

	Total (n=395)		Male (n=197)		Female (n=198)			
Domain	mean	SD	mean	SD	mean	SD	t-value	p-value
Shopping and errands	9.9	34.54	11.7	43.65	8.1	21.99	1.04	0.298
Household chores	27.3	54.35	13.3	44.48	41.3	59.54	-5.30	<0.001
Work outside the home	4.4	35.60	6.6	43.18	2.4	25.92	1.17	0.242
Active play	176.4	134.97	181.1	134.30	171.7	135.82	0.69	0.490
Travel	92.1	84.81	96.4	88.90	87.8	80.54	1.00	0.318
Child and plant care	1.8	10.85	0.9	7.96	2.7	13.07	-1.69	0.092

*p<0.05,** p<0.01, ***p<0.001

Table 7. Participation of school-going adolescents (aged 13-16), in Bijapur, India, in each physical activity.

Activity	Total (n=395) %	Male (n=197) %	Female (n=198) %	Chi2	p-value
Shopping for household items	8.86	9.14	8.59	0.04	0.847
Shopping for clothes or games	0.51	0.51	0.51	0.00	1.000
Shopping for snacks, tobacco, drinks	0.51	0.00	1.01	2.00	0.157
Errands	8.35	7.61	9.09	0.28	0.596
Preparing food	5.82	1.02	10.61	16.56	<0.001
Serving food	3.54	0.51	6.57	10.60	0.002
Meal cleanup	8.35	0.00	16.67	38.83	<0.001
Indoor cleaning	15.44	3.05	27.78	46.26	<0.001
Laundry	9.37	1.52	17.17	28.48	<0.001
Home repairs and outdoor chores	11.90	10.15	13.64	1.14	0.285
Other indoor things around the house	2.53	3.05	2.02	0.42	0.543
Other outdoor chores	1.77	0.51	3.03	3.61	0.122
Vehicle care	2.03	3.55	0.51	4.62	0.037
Paid work	2.28	3.55	1.01	2.87	0.105
Active play outdoors	32.91	46.94	19.70	31.40	<0.001
Active play indoors	8.10	5.58	10.61	3.35	0.067
Biking	20.51	31.47	9.60	28.99	<0.001
Walking or running	67.09	54.97	69.19	0.80	0.372
Gardening	0.25	0.00	0.51	1.00	1.000
Playing with younger child	0.51	0.00	1.01	2.00	0.499

*p<0.05,** p<0.01, ***p<0.001

Table 8. Participation of school-going adolescents (aged 13-16) in Bijpaur, India, in each activity domain.

	Total (n=395)		Male (n=197)		Female (n=198)			
Domain	N	%	N	%	N	%	Chi2	p-value
Shopping and errands	67	16.96	32	16.24	35	17.68	0.14	0.704
Household chores	139	35.19	38	19.29	101	51.01	43.57***	<0.001
Work outside the home	9	2.28	7	3.55	2	1.01	2.87	0.105
Active play	152	38.48	98	49.75	54	27.27	21.07***	<0.001
Travel	305	77.22	156	79.19	149	75.25	0.87	0.351
Child and plant care	3	0.76	0	0.00	3	1.52	3.01	0.248

*p<0.05,** p<0.01, ***p<0.001

Table 9. Girls' physical activity duration affected by parents rule on outdoor play

	Yes (n=67)		No (n=131)			
	mean PA duration	sd	mean PA duration	sd	t-value	p-value
Parents allow regular play outside school hours for girls (n=198)	106.4	93.8	136.8	116.6	1.98*	0.049

PA= Physical Activity

*p<0.05,** p<0.01, ***p<0.001

Table 10. Boys' physical activity duration not affected by parents rule on outdoor play

	Yes (n=170)		No (n=22)			
	mean PA duration	sd	mean PA duration	sd	t-value	p-value
Parents allow regular play outside school hours for boys (n=198)	131.4	115.0	133.2	127.9	0.07	0.946

PA= Physical Activity

*p<0.05,** p<0.01, ***p<0.001

Table 11. Girls' physical activity duration affected by household having domestic help

	Yes (n=48)		No (n=150)			
	mean PA duration	sd	mean PA duration	sd	t-value	p-value
Household has domestic help (n=192)	71.4	93.1	131.2	101.8	3.61***	<0.001

PA= Physical Activity

*p<0.05,** p<0.01, ***p<0.001

Table 12. Boys' physical activity duration not affected by household having domestic help

	Yes (n=48)		No (n=149)			
	mean PA duration	sd	mean PA duration	sd	t-value	p-value
Household has domestic help (n=197)	108.4	126.3	137.7	111.1	1.54	0.126

PA= Physical Activity

*p<0.05,** p<0.01, ***p<0.001