Journal of Transport & Health 14 (2019) 100602

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

An examination of active travel trends before and after college graduation

Melissa Bopp*, Oliver W.A. Wilson, Michele Duffey, Zack Papalia

Dept. Kinesiology, Pennsylvania State University, University Park, PA, 16802, USA

A B S T R A C T

Background: Active travel (AT); walking and biking for transportation; has many health, environmental and economic benefits, yet rates of participation remain low in the US. During college years AT participation is typically higher than in older adulthood, but it is unknown how this behavior tracks into later life stages. Therefore this study examined AT participation before and after graduation from college. Methods: A volunteer sample of college students participated in an online baseline survey with follow-ups at regular intervals, up to, and including, post-graduation. The survey assessed participant demographics, AT participation (dichotomized as high/low AT), physical activity (PA) participation, and post-graduation work details (hours worked, sit time at work, distance to work), and health outcomes (body mass index, stress, depression,). Separate logistic regression models predicted AT status according to pre/post-graduation factors and significant factors were examined simultaneously in a multivariate logistic model. Results: Students (n = 204) were predominately female (n = 122, 60.7%) and Non-Hispanic White (n = 166, 83%). The high post-graduation AT group reported 324.73 ± 193.10 min of AT/week versus those in the low AT group (24.69 ± 41.81; $p < .001$). Higher post-graduation AT was associated with higher vigorous PA and AT in the last semester of college, higher moderate PA post-graduation, lesser distance to work, and less sit time at work. The final multivariate model resulted in a Nagelkerke R^2 of 0.33 with pre-graduation vigorous and AT minutes/week, post-graduate moderate PA, and distance to work as significant predictors of post-grad AT. Discussion: The current study examined how AT behavior tracks across a major life transition, indicating the importance of supporting health-related behaviors during the college years. College campuses may use these findings to support AT among students for positive long-term health outcomes well beyond the time spent in college.

1. Introduction

Active travel (AT; walking and biking for transportation) is associated with a number of significant benefits, including health-related (e.g. decreased disease prevalence, improved mental and physical health) (Frank et al., 2010; García-Hermoso et al., 2018; Giles-Corti et al., 2010; Hamer and Chida, 2008; Saunders et al., 2013; Shephard, 2008), environmental (e.g. decreased pollution and congestion)(Lindsay et al., 2011; Rails to Trails Conservancy, 2008) and economic outcomes (e.g. decreased travel costs)(Flusche, 2009, 2012; Frank, 2004). Despite these known benefits, rates of AT remain relatively low, especially in the United States (Bassett et al., 2008; League of American Bicyclists, 2018; Whitfield et al., 2015). Therein it is essential to investigate influences on AT participation to inform policies, programs and strategies to promote AT.

It is well established that AT participation rates are highest among the youngest age groups (Bopp et al., 2012; Bopp et al., 2013; Downward and Rasciute, 2015; Fan et al., 2015; Hino et al., 2014; Lachapelle, 2015; Laverty et al., 2013; Porter et al., 2018), similar to trends in physical activity (PA) participation. In analyses of multiple national surveillance systems, Whitfield et al. (2016) noted consistently from 2005 to 2012 that the percentage of young adults (aged 16–39) who reported walking and biking to work was nearly twice the rate of those in older age groups. The youngest adults are often students at institutions of higher education, with nearly 20 million college students in 2018 in the United States alone (National Center for Education Statistics, 2018). The travel

* Corresponding author. 266 Recreation Building, Dept. Kinesiology, Pennsylvania State University, University Park, PA, 16802, USA.
E-mail address: Mjb73@psu.edu (M. Bopp).

https://doi.org/10.1016/j.jth.2019.100602
Received 7 February 2019; Received in revised form 23 July 2019; Accepted 23 July 2019
Available online 30 July 2019
2214-1405/

habits of this population specifically are often not well understood.

Residential zoning laws near campuses and the availability of on-campus housing can impact travel habits for students, indicating that AT in this life stage warrants specific study beyond the general adult population. There are several studies that have documented student-specific influences on AT at individual (e.g. perceived behavioral control, perceived benefits, attitudes, fitness level, weight status) social (e.g. social support), and environmental levels (e.g. proximity to campus, walkability/bikeability of neighborhood) (Bopp et al., 2014; Bopp et al., 2015; Bopp et al., 2011; Chaney et al., 2013; Cole et al., 2008; Molina-Garcia et al., 2010; Peachey and Baller, 2015; Sisson et al., 2008). This time during young adulthood is essential for establishing healthy habits and encourages more self-regulation with expanded independence and autonomy typically experienced by college students. Leisure-time PA often declines with the transition to college, and during the time in college, therefore AT could play a role in helping to maintain overall activity levels (Small et al., 2013).

Limited research has addressed changes in PA with the transition into and out of higher education. A systematic review by Allender et al. (2008) examining life change events and participation in physical activity noted that few studies examined the transition in or out of university specifically but noted that relocation and change in employment status were potentially related to changes in behavior. Deforche et al. (2015) have noted a decline in sport participation with the transition into college and other research has noted that participation in and positive attitudes toward sport and PA during college years was related to post-graduation participation in PA (Forrester et al., 2006, 2007; Simon and Docherty, 2017; Sparling and Snow, 2002). Predictors of transport-related PA are typically different than those for leisure-time PA, therein research must examine domains of PA separately, especially for determining temporal trends. Despite these insights on overall PA, relatively little research has addressed AT habits post-graduation, or from a longitudinal perspective. Therefore, the purpose of the current study was to examine pre- and post-graduation AT participation, the relationship between the two, and what factors impact AT participation. We hypothesize that pre-graduation AT will be significantly related to post-graduation AT participation.

2. Methods

2.1. Design

This was a longitudinal cohort study with a volunteer sample conducted from August 2014 through May 2018, examining outcomes pre- and post-graduation. This study was approved by the institutional review board at BLINDED.

2.2. Participants and recruitment

Participants were a volunteer sample of undergraduate students who were enrolled in general education health and wellness classes at a large northeastern university in the United States. General education health and wellness classes are required for all undergraduate students, therein students enrolled in these classes are representative of the general undergraduate student body in terms of sex, race/ethnicity and year of enrollment. Students enrolled in general education classes were emailed with an invitation to participate in a survey about health and wellness at the start of the semester (August or January). Upon opening the invitation students were presented with an informed consent statement and could begin the survey after accepting the statement. Participants who completed the survey were eligible to enter a drawing for a prize. Students who responded to the baseline survey were emailed again at the end of the semester (December or April) to complete a similar survey, and then again every six months up to a total of eight total collection points (baseline, end of semester, up to six follow-up surveys) to be able to determine how outcomes may change across time during enrollment as well as pos-graduation. Among those students who were eligible and received the survey (n = 20,782), 18.6% (n = 3875) started the survey, 14.7% completed the survey (n = 3063) for a 79% completion rate at baseline. Employed (full or part time) participants (n = 204) who responded to the follow-up surveys at two time-points: 1)immediately pre-graduation and 2) reported graduating in the last six months were included in the current study.

2.3. Measures

Demographics: Participants self-reported their age, sex, race/ethnicity, height, and weight (from which body mass index was calculated). Participants reported on their stress levels with a single item and two items for depressive symptoms from the National College Health Association survey (American College Health Association, 2018). The end of the semester follow-up survey asked if students were graduating that semester and subsequent surveys asked students if they had graduated. The last follow-up prior to graduation and first follow-up immediately after graduation were used in analyses.

Active travel during time in college: Minutes/week of AT were measured via the active transportation module in the Global Physical Activity Questionnaire (GPAQ; Armstrong and Bull, 2006).

Physical activity: Minutes of moderate and vigorous leisure-time PA was assessed pre and post-graduation with the GPAQ (Armstrong and Bull, 2006), with participants reporting frequency and duration of activity.

Post-graduation: Participants were asked to report the number the minutes/week of AT were measured via the active transportation module in the GPAQ. Those in the top quartile of AT trips were categorized as high active travelers. Employed participants were asked to report the amount of sedentary time at the job with a modified question from the GPAQ asking about the number of minutes per day spent sitting at their place of employment in a typical day. Participants were also asked to report on their current weight for calculating post-graduation body mass index and reported on their stress levels and depressive symptoms with the same items from pre-graduation.

Table 1
Demographics of the sample (n = 204).

Variable	Pre-graduation (n = 204)		Post-graduation				
			Low AT (n = 152)		High AT (n = 52)		t or $\chi 2$ for low vs. high AT
	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	
% male		78 (38.5)		61 (41.5)		18 (34.6)	0.76
% Non-Hispanic White		165 (71)		118 (80.8)		46 (88.5)	1.57
Body mass index (kg/m2)	23.52 (7.39)		23.97 (4.38)		24.53 (4.64)		0.76
Moderate Physical activity (min/week)	177.77 (164.28)		102.14 (118.78)		197.21 (181.49)		4.31***
Vigorous Physical activity (min/week)	129.53 (131.46)		116.03 (117.46)		187.09 (205.79)		3.05**
AT minutes/week	273.43 (203.32)		24.69 (41.81)		324.73 (193.10)		18.04***
Hours worked, post-graduation			35.92 (11.77)		32.16 (14.4)		1.57
Minutes/day sitting during typical workday			307.32 (158.67)		248.10 (160.62)		2.02*

Note: * < .05, **, p < .01, ***p < .001.

2.4. Analyses

Basic frequencies and descriptives described the sample. Separate logistic regression models predicted the primary dependent variable; post-graduation AT status (high vs. low AT) according to pre/post-graduation factors (e.g. activity level, work outcomes). Significant pre/post-graduation factors were examined simultaneously in a multivariate logistic model. To address issues of collinearity, the variable with the strongest relationship was the only one included in the full model for variables that were highly correlated (e.g. moderate and vigorous PA). All analyses were conducted using SPSS 24.0 (IBM, Armonk, NY) and significance levels were set at $p < .05$.

3. Results

Participants (n = 204) were predominately female (n = 122, 60.7%) and Non-Hispanic White (n = 166, 83%). Post-graduation 79.1% (n = 163) were employed full or part time. Those in the high post-graduation AT group reported 324.73 ± 193.10 min of AT/week compared with those in the low AT group (24.69 ± 41.81; $p < .001$). Demographics of the sample are reported in Table 1. The post-graduation high-AT group had greater moderate ($t = 4.31$, $p < .001$) and vigorous PA ($t = 3.05$, $p = .01$), and less sedentary time at work ($t = 2.02$, $p = .04$) relative to the low-AT group.

Odds ratios (OR) were used to predict post-graduation AT level and are found in Table 2. The only pre-graduation variables that significantly predicted higher post-graduation AT were vigorous PA (OR = 1.01 95% CI = 1.00–1.06) and AT minutes/week

Table 2
Odds ratio for high active travel post-graduation.

	Odds Ratio	95% Confidence Interval
Variable		
Pre-graduation		
Body mass index (kg/m2)	0.99	0.94–1.05
Moderate Physical activity (min/week)	0.79	0.99–1.00
Vigorous Physical activity (min/week)	1.01	1.00–1.06*
AT minutes/week	2.69	1.26–5.74**
Stress level	1.23	0.80–1.88
Depressive symptoms	1.15	0.89–1.49
Post-graduation		
Body mass index (kg/m2)	1.03	0.96–1.10
Moderate Physical activity (min/week)	1.01	1.00–1.08***
Vigorous Physical activity (min/week)	1.01	1.00–1.10**
Hours worked, post-graduation	0.98	0.95–1.01
Minutes/day sitting during typical workday	0.99	0.96–1.00*
Distance to work	0.88	0.78–0.95**
Employed	0.72	0.32–1.64
Stress level	1.21	0.79–1.83
Depressive symptoms	1.27	1.02–1.57*

Note: * < .05, **, p < .01, ***p < .001.

Table 3
Multivariate regression predicting high AT post-graduation (n = 206).

	Odds Ratio	95% Confidence Interval	p
Pre-graduation			
Vigorous Physical activity (min/week)	1.01	1.00–1.01	0.047
AT minutes/week	1.001	1.00–1.10	0.003
Post-graduation			
Moderate Physical activity (min/week)	1.01	1.00–1.01	0.01
Minutes/day sitting during typical workday	0.99	0.98–1.01	0.68
Distance to work	0.89	0.82–0.96	0.005
Depressive symptoms	1.32	0.91–1.92	0.15

(OR = 2.69, 95% CI = 1.26–5.74). Post-graduation moderate (OR = 1.01, 95% CI = 1.00–1.08) and vigorous (OR = 1.01, 95% CI = 1.00–1.10) also predicted higher AT, along with higher depressive symptoms (OR = 1.27 95% CI = 1.02–1.57). Post-graduation employment variables were also significantly related to higher AT, including less sedentary time at work (OR = 0.99, 95% CI = 0.96–1.00) and less distance to work (OR = 0.88, 95% CI = 0.78–0.95) . The final multivariate model, found in Table 3, resulted in a Nagerlkerke R^2 of 0.33, with pre-graduation vigorous PA (OR = 1.01, 95% CI 1.00–1.01, p = .0047) and AT minutes/week (OR = 1.001, 95% CI = 1.00–1.10, p = .003), post-graduate moderate PA (OR = 1.01, 95% CI 1.00–1.07, p = .01), and distance to work (OR = 0.89, 95% CI 0.82–0.65) as significant predictors of post-grad AT.

4. Discussion

This study was among the first to explore AT habits across the major life transition of graduating from an institution of higher education. Given the multitude of health, environment and economic benefits associated with participation in regular AT, it is essential to understand the influences on this behavior for all life stages, particularly since AT behavior differs from other domains of PA. Pre-graduation AT habits were significant predictors of post-graduation AT participation, suggesting the establishment of transportation behavioral patterns in college could track into early adulthood. Physical activity participation, pre and post-graduation were also related to AT participation, consistent with other research. These findings suggest that policies, programs and infrastructure designed to support AT participation on college campuses and build foundational transportation habits could have long-lasting effects and is a significant rationale for further examination into this behavior in this context.

In line with our hypothesis, the most significant finding in the current study is that pre-graduation AT predicted post-graduation AT. When considering the multitude of typical changes associated with this transition (e.g. relocation, full-time employment, etc.), the tracking of this behavior into early adulthood is meaningful. Previous research with college students has time and cost savings are among the most motivating factors for AT, recognizing the notable benefits of AT (Bopp et al, 2014; Bopp et al., 2011; Molina-Garcia et al., 2010; Whalen et al., 2013). Perhaps the most relevant to the current study is the evidence on habit strength for active commuting, which has been studied among a general adult population adults (de Bruijn et al., 2009; Shannon et al., 2006), with some related research to suggest this is an important factor for students as well. De Bruijin and Gardner (2011) found that habit strength was the strongest correlate of AT and related to intention in a sample of undergraduate students. Other qualitative studies have supported the importance of habit strength on AT participation (Guell et al., 2012). The current study supports these findings, with AT habits from pre-graduation predictive of post-graduation AT. This suggests the importance of college campuses building programs and policies to support AT throughout students' tenure to create a strong foundation that can carry forward into future life stages, indicating that there could be worthwhile return on investment for programs promoting AT during young adulthood. Frameworks such as the League of American Bicyclists' Bicycle Friendly Campus program provide guidance on comprehensive strategies for promoting AT on college campuses (League of American Bicyclists, 2013). Best practices on college campuses have included strategies that address physical infrastructure as well as education and encouragement (Wilson et al., 2018).

This study also aimed to examine influences on AT participation and the findings revealed the relationship between a physically active lifestyle and AT. A wide range of research has also concluded that there is a strong relationship between activity or fitness level and AT participation (Avila-Palencia et al., 2017; Butler et al., 2007; Cole-Hunter et al., 2015; Sahlqvist and Heesch, 2012). Bopp et al., 2015 noted that objectively measured fitness was positively related to AT participation among college students, confirming this relationship. With the typical decline in physical activity seen across the first seven semesters of college life and the finding that moving off-campus away from readily accessible exercise resources often exacerbates this decline (Small et al., 2013), AT could serve as a way to maintain activity levels and combat this trend, including through the transitional period post-graduation. A longitudinal study by Miller et al. (2019) noted that there was a decline in moderate-vigorous PA when leaving post-secondary education, indicating that participation in AT could help combat this decline as well. Campus recreation programs could build in programming to help provide the skills for urban active transportation (e.g. bicycling safety in traffic) and campus transportation departments support AT through the provision of resources (e.g. bike share, bike parking).

Although there were some insightful findings there were some significant limitations. First, there could have been self-selection issues for students initially responding to the survey and attrition to post-graduation could have resulted in a non-representative sample. Future studies should aim to include a wider, more representative sample of the student body and use strategies to prevent attrition. Second, the self-report measures may have resulted in inaccurate reporting of the main outcome measures; further research

in this area may benefit from the use of more objective methods of assessment (e.g. travel diaries, accelerometer). Also, the time period immediately post-graduation may be too early to capture any habits established at a new place of employment, so further follow-up is warranted. Lastly, it is unclear whether these findings would generalize to other student populations.

5. Conclusion

Despite these limitations this study is among the first to examine how AT participation changes across a major life transition for adults and some of the possible influences on AT behavior. Given the importance of establishing healthy habits earlier in life, the focus on encouraging and supporting AT participation in this population shows promise. This study provides a foundation for future research addressing how AT could change across life transitions. The long-term health, environmental, and economic implications of AT necessitates a multi-level approach to targeting this behavior, indicating that communities and institutions such as college campuses and workplaces can play a significant role in improving participation across the lifespan.

Financial disclosure

The Authors did not receive any specific funding for this work.

References

Allender, S., Hutchinson, L., Foster, C., 2008. Life-change events and participation in physical activity: a systematic review. Health Promot. Int. 23, 160–172.
American College Health Association, 2018. About ACHA-NCHA. Survey.
Armstrong, T., Bull, F., 2006. Development of the world health organization global physical activity questionnaire (GPAQ). J. Public Health 14, 66–70.
Avila-Palencia, I., de Nazelle, A., Cole-Hunter, T., Donaire-Gonzalez, D., Jerrett, M., Rodriguez, D.A., Nieuwenhuijsen, M.J., 2017. The relationship between bicycle commuting and perceived stress: a cross-sectional study. BMJ open 7 e013542.
Bassett Jr., D.R., Pucher, J., Buehler, R., Thompson, D.L., Crouter, S.E., 2008. Walking, cycling, and obesity rates in Europe, North America, and Australia. J. Phys. Act. Health 5, 795–814.
Bopp, M., Behrens, T.K., Velecina, R., 2014. Associations of Weight Status, Social Factors, and Active Travel Among College Students. Am. J Health Edu. 45, 358–367.
Bopp, M., Bopp, C., Schuchert, M., 2015. Active Transportation to and on Campus is Associated With Objectively Measured Fitness Outcomes Among College Students. J. Phys. Act. Health 12, 418–423.
Bopp, M., Kaczynski, A.T., Besenyi, G., 2012. Active commuting influences among adults. Prev. Med. 54, 237–241.
Bopp, M., Kaczynski, A.T., Campbell, M.E., 2013. Social ecological influences on work-related active commuting among adults. Am. J. Health Behav. 37, 543–554.
Bopp, M., Kaczynski, A.T., Wittman, P., 2011. Active commuting patterns at a large, midwestern college campus. J. Am. Coll. Health 59, 605–611.
Butler, G.P., Orpana, H.M., Wiens, A.J., 2007. By your own two feet: factors associated with active transportation in Canada. Canadian journal of public health = Revue canadienne de sante publique 98, 259–264.
Chaney, R.A., Bernard, A.L., Wilson, B.R., 2013. Characterizing active transportation behavior among college students using the theory of planned behavior. Int. Q Community Health Educ. 34, 283–294.
Cole-Hunter, T., Donaire-Gonzalez, D., Curto, A., Ambros, A., Valentin, A., Garcia-Aymerich, J., Martinez, D., Braun, L.M., Mendez, M., Jerrett, M., Rodriguez, D., de Nazelle, A., Nieuwenhuijsen, M., 2015. Objective correlates and determinants of bicycle commuting propensity in an urban environment. Transp. Res. D Transp. Environ. 40, 132–143.
Cole, R., Leslie, E., Donald, M., Cerin, E., Neller, A., Owen, N., 2008. Motivational readiness for active commuting by university students: incentives and barriers. Health Promot. J. Aust. : official journal of Australian Association of Health Promotion Professionals 19, 210–215.
de Bruijn, G.-J., Gardner, B., 2011. Active commuting and habit strength: an interactive and discriminant analyses approach. Am. J. Health Promot. 25, e27–e36.
de Bruijn, G.J., Kremers, S.P., Singh, A., van den Putte, B., van Mechelen, W., 2009. Adult active transportation: adding habit strength to the theory of planned behavior. Am. J. Prev. Med. 36, 189–194.
Deforche, B., Van Dyck, D., Deliens, T., De Bourdeaudhuij, I., 2015. Changes in weight, physical activity, sedentary behaviour and dietary intake during the transition to higher education: a prospective study. Int. J. Behav. Nutr. Phys. Act. 12, 16.
Downward, P., Rasciute, S., 2015. Assessing the impact of the National Cycle Network and physical activity lifestyle on cycling behaviour in England. Transp. Res. A Policy Pract. 78, 425–437.
Fan, J.X., Wen, M., Kowaleski-Jones, L., 2015. Sociodemographic and environmental correlates of active commuting in rural America. J. Rural Health 31, 176–185.
Flusche, D., 2009. The Economic Benefits of Bicycle Infrastructure Investments. League of American Bicyclists, Washington DC.
Flusche, D., 2012. Bicycling Means Business. The Economic Benefits of Bicycle Infrastructure. League of American Bicyclists & The Alliance for Biking and Walking, Washington DC.
Forrester, S., Arterberry, C., Barcelona, B., 2006. Student attitudes toward sports and fitness activities after graduation. Recreat. Sports J. 30, 87–99.
Forrester, S., Ross, C.M., Hall, S., Geary, C., 2007. Using past campus recreational sports participation to explain current physical activity levels of alumni. Recreat. Sports J. 21, 83–94.
Frank, L.D., 2004. Economic determinants of urban form - resulting trade-offs between active and sedentary forms of travel. Am. J. Prev. Med. 27, 146–153.
Frank, L.D., Greenwald, M.J., Winkelman, S., Chapman, J., Kavage, S., 2010. Carbonless footprints: promoting health and climate stabilization through active transportation. Prev. Med. 50 (Suppl. 1), S99–S105.
García-Hermoso, A., Quintero, A.P., Hernández, E., Correa-Bautista, J.E., Izquierdo, M., Tordecilla-Sanders, A., Prieto-Benavides, D., Sandoval-Cuellar, C., González-Ruíz, K., Villa-González, E., Ramírez-Vélez, R., 2018. Active commuting to and from university, obesity and metabolic syndrome among Colombian university students. BMC Public Health 18, 523.
Giles-Corti, B., Foster, S., Shilton, T., Falconer, R., 2010. The co-benefits for health of investing in active transportation. New South Wales public health bulletin 21, 122–127.
Guell, C., Panter, J., Jones, N.R., Ogilvie, D., 2012. Towards a differentiated understanding of active travel behaviour: using social theory to explore everyday commuting. Soc. Sci. Med. 75, 233–239.
Hamer, M., Chida, Y., 2008. Active commuting and cardiovascular risk: a meta-analytic review. Prev. Med. 46, 9–13.
Hino, A.A., Reis, R.S., Sarmiento, O.L., Parra, D.C., Brownson, R.C., 2014. Built environment and physical activity for transportation in adults from curitiba, Brazil. J. Urban Health 91, 446–462.
Lachapelle, U., 2015. Walk, bicycle, and transit trips of transit-dependent and choice riders in the 2009 United States national household travel survey. J. Phys. Act. Health 12, 1139–1147.
Laverty, A.A., Mindell, J.S., Webb, E.A., Millett, C., 2013. Active travel to work and cardiovascular risk factors in the United Kingdom. Am. J. Prev. Med. 45, 282–288.
League of American Bicyclists, 2013. Building A Bicycle Friendly America. League of American Bicyclists, Washington DC.
League of American Bicyclists, 2018. Bicycling and Walking in the United States: 2018 Benchmarking Report. League of American Bicyclists, Washington DC.

Lindsay, G., Macmillan, A., Woodward, A., 2011. Moving urban trips from cars to bicycles: impact on health and emissions. Aust. N. Z. J. Public Health 35, 54–60.
Miller, J., Nelson, T., Barr-Anderson, D.J., Christoph, M.J., Winkler, M., Neumark-Sztainer, D., 2019. Life events and longitudinal effects on physical activity: adolescence to adulthood. Med. Sci. Sport. Exerc. 51, 663–670.
Molina-Garcia, J., Castillo, I., Sallis, J.F., 2010. Psychosocial and environmental correlates of active commuting for university students. Prev. Med. 51, 136–138.
National Center for Education Statistics, 2018. Back to School Statistics.
Peachey, A.A., Baller, S.L., 2015. Perceived built environment characteristics of on-campus and off-campus neighborhoods associated with physical activity of college students. J. Am. Coll. Health 63, 337–342.
Porter, A.K., Salvo, D., Pérez, A., Reininger, B., Kohl, H.W., 2018. Intrapersonal and environmental correlates of bicycling in U.S. Adults. Am. J. Prev. Med. 54, 413–418.
Rails to Trails Conservancy, 2008. Active Transportation for America: the Case for Increased Federal Investment in Bicyling and Walking. Rails to Trails Conservancy, Washington DC.
Sahlqvist, S.L., Heesch, K.C., 2012. Characteristics of utility cyclists in Queensland, Australia: an examination of the associations between individual, social, and environmental factors and utility cycling. J. Phys. Act. Health 9, 818–828.
Saunders, L.E., Green, J.M., Petticrew, M.P., Steinbach, R., Roberts, H., 2013. What are the health benefits of active travel? A systematic review of trials and cohort studies. PLoS One 8 e69912.
Shannon, T., Giles-Corti, B., Pikora, T., Bulsara, M., Shilton, T., Bull, F., 2006. Active commuting in a university setting: assessing commuting habits and potential for modal change. Transp. Policy 13, 240–253.
Shephard, R.J., 2008. Is active commuting the answer to population health? Sport. Med. 38, 751–758.
Simon, J.E., Docherty, C.L., 2017. The impact of previous athletic experience on current physical fitness in former collegiate athletes and noncollegiate athletes. Sports health 9, 462–468.
Sisson, S.B., McClain, J.J., Tudor-Locke, C., 2008. Campus walkability, pedometer-determined steps, and moderate-to-vigorous physical activity: a comparison of 2 university campuses. J. Am. Coll. Health 56, 585–592.
Small, M., Bailey-Davis, L., Morgan, N., Maggs, J., 2013. Changes in eating and physical activity behaviors across seven semesters of college: living on or off campus matters. Health Educ. Behav. : the official publication of the Society for Public Health Education 40, 435–441.
Sparling, P.B., Snow, T.K., 2002. Physical activity patterns in recent college alumni. Res. Q. Exerc. Sport 73, 200–205.
Whalen, K.E., Páez, A., Carrasco, J.A., 2013. Mode choice of university students commuting to school and the role of active travel. J. Transp. Geogr. 31, 132–142.
Whitfield, G.P., Paul, P., Wendel, A.M., 2015. Active transportation surveillance - United States, 1999-2012. MMWR Surveill Summ 64 (Suppl. 7), 1–17.
Whitfield, G.P., Wendel, A.M., Auchincloss, A.H., 2016. Ecological analysis of parking prices and active commuting in US cities. Prev. Chronic Dis. 13, 5 2009.
Wilson, O.W.A., Vairo, N., Bopp, M., Sims, D., Dutt, K., Pinkos, B., 2018. Best practices for promoting cycling amongst university students and employees. J. Transport. Health. 9, 234–243.