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Pediatrician prescriptions for outdoor physical activity among children: A pilot study

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ABSTRACT

Research indicates that promoting time spent in the outdoors and outdoor physical activity increases children's daily physical activity and improves health. One method showing promise is doctor prescriptions for outdoor physical activity for children; however, no empirical evidence currently exists on prescriptions for children's outdoor physical activity. A pilot study was conducted at one pediatric practice in western North Carolina during 2015 to test the feasibility and potential effectiveness of conducting an outdoor physical activity prescription program for children aged 5–13 years. Three pediatricians wrote prescriptions for children ($n = 38$), discussed benefits of outdoor physical activity, and provided information packets to parents on nearby places for physical activity. Parents of patients of five pediatricians served as control ($n = 32$). Prior to seeing a pediatrician, parents completed a baseline survey that asked height and weight, assessed their views of children's physical activity, and their personal and child's physical activity/sedentary behaviors. A nurse measured children's height and weight. Parents were emailed one-month and three-month follow-up surveys that asked the questions listed above. Changes in children's physical activity, outdoor physical activity, time spent in the outdoors, and sedentary activities were not significant between intervention and control groups. About half of parents (49%) viewed prescriptions as beneficial for their children and most used the intervention materials at home (70%). A larger study is needed to assess whether prescriptions increase children's physical activity. A critical examination of the intervention, pilot study design, and suggestions for a larger future study are provided.

1. Introduction

Children's time spent in the outdoors has been linked with positive health outcomes such as reduced childhood stress, symptoms of attention deficit disorder, depression, anxiety disorder, myopia, asthma, and increased feelings of wellbeing (Coon et al., 2011; Kuo and Taylor, 2004; Lovasi et al., 2008; Maas et al., 2009; Rose et al., 2008; Taylor et al., 2001; Wells and Evans, 2003). The average child, however, spends only four to seven minutes in the outdoors each day (Hofferth and Sandberg, 2001; Juster et al., 2004). Additionally, high prevalence rates of overweight among U.S. children are related to decreased physical activity (PA) levels and increased sedentary behavior, which have been shown to be associated with decreased time spent outdoors (Cleland et al., 2008; Dyment and Bell, 2008). Given the strength of the evidence on the separate health benefits of PA and time spent in the outdoors and the relationship between time spent in the outdoors with participation in more vigorous PA among children, the promotion of outdoor PA is warranted.

The American Academy of Pediatrics has taken a strong stance in defense of PA through recommendations for pediatricians to promote unstructured activity for children and to help parents identify opportunities in nearby parks and open spaces (Daniels and Hassink, 2015; Ginsburg and Committee on Communications and the Committee on Psychosocial Aspects of Child and Family Health, 2007). Physician prescriptions for PA have become more widespread in recent years, fueled by several national initiatives. Examples include the "Exercise is Medicine" campaign which focuses on PA as a vital sign for health (Lobelo et al., 2014; Sallis et al., 2016) and the National ParkRx Initiative (The National ParkRx Initiative, 2016) which emphasizes the use of parks and other public lands to improve the overall health and wellness of a community. In addition, the National Physical Activity Plan, most recently launched in April 2016 lists four specific strategies that focus on health care providers and their ability to promote and discuss PA with their patients (The National Physical Activity Plan Alliance, n.d.). Clearly, pediatricians can act as the agent of awareness to promote outdoor PA and discuss the health benefits. Pediatricians, however, often do not receive adequate training and education on the specific benefits of PA and the best methods for communicating these to patients and parents (McCurdy et al., 2010). Programs that use prescriptions have found that providing additional resources to pediatricians such as brochures

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and websites that map locations of outdoor places for children to be active are useful in facilitating the communication between doctors, patients, and their parents (National Recreation and Park Association, 2014). Most research conducted on PA prescription programs has focused on adults (Galaviz et al., 2012), program distribution (Petrella et al., 2007), program evaluation (Aittasalo et al., 2006), and prescription program acceptance by general practitioners (Rowland et al., 2007). Of the limited studies that have been done with children, few have had control groups while others had little success increasing PA in unmotivated patients (Ortega-Sanchez et al., 2004; Patrick et al., 2001; Rowland et al., 2007; Saelens et al., 2002). Nonetheless, there is little empirical evidence supporting the use of prescriptions for children and youth (Rowland et al., 2007) specifically targeting outdoor PA.

The purpose of this pilot study was to assess the potential effectiveness and feasibility of conducting an intervention involving health care providers talking to their patients and parents about the importance of outdoor PA and prescribing outdoor activity for children. The project focused on a rural area that provides many local outdoor opportunities, but the need for awareness of the importance of outdoor activity and places for activity still exist (Parks et al., 2003). The study hypotheses were that an increase in children's daily PA levels and time spent outdoors and a decrease in time spent in sedentary activity would be seen among those who received the intervention while no changes would occur among children in the control group.

2. Method

This pilot study with longitudinal data collection, was conducted from August to December 2015 at the sole pediatric medical office that serves one rural county in the Appalachian Mountains of western North Carolina. The study outcome variables were children's PA and outdoor PA, sedentary behaviors, and child's time spent outdoors. The university's institutional review board approved all study procedures.

2.1. Participants

Parents with children 5–13 years of age living in the county served by the pediatric office were eligible to participate in the study. Upon check in for a well-child visit parents were given a survey packet that included the informed consent, description of the study, instructions, and a baseline survey. Parents were not asked to participate if a reason for their child seeing the pediatrician was due to the child being sick or injured. One parent completed the healthcare provider baseline survey in the office waiting room prior to seeing their child's pediatrician. Seventy-one parent-child dyads were recruited for the study ($n_{\text{intervention}} = 38$; $n_{\text{control}} = 33$). Loss to follow-up resulted in a final sample size of 70 ($n_{\text{intervention}} = 38$; $n_{\text{control}} = 32$).

2.2. Intervention

Three pediatricians delivered the intervention during regular annual well-child visits. Patients and their parents that were scheduled to see one of these three pediatricians received the intervention while patients and parents that were scheduled to see any of the other five pediatricians did not receive the intervention. The intervention took from 4 to 6 min to deliver.

The prescription program consisted of pediatricians talking to patients and their parents about the importance of getting 60 min or more of PA per day in the form of outdoor PA and provided information about places in the local community to go for outdoor activities. Pediatricians wrote the children prescriptions to get 60 min or more of outdoor PA per day and parents were provided information resources. The information resources consisted of: a folded outdoor topographical map showing the locations of places with opportunities for outdoor PA within the region; a brochure with information concerning the importance of outdoor PA and strategies that parents can use to make sure their children are getting 60 min or more of outdoor activity per day; a leaflet with free mobile phone applications that patients and parents can download that provide additional resources; a laminated one-page information sheet that depicted the benefits of outdoor activity for children; and several leaflets provided by the regional Kids in Parks TRACK Trails program (a national system of family-friendly trails that include self-guided brochures and signs that enhance the outdoor experience).

2.3. Data collection

To evaluate the effectiveness of the intervention, three surveys were completed by parents: 1) at baseline in the pediatrician office waiting room; 2) at one month after the pediatrician visit; and 3) at three months after the pediatrician visit. The baseline survey assessed demographic variables of parent and child including sex, age, race/ethnicity, parent level of education, total household income, parent marital status, and parent self-reported height and weight. At baseline, a nurse recorded the child's height and weight after being measured as part of the pediatrician office visit.

The surveys consisted of items taken from previously validated instruments. Child's PA was assessed using the standard Youth Risk Behavior Surveillance System (YRBSS) item adapted for parent report asking for the number of days during the past week that the child was physically active for a total of at least 60 min per day. Outdoor specific PA was assessed with a similar question that asked for the number of days during the past week that the child was physically active outside for a total of at least 60 min per day. The Godin Leisure-Time Exercise Questionnaire (LTEQ) was used to assess frequency of PA participation using a 5-point scale anchored by 1 (*Never*) and 5 (*Always*) with higher scores indicating greater frequency (Godin and Shephard, 1997). A similar item measured frequency of outdoor PA. The LTEQ has been shown to be valid for use with children (Sallis et al., 1993a).

Sedentary behavior was assessed through two questions asking for the amount of time during an average weekday and weekend day that the child spends in sedentary activities such as sitting while listening to music, watching TV, playing video games, using a computer or tablet/iPad, doing homework, reading, etc. These questions were asked on a 7-point scale from “none” to “5 or more hours per day.”

Time spent outdoors was assessed by asking how often the child spends time outdoors such as outside in the backyard, neighborhood, etc. The item was asked on a 5-point scale from “never” to “always.”

To evaluate the feasibility of conducting the intervention, the 1-month and 3-month follow up online surveys asked parents in the intervention group additional questions related to use (specific type and frequency) of the intervention materials. These surveys also asked whether the parent viewed the prescriptions as beneficial to their child's PA levels.

2.4. Data analyses

All statistical analyses were conducted using IBM SPSS Statistics, version 24 (IBM Corp., Armonk, N.Y., USA). To test whether children's daily PA levels, outdoor PA, and time spent in the outdoors increased and time spent in sedentary activity decreased from baseline to 3-month follow up in those who received the prescription program compared to the control, generalized estimating equations (GEE) were conducted. The GEE analyses modeled the variability within physicians and examined the simple effects for differences across the three time periods (baseline, 1-month, and 3-month) and group (prescription program compared and control) and the interaction between the two. The alpha level was set at $p < 0.05$.

3. Results

Table 1 provides the demographic characteristics of the intervention and control groups. Parents were highly educated with 97.4% (intervention) and 81.3% (control) having at least attended some college. Household income was relatively high with 57.8% (intervention) and 56.3% (control) making over $55,000 annually. The mean ages of parents (and their children) in the intervention and control groups were 38.4(8.8) and 41.5(9.2) years, respectively. Children were mostly of normal weight with only 21.1% (intervention) and 21.9% (control) overweight or obese. *t*-tests showed no significant differences in child's sex, age, race/ethnicity, BMI percentile, highest level of education of adults in household, and total household income between the intervention and control groups. The means and standard deviations for the dependent variables are provided in Table 2. Contrary to expectations, the means for all of the PA variables including outdoor specific PA decreased from baseline to the 3-month follow up in both the intervention and control groups. Time spent outdoors also decreased in both groups from baseline to the 3-month follow up. Time spent in sedentary activity on weekdays decreased in both groups while time spent in sedentary activity on weekend days stayed the same in the intervention group and increased in the control group.

The results of the GEE analyses are provided in Table 3. The GEE analyses indicated that from baseline to 3-month follow up the changes in number of days per week that children were physically active for at least 60 min, days per week that children were physically active outdoors for at least 60 min, frequency of PA, frequency of outdoor PA, and time spent in the outdoors were not statistically significant between the intervention and control groups. For time spent in sedentary activity, there was no statistical significance between the intervention and control groups for weekdays and weekend days.

According to the questions asking about parent and family use of intervention materials over the past 30 days, the percent of parents that reported at the one-month and three-month follow ups that their families either “sometimes” or “very often” used the: information brochure and leaflet was 35.5% and 29.0%; TRACK Trails leaflets was 38.7% and 29.0%; regional outdoor recreation map was 45.2% and 51.6%; laminated one-page information sheet was 35.5% and 19.3%, respectively. Overall, 70.1% of parents reported using at least one of the intervention materials in some form. Parents reported their use of these materials in a variety of ways including putting the brochure and leaflets in a place at home where the family would see it regularly as a reminder, downloading the recommended free mobile applications, hiking a TRACK Trail listed on the leaflets, and using the map to locate a place for outdoor PA. Forty-four percent of parents reported that they believe that receiving a prescription encouraged their child to participate in outdoor activity.

Table 1
Demographic characteristics of parents and children.

Variable	Intervention (%)	Control (%)
Parent		
Race/ethnicity		
White	36 (94.7)	30 (93.8)
Hispanic or Latino	1 (2.6)	0 (0.0)
Other[a]	1 (2.6)	2 (6.2)
Body mass index		
Normal or healthy weight (18.5–24.9)	11 (28.9)	17 (53.1)
Overweight (25–29.9)	18 (47.4)	8 (25.0)
Obese (≥30)	9 (23.7)	7 (21.9)
Highest level of education of all adults in household		
High school grad or GED	1 (2.6)	6 (18.8)
Some college	6 (15.8)	4 (12.4)
College grad	19 (50.0)	14 (43.8)
Graduate/professional school	12 (31.6)	8 (25.0)
Total household annual income		
Under $15,000	2 (5.3)	3 (9.4)
$15,000–$34,999	6 (15.8)	3 (9.4)
$35,000–$54,999	8 (21.1)	5 (15.6)
Over $55,000	22 (57.8)	18 (56.3)
Marital status		
Single/never married	4 (10.5)	1 (3.1)
Married	25 (65.8)	28 (87.5)
Not married, living with someone in a marriage-like relationship	3 (7.9)	1 (3.1)
Separated	2 (5.3)	0 (0.0)
Divorced	4 (10.5)	2 (6.3)
Child		
Sex		
Female	20 (52.6)	11 (34.4)
Male	18 (47.4)	21 (65.6)
Race/ethnicity		
White	36 (94.7)	29 (90.6)
Hispanic or Latino	1 (2.6)	2 (6.3)
Other[a]	1 (2.6)	1 (3.1)
Body mass index		
Underweight (<5th percentile)	2 (5.3)	4 (12.5)
Normal or healthy weight (5th to <85th percentile)	28 (73.7)	21 (65.6)
Overweight (85th to <95th percentile)	6 (15.8)	4 (12.5)
Obese (≥95th percentile)	2 (5.3)	3 (9.4)

[a] Category does not include Black/African American.

4. Discussion

In this pilot study, an outdoor PA prescription program was examined to identify any potential effects on children's PA, time spent outdoors, and sedentary behaviors as well as the feasibility of conducting a larger study of the prescription program. The pilot study did not support the authors' hypotheses that the children who received the prescription program would show increased PA and time spent outdoors and decreased time spent in sedentary activity. These findings are consistent with other studies on physician prescriptions for children's PA and exercise (Ortega-Sanchez et al., 2004; Patrick et al., 2001; Rowland et al., 2007; Saelens et al., 2002).

Prescribing patients PA is gaining acceptance among health care providers, however, feasibility studies as well as determining objectively measured PA levels are lacking (Rowland et al., 2007). Given that this pilot study is the first to empirically evaluate this type of intervention (prescribing outdoor PA for children), it is important to discuss the factors that affect feasibility of conducting the prescription program and evaluating the outcomes to inform future research. Future research should account for the effect of seasonality or the natural changes in children's PA levels and time spent outside during the year (Beighle et al., 2008). Recruitment and baseline data collection for this pilot study occurred during August with the one-month follow up occurring in September–October and the three-month follow up in November–December. Given these time frames, it is plausible that children's PA and time outside decreases from August to December due to seasonal weather and temperature changes in the study's mountainous region. This would also explain the observed increase from baseline to one-month follow up and subsequent decrease from one-month to three-month follow up in days per week that children in the intervention group were physically active for at least 60 min and frequency of participation in PA.

A second aspect that future research should account for is the school year and when children are regularly in school. The current pilot study began during the summer when children were not in school and ended during the school year. The timing of the study was due to logistical concerns regarding the large number of well-child checkups that occur in August compared to once school is in session. Children's PA and time outside likely change from “summer vacation” to the regular academic year, though as a recent literature review by Baranowski et al. (2014) indicates, the research is conflicting. Nevertheless, these changes in children's PA can likely affect the findings of studies and negate any possible influence of a prescription program.

Table 2
Means and standard deviations for outcome variables at baseline, 1-month, and 3-month follow-ups.

Variable	Baseline (SD)	1-month (SD)	3-months (SD)
Days in the past week that child was physically active for at least 60 min			
Intervention	6.45 (1.67)	6.46 (1.04)	5.45 (1.73)
Control	6.72 (1.67)	6.11 (1.79)	5.86 (1.86)
Days in the past week that child was physically active outdoors for at least 60 min			
Intervention	6.45 (1.62)	5.86 (1.58)	3.71 (1.60)
Control	6.75 (1.81)	5.53 (1.80)	4.14 (1.89)
Frequency of physical activity[a]			
Intervention	3.68 (0.74)	3.71 (0.66)	3.57 (0.63)
Control	3.56 (0.72)	3.39 (0.85)	3.45 (0.74)
Frequency of outdoor physical activity[a]			
Intervention	3.63 (0.71)	3.61 (0.63)	3.29 (0.74)
Control	3.65 (0.76)	3.26 (0.87)	3.36 (0.73)
Time spent outdoors[a]			
Intervention	3.95 (0.70)	3.89 (0.74)	3.55 (0.81)
Control	4.16 (0.77)	3.84 (0.50)	3.68 (0.72)
Time spent in sedentary activity on weekdays[b]			
Intervention	3.41 (1.09)	3.21 (1.03)	3.29 (1.10)
Control	3.56 (0.98)	3.79 (0.86)	3.55 (1.10)
Time spent in sedentary activity on weekend days[b]			
Intervention	3.94 (1.45)	3.61 (1.32)	3.94 (1.50)
Control	3.97 (1.03)	4.05 (1.31)	4.00 (1.16)

Note: The analytic sample in the intervention group contained 38 at baseline, 28 at 1-month, and 31 at 3-months and the control group contained 32 at baseline, 19 at 1-month, and 22 at 3-months.
[a] 5-point scale from 1 (*Never*) to 5 (*Always*).
[b] 7-point scale from 1 (*None*) to 7 (*5 or more hours per day*).

Future research should also be conducted with larger sample sizes and potentially with parents of children that are not physically active. The current pilot study had a "ceiling effect" that occurred with the variables of days per week that children were physically active and physically active outdoors for at least 60 min (Zhu and Chodzko-Zajko, 2006). The means for these variables for the intervention and control groups at baseline were 6.45/6.45 and 6.72/6.75, respectively. This indicates that at baseline parents reported their children were getting at least 60 min of PA per day on six to seven days per week. Given this, it is reasonable to assume that the prescription program could not have made any significant impact on children's activity as they were currently physically active. Children in the study were also of relatively healthy weight status with about 70% categorized as normal weight for their age and 14.3% and 7.1% categorized as overweight and obese, respectively. According to the regional health district, the rate of overweight and obesity among children are 15.9% and 15.6%, respectively (Appalachian District Health Department, 2013). The sample of this pilot study, therefore, was not representative of all children living in the study area.

The purpose of the current pilot study was to evaluate the feasibility of conducting a program with prescriptions for outdoor PA and to investigate whether such a program may increase children's activity levels regardless of current activity level. It is possible, however, that prescriptions for outdoor PA may be warranted and more effective in those children with low levels of PA. Targeting these children may also prove to be the best use of the health care provider's time with patients.

Another aspect that future research should account for concerns the characteristics of the study sample. Parents in the study sample were highly educated with 100% of parents having completed at least high school or GED, 90% of parents having attended at least some college, and 75.7% having completed college or Graduate/professional School. Given the level of education, it is not surprising that the annual household incomes of the study population were also high with about 75.7% of household incomes above $35,000 and about 57.1% above $55,000. Studies have found that the education of the parents and socioeconomic status (SES) are related to children's PA with children from homes with higher levels of education and SES being more physically active than children from homes with lower levels of education and SES (Ferreira et al., 2007; Hinkley et al., 2008; Sallis et al., 1993b). These demographic characteristics of the study sample could explain the high levels of children's PA reported by parents. According to the U.S. Census Bureau, the county that this study was conducted in has a poverty rate higher than the state of North Carolina and a median household income about $10,000 lower than the state (U.S. Census Bureau, 2014). The sample of this pilot study, therefore, was not representative of households in the study area. Future research should be conducted with larger samples to ensure representativeness.

The data collected from parents about the prescription program are important to inform future research in this area. Parents in the intervention group felt that the prescription had a positive impact on their child's PA. In addition, parents used the materials provided to them. Of the intervention materials, the outdoor recreation map was used the

Table 3
Results from the generalized estimating equations.

Variable	Simple effect: time	Simple effect: group	Interaction: time × group
Days in the past week that child was physically active for at least 60 min	19.51 (<0.01)	0.05 (0.82)	3.97 (0.14)
Days in the past week that child was physically active outdoors for at least 60 min	122.82 (<0.01)	0.07 (0.79)	2.46 (0.29)
Frequency of physical activity	0.46 (0.79)	2.10 (0.15)	1.28 (0.53)
Frequency of outdoor physical activity	9.66 (0.01)	0.11 (0.74)	2.34 (0.31)
Time spent outdoors	31.40 (<0.01)	0.55 (0.46)	2.99 (0.32)
Time spent in sedentary activity on weekdays	0.12 (0.94)	1.90 (0.17)	1.80 (0.41)
Time spent in sedentary activity on weekend days	1.78 (0.41)	0.05 (0.82)	0.80 (0.67)

Note: Numbers presented in the table are Wald Chi-Square tests of model effect with *p*-values in parentheses. df = 2 for the time simple effect, df = 1 for the group simple effect, df = 2 for the interaction. The analytic sample in the intervention group contained 38 at baseline, 28 at 1-month, and 31 at 3-months and the control group contained 32 at baseline, 19 at 1-month, and 22 at 3-months.

most and the only material that saw an increased use at the three-month follow up. This may indicate that parents should be provided resources to locate places for their children to be active outdoors in their local communities. The DC Park Rx program, a program where physicians write prescriptions for parks in Washington, DC, has established an online database where residents can find local places for activity along with information on each location such as safety, activities available, transportation, parking, restrooms, etc. (DC Park Rx, 2016). The authors, however, are unaware of any available data on the use of this database.

A key strength of this pilot study is the multiple follow-ups assessing children's PA as an outcome. The study also investigated a nascent intervention strategy for promoting children's outdoor PA to provide the first empirical data. Some limitations, however, need mention. First, given this was a pilot study, the small sample size likely impacted the findings in a variety of ways as mentioned previously. Secondly, children's PA and outdoor PA was collected through parent report. While parent report of children's PA is a common method of data collection and instruments have been validated, sources of measurement error are introduced (Adams et al., 2005; Sallis and Saelens, 2000). Parents may be more likely to over report their child's PA since they may feel that their parenting skills are being questioned. Future research should use more objective measures of children's PA. Further research is also needed on the potential mediating variables and outcomes of PA prescription programs. For instance, barriers to children's outdoor PA that have been well researched, such as parental perceptions of neighborhood safety (Carver et al., 2008; Weir et al., 2006), should be assessed by future research on prescription programs. Finally, while the rate of attrition was low with about 32% of parents not completing all follow up (no significant differences in characteristics were found between parents completing follow up and parents lost to follow up), future research should aim for higher response rates at follow up.

In conclusion, while this pilot study of an outdoor prescription program did not have an effect on children's PA, time spent outside, and sedentary behavior, further research is needed to understand the potential benefit and methods of delivering pediatrician prescriptions for children's outdoor PA. With complex lifestyle behaviors such as PA, research has shown that individuals are influenced at multiple levels (Mehtala et al., 2014). Hearing health messages from a variety of important sources is embedded in these levels and one of these sources should be a health care provider.

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Conflict of interest

The authors declare there is no conflict of interest.

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