

Mobile Device Use and Work Safety in a Healthcare System

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**Abstract**

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*Objectives:* The purpose of this descriptive study was to explore the factors contributing to the use of mobile devices at work and to assess for a relationship between mobile device use/user characteristics and injuries at work.

*Methods:* A cross sectional survey was performed within a healthcare organization employee pool of 2569 individuals.

*Result:* A 25.7 % response rate was achieved. Descriptive data was calculated for demographic, mobile device, and work safety variables and then cross-tabulated against mobile device use. Smartphones, unlimited data plans, use while driving and walking, full time work, day shifts, income, and male sex were associated with the increased use of mobile devices for work. An association between use and mobile device related injuries was not found. Mobile device use while driving, standard phones, coworker use, unlimited data plans, older age, male sex, lower income, part time work, and night shifts were associated with increased risk of work injuries.

*Conclusions:* While some mobile device and user characteristics appeared to be related to work injuries and use at work, no reliable statically significant associations were found.

Future studies should be sensitive to privacy and reprimand concerns among participants and potential confounding. In addition, a qualitative research approach would also be useful in exploring this important area of work safety.

TABLE OF CONTENTS

List of Figures ..... ii

List of Tables ..... iii

Acknowledgements ..... iv

I. Introduction .....1

II. Methods .....6

III. Results .....10

IV. Discussion .....14

IV. References .....22

LIST OF FIGURES

Figure Number	Page
1. Conceptual diagram of factors contributing to mobile device use at work and work injuries.....	5
2. Revised conceptual diagram of factors contributing to mobile device use at work and work injuries .....	18

## LIST OF TABLES

Table Number	Page
1. Study Variables.....	9
2. Demographics and Work Characteristics.....	24
3. Mobile Device Characteristics.....	26
4. Mobile Device Usage.....	28
5. Work Injuries Variables.....	29
6. Mobile Device Characteristics and Usage.....	30
7. Work Characteristics and Usage.....	31
8. Demographic Variables and Usage.....	32
9. Mobile Device Use Reported While Driving or Walking.....	33
10. Stratification of Work Injury Versus Non-work Injury Population Following Binary Conversion of Demographic Data.....	35
11. Stratification of Work Injury Versus Non-work Injury Populations Following Binary Conversion of Mobile Device Data.....	37
12. Stratification of Work Injury Versus Non-work Injury Population Following Binary Conversion of Mobile Device Use Data.....	39
13. Injury Rates Adjusted.....	40

## INTRODUCTION

Mobile communication devices have become permanent fixtures of the modern world. Only a cursory observation of any public gathering is needed to appreciate the pervasiveness of such devices. Recent survey data from the Cellular Telecommunications & Internet Association (CTIA) shows that greater than 80 percent of US adults now own a cellular phone.<sup>11</sup> Moreover, an estimated 35 percent of adults own a smartphone.<sup>12</sup> The combined minute and message use of mobile devices has consistently increased by 3.2 percent annually. Between June 2011 and 2012, over 2.32 trillion phone call minutes were used. In the same time period, 2.27 trillion text messages and 58 billion multimedia messages were sent. This represents a substantial increase from 2008, when only 601 billion text messages were sent annually. Between 2008 and 2012, mobile device data use also increased by 104 percent annually. The increase in mobile device usage is due in large part to both decreased costs and improved network infrastructure. The average monthly mobile device bill decreased from \$95.00 in 1988 to \$47.16 in 2012. Cellular sites increased by 11% annually between 1985 and 2012.<sup>1</sup>

Paralleling this growth, research exploring the effects of mobile device use on health and safety has also significantly increased. The use of mobile devices while driving, particularly among adolescents, has been a fervent area of study. Several studies have discovered a detrimental effect of both texting and talking on driving performance. Redelmeier and Tibshirani's landmark 1997 study of phone records from 669 drivers involved in accidents found that the risk of collision was 4 times higher when talking on a

cell phone. Moreover, the authors found that the risk increased with proximity to the time of the call. The relative risk of collision was 4.8 for calls made within 5 minutes of an accident versus 1.3 for calls made within 15 minutes. The use of a hands free device (i.e. a Bluetooth headset) did not mitigate risk.<sup>2</sup> While this early risk may have been over-estimated, an increased risk was also found by Strayer and Johnston's study. Their research found that cell phone conversations doubled the risk of missing traffic signals and delayed response times to signals.<sup>3</sup>

Similar results have been found with text messaging. A 2009 study using a driving simulator found that texting resulted in slower responses to brake lights, impaired vehicular control, and more crashes when compared to driving alone.<sup>4</sup> Hosking et al. found that time spent looking away from the road increased 400 percent while text messaging when compared to non-distracted driving. Significant increases in lane variability, traveling distance variability, and missed lane changes were also noted with driving and texting.<sup>5</sup> Wilson and Stimpson estimated that increased text messaging resulted in 16,000 additional traffic fatalities between 2001 and 2007.<sup>6</sup> Due to such data, mobile device use while driving has become a paramount public health concern, and laws regulating mobile devices while driving have proliferated in recent years.

Unfortunately, the hazards associated with mobile device use are not limited to automobiles. Schwebel et al have examined extensively the effect of mobile devices on pedestrian safety. Using simulation, they found college students were more likely to be struck by vehicles and to be distracted when crossing a street while texting.<sup>7</sup> Browsing the internet on a mobile device while walking is also risky. Byington found that

pedestrians using the internet while walking took longer to initiate street crossings, had an increased number of missed safe crossing opportunities, looked both ways less often, spent more time looking away from the street, and were more likely to be hit by a vehicle.<sup>8</sup> A recent observational study of pedestrian behavior at 20 high-risk intersections in Seattle, Washington, found that roughly 1/3 of all pedestrians were distracted while crossing a street and that pedestrians who were text messaging were 3.9 times more likely to perform an unsafe action (i.e. disregarding walking lights or failing to look both ways).<sup>9</sup> Similar findings have been found in adolescents.<sup>10</sup>

While there has been substantial research on the effect of mobile devices on driving and walking, the ramifications of this technology on work place safety remains largely unexplored. A search of PubMed using terms such as "cell phone work safety" or "cell phone work injuries" returned no relevant search results. This is surprising considering the steadily growing use of mobile device technologies by businesses. Analysis by ABI Research estimates that 346 billion text messages were sent by businesses alone in 2011. Based on growth trends, it is anticipated that this number will rise to 643 billion by 2015.<sup>13</sup>

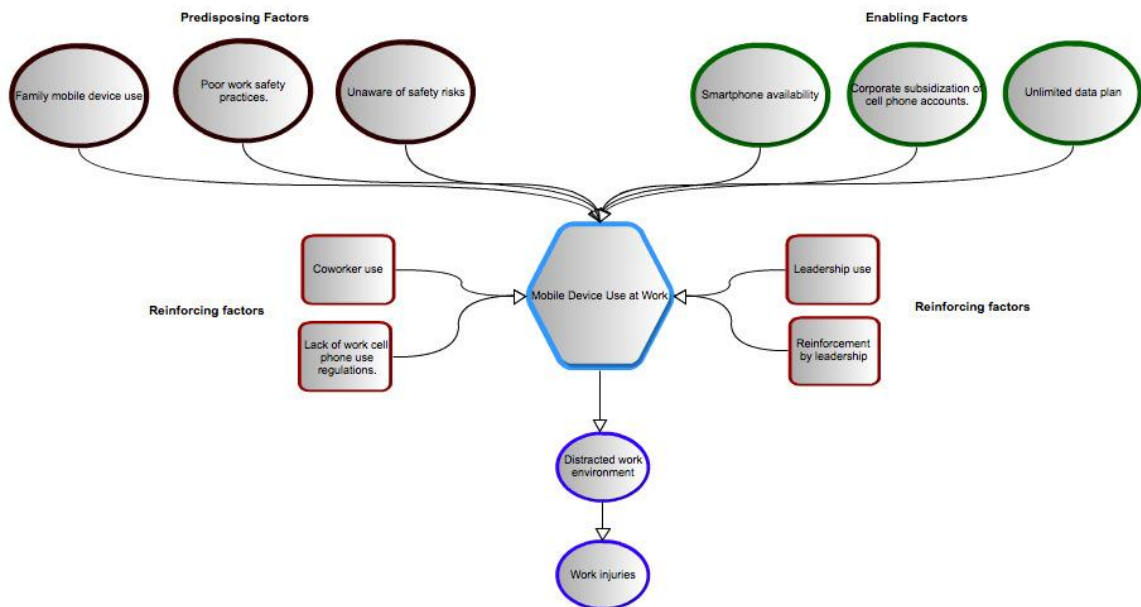
The burden of work-related injuries in the US also makes this knowledge gap concerning. In 2011, private industry reported roughly 3 million workplace injuries. More than half of these cases were severe enough to require work restrictions, job transfers, and/or time off from work.<sup>14</sup> The cost of work related injuries is equally alarming. The estimated costs for workers compensation care in the US was 250 billion dollars in 2007, an expenditure equal to the cost associated with cancer treatment.<sup>15</sup>

Finally, the absence of research examining the relationship between mobile devices and work safety is even more alarming when one considers both the known safety ramifications of mobile technology and the latest work injury statistics. The US Department of Transportation estimates that 5.6 million commercial vehicles were in operation in 2010. In 2009, an estimated 23,000 people were either injured or killed in an accident involving a large truck or bus. The cost of commercial motor vehicle related injuries in 2009 was 48 billion dollars and motor vehicle accidents were the leading cause of work related deaths.

Second to driving related deaths, pedestrian accidents comprised 15 percent of all workplace fatalities.<sup>17</sup> Per the National Safety Council, slips, trips, and falls (STF's) were responsible for 25,000 deaths in 2009, making them the second leading cause of unintentional deaths in communities and homes.<sup>18</sup>

Based on current research, a logical connection between mobile device use and impaired work safety can be made. In addition, several factors that contribute to the use of mobile devices at work can also be rationally hypothesized. These conceptual connections are summarized in Figure 1.

**Figure 1. Conceptual diagram of factors contributing to mobile device use at work and work injuries.**



With the demonstrated detrimental effects that mobile devices have had on routine activities such as walking, the potential consequence of this technology on the dangerous tasks typically encountered in industries such as construction and manufacturing are a valid concern. This descriptive study represents the initial exploratory steps in understanding the safety consequences of mobile technology in the work place. The objectives of this study are to investigate the prevalence of mobile device use in a healthcare system, to assess for the factors that contribute to the use of mobile devices at work, and to explore for a potential association between mobile device use/user characteristics and work injuries. This research will hopefully lead to improved work place safety.

## METHODS

### *Population Source*

The study sample was drawn randomly and voluntarily from the 2569 employees of the Kalispell Regional Healthcare organization in Kalispell, Montana. This population encompassed a wide spectrum of age, income, education, and other demographic variables. The study sample was not chosen purely for convenience. Research has shown that pedestrian safety is reduced by mobile device use. Per OSHA, pedestrian accidents such as slip, trips, and falls (STF's) are among the most common and costly work injuries in the healthcare setting. In 2009, the incidence of lost workdays due to STF's in the healthcare industry was 38.2 per 10,000, nearly 90 percent higher than all other private industries (20.1 per 10,000). STF's were second only to overexertion as the leading cause of lost workdays in hospitals, overshadowing violent events, exposures, and repetitive motion injuries. Moreover, STF's events were more likely to result in fractures and multiple injuries when compared to other common events in the healthcare setting.<sup>19</sup> Thus, examining how mobile devices affect safety in a healthcare work force is both a relevant and useful initial inquiry.

### *Recruitment and Inclusion/Exclusion Criteria*

Participants were recruited from the employee pool of the Kalispell Regional Healthcare organization. Participants were solicited through corporate email and a posted bulletin. The single inclusion criterion was that survey participants be employed by the Kalispell Regional Healthcare organization. Employees under the age of 18 were excluded from the study, as adolescent mobile device use was deemed too variable to

relate to work activities reliably.

### *Study Protocol*

We provided participants a statement of intent and a consent form to review prior to participation. These documents described the purpose of the research, background information, ramifications of the study, and the measures taken to protect confidentiality.

To decrease selection bias for those participants that used computers and other electronic devices frequently, we provided two means of completing the survey. One method utilized Survey Monkey, an online based survey tool. The second method was a physical polling station located within the hospital cafeteria. Blank surveys and a locked drop box were provided at the polling station through the entire study. Both electronic and handwritten responses were collected over a two-week period. The primary researcher entered the handwritten responses into the electronic database manually.

To improve response rates, survey participants were allowed to enter a raffle for a \$100 Amazon gift certificate following completion of the survey. To protect confidentiality, identifying information for the raffle was collected separately from the study data. It is not possible to connect raffle participants to survey responses.

### *Confidentiality*

Participant identity was protected at all times. No unique identifying information, such as name, social security number, or date of birth was collected. In addition, while information regarding work was obtained, identification of an individual by combining survey responses was not possible. Research data was secured in a locked filing cabinet

within the office of Occupational Health Services, a clinic of Kalispell Regional Healthcare. Access to the office space containing the research data was restricted as well. Access to research files was limited only to the research team. Online research data was also secured digitally.

### *Survey*

We used a 33-question, multiple-choice survey for data collection. The survey questions were formulated by examining other mobile device surveys, searching Survey Monkey's question database, and by collaboration with statisticians and worker's compensation experts/practitioners.<sup>20,21</sup> Prior to use, the survey was piloted in a heterogeneous selection of hospital employees. As discussed prior, both an Internet based survey and a physical drop box were used to collect data. The survey was deployed over a two-week period. The time needed to complete the survey was approximately 5 to 10 minutes.

### *Statistical Analysis*

Data collected was first condensed via Survey Monkey's built in tabulation tools. The University of Washington statistical consulting service provided significant assistance in planning and analysis. Internet based statistical calculators (<http://graphpad.com/quickcalcs/contingency1.cfm>) were used to perform the Fisher's exact test where applicable. During the planning of the study, we recognized that we might not obtain the power necessary to accurately measure a statistical association between work injuries and mobile devices. This concern was compounded by the lack of prior research on which to estimate the prevalence/incidence of mobile device related

work injuries. Nevertheless, we decided to continue the study, as our inquiry would at least provide descriptive information for the individuals who use mobile devices at work and the factors contributing to such use. Table 1 summarizes the variables measured in this study.

<b>Table 1. Study Variables</b>
<p>Study Population Variables</p> <ul style="list-style-type: none"> <li>· Average age</li> <li>· Sex</li> <li>· Household income</li> <li>· Children under age 17 in the home</li> <li>· Occupation</li> <li>· Type of shift</li> <li>· Full versus part time work</li> </ul>
<p>Mobile Device Variables</p> <ul style="list-style-type: none"> <li>· Use at work</li> <li>· Use for work</li> <li>· Cell phone type (smart versus standard)</li> <li>· Employer subsidization</li> <li>· Data plan type</li> <li>· Coworkers use of mobile devices at work</li> <li>· Supervisors use of mobile devices at work</li> <li>· Activity frequency (text messaging, video, internet, email)</li> </ul>
<p>Work Injuries/Safety Variables</p> <ul style="list-style-type: none"> <li>· Work injuries</li> <li>· Mobile device work related injuries</li> <li>· Type of mobile device work related injuries</li> <li>· Medical care for a injuries associated with a mobile device</li> <li>· Work compensation claims for an injury associated with a mobile device</li> <li>· Time off work from an injury associated with a mobile device</li> <li>· Mobile device use while driving for work</li> <li>· Mobile device use while walking at work</li> </ul>

The statistical analysis plan was divided into three phases:

*Phase 1: Study Population Descriptive Data Statistical Analysis*  
Descriptive data describing our study population was calculated.

*Phase 2: Mobile Device Use Association Analysis*  
Cross tabulation was used to assess for associations between study population characteristics and mobile device use in the work environment.

### *Phase 3: Work Injury Association Analysis*

Fischer exact tests and additional cross tabulations were used to assess for statistical associations between mobile device use/user characteristics and work injuries.

### *Participant Risks*

We anticipated minimal risks for this study. Participants were informed that their responses might affect future organization policy on mobile device use at work. This is an unavoidable ramification of the study as the results will be published publicly. Other than this, no other risks were anticipated. The potential safety benefits of this study were deemed to outweigh the possible risks.

### *Ethical Considerations*

The research team had no financial interests to disclose. In addition, deception was not a component of this research protocol.

## RESULTS

During the two-week study period, 660 of the 2569 employee population accessed the survey. The overall response rate was 25.7 %. Only 1% (7) of the surveys were completed on paper. 96.8 % (640) agreed to the consent and submitted responses. Of these participants, 85.4 % (547) fully completed the survey. 24 Individuals reported not owning a mobile device or did not provide a response, and these individuals were removed from the population.

Table 2 summarizes the survey population's demographic characteristics. The study population was comprised of a wide range of age groups. The 30-49 year old age

group was slightly larger than the 50 years and older group. Household income was also similarly evenly distributed. Interestingly, the sample population consisted of mainly females, who represented 87.2 % of participants. The majority of the population reported having no children less than 17 years of age living in their household. Consistent with the study population, most participants reported working full time and day shifts. The distribution of occupation categories was not representative, consisting mainly of clerical, nursing, and non-nursing/physician health professionals.

Table 3 summarizes cell phone related variables. Smartphones were more predominant than standard cell phones. Less than half of the study population reported using mobile devices at work regularly. A lower percentage reported using mobile devices for work related activities. In contrast, an overwhelming percentage of participants reported that their coworkers and supervisors used mobile devices regularly at work. Data plan distribution was fairly equal, and nearly 26.0 % of the population was unaware of their data plan type. The two most common reported mobile device activities were making phone calls and sending instant messages. Sending email was the third most common activity, but this was reported much less than making phone calls and instant messaging.

Table 4 provides additional information about the relative frequency of common mobile device activities within the work environment. Consistent with Table 3, making phone calls and instant messaging were the most frequent mobile device activities. The most common frequency for each of these activities was "some (1-5X/day)." The most reported frequency for other activities, such as accessing social media sites, was "never."

Table 5 summarizes the work injury data for the sample population. The percentage of reported work injuries was low at 8.0 % (45). Only one mobile device related injury was reported. Five participants reported nearly suffering a mobile device related injury. Of these mobile device related injuries or near injuries, the injury types reported were trips and lacerations.

Table 6 provides a cross tabulation of cell phone factors and use of mobile devices, both at work and for work. "No response" and "unknown" results were omitted from the calculations. Increased work related use was seen with unlimited data plans, smartphones, and employer subsidy of costs. No significant differences in use were noted with perceived coworker or supervisor use of mobile devices.

Similar cross tabulations for occupational factors and demographics are summarized in Tables 7 and 8. Increased work related use was seen in those reporting full time and day shift work. As for occupations, a difference between general use at work and work related use was reported for clerical positions. Nursing positions reported the highest usage for both at work and for work. The 30-49 year old age group also reported the highest prevalence of mobile device use at work and for work. Male participants reported increased work related use while females reported less when compared to general usage at work. General and work related usage both increased with income. A slightly higher percentage of work related use was seen in households with 1-2 dependents less than 17 years of age.

48.2 % (258) of participants reported using a mobile device while walking at work. 30.5 % (168) reported using a mobile device while driving for work. As we have discussed above, using a mobile device while walking and/or driving is associated with

increased risk. As such, we decided to examine the characteristics of the individuals reporting these activities separately and the pertinent findings are summarized in Table 9. Both groups reported a greater use of mobile devices at work and for work when compared to the remainder of the population. Smartphones were also more predominant in both groups. A greater proportion of males were also seen in the driving and walking groups. Overall, a higher frequency of use was reported for making phone calls, for emailing, and especially for text messaging greater than five times a day.

While only one participant reported suffering a work injury from a mobile phone, 8.0 % (45) of participants reported experiencing some form of a work injury. This population provided the opportunity to study the factors possibly contributing to work injuries in a population of mobile device users. Tables 10-12 summarize this data. To aid detection of an association, data was grouped into binary variables and 2 tailed p-values were calculated via the Fisher's exact test. For demographic and occupational variables, older age, male sex, lower income, part time work, night shift work, and use while driving were associated with a higher incidence of work related injuries. For mobile devices variables, unlimited data plans, standard phones, and coworker use were associated with increased work injuries. Interestingly, less work injuries were seen with smart phones, general and work related use, supervisor use, use while walking at work, and subsidization. Instant messaging and emailing remained the most common activities for the population reporting work injuries. No significant differences in mobile device activities were seen among those reporting work injuries.

## DISCUSSION

One of the primary objectives of this study was to determine if the use of mobile devices was associated with injuries at work due to mobile devices. 8.0 % (45) of participants reported suffering a work related injury of some kind. Of these, only one participant reported experiencing a work injury directly related to a mobile device. Even when considering the five individuals that reported almost having a mobile device related injury, adequate information relating mobile device work injuries to mobile device use was not found in this survey. The null hypothesis, that mobile device use is not related to mobile device injuries at work, cannot be rejected based on our data.

However, the 45 participants reporting a work injury of some type allowed us to examine for a potential association between mobile device use and work injuries in general. Standard cellular phones had nearly twice the injury prevalence than smartphones. This is somewhat surprising, considering the greater use capabilities of smartphones. However, the higher injury prevalence seen with standard phones can be potentially explained by the difficulty associated with using a standard mobile device. For example, it is harder to send text messages with a numeric keypad than with a virtual keyboard. Surprisingly, both use at work and for work were associated with less injury risk. One explanation for this paradox is that regular users of mobile devices are more efficient, and therefore safer, when using their phones in the work environment. Subsidization was also associated with decreased risk. Such financial support by employers may cause employees to view their mobile devices as “work tools”, and thus result in more careful and attentive use.

We also examined what demographic and occupational variables in mobile device users were associated with injuries. Older age and lower income showed an apparent positive relationship with injury risk. Increased risk was also seen for part time work and night shifts. This appears logical as part time workers may be less familiar with their work environment. Night shift workers can be subject to increased fatigue and sedation, thus making them more prone to injury. As expected, nurses, with their exposure to multiple risks, fast paced work, and fatigue; had significant rates of injuries. Similarly, general services, which included occupations such as grounds keeping and custodians, also had higher injury rates.

It is important to note that none of the above associations were found to be statistically significant except for the relationship between cell phone type and injuries. In addition, some of the findings will require further research to understand. Coworker use was associated with increased injury risk. In contrast, supervisor use appeared to be protective. As expected, mobile device use while driving was associated with increased injury risk. This is consistent with the data in Table 9, which shows greater at work and for work use in participants reporting using a mobile device while driving for work. However, mobile device use while walking was apparently protective, despite the increased use seen in this group as well. Many of these conundrums may be secondary to the limitations of the study and confounding.

A second objective of this study was to determine what factors were associated with mobile device use in the work place and for work activities. In regards to demographic factors, our preliminary data shows a potential positive association between work related use and both income and male gender. Increased work related use with

higher incomes appears plausible, as a greater income would allow for ownership of advanced mobile devices that are more useful for work related activities. This finding, when considered with the decreased injury risk seen with smartphones, may indicate that smartphones are actually safer despite their increased use. The mechanism of how male gender allows for increased work related use remains to be elucidated. No significant differences in usage were appreciated among age groups or number of family members less than 17 years of age in the household.

In regards to work factors, full time work and day shifts were positively associated with increased work related use. As the majority of our participants reported working during the day, this association appears logical since there would be a greater pool of individuals to communicate with during day shifts. The same logic can explain the increased usage associated with full time work. These findings are especially interesting when one considers that part time work and night shifts were associated with more work injuries. In examining the most prevalent occupation types, the only significant difference was seen in clerical occupations, which were associated with a decrease in work related use. This decrease may be secondary to the limited breaks in duties inherent in routine clerical work.

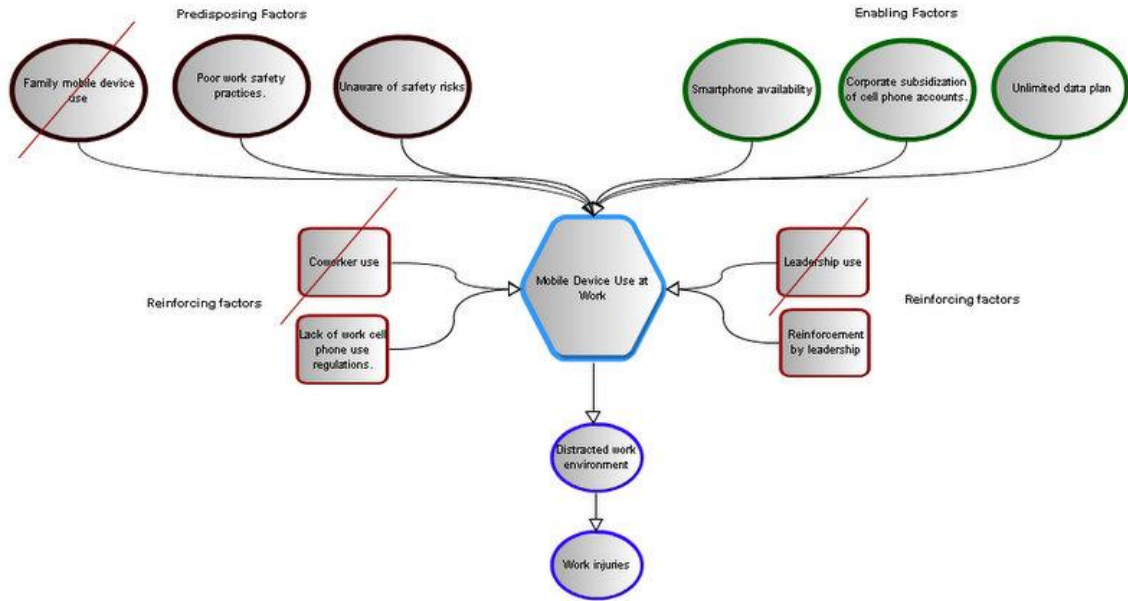
Smartphones, unlimited data plans, and subsidization of costs also appear to be associated with increased work use. This appears plausible as the decreased financial burden associated with unlimited data plans and subsidization may result in employees being more willing to use their "phone resources" for work related activities. In addition, subsidization of costs may be interpreted, subconsciously or consciously, as employer support of mobile device use in the work place. The increase in work use seen with

unlimited data may explain the aforementioned increase in work injuries seen with such plans. Interestingly, coworker and supervisor use, while both highly reported, did not appear to be associated with work related usage. Using a mobile device while driving or walking was also associated with increased at work and for work use.

The finding that smart phones, unlimited data plans, full time work, day shifts, and subsidization are associated with both increased use and decreased work injury risk deserves special attention. This apparent paradox could indicate that the association between mobile devices and work safety is not via frequency of use. In other words, using a mobile device more frequently does not necessarily increase the risk of injury. Instead, this finding raises the notion that the more important risk-determining factor is how one uses their mobile device.

Our preliminary data supports some components of the proposed conceptual diagram. However, the data currently does not support family, leadership, and coworker use as factors contributing to mobile device use at work or for work. Thus a new conceptual diagram can be tentatively proposed as such:

**Figure 2. Revised Conceptual Diagram of Mobile Device Use and Work Safety**



While it is tempting to refine the conceptual model as such, our findings must be considered with significant uncertainty. Despite our best attempts, the study suffers from several weaknesses. One such weakness is the poor response rate of 25.7 %. This low participation rate significantly reduced the power of our study, and is one of the main reasons for our study’s non-significant p-values. One possible explanation for the low participation rate was the length of the survey. Other potential factors were the use of only a single recruitment email and the budget limitations for advertising within the organization. Based on unsolicited feedback, concerns over privacy and the potential for reprimand remained a significant concern for many participants. These fears persisted despite the careful attention given to protection of privacy in the provided consent. The persistent skepticism by participants likely explains the rather surprising finding that 81.9 % of participants reported never checking social networking sites while at work.

Another significant limiting factor is the skewed sample population. Over 80% of the participants were female; a distribution far from being representative of the study population. Moreover, occupation types were over-represented by clerical, nursing, and "health professionals" positions. Only 4 physicians completed the survey. In addition, roughly 80% of participants reported working full time and during the day shift.

Finally, significant confounding likely exists for many of the variables. Table 13 examines work injury risk for some variables with adjustments for sex and income. The increase in work injuries seen with standard phone use remained when adjusted for sex. However, the results reversed when adjusted for income. Income appeared to be a significant confounder overall, with income adjustment also reversing findings for data plans, mobile device use while driving, and age. Such a level of confounding could certainly also explain many of the less logical findings mentioned previously.

Even though the results are burdened by several weaknesses, the study does make pertinent contributions to future research. First and foremost, this study highlights the importance of appropriate marketing and the consideration of privacy/reprimand concerns in research involving mobile devices. Mobile devices, much like cars, are often seen as personal devices, perhaps even rights, of individuals. Tackling the ingrained "protection of private property" instinct will be necessary to accurately study the use of mobile devices in the work place.

A surprising amount of unsolicited feedback was provided by research participants. The information we received provided valuable insight into concerns over

privacy and the use of mobile devices at work. In the future, a qualitative research approach, using methods such as focus groups, will likely be very productive.

While our study was limited at best, the information collected does indicate that a safety concern does exist with mobile devices. Numerous participants, via the aforementioned feedback, stated that mobile devices interfered with their work and impaired work safety. In addition, a significant number of individuals reported using their devices while driving and walking despite the widely accepted risk of such behaviors. Moreover, as shown in Table 9, it is these individuals that report greater work related use overall. Clearly, the impact of mobile devices on safety needs to be examined further.

## CONCLUSION

This study indicates that higher income, male sex, smartphone use, unlimited data, full time work, and day shift work is potentially associated with increased use of mobile devices for work related activities. Older age, male sex, lower income, part time work, night shifts, mobile device use while driving, standard phones, coworker use, and unlimited data plans may be associated with increased work injury risk. Our results also indicate that the safety risks of mobile devices are dependent not on frequency, but rather on the method of use. Unfortunately, our study was limited by a poor response rate, a skewed sample population, and confounding. An association between mobile device use and injuries from mobile devices was not found. The developments in this study indicate that careful attention to privacy, consideration of confounding, and a qualitative research approach will be beneficial in future studies. With this direction, the

consequences of mobile devices in the work place will hopefully be further understood, yielding crucial improvements in work safety.

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<b>Table 2. Demographics and Work Characteristics</b>	
Age Group, % (n)	(556)
18-29	14.7 % (82)
30-49	45.0 % (250)
≥ 50	40.3 % (224)
Sex, % (n)	(553)
Female	87.2% (482)
Male	15.7% (71)
Household Income, % (n)	(472)
≤ 20,000	3.6 % (17)
20,000-34,999	18.2 % (86)
35,000-49,999	17.2 % (81)
50,000-74,999	24.6 % (116)
75,000-99,999	18.9 % (89)
100,000-149,999	11.2 % (53)
≥ 150,000	6.43% (30)
Children ≤ 17 years of age living in household, % (n)	(462)
0	57.4 % (265)
1	15.8 % (73)
2	18.4 % (85)
3	7.8 % (36)
4	0.6 % (3)
Work Schedule % (n)	(561)
Full time	79.9 % (448)
Part time	18.0 % (101)
Other	2.1 % (12)
Shift % (n)	(562)
Day	82.9% (466)

Night	8.0% (45)
Variable	9.1% (51)
Occupation Category, % (n)	(533)
Clerical (i.e. billing, ward clerk)	32.6 % (174)
Nursing	33.6 % (179)
Health Professionals (i.e. physical therapy, phlebotomist)	13.2 % (70)
Physicians	0.6 % (3)
General Services (i.e. housekeeping, nutrition)	3.0 % (16)
Other	17.0 % (91)

<b>Table 3. Mobile Device Characteristics</b>	
Type, % (n)	(604)
Standard Cellular Phone	43.2 % (271)
Smartphone	53.0 % (333)
Regular use at work, % (n)	(560)
Yes	46.6 % (261)
No	53.3 % (299)
Regular use at work for occupation activities, % (n)	(567)
Yes	33.5 % (190)
No	66.5 % (377)
Data plan, % (n)	(527)
Unlimited	40.4 % (213)
Tiered	34.0 % (179)
Unaware	25.6 % (135)
Employer subsidy of mobile device costs, % (n)	(558)
Yes	28.1 % (157)
No	71.9 % (401)
Use of mobile devices by coworkers, % (n)	(516)
Yes	88.6 % (457)
No	11.4 % (59)
Use of mobile devices by supervisors, % (n)	(469)
Yes	88.5 % (414)
No	11.7 % (55)
Most common uses of mobiles devices at work, % (n)	(427)
Phone calls	44.3 % (189)
Instant messaging	37.2 % (159)

Email	9.6 % (41)
Use of a mobile device while walking at work, % ( <i>n</i> )	(535)
Yes	48.2 % (258)
No	51.8 % (277)
Use of a mobile device while driving for work, % ( <i>n</i> )	(550)
Yes	30.5 % (168)
No	69.5 % (382)

<b>Table 4. Mobile Device Usage</b>		
Social Networking, % ( <i>n</i> )	81.9 % (462)	Never
	15.1 % (85)	Some (1-5x/day)
	0.9 % (5)	Several (>5x/day)
Instant Messaging, % ( <i>n</i> )	31.9 % (179)	Never
	56.7 % (318)	Some (1-5x/day)
	9.3 % (52)	Several (>5x/day)
Email, % ( <i>n</i> )	75.0 % (422)	Never
	17.0 % (96)	Some (1-5x/day)
	8.0% (45)	Several (>5x/day)
Phone calls, % ( <i>n</i> )	35.2 % (195)	Never
	54.5 % (302)	Some (1-5x/day)
	10.3 % (57)	Several (>5x/day)
Photography, % ( <i>n</i> )	90.6% (508)	Never
	9.1% (51)	Some (1-5x/day)
	0.3% (2)	Several (>5x/day)
Games, % ( <i>n</i> )	96.8% (546)	Never
	3.0% (17)	Some (1-5x/day)
	0.2% (1)	Several (>5x/day)

<b>Table 5. Work Injuries Variables</b>	
Occurrence of a work injury in prior 2 years, % ( <i>n</i> )	(563)
Yes	8.0 % (45)
No	92.0 % (518)
Occurrence of a work injury due to a mobile device in prior 2 years, % ( <i>n</i> )	(561)
Yes	0.2 % (1)
No	99.8 % (560)
Nearly suffered a work injury due to a mobile device in prior 2 years, % ( <i>n</i> )	(561)
Yes	0.9 % (5)
No	99.1 % (556)
Type of injury associated with a mobile device, % ( <i>n</i> )	
Slip, Trip, Fall	0.4% (2)
Cut/Laceration	0.2% (1)

<b>Table 6. Mobile Device Characteristics and Usage</b>		
Mobile Device Variable	General use at work, % ( <i>n</i> )	Work related Use, % ( <i>n</i> )
Phone type, % ( <i>n</i> )		
Standard Cell Phone	36.0 % (94)	33.2 % (63)
Smartphone	64.0 % (167)	66.8 % (127)
Data plan, % ( <i>n</i> )		
Tiered	44.2 % (84)	41.4 % (55)
Unlimited	55.8 % (106)	58.6 % (78)
Employer subsidy of mobile device cost, % ( <i>n</i> )		
Yes	38.7 % (99)	45.7 % (85)
No	61.3 % (157)	54.3 % (101)
Coworker use, % ( <i>n</i> )		
Yes	96.0 % (241)	96.2 % (178)
No	4.0 % (10)	3.8 % (7)
Supervisor use, % ( <i>n</i> )		
Yes	96.1 % (224)	97.1 % (167)
No	3.9% (9)	2.9 % (5)
Mobile Device Activities, % ( <i>n</i> )		177
Instant Messaging	31.1 % (76)	26.6 % (47)
Phone Calls	43.4 % (106)	46.3 % (82)
Email	13.9 % (34)	11.3 % (20)

<b>Table 7. Work Characteristics and Usage</b>		
Work Variable	General use at work, % ( <i>n</i> )	Work related Use, % ( <i>n</i> )
Work hours, % (n)		
Full time	86.3 % (222)	90.3 % (167)
Part time	13.6 % (35)	9.7 % (18)
Shift, % (n)		
Day	92.2 % (214)	93.4 % (155)
Night	7.8 % (18)	6.6 % (11)
Occupation classification, % (n)		
Nursing	30.9 % (80)	31.9 % (60)
Clerical	24.7 % (64)	17.0 % (32)
Other health professional	11.6 % (30)	12.2 % (23)
General services	3.9 % (10)	5.9 % (11)
Transportation	1.5 % (4)	2.1 % (4)

<b>Table 8. Demographic Variables and Usage</b>		
Demographic Variable	General use at work, % (n)	Work related Use, % (n)
Age, % (n)		
18-29	15.4 % (40)	12.7 % (24)
30-49	48.3 % (125)	50.3 % (95)
50 and older	36.3 % (94)	37.0 % (70)
Sex, % (n)		
Male	19.7 % (51)	24.3 % (46)
Female	80.3 % (208)	75.7 % (143)
Income, % (n)	226	
<34,999 \$	15.9 % (36)	8.33 % (14)
35,000-74,999 \$	39.4 % (89)	41.1 % (69)
75,000 and greater \$	44.7 % (101)	50.6 % (85)
Children younger than 17 in household, % (n)		
0	48.6 % (108)	48.1 % (77)
1-2	40.5 % (90)	41.3 % (66)
3-4	10.0 % (22)	10.0 % (16)

<b>Table 9. Mobile Device Use Reported While Driving and Walking</b>				
<b>Work Variable</b>		<b>Participants reporting no mobile device use while driving/walking</b>	<b>Participants reporting mobile device usage while driving</b>	<b>Participants reporting mobile device usage while walking</b>
<b>Type, % (n)</b>				
Standard Cellular Phone		53.0 % (124)	40.5 % (68)	38.4 % (99)
Smartphone		47.0 % (110)	59.5 % (100)	61.6 % (159)
<b>Regular use at work, % (n)</b>				
Yes		25.8 % (60)	64.2 % (106)	69.0 % (176)
No		74.2 % (173)	35.8 % (59)	31.0 % (79)
<b>Regular use at work for occupation activities, % (n)</b>				
Yes		12.8 % (30)	51.8 % (86)	54.7 % (141)
No		87.2 % (205)	35.8 % (80)	45.3 % (117)
<b>Employer subsidy of mobile device costs, % (n)</b>				
Yes		18.2 % (42)	43.0 % (71)	36.6 % (93)
No		81.8 % (189)	57.0 % (94)	63.4 % (161)
<b>Sex, % (n)</b>				
Female		94.8 % (219)	76.8 % (126)	80.0 % (204)
Male		5.2% (12)	23.2 % (38)	20.0 % (51)
<b>Frequency of common mobile device related activities</b>				
Social Networking, % (n)	Never	88.6 % (203)	80.7 % (130)	78.9 % (198)
	Some (1-5x/day)	10.9 % (25)	18.0 % (29)	19.9 % (50)
	Several (>5x/day)	0.5 % (1)	1.2 % (2)	1.2 % (3)
Instant Messaging, % (n)	Never	44.0 % (100)	28.9 % (46)	20.2 % (51)
	Some (1-5x/day)	52.9 % (120)	54.7 % (87)	64.4 % (163)

	Several (>5x/day)	3.1 % (7)	16.4 % (26)	15.4 % (39)
Email, % (n)	Never	87.2 % (205)	61.8 % (102)	62.5 % (160)
	Some (1-5x/day)	10.6 % (25)	22.4 % (37)	23.4 % (60)
	Several (>5x/day)	2.1 % (5)	15.8 % (26)	14.1 % (36)

<b>Table 10. Stratification of Work Injury Versus Non-work Injury Population following Binary Conversion of Demographic Data</b>		
<b>Key Variable</b>	<b>Reporting a Work Injury (45)</b>	<b>Not Reporting a Work Injury (518)</b>
Age Group, % (n) ( <i>p</i> =0.7457)		
≤ 50 (331)	7.3 % (24)	92.7 % (307)
≥ 50 (224)	8.0 % (18)	92.0 % (206)
Sex, % (n) ( <i>p</i> =0.532)		
Female (481)	6.9% (33)	93.1% (448)
Male (71)	14.1% (10)	85.9% (61)
Household Income, % (n) ( <i>p</i> =0.2798)		
< 50,000 (184)	9.2% (17)	90.8% (167)
≥ 50,000 (288)	6.3% (18)	93.7% (270)
Children ≤ 17 years of age living in household, % (n) ( <i>p</i> =0.8479)		
< 2 (338)	8.6 % (29)	91.4% (309)
> 2 -3(120)	7.5 % (9)	92.5% (111)
Work Schedule % (n) ( <i>p</i> =0.6852)		
Full time (448)	7.8% (35)	92.2% (413)
Part time (100)	9.0% (9)	91.0% (91)
Shift % (n) ( <i>p</i> =0.2476)		
Day (466)	7.7% (36)	92.3% (430)
Night (45)	13.3% (6)	8.7% (39)
Occupation Category, % (n)		
Clerical (i.e. billing, ward clerk) (174)	4.6% (8)	95.4% (166)
Nursing (179)	9.5% (17)	90.5% (162)
Health Professionals (i.e. physical therapy,	7.1% (5)	92.9% (65)

phlebotomist) (70)		
Physicians (3)	33.3% (1)	66.3% (2)
General Services (i.e. housekeeping, nutrition) (16)	18.7% (3)	81.3% (13)

<b>Table 11. Stratification of Work Injury Versus Non-work Injury Populations following Binary Conversion of Mobile Device Data</b>		
<b>Variable</b>	<b>Reporting Work Injury (45)</b>	<b>Not Reporting Work Injury (518)</b>
Type, % (n) ( <i>p</i> =0.0416)		
Standard Cellular Phone (252)	10.7% (27)	89.3% (225)
Smartphone (310)	5.8% (18)	94.2% (292)
Regular use at work, % (n) ( <i>p</i> =0.3537)		
Yes (259)	6.9% (18)	93.1% (241)
No (293)	9.2% (27)	90.8% (266)
Regular use at work for occupation activities, % (n) ( <i>p</i> =0.5159)		
Yes (188)	6.9 % (13)	93.1 % (175)
No (371)	8.6% (32)	91.4% (339)
Data plan, % (n) ( <i>p</i> =0.6999)		
Unlimited (209)	8.1% (17)	91.9% (192)
Tiered (178)	6.7% (12)	93.3% (166)
Employer subsidy of mobile device costs, % (n) ( <i>p</i> =0.4869)		
Yes (154)	6.5% (10)	93.5% (144)
No (397)	8.6% (34)	91.4% (363)
Use of mobile devices by coworkers, % (n) ( <i>p</i> =0.6045)		
Yes (451)	8.2% (37)	91.8% (414)
No (58)	5.2% (3)	94.8% (55)
Use of mobile devices by supervisors, % (n) ( <i>p</i> =0.1148)		

Yes (407)	7.6% (31)	92.4% (376)
No (55)	14.5% (8)	85.5% (47)
Most common uses of mobiles devices at work, % ( <i>n</i> )		
Phone calls (187)	7.0% (13)	93.0% (174)
Instant messaging (158)	7.0% (11)	93% (147)
Use of a mobile device while walking at work, % ( <i>n</i> ) ( <i>p</i> =0.4178)		
Yes (258)	6.6% (17)	93.4% (241)
No (277)	8.6% (24)	91.3% (253)
Use of a mobile device while driving for work, % ( <i>n</i> ) ( <i>p</i> =0.4966)		
Yes (168)	8.9% (15)	91.1% (153)
No (382)	7.3% (28)	92.7% (354)

<b>Table 12. Stratification of Work Injury Versus Non-work Injury Population following Binary Conversion of Mobile Device Use Data</b>			
<b>Variable</b>	<b>Reporting Work Injury (45)</b>	<b>Not Reporting Work Injury (518)</b>	<b>Frequency</b>
Social Networking, % ( <i>n</i> )	7.1% (6)	92.9% (79)	Some (1-5x/day) (85)
	0% (0)	100% (4)	Several (>5x/day) (4)
Instant Messaging, % ( <i>n</i> )	5.4% (17)	94.6% (299)	Some (1-5x/day) (316)
	5.9% (3)	94.1% (48)	Several (>5x/day) (51)
Email, % ( <i>n</i> )	4.2% (4)	95.8% (92)	Some (1-5x/day) (96)
	2.3% (1)	97.7% (42)	Several (>5x/day) (43)
Phone calls, % ( <i>n</i> )	6.0% (18)	94.0% (283)	Some (1-5x/day) (301)
	5.5% (3)	94.5% (52)	Several (>5x/day) (55)
Photography, % ( <i>n</i> )	8.0% (4)	92.0% (46)	Some (1-5x/day) (50)
	0% (0)	100% (2)	Several (>5x/day) (2)
Games, % ( <i>n</i> )	12.5% (2)	87.5% (14)	Some (1-5x/day) (16)
	0% (0)	100% (1)	Several (>5x/day)

<b>Table 13. Injury Rates Adjusted</b>				
<b>Standard versus Smartphone Injury Rates Adjusted for Sex</b>				
Mobile Device Type	Males Only ( <i>p</i> =0.1712)		Females Only ( <i>p</i> =0.1466)	
	Injury	No Injury	Injury	No Injury
Standard Cell Phone	21.2 % (7)	78.8 % (26)	8.9 % (19)	91.1 % (195)
Smartphone	7.9 % (3)	92.1 % (35)	5.3 % (14)	94.7 % (252)
<b>Standard versus Smartphone Injury Rates Adjusted for Income</b>				
	< 50,000\$ annual income ( <i>p</i> =0.0795)		≥ 50,000\$ annual income ( <i>p</i> =1.0)	
Mobile Device Type	Injury	No Injury	Injury	No Injury
Standard Cell Phone	13.0 % (11)	87.0 % (74)	6.5 % (8)	93.5 % (116)
Smartphone	31.6 % (6)	68.4 % (13)	6.1 % (10)	93.9 % (153)
<b>Mobile Device Use While Driving Injury Rates Adjusted for Income</b>				
	< 50,000\$ annual income ( <i>p</i> =0.0386)		≥ 50,000\$ annual income ( <i>p</i> =0.7962)	
Mobile Device Use While Driving	Injury	No Injury	Injury	No Injury
Yes	16.7 % (8)	83.3 % (40)	5.3 % (5)	94.7 % (90)
No	6.1 % (8)	93.9 % (123)	6.5 % (12)	93.5 % (174)
<b>Data Plan Injury Rates Adjusted for Income</b>				
	< 50,000\$ annual income ( <i>p</i> =0.0863)		≥ 50,000\$ annual income ( <i>p</i> =0.2717)	
Data Plan	Injury	No Injury	Injury	No Injury
Unlimited	3.1 % (2)	96.9 % (63)	6.5 % (10)	93.5 % (143)
Tiered	11.7 % (7)	88.3 % (53)	3.1 % (4)	96.9 % (125)
<b>Age Group Injury Rates Adjusted For Income</b>				
	< 50,000\$ annual income ( <i>p</i> =0.5741)		≥ 50,000\$ annual income ( <i>p</i> =0.4636)	
Age Group	Injury	No Injury	Injury	No Injury
<50 years of age	7.9 % (10)	92.1 % (117)	7.5 % (12)	92.5 % (149)

$\geq 50$ years of age	10.7 % (6)	89.3 % (50)	4.7 % (6)	95.2 % (121)
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