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Distracted Biking: An Observational Study

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Abstract

Commuting via bicycle is a very popular mode of transportation in the Northeastern United States (US). Boston, MA has seen a rapid increase in bicycle ridership over the past decade which has raised concerns and awareness about bicycle safety. An emerging topic in this field is distracted bicycle riding. This study was conducted to provide descriptive data on the prevalence and type of distracted bicycling in Boston at different times of day. This was a cross-sectional study in which observers tallied bicyclists at four high traffic intersections in Boston during various peak commuting hours for two types of distractions: auditory (ear buds/phones in or on ears), and visual/tactile (electronic device or other object in hand). Nineteen hundred seventy-four bicyclists were observed and 615 (31.2%, 95% CI: 29%-33%) were distracted. Of those observed, auditory distractions were the most common (N= 349 [17.7%, 95% CI: 16%-19%], $p=0.0003$) followed by visual/tactile distractions (N= 266 [13.5%, 95% CI: 12%-15%]). The highest proportion (40.7%, 95% CI: 35%-46%) of distracted bicyclists was observed during the midday commute (between 13:30-15:00). Distracted bicycling is a prevalent safety concern in the city of Boston, as almost one-third of all bicyclists exhibited distracted behavior. Education and public awareness campaigns should be designed to decrease distracted bicycling behaviors and promote bicycle safety in Boston. An awareness of the prevalence of distracted biking can be utilized to promote bicycle safety campaigns dedicated to decreasing distracted bicycling and to provide a baseline against which improvements can be measured.

Keywords

Bicycle; Distraction; Safety; Behaviors

Introduction

Commuting via bicycle/pedal cycle has become a very common mode of transportation in many American cities, including Boston, Massachusetts (Boston Bikes, 2013). Like many cities within the United States (US), Boston has had over a 100% increase in bicycle ridership since 2007 (Boston Bikes, 2013; Byrnes, 2011). Additionally, the Boston bicycle share program has created even more interest in bicycling within the city and has had more than 1.5 million rides recorded since their inception in July of 2011 (Boston Bikes, 2013). With larger amounts of bicyclists using and sharing the city roads, concern for safety of bicyclists, pedestrians, and even motorists has also increased. In January of 2013, the state of Massachusetts passed acts to protect vulnerable road users and bicyclists on shared public roadways (188th General Court of the Commonwealth of Massachusetts, n.d.; Brownsberger, 2013a; Brownsberger, 2013b). These acts are some of the many initiatives across the country aimed at protecting bicyclists from motorized vehicles, but there are fewer initiatives aimed at helping bicyclists better protect themselves.

While bicyclists everywhere are more vulnerable to sustaining injuries compared to other road users, an urban climate requires constant vigilance and awareness of their surroundings. Bicyclists must rely upon their vision, hearing, and full attention in order to best protect themselves from potential hazards (Stelling-Konczak, Hagenzieker, & van Dee, 2013). Reduced attention can place bicyclists and other road users at greater risk of sustaining an injury (deWaard, Schepers, Ormel, & Brookhuis, 2010; Terzano, 2013; deWaard, Westerhuis, & Lewis-Evans, 2015; Edell, Jung, Solomon, & Palu, 2013; Golden, Houtenbos, Ehlers, & deWaard, 2012; deWaard, Edlinger, & Brookhuis, 2011). The number of bicycle crash injuries in the US has risen 75% over the past 15 years from 8,791 in 1998 to over 15,400 in 2013 (Sanford, McCulloh, Callcut, Carroll, & Breyer, 2015). In Boston, some of the most common probable causes for bicycle crashes are due to: running red lights (28%), motorists opening car doors (18%), and riding into oncoming traffic (10%) (City of Boston, 2013). One of the least documented probable causes for a bicycle crash is the use of electronic devices (1%), and this statistic warrants further study as the use of electronic devices while commuting is becoming more popular within Boston (City of Boston, 2013).

An emerging safety concern for cyclists is distracted behaviors that occur when using portable electronic devices (Edell, Jung, Solomon, & Palu, 2013; Golden, Houtenbos, Ehlers, & deWaard, 2012; deWaard, Edlinger, & Brookhuis, 2011; Ichikawa & Nakahara, 2008). To date, most of the distracted bicycling literature is from Europe and Japan, and little is known about distracted bicycling within the US (deWaard, Schepers, Ormel, & Brookhuis, 2010; Terzano, 2013; deWaard, Westerhuis, & Lewis-Evans, 2015; Golden, Houtenbos, Ehlers, & deWaard, 2012; deWaard, Edlinger, & Brookhuis, 2011; Wilbur & Schroeder, 2014; Stimpson, Wilson, & Muelleman, 2013). Multiple studies involving observations of cyclists in a given time and place have assessed bicyclist safety behaviors to

better understand vulnerabilities associated with this mode of transportation.(Glass et al., 2014; Boston Bikes, 2012). However, distracted bicycle riding behaviors within the city of Boston has not been well-documented, and the prevalence of distracted bicycling behaviors is currently unknown.

The purpose of this study was to observe bicyclists in a large metropolitan area in the US and gather information about distracted bicycling behaviors that are commonly displayed in high bicycle traffic intersections across the city. This study aimed to quantify and establish a baseline measurement of distracted bicycling behaviors in order to support evidence-based public education and awareness programs that aim to reduce distracted bicycling behaviors. Additionally, with this study we hope to provide injury prevention specialists, local law enforcement, as well as state and federal highway safety agencies with information about the prevalence of this emerging bicycle safety issue within the Boston bicycling community.

In line with the purpose of this study our primary research question was: what is the prevalence of distracted bicycling behaviors in Boston? Furthermore, what types of distractions (auditory or tactile) are most prevalent in the Boston bicycling community? Overall, we predicted that at least one quarter (25%) of bicyclists would be observed with either an auditory or tactile distraction while riding. We predicted that auditory distractions would be more prevalent than tactile distractions as auditory devices are easy to wear and helpful with hands free use of an electronic device. We predicted the highest proportion of distracted cyclists would be observed during the morning and evening rush hours (7:30-9:00 & 16:00-17:30) as bicyclists would be more likely to listen to music, talk on the phone, text or email, or carry items as they commute to and from home and work.

Methods

This was a cross-sectional study where bicyclists were observed at specific times of day and intersections within the city of Boston. Consistent with prior bicycle observation studies, four high bicycle traffic and collision intersections were chosen around the city of Boston as observation sites (City of Boston, 2013; Powers, 2014). All intersections had a traffic light, bicycle lane, four lanes of motor vehicle traffic, and were in business/university districts. Each intersection was observed twice during morning (07:30-09:00) and evening rush hours (16:00-17:30) as well as the busy daytime commuting hours (10:30-12:00 and 13:30-15:00). Observations occurred only on weekdays during the summer months (June-August) with good weather (sunny or cloudy with dry pavement) to capture as much bicyclist data as possible. The Institutional Review Board at Tufts Medical Center approved this study, and in order to protect the privacy of those observed the investigators were not able to video record, take pictures, or collect any demographic data (e.g. - gender, age, etc.).

Two observers were used at each observation, and each observer simultaneously recorded one specific distracted bicycling behavior. No demographic or personal information about bicyclists was collected. The distractions observed in this study were either auditory (i.e. – headphones, ear buds, or Blue Tooth devices) or visual/tactile (i.e. – cell phone in hand, object in hand, or object handing from handlebars). Observers only viewed bicyclists traveling in one direction (towards the observers) as they rode through the intersection and a

tally system was used to capture all data. Inter-observer reliability was assessed by having the observers confirm the number of bicyclists and distractions tallied at the end of each street light change/cycle. The observers were discrepant on average less than 1.1% which is similar to another recent US distracted pedestrian behavior observational study (Basch, Ethan, Zybert, & Basch, 2015). When the number of observations did not match on reliability checks, the observers used the lower number recorded for data collection.

According to the Commonwealth of Massachusetts bicyclist laws, a bicyclist may not carry anything on their bicycle unless the object is placed in a basket, rack, or bag that is designated for that purpose, and this study observed bicyclist compliance with this law (Llerena et al., 2015). Currently, there are no laws restricting the use of electronic or auditory devices while riding a bicycle in Massachusetts.

Data were collected from this study was analyzed using basic descriptive statistics (QuickCalcs, GraphPad, Inc., La Jolla, CA and McCallum Layton Stats Calculator, Leeds, UK).

Results

A total of 1974 bicyclists were observed in this study. Of the 1974, 615 (31.2%) were distracted. The most common distraction observed in this study was auditory (N=349, 17.7%, ear buds and headphones) followed by visual/tactile distractions (N=266, 13.5%, object/cell phone in hand or on handlebars). In this study, 86.5% of bicyclists were not carrying objects in their hand while riding a bicycle. A summary of the distractions by each observation period is provided in Table 1. The largest proportion of distracted bicyclists was observed during the mid-day (13:30-15:00, 40.7%) and mid-morning commute times (10:30-12:00, 32.2%) and not during the 7:30-9:00 (29.3%) and 16:00-17:30 (28.6%) rush hour time periods as predicted. The mid-day commute from 13:30-15:00 also had the highest proportions of both auditory (21.1%) and visual/tactile (19.6%) distractions over all of the other observation sites. Additional data are provided in Table 2.

Discussion

We found that distracted bicycling was common in Boston, with almost one-third of all observed bicyclists appearing visually or tactically distracted. Our hypothesis that at least one quarter (25%) of bicyclists would be distracted by either an auditory or tactile distraction was supported and was in fact higher than expected (31.2%). The highest proportion of distracted bicycling occurred during the mid-day commute from 13:30-15:00 (40.7%), contrary to our hypothesis that distractions would be more prevalent during the morning (07:30-9:00) and afternoon rush hours (16:00-17:30). Although the highest proportion of distracted bicyclists was observed during the mid-day commute (13:30-15:00), prior Boston bicycle crash data show that on average 300 bicycle crashes occur during this time period, which is higher than the morning commute (7:30-9:00, N=280) but lower than the afternoon commute (16:00-17:30, N=450) (City of Boston, 2013). While distracted bicycling behavior may not be the sole cause of bicycle crashes, bicycling while distracted could be an important contributing factor in Boston bicycle crashes.

Objects that were observed being carried by the bicyclists during this study were: coffee or other beverages, food, electronic devices, bags (grocery/shopping), briefcase or laptop cases, and a floor lamp. Other distractions observed included: clothing (dresses and skirts that had to be held down with one hand while riding, women's shoes that didn't fit on the pedals), large purses and book bags that obstructed the riders' legs from pedaling, second passenger standing on bicycle pegs behind the bicycle driver, and stereo systems that were attached to the bicycle and playing music at high volume.

Distracted Bicycling in the US and Abroad

Distracted driving and motorcycle riding have been widely studied in the US, Mexico, Brazil, and Italy, and the consensus is that cell phone use while operating a motor vehicle increases the risk that one will be involved in an incident due to be distracted (Rumschlag et al, 2015; Overton, River, Hecht, Shafi, & Gandhi, 2014; Perez-Nunez et al., 2014; daSilva et al., 2012; Pileggi, Bianco, Nobile, & Angelillo, 2006; U.S. Department of Transportation, 2014). With the creation and utilization of new technology, many municipalities and state law enforcement agencies have established laws/ordinances that do not allow the use of a mobile electronic device while operating a motor vehicle (City of Chicago, n.d.). Although not illegal in the state of Massachusetts, riding a bicycle while distracted (i.e. - headphones/ear buds, texting or talking on phone) inhibits a rider's ability to sense potential dangers and other road users around them which can lead to serious harm and/or injury. Within the US and countries abroad, a universal definition of distracted bicycling has not been established and furthermore the laws that prohibit distracted bicycling are very diverse.

In the US, distracted biking laws/ordinances are becoming more popular in cities and states with higher vulnerable road user traffic including Chicago (IL), California, Virginia, Oregon, and Florida (Mwakalonge, White, & Siuhi, 2014; Stelling-Konczak, Hagenzieker, & van Dee, 2015). Most of the distracted biking laws/ordinances that currently exist in these cities and states only restrict a bicyclist from riding with ear buds and/or operating a cell phone while biking (Stelling-Konczak, Hagenzieker, & van Dee, 2015). However, the city of Chicago urges the use of hands-free technology (e.g.-Blue Tooth devices and ear buds) while bicycling within the city (City of Chicago, n.d.; Mwakalonge, White, & Siuhi, 2014). Chicago police officers will ticket cyclists who are using a cell phone or electronic device in their hand(s) while riding, however it is not against the law to use a hands-free device to operate a cellular device while riding a bicycle (City of Chicago, n.d.; Mwakalonge, White, & Siuhi, 2014). In the US, there is a lack of consistency on what specific behaviors constitute distracted bicycle riding, and if there are safe alternatives to riding and operating a cellular device.

Distracted biking has been widely studied in the Netherlands, Japan, and New Zealand since the mid-2000s (deWaard, Schepers, Ormel, & Brookhuis, 2010; Terzano, 2013; deWaard, Westerhuis, & Lewis-Evans, 2015; Golden, Houtenbos, Ehlers, & deWaard, 2012; deWaard, Edlinger, & Brookhuis, 2011; Wilbur & Schroeder, 2014; Stelling-Konczak, Hagenzieker, & van Dee, 2015; Bacchieri, Barros, vos Santos, Goncalves, & Gigante, 2010). One new and emerging safety concern for bicyclists in the Netherlands are hybrid/electric cars as they are quiet, and can be difficult to hear, which increases the risk of collision (Bacchieri, Barros,

vos Santos, Goncalves, & Gigante, 2010). However, much like the US, each country has its own definition and laws surrounding distracted biking. There does not seem to be a gold or universal standard for the amount of distraction that is safe while operating a bicycle on a shared or public road. Cyclists often rely as heavily, if not more heavily, on their senses as motorists do in order to remain safe. If bicycling requires as much attention to one's senses as is needed for driving a car, then it can likely be assumed that distracting attention from those senses is equally as dangerous for bicyclists.

Education and Awareness

Education and public awareness are essential in preventing distracted biking incidents. Community-based bicycle education interventions have been used to deter unsafe behaviors in Pelotas, Brazil; however, only 55% of the participants attended the educational sessions and this program did not reduce the amount of injuries/crashes within Pelotas (AAA of Hawai'i, 2012). In the US, the American Automobile Association (AAA) has begun safe bike riding campaigns in states with high bicycle traffic and tourism, such as Hawaii. In their "Sharing the Road: A Guide to Safe Bike Riding in Hawaii", AAA provides pictures, safety tips, explains the state and local bike laws so that bicycling tourists can enjoy the islands in a safe way (AAA of Hawai'i, 2012). Further, one section in this bike riding guide states that bicyclists should not ride: with headphones, while talking on the phone, while texting, or using a mobile device for social media or electronic communication purposes (AAA of Hawai'i, 2012). It is not known if the AAA bicycling guide is effective in deterring distracted bicycling, but this is a good resource to raise awareness in the US and for community outreach programs educational materials.

In 2014, the Allstate Insurance ranked Boston as the second worst city in the US for having the most unsafe drivers which places vulnerable road users at risk for being involved in an incident with a motor vehicle (Allstate, 2014). Boston bicyclists must be defensive and aware of their surroundings at all times while riding on the busy city streets. Diverting their attention with a mobile electronic device and/or impeding their hearing with ear buds/ear phones can place them at even higher risk for being involved in an incident (Stelling-Konczak, Hagenzieker, & van Dee, 2013). With AAA leading safety awareness around this issue in the tourism community, future outreach needs to utilize similar resources that already exists but yet tailored to specific audiences so that it is relevant to their safety needs. In line with distracted driving (Overton, River, Hecht, Shafi, Gandhi, 2014), safety campaigns raising public awareness about distracted bicycling are essential and need to begin as soon as possible. Two avenues that can be used to promote and market this safety issue in Boston are through social media (e.g., Facebook, Twitter, etc.) and community events (e.g., concerts, city events, etc.). Injury prevention and bicycle safety advocates can create short videos (e.g.- Vines or GIFs) or info-graphics to relay information and encourage bicyclists to not ride while distracted.

Limitations

One limitation of this study was that not all bicyclists were able to be captured due to the large volume of bikers traveling at one time, vehicles obstructing the view of the observers, or a bicyclist riding so quickly that information was not able to be collected. Additionally, in

order to protect the confidentiality of the cyclists observed and to remain in compliance with Institutional Review Board policies, the investigators were not allowed to video record or take pictures for any of the observations involved with data collection. Video recordings would have provided more in-depth observations and as well as data to assess inter- and intra-observer reliabilities.

Conclusion

This study found that distracted bicycling is prevalent in Boston, with almost one-third of bicyclists showing distracted behavior. Distracted bicycling has been widely studied outside of the US, and this study will support an existing body of knowledge with information from a large bicycling city in the US. Future observational studies are warranted to evaluate the safety behaviors of distracted bicyclists (i.e. – obeying street laws, wearing a helmet, use of night reflectors and lights), and crash frequency and injury severity of distracted bicyclists. Data collected from these studies could be used to support new distracted bicycling legislation and nationwide education and awareness to prevent injuries and deaths that stem from distracted bicycle riding. An awareness of the prevalence of distracted biking can also be utilized to promote bicycle safety campaigns dedicated to decreasing distracted bicycling and to provide a baseline against which improvements can be measured.

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Key Points

1. The prevalence of distracted bicycling is not well documented in Boston, and the purpose of this study was to establish a baseline measurement of distracted bicycling behaviors for bicyclists in the city of Boston.
2. Distracted bicycling is a prevalent safety concern in the city of Boston, as almost one-third of all bicyclists exhibited distracted behavior. Bicyclists are more likely to be distracted by auditory than visual/tactile interferences.
3. An awareness of the prevalence of distracted biking can be utilized to promote bicycle safety campaigns dedicated to decreasing distracted bicycling and to provide a baseline against which improvements can be measured.

Table 1

Distracted bikers by observation time period and type of distraction

			Auditory Distractions		Visual/ Tactile Distractions	
Time	Total Bikers	Total Distractions	EB/H	BT	CIH	OIH/H
07:30	318	79	52	2	2	23
10:30	180	58	30	0	1	27
13:30	90	35	16	0	1	18
07:30	347	413	63	1	3	49
16:00	446	123	71	3	4	45
16:00	366	110	60	0	7	43
13:30	135	53	31	0	7	15
13:30	92	41	20	0	4	17
	1974	615	343	6	29	237
			349		266	

EB/H: ear buds/headphones; BT: blue tooth; CH: cell in hand; OH/H: object in hand/handlebars

Table 2

Distractions by time of day

Time	Total Bikers	Total Distracted Bikers (N, % of Total Bikers)	Distracted Biker vs. Non-Distracted Biker (P-value)	Auditory Distractions (N, % of Total Bikers)	Visual/Tactile Distractions (N, % of Total Bikers)	Auditory vs. Visual/T (P-value)
07:30	665	195 (29.3%)	0.0844 *	118 (17.7%)	77 (11.5%)	0.0019
10:30	180	58 (32.2%)	0.1615 *	30 (16.7%)	28 (15.5%)	1.0000
13:30	317	129 (40.7%)	0.0001 *	67 (21.1%)	62 (19.6%)	0.6932
16:00	812	232 (28.6%)	0.1166 *	134 (16.5%)	98 (12.1%)	0.0129
Total	1974	615 (31.2%)	0.0001 *	349 (17.7%)	265 (13.4%)	0.0003

* Value calculated based on expected distracted biker rate of 25%.