

Parental Impact on Child Physical Activity and Sedentary Time

by

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Honors Thesis

Appalachian State University

Submitted to the Department of Health and Exercise Science and The Honors College
in partial fulfillment of the requirements for the degree of

Bachelor of Science

May, 2020

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Abstract

Background: Being physically active outdoors is linked with positive health outcomes.

Despite having ample availability of outdoor space for physical activity in the Appalachian Mountain region, there are low rates of physical activity (PA) and increased prevalence of overweight individuals across all age groups. Therefore, the need to get children and parents active outdoors is ever-present. **Purpose:** To assess whether parental attitudes and behaviors influence children's outdoor physical activity and sedentary time. **Methods:** The current study was a secondary analysis of the baseline data from a pilot study of a pediatrician prescription program for outdoor physical activity. Parents ($N = 70$) with children aged 5-13 years living in a county served by a single pediatrician office completed surveys in the pediatrician office during a well-child visit. The survey included questions related to parental attitudes toward children's PA and the PA and sedentary time performed by the parent and their child, both indoors and outdoors. **Results:** Parental sedentary time was the only factor that had an impact on child sedentary time, with 18% of the variance in children's sedentary time being explained by parent sedentary time. **Conclusion:** To decrease child sedentary time, interventions should focus on reducing parental and joint parent-child sedentary time.

Introduction

Physical activity is an important component of health as it reduces the risk of various chronic diseases both physical and mental. Despite the health benefits, according to the Child and Adolescent Health Measurement Initiative, only 24% of children 6 to 17 years old meet the recommended 60 minutes of moderate to vigorous physical activity. It has been suggested that the family unit may impact children's physical activity, particularly the parent's role in their child's physical activity.^{1,2} For example, Trost et al. discovered parental physical activity, enjoyment, and performance were positively associated with parental support for child physical activity while Bauer et al. suggested parents modeling physical activity, does not mean their child will be physically active.^{1,2} Nonetheless, it has been suggested that parental support, particularly tangible and intangible social support is positively associated with child physical activity.¹⁻³

Physical activity is not the only type of activity that impacts health outcomes; sedentary activity, which includes time spent sitting at work or school, watching television, or playing video games also affects children's health. Sedentary time poses great health risks, including low metabolism and poor musculoskeletal health.⁴ Increased time spent in sedentary activities is predominant in both adults and children. For example, Owen et al. reported that adults are spending less time doing physical activity and more time engaging in sedentary behavior.⁴ Sitting time, a component of sedentary time is associated with all-cause mortality and cardiovascular disease, independent of physical activity.⁵ If the focus is on the family unit, perhaps parental sedentary time may influence the child. Bauer et al. suggested children tend to mirror their parents in sedentary behavior, but having a parent model

physical activity does not necessarily make a child more physically active.² Additionally, parental beliefs about physical activity have also been shown to have an influence on children's physical activity and sedentary behavior, regardless of children's perception of these beliefs.^{1-3, 6} Thus, parents placing limits on their child's computer, television, and video game time, may decrease child sedentary time.⁷ Nonetheless, there is limited research investigating the relationship between parent physical activity on child sedentary time; parent sedentary time on child physical activity; and parent limiting sedentary time on child's physical activity and sedentary time. Therefore, the goal of this study was to fill gaps in the literature related to the influence of parents' physical activity and sedentary behaviors, parental beliefs about the importance of children's physical activity, and parents limiting screen time on children's physical activity and sedentary behavior.

Methods

Study Design and Population

This study is a secondary data analysis of baseline data from a pilot study of a pediatrician prescription program for outdoor physical activity for children. Full study procedures are described elsewhere.⁸ Parents with children aged 5 to 13 years were recruited from the single pediatrician's office in a county in the Appalachian Mountains in western North Carolina during a well-child visit. Parents completed a baseline survey prior to being randomly assigned to intervention and control groups. A total of 70 parents were recruited.

Measures

The survey collected data on the age of the child, parent race/ethnicity, total household income, and highest level of education in the home (Table 1). Survey questions assessed child and parent physical activity, sedentary time, whether parents regularly limit their child's screen time (watching TV, playing video games, using the computer), and parental beliefs about children's physical activity (Figures 1-4). Parent and child moderate-to-vigorous physical activity was assessed using the Godin Leisure-Time Exercise Questionnaire (LTEQ).⁹ Parents putting limits on their child's screen time was assessed by using three questions on 5-point Likert scale anchored by "never" and "always".

Child's sedentary behavior was assessed using two questions that asked the amount of time during an average weekday and weekend day 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. Parent sedentary behavior was assessed using

similar questions adapted for adults. All questions were asked on a 7-point scale from “none” to “5 or more hours per day.” Parent and child’s time spent in sedentary activities per week was estimated by the sum of weekday sedentary time multiplied by five and weekend day sedentary time multiplied by two.

Parental beliefs related to the importance of children’s physical activity was measured using the Psychometric Properties of Psychosocial Measure Scales.¹⁰ The instrument consisted of six items on 5-point Likert scales anchored by “strongly disagree” and “strongly agree.” To allow for regression analysis, each of these instrument items was converted to a dichotomous variable where “0” was “strongly disagree to neither disagree nor agree” and “1” was “agree to strongly agree.”

Parental limits placed on children’s screen time sedentary behavior was assessed by three questions that asked “how often [parents] put limits on how much time [their] child may watch TV, play video games, and use the computer.” Each of these questions was asked on a 5-point Likert scale anchored by “never” and “always.” To allow for regression analysis, each of these questions was converted to a dichotomous variable where “0” was “never to sometimes” and “1” was “very often to always.”

Data Analysis

Multiple linear regression ($p < 0.05$) was conducted to assess whether parent physical activity, sedentary time, beliefs about child’s physical activity, and limiting child’s screen time predicted child’s physical activity and sedentary time. All statistical analyses were conducted using IBM SPSS Statistics, version 24. A hierarchical multiple regression was

then conducted on models that were statistically significant to assess whether significance was maintained with the inclusion of parent race/ethnicity, the highest level of education in the home, total household income, and child's age as control variables.

Figure 1. Questions from Godin Leisure-Time Exercise Questionnaire⁹

Strenuous Physical Activity or Exercise: heartbeats rapidly (some examples could be: running, jogging, football, soccer, basketball, roller skating, vigorous swimming, vigorous long-distance bicycling)

- ☐ 0 hours
- ☐ Less than ½ hour a week
- ☐ 1 to 2 hours a week
- ☐ 2½ to 3½ hours a week
- ☐ 4 to 5 hours a week
- ☐ 5½ to 6½ hours a week
- ☐ 7 or more hours a week

Moderate Physical Activity or Exercise: not exhausting (some examples could be: fast walking, baseball, softball, easy bicycling, volleyball, easy swimming, popular and folk dancing, climbing stairs, sweeping and scrubbing floors, raking, digging in the garden or yard)

- ☐ 0 hours
- ☐ Less than ½ hour a week
- ☐ 1 to 2 hours a week
- ☐ 2½ to 3½ hours a week
- ☐ 4 to 5 hours a week
- ☐ 5½ to 6½ hours a week
- ☐ 7 or more hours a week

Figure 2. Question for assessing parent and child sedentary time.

Sedentary Time for Parents and Children

	None	Less than 1 hour per day	1 hour per day	2 hours per day	3 hours per day	4 hours per day	5 or more hours per day
Time spent in sedentary activity (sitting while listening to music, watching TV, playing video games, using a computer or tablet/iPad, doing homework, reading, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 3. Parental belief questions from Psychometric Properties of Psychosocial Measure Scales.¹⁰

Parental Belief Questions
Kids who do regular physical activity have more self-confidence.
Kids who do regular physical activity are healthy.
Kids who do regular physical activity will be healthier adults.
It is the parents' responsibility to help their child find physical activity.
All kids should be physically active every day.
Parents play an important role in whether their kids are physically active when they grow up.

Figure 4. Parental limits on technology questions.

Parental Limits on Technology

	Never	Rarely	Sometimes	Very Often	Always
How often do you put limits on how much time your child may watch TV?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How often do you put limits on how much time your child may play video games?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How often do you put limits on how much time your child may use the computer?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Results

The participants were mostly white and highly educated, with more than half of parents having a college degree or higher, (see Table 1). Most households consisted of married parents. The families were also of higher socioeconomic status, with a majority having a household income of \$55,000 per year. This is not a typical representation of the county as a whole, with residents outside of the town having lower levels of education and household income. However, the race and ethnicity of the participants is representative of the area, which is predominantly white.

To predict child's physical activity, a multiple linear regression was calculated based on parent physical activity, sedentary time, beliefs about child's physical activity, and limiting child's screen time. The regression equation was found to not be significant ($F(11,56) = 1.04, p = .43$).

A second multiple linear regression was calculated to predict child's sedentary time based on parent physical activity, sedentary time, beliefs about child's physical activity, and limiting child's screen time. Distributional statistics (means, standard deviations) are presented in Tables 2 and 4 for the predictors and criterion. This regression equation was significant ($F(11,55) = 3.71, p = .001$), with an R^2 of .43. Results from the multiple regression analyses are summarized in Table 2. More specifically, parent sedentary time, one parental belief variable (the belief that it is the parents responsibility to help their child find physical activity), limiting child's time watching TV, and limiting child's playing video games made statistically significant, unique contributions to the estimation of child's sedentary time ($p \leq .05$). The relative contribution of the independent variables was

evaluated through the interpretation of squared semi-partial coefficients.^{11,12} Results indicated parent sedentary time made the largest unique contribution and revealed a predictive efficacy of over 1^{1/2} times larger of the one parental belief (i.e., $.116/.070 = 1.7$), and two times larger than that for limiting child's time watching TV (i.e., $.116/.049 = 2.4$) and playing video games (i.e., $.116/.050 = 2.3$).

Effect sizes were calculated for the four predictors using Cohen's f^2 , where values of .02 represent a small effect, values of .15 equal a medium effect, and values of .35 denote a large effect (Table 3).¹³ Results illustrate parent sedentary time had a medium-to-large effect size ($f^2 = .20$), the one parental belief had a small-to-medium effect size ($f^2 = .12$), and that both limiting child's time watching TV and playing video games had small effect sizes ($f^2 = .09$) in predicting child's sedentary time.

A hierarchical multiple regression was calculated, stratified by child's age, to predict child's sedentary time based on parent sedentary time. This was done due to differences in parental influence among children and adolescents. Variables including parent race/ethnicity, highest level of education, and total household income were also controlled for in the regression analysis. This two-stage model has been recommended by Keith.¹⁴ Child's age was stratified into two age groups, 5-9 years of age and 10-13 years of age. This stratification is based on the literature indicating that sedentary behavior tends to increase at early adolescence.¹⁵ First, the control variables were entered simultaneously into the analysis. Second, a simultaneous entry of the variables of interest occurred which included: parent sedentary time, the belief that it is the parents responsibility to help their child find physical activity, and parent's role in limiting child's TV and video game use. Distributional statistics

(means, standard deviations) are presented in Table 4 for the predictors and criterion. Results from this hierarchical multiple regression are summarized in Table 5. The background variables of parent race/ethnicity, highest level of education in the home, and total household income were not statistically significant for either the 5-9 year old group ($F(3,29) = 1.74, p = .18$) or the 10-13 year old group ($F(3,27) = 1.80, p = .17$). Results from the second block of the hierarchical multiple regression revealed a statistically significant increase in the variance explained in child's sedentary time among the 10-13 year old group, $\Delta R^2 = .35, F(4,23) = 4.06, p = .01$, but not the 5-9 year old group, $F(4,25) = 0.88, p = .49$. In fact, only parent sedentary time made a statistically-significant unique contribution to the prediction of child's sedentary time among the 10-13 year old group ($p = .01$). Additionally, parent sedentary time had a large effect size ($f^2 = .44$).

Table 1 - Demographic characteristics for parents and children

Variable	Participants (%)
<u>Child</u>	
Gender	
Female	31(44.3)
Male	39(55.7)
Race/ethnicity	
White	65(92.9)
Hispanic or Latino	3(4.3)
Other*	2(2.9)
<u>Parent</u>	
Race/ethnicity	
White	66(94.3)
Hispanic or Latino	1(1.4)
Other*	3(4.3)
Highest level of education of all adults in household	
High school grad or GED	7(10.0)
Some college	10(14.3)
College grad	33 (47.1)
Graduate/professional school	20(28.6)
Total household annual income	
Under \$15,000	5(7.1)
\$15,000 - \$34,999	9(12.9)
\$35,000 - \$54,999	13(18.6)
Over \$55,000	40(57.1)

Table 2 *Distributional Statistics for Child's Sedentary Time and Predictors*

Variable	<i>M</i>	<i>SD</i>
Child's Sedentary Time	18.33	7.09
Parent's Physical Activity	9.01	4.87
Parent's Sedentary Time	18.07	10.06
Parental Beliefs		
Kids who do regular physical activity have more self-confidence	.93	.27
Kids who do regular physical activity are healthy	.99	.12
Kids who do regular physical activity will be healthier adults	.93	.27
It is the parents responsibility to help their child find physical activity	.93	.27
All kids should be physically active every day	.97	.17
Parents play an important role in whether their kids are physically active when they grow up	.99	.12
Frequency of Limiting Screen Time		
Watching TV	.54	.50
Playing Video Games	.61	.49
Using the Computer	.61	.49

Note: *M* = mean, *SD* = standard deviation, *N* = 380.

Table 3 - Regression Analysis Summary for Variables Predicting Child's Sedentary Time

Variable	<i>B</i>	SE <i>B</i>	β	sr^2	f^2
Parent's Physical Activity	-.162	.163	-.111	.010	.019
Parent's Sedentary Time	.261	.078	.370**	.116	.216
Parental Beliefs					
Kids who do regular physical activity have more self-confidence	4.76	3.76	.178	.017	.031
Kids who do regular physical activity are healthy	-4.48	7.15	-.077	.004	.008
Kids who do regular physical activity will be healthier adults	4.82	3.94	.180	.016	.029
It is the parents' responsibility to help their child find physical activity	-8.45	3.25	-.316*	.070	.131
All kids should be physically active every day	4.53	4.80	.109	.009	.017
Parents play an important role in whether their kids are physically active when they grow up	.424	7.29	.007	.00004	.00007
Frequency of Limiting Screen Time					
Watching TV	-7.31	3.38	-.518*	.049	.091
Playing Video Games	6.75	3.10	.468*	.050	.092
Using the Computer	-3.22	3.08	-.223	.011	.021

Note: $R^2 = .231$ ($N = 380$, $p = .001$), sr^2 = squared semi-partial coefficient, f^2 = Cohen's (1988) effect size statistic for multiple regression analyses.

* $p = .05$, ** $p = .01$, *** $p = .001$.

Table 4 *Distributional Statistics for Child's Sedentary Time and Predictors for Hierarchical Multiple Regression*

Variable	<i>M</i>	<i>SD</i>
Child's Sedentary Time	18.30	7.20
Parent Race/Ethnicity	1.25	1.08
Highest Level of Education in Home	5.84	1.14
Total Household Income	3.91	1.58
Parent's Sedentary Time	17.61	9.98
Parental Belief		
It is the parents' responsibility to help their child find physical activity	.92	.27
Frequency of Limiting Screen Time		
Watching TV	.52	.50
Playing Video Games	.59	.50

Note: *M* = mean, *SD* = standard deviation, *N* = 380.

Table 5 *Hierarchical Multiple Regression Analysis Summary for Variables Predicting Child's Sedentary Time*

Variable	<i>B</i>	<i>SE B</i>	β	pr^2	f^2
5-9 Year Old Group					
Step 1					
Parent Race/Ethnicity	.417	.561	.128	.019	.073
Highest Level of Education in Home	-.463	.757	-.133	.013	.050
Total Household Income	-.731	.590	-.269	.050	.194
Step 2					
Parent Sedentary Time	.078	.086	.164	.032	.126
Parental Belief	-3.08	3.51	-.162	.030	.116
Limiting TV	-6.87	5.09	-.749	.068	.264
Limiting Video Games	6.01	5.04	.648	.054	.209
Constant	18.44	5.12			
10-13 Year Old Group					
Step 1					
Parent Race/Ethnicity	5.13	2.74	.339	.115	.225
Highest Level of Education in Home	-.113	1.97	-.012	.0001	.0002
Total Household Income	-1.80	1.18	-.315	.080	.156
Step 2					
Parent Sedentary Time	.405	.134	.522**	.285	.558
Parental Belief	-5.50	5.20	-.203	.046	.090
Limiting TV	-6.55	3.78	-.407	.116	.226
Limiting Video Games	3.71	3.87	.228	.038	.075
Constant	29.64	10.60			

Note: $R^2 = .231$ ($N = 380$, $p = .001$), pr^2 = squared semi-partial coefficient, f^2 = Cohen's (1988) effect size statistic for multiple regression analyses.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Implications

This study investigated the impact of parent physical activity, sedentary time, parental beliefs about children's physical activity, and parents limiting child's sedentary activities on child physical activity and sedentary behavior. We found that parent sedentary time was the only significant predictor of child sedentary time among early adolescents (10-13 year olds). In fact, no significant predictors of child sedentary time were found among children (5-9 year olds). Parent physical activity, sedentary behavior, beliefs, and limits on child's sedentary activities did not predict child physical activity. The findings from this study, along with current literature are important in drawing conclusions and future utilization of this data.

Results examining the influence of parental physical activity on child physical activity is varied, with conflicting findings. Our study's finding that parental physical activity is not related to child physical activity, is consistent with a majority of current literature. Parental modeling of physical activity, simply parents being physically active, has been found to not be related to their child's physical activity.^{1,2,6,16-18} However, several studies have shown a positive relationship.¹⁹⁻²¹ For example, Zarychta et al. concluded parents that modeled a healthy diet and physical activity were more likely to have adolescents who were more physically active and had overall healthier lifestyles.¹⁹ Similarly, Fuemmeler et al. found that children with two physically active parents had significantly higher moderate-to-vigorous (MVPA) than children with two inactive parents.²⁰ These studies suggest the relationship between parent and child physical activity may be more complex than simple parent modeling of behavior. Beets et al. discovered parents and children performing physical activity together was related to increased child physical activity.³

Likewise, Dunton et al. suggested promoting family physical activity may combat declining youth and adult physical activity levels.²²

In terms of sedentary behaviors, the current study found that parents' sedentary time was a significant predictor of children's sedentary time among early adolescents, but not among children. In fact, the effect size of parents' sedentary time among early adolescents was large ($f^2 = .54$). Our results are similar to Jago et al. when looking at both physical activity and sedentary time.¹⁶ However, Jago et al. determined, television viewing was the only factor associated between parents and children.¹⁶ Additionally, Dunton et al. found that parents and children are more likely to engage in sedentary activity together (92.9 minutes/day) than physical activity (2.4 minutes/day).²²

When examining parental physical activity, beliefs about their child's physical activity on adolescents' physical activity and sedentary time, Bauer et al. concluded there is a complicated relationship between parent and child sedentary time, with parental encouragement and perception not having an impact on child sedentary time.² In other words, parents may have a greater impact on adolescent sedentary time compared to child sedentary time because of decreasing physical activity levels as children age. However, they also suggested further investigation is needed in order to determine ways for parents to reduce child sedentary time and examine the relationships between parents and their child's sedentary time.² Our study bridged the gap and discovered a relationship between parent and child sedentary time. Thus, parent sedentary time may be an important factor in child sedentary time.

Literature regarding the influence of parental beliefs about children's physical activity on behavior is conflicting. For instance, Kimieck et al. identified children's perceptions of their parents' beliefs were not related to their own physical activity.⁶ This article suggests parental support, specifically belief in their child's physical activity competency, was related to increased physical activity among children.⁶ Yet, still other studies revealed parental encouragement was the main factor impacting child physical activity.^{2,23} Thus, there may be a complicated relationship between parental beliefs and child physical activity and parents must take an active role in their child's physical activity through supporting and motivating physical activity behavior.

Few studies have investigated the influence of parental physical activity, sedentary behavior, beliefs about physical activity, and limiting children's screen time on children's physical activity and sedentary behavior. Most have examined only physical activity.^{1,6,17,21,24} with some looking at both physical activity and sedentary time.^{2,3,16} Previous studies have observed parental social support and physical activity but not sedentary time, parental beliefs, or parent physical activity and sedentary time on child physical activity and sedentary time.^{2,3,16} Bauer et al. suggested a further understanding of how parents can help their children lower their sedentary time.² There is support for the interrelatedness of all of these factors, however the current study is the first to examine all of these factors together. Even so, another component of child sedentary time that should be considered is parents placing limits on a child's computer, television, and video game time. In fact, Salmon et al. found that these limits may decrease child sedentary time.⁷ Nonetheless, further research into the impact

of parental beliefs, physical activity, and sedentary time on child physical activity and sedentary time.

Healthy People 2020 aims to increase child physical activity and decrease the proportion of children who exceed recommended limits for screen time.²⁵ Our results provide evidence for the creation of effective interventions to achieve these goals. It is important that more children meet physical activity recommendations and less are exceeding the suggested amount of daily screen time, to prevent future health implications. Decreasing parent sedentary time is valuable in improving the health of individuals, as well as improving the health outcomes of their children. The results from this study can be used by health professionals to help accomplish the objectives of Healthy People 2020.

Overall, our study fills an important gap in the literature regarding the relationship between parental physical activity, sedentary time, beliefs, and limits placed on their child's screen time and child physical activity and sedentary time. Currently, there is a lack of research exploring parent and child sedentary time, with only some focusing on physical inactivity, not getting an adequate amount of MVPA, as a proxy for sedentary behavior.^{3,26,27} On the other hand, it is important that physical activity and sedentary behaviors are observed as separate variables because they are not merely opposites but rather separate factors associated with different health outcomes.^{4,28} Interventions should approach changing sedentary time and physical activity differently because they are separate health outcomes. Nonetheless, this study is important as it not only fills the gaps in the literature but also provides evidence for future research and interventions.

Specific to Appalachia, there is limited research on parent impact on child physical activity and sedentary time. The Appalachian region is unique in the challenges it faces including being rural and geographically isolated while having low average income and poor health outcomes. Other challenges include limited access to recreation, sports programs, and transportation. In North Carolina, the Appalachian region has higher levels of physical inactivity and almost half of adults fail to meet physical activity recommendations.^{26,27} With limited previous research regarding parent and child physical activity, our results provide the specific impact of parents on child physical activity and sedentary time in Appalachia. This information could be used by health professionals to create programming targeted at improving child physical activity and lowering child sedentary time, that incorporates parents. Future interventions should focus on creating more opportunities for sports, adding programming opportunities, and providing transportation.

To the best of the authors' knowledge, this study is one of the few that has measured and examined predictors of children's physical activity and sedentary behaviors separately rather than using physical inactivity as a proxy for sedentary behavior. However, this study had several limitations. The small sample size, with an n=70 parent-child pairs, conclusions drawn from this data are limited. In addition, subjects only came from a single pediatrician's office, which both limited the sample size and the diversity of subjects. However, the area where this study was conducted only had one pediatric office which served a three county area. Another limitation was that parent physical activity and sedentary time were self-reported, while parents reported their child's physical activity and sedentary time.

Parents have been found to often overestimate their child's physical activity and this could have impacted the results.²⁹

In summary, these findings and current literature indicate the impact of parent sedentary time on child sedentary time. While parent physical activity did not have an impact on child physical activity, it is one of the many factors that contribute to child physical activity. Sedentary time may have more of an impact on child behavior than physical activity because parents are more often engaged in joint sedentary time than joint physical activity. Parental beliefs about the importance of physical activity are also important factors in child physical activity and should be considered when creating interventions. Future interventions should incorporate decreasing parent sedentary time as a means to lower child sedentary time. Interventions should encourage joint parent and child physical activity to increase child physical activity.

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