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Limitations of Data on Cell Phone Involvement in Collisions: A Case Study of California

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1 **LIMITATIONS OF DATA ON CELL PHONE INVOLVEMENT IN COLLISIONS: A CASE**  
2 **STUDY OF CALIFORNIA**

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1 **ABSTRACT**

2 With the increasing prevalence of mobile technology and high-profile crashes bringing attention to  
3 distracted driving, data on cell phone involvement in collisions is critical for understanding the extent of  
4 the problem, examining the effectiveness of policies, and developing interventions to improve safety.  
5 Some limitations of existing data have been previously identified, but this paper examines the specific  
6 case of California's collision data. Temporal, geographic, and jurisdictional trends are analyzed to  
7 identify the source and type of inconsistencies in the cell phone involvement data. Matching and  
8 comparison of state and federal data sources highlight further limitations. Data could be improved by  
9 simplifying the California crash report form and aligning variables to be more consistent with federal  
10 standards. In the meantime, it is not recommended that existing data on cell phone involvement in  
11 collisions be used for any analyses to evaluate policy or driver behavior.

12

13

14 *Keywords:* safety, distracted driving, collision data, cell phones

15

## 1 INTRODUCTION

2 Driver distraction due to cell phone use has become a common concern with the increased prevalence of  
3 mobile technology. Research has focused on potentially distracting behaviors, including dialing a phone,  
4 handheld talking, hands-free talking, and texting, their effects on driving performance, their prevalence  
5 among different driving populations, and the increased risk of collision when drivers engage in them.  
6 Although there has been no means universal agreement among researchers, there has been sufficient  
7 scientific evidence and public outcry over high profile collisions that 49 states have passed legislation  
8 prohibiting either texting or handheld cell phone use for some population of drivers (1). Several recent  
9 studies have attempted to evaluate the effectiveness of these laws at reducing traffic collisions.  
10 Unfortunately, due to poor quality data on cell phone involvement in collisions, researchers tend to look  
11 at the effect of the cell phone laws on the rate of all collisions at a given severity level, rather than  
12 limiting the analysis to cell-involved collisions. Studying the effect on all crashes, rather than the  
13 pertinent crashes, can cloud the results and make it more difficult to identify a significant effect. Data on  
14 cell phone involvement in collisions are therefore central for understanding the extent of the problem,  
15 examining the effectiveness of policies, and developing interventions to improve safety.

16 Collision data have been shown to suffer from underreporting of driver distraction. A study  
17 conducted by the National Highway Traffic Safety Administration (NHTSA) compared coding of  
18 distraction among matched collisions in three NHTSA databases. Distraction was identified in 11 percent  
19 of collisions based on police reports, but it was identified in 28 percent of the same collisions based on  
20 data coming from special investigators who were sent to the scene to collect precrash information (2). In  
21 an investigation of fatal cell-phone-involved crashes, the National Safety Council found that only 52  
22 percent were coded as involving cell phones in FARS. Of collisions where the driver admitted using a cell  
23 phone, only 50 percent were coded as such in FARS (3).

24 There are several reasons for underreporting of cell phone use in collisions. Since many states  
25 have enacted bans, drivers may not want to admit engaging in an illegal or negative behavior if  
26 interviewed by police (4). If the driver is fatality injured, there may not be a witness to provide evidence  
27 of whether a cell phone was in use (4). Collision report forms are infrequently updated, so it is difficult  
28 for them to keep up with the changes in communications technology (4).

29 This paper examines some of the limitations of cell phone use data in collisions by looking at a  
30 case study of California. Temporal, geographic, jurisdictional trends highlight the sources of confusion  
31 and inconsistency in coding cell phone involvement in crashes.

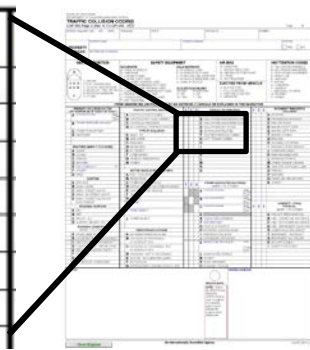
32 The following section describes California's traffic collision report form and how it is entered  
33 into the state and national collision databases. Then, the trends of coding cell phone involvement in the  
34 state database are examined. Collisions are matched from the state and national databases to identify the  
35 consistency in coding. Subsequently, discussion is presented on the potential sources of errors and  
36 inconsistencies in the databases.

## 37 CALIFORNIA COLLISION DATA

38 The description of any traffic collision in California is recorded in the California Highway Patrol (CHP)  
39 555 Traffic Collision Report (555) by the responding law enforcement officer. The 555 form contains  
40 four standard pages for entering information on crash conditions, drivers, vehicles, passengers, injured  
41 parties, and witnesses, as well as room for collision diagrams and narrative. It first included elements for  
42 indicating cell phone presence or usage for each driver in April, 2001. In July, 2003, the distinction was  
43 changed to indicate handheld (HH) vs. handsfree (HF) cell phone usage. There are two locations on a 555  
44 form where an officer can mark these characteristics, under SPECIAL INFORMATION (Figure 1) and under  
45 INATTENTION (Figure 2); however, the distinction can be confusing for even highly-trained officers. The  
46 CHP Collision Investigation Manual (CIM) says that the INATTENTION element should be marked "if, in  
47 the officer's opinion, inattention was an associated factor in the collision" (5). If they mark INATTENTION,  
48 officers must then select an inattention code to enter in the right side of box F (Figure 2). The CIM also  
49 instructs officers not to use the INATTENTION element as a "catch-all," suggesting that the default option  
50 for entering cell phone usage should be under SPECIAL INFORMATION.  
51

1

1	2	3	SPECIAL INFORMATION
			<b>A</b> HAZARDOUS MATERIAL
			<b>B</b> CELL PHONE HANDHELD IN USE
			<b>C</b> CELL PHONE HANDSFREE IN USE
			<b>D</b> CELL PHONE NOT IN USE
			<b>E</b> SCHOOL BUS RELATED
			<b>F</b> 75 FT MOTORTRUCK COMBO
			<b>G</b> 32 FT TRAILER COMBO
			<b>H</b>



2

3

FIGURE 1. SPECIAL INFORMATION section on the 555 form

4

**INATTENTION CODES**

- A - CELLPHONE HANDHELD
- B - CELLPHONE HANDSFREE
- C - ELECTRONIC EQUIPMENT
- D - RADIO / CD
- E - SMOKING
- F - EATING
- G - CHILDREN
- H - ANIMALS
- I - PERSONAL HYGIENE
- J - READING
- K - OTHER

			<b>E</b> VISION OBSCUREMENT:
			<b>F</b> INATTENTION*:
			<b>G</b> STOP & GO TRAFFIC

5

6

FIGURE 2. INATTENTION field on the 555 form

7

8

The Statewide Integrated Traffic Records System is the database used to collect information coded in 555 collision reports. SWITRS is an important resource for researchers, as it is the only place to find information on all injury collisions in the State. Law enforcement agencies are required to forward 555 forms for all injury and fatal collisions to CHP for entry into the database. For information about cell phone involvement, the data are entered as coded on the form, but details are not confirmed based on the narrative. The narrative, sketches, crash diagrams, and personally identifiable information are excluded.

14

In addition to SWITRS, all fatal collision reports are forwarded for entry into the NHTSA Fatality Analysis Reporting System (FARS). FARS contains a national census of collisions where at least one victim died within 30 days of the crash. The data are entered and coded completely independently of SWITRS, since some of the fields and coding of variables are different. FARS only lists cell phone involvement as a possible distraction inside the vehicle under the driver level related factors. Beginning in 1991, “cellular telephone” was an option, and in 2002, “cellular telephone in use in vehicle” was added as an option. In 2010, the database was restructured and a separate variable was created called “driver distracted by.” The cell phone-related options include “while talking or listening to cellular phone,” “while dialing cellular phone,” and “other cellular phone related.” Since the coding in the 555 form is different, FARS data entry technicians must use information from the narrative to determine which choices to select.

24

25

**CELL PHONE USAGE COLLISION DATA TRENDS**

26

27

**SWITRS**

28

Eleven years (2001-2011) of SWITRS injury and fatal collision data were compiled to evaluate the patterns and trends of indication of cell phone involvement in collisions using Stata software. SWITRS is a relational database that contains three tables—crash, party, and victim—connected by a variable, caseid, that is unique for each collision. Since cell phone usage applies to the drivers involved in a collision,

29

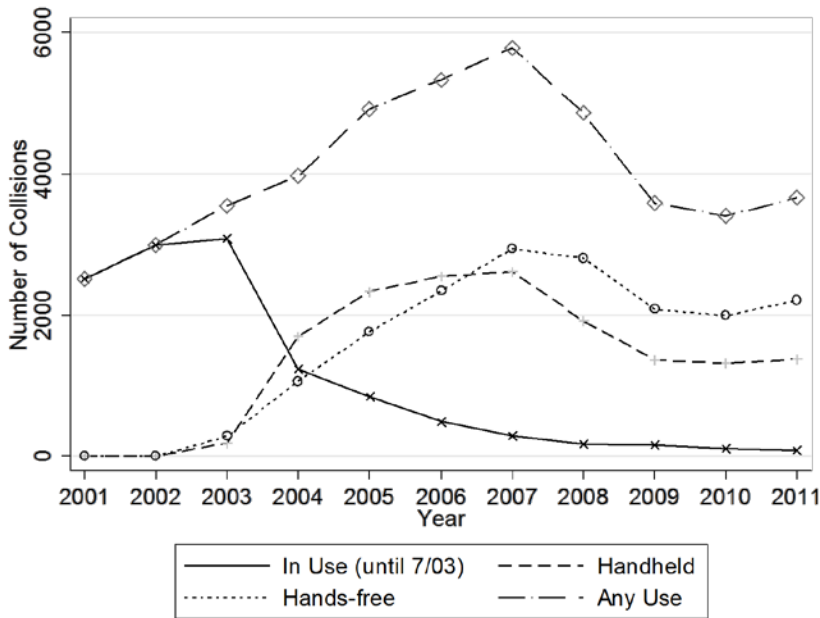
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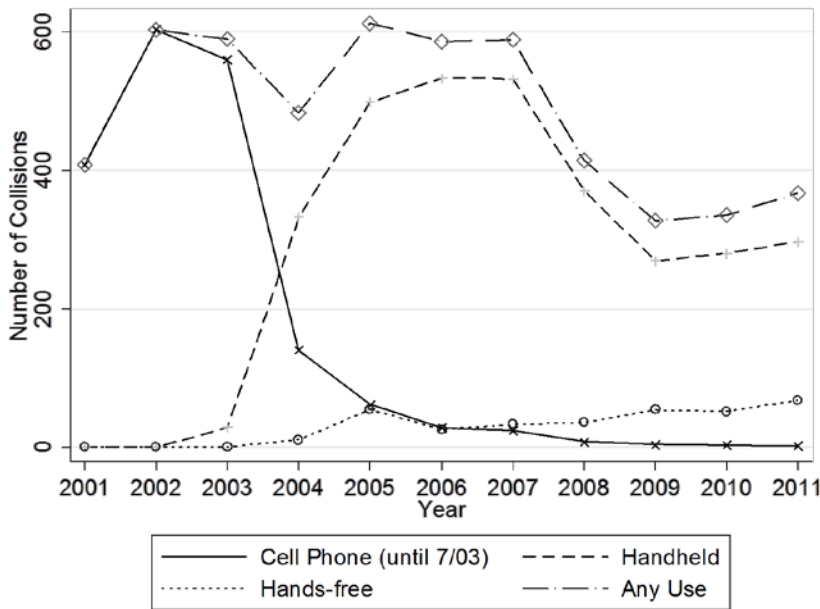
1 those data are stored in the party file. Multiple drivers in a collision could have been using a cell phone,  
 2 and the values were collapsed into dummy variables at the collision level.

3 Figures 3 and 4 show the trends in coding cell phone usage under SPECIAL INFORMATION and  
 4 INATTENTION, respectively, in SWITRS. Both figures show the transition from the original coding to the  
 5 newer coding, which began in 2003 (traces of the original coding are still visible through 2011). In  
 6 Figure 3, the cases where the cell phone was not indicated as a distraction, the overall trend increases  
 7 steadily through 2007, and then dips considerably starting in 2008, when the HH ban for all drivers and  
 8 the all cell phone ban for teens went into effect. Both HH and HF involvement reduced starting in 2008,  
 9 although HF involvement surpassed HH in 2007. At first glance, the reduction in HH crashes, suggest that  
 10 the HH ban may have been effective, but in reality, one would not expect collisions involving HF cell  
 11 phone usage to decrease, too. It is difficult to collect data on HF usage for drivers involved in a crash, but  
 12 researchers have suggested that it would increase in response to a HH ban since law-abiding drivers may  
 13 switch from HH to HF (6). Under that assumption, and assuming quality data, there are two logical  
 14 outcomes: if HF usage is safer than HH, then the number of collisions involving HF phones would remain  
 15 stable or increase slightly; if HF usage is no safer than HH, then the number of HF collisions would  
 16 increase as drivers shift from HH to HF. Therefore, the decrease for HF under SPECIAL INFORMATION  
 17 does not necessarily capture an underlying behavioral or risk change and must be explained by another  
 18 phenomenon.



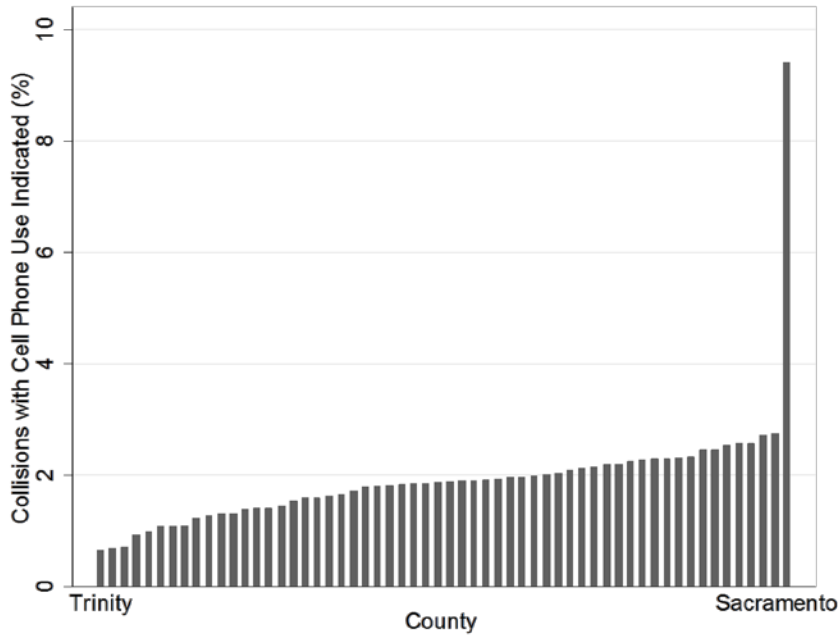
19  
 20 FIGURE 3. Frequency of cell phone coding under SPECIAL INFORMATION in SWITRS 2001-2011  
 21

22 Figure 4 shows the cases where a cell phone was identified as a source of the inattention. The  
 23 scale of the occurrences is one tenth that of the special information variable, shown in Figure 3,  
 24 suggesting that there are many fewer cases when an officer is able to make a judgment about inattention.  
 25 The dip in the total trend line in 2004 may be caused by confusion among officers during the transition  
 26 between versions of the 555 form. As expected, HH carries most of the weight for inattention caused by  
 27 cell phone use. Again, a considerable reduction in HH crashes is observed in conjunction with the HH ban  
 28 introduced in 2008. Accordingly, HF is much less frequently identified as a source of inattention and it  
 29 has a slightly increasing trend. While there are no indications that the INATTENTION data is unreliable it is  
 30 only coded for less than 0.5 percent of the crashes and carries very limited weight for studying the impact  
 31 of cell phone use on traffic safety.

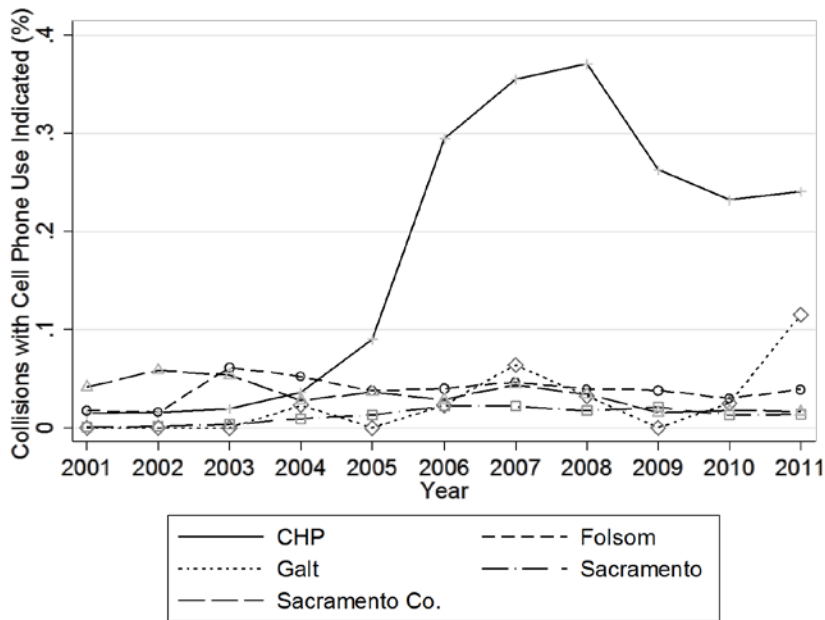


1  
2 FIGURE 4. Frequency of cell phone coding under INATTENTION in SWITRS 2001-2011

3  
4 Figure 5 combines both the SPECIAL INFORMATION and INATTENTION coding as any cell phone  
5 use and compares the percent of collisions with any cell phone use by county. The presented data reveals  
6 a considerable variation by jurisdiction. The mean is 1.92 percent with a standard deviation of 1.13.  
7 Trinity County, a sparsely populated rural county, has the lowest rate at 0.65 percent, while Sacramento  
8 County, the location of the state capitol, has the highest rate at 9.41 percent. Sacramento is clearly an  
9 outlier and requires further exploration. To examine it further, Figure 6 breaks down the rate of cell phone  
10 use in collisions for the five jurisdictions in Sacramento County. The rates for the four local jurisdictions  
11 are fairly flat relative to the large peak in cell phone use in CHP-recorded collisions, which approaches 40  
12 percent. Differences across jurisdictions are occasionally explained by underlying differences in the  
13 driver population. However, in this case the CHP jurisdiction is networked through the entire county and  
14 accordingly associated with the driver population across the local jurisdictions. Another possible source  
15 of difference can be associated with the nature of the highway facilities that are typically covered by  
16 CHP. However, looking at the coding under SPECIAL INFORMATION for just CHP-recorded collisions in  
17 Sacramento (Figure 7), the number of collisions with HF use stands out at nearly 1500 in 2007 which  
18 comprise roughly 50 percent of the HF-indicated collisions, and more than 25 percent of all collisions  
19 marked as cell-involved under SPECIAL INFORMATION for the entire state in 2007. In light of this, the  
20 differences across jurisdictions are more likely to be associated with attributes that are not directly related  
21 to the safety or cell phone use.



1  
2  
3  
FIGURE 5. Percent of collisions with any kind of cell phone use by county 2001-2011



4  
5  
6  
7  
FIGURE 6. Percent of collisions in Sacramento County with any kind of cell phone use by jurisdiction 2001-2011



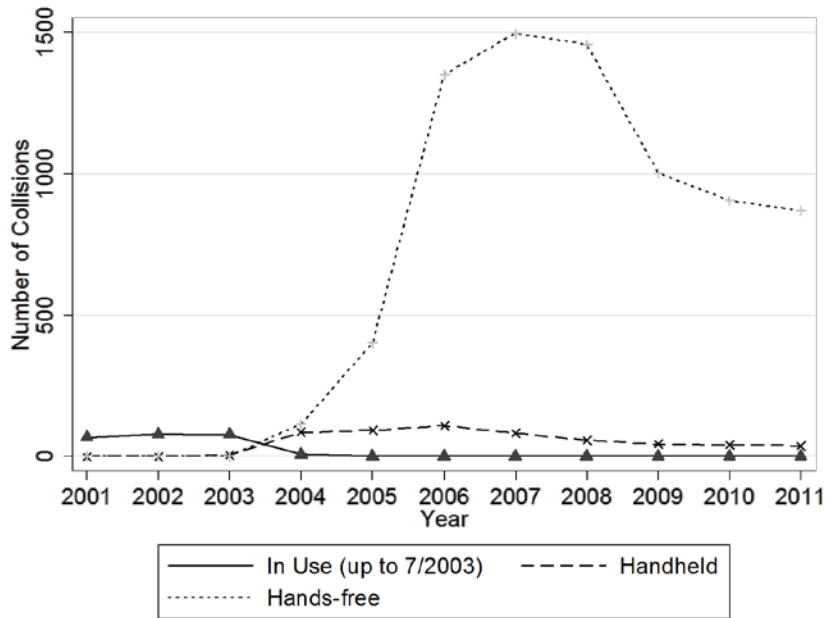


FIGURE 7. Frequency of collisions with cell phone coding under SPECIAL INFORMATION in SWITRS for CHP-recorded collisions in Sacramento County 2001-2011

## FARS

Eleven years (2001-2011) of FARS fatal collision data for California were compiled to compare cell phone coding with SWITRS. Like SWITRS, FARS is a relational database with multiple tables connected by a collision id. Between 2001 and 2009, the database tables were *accident*, *person*, and *vehicle*. The *vehicle* table contained the data on driver distraction. When the database was redesigned, a new table called *distract* contained the cell phone information. The cell phone data for each year was collapsed to the *accident* level, and collisions were matched to SWITRS based on the county, time, and date. Of the 36,923 FARS collisions and 37,522 SWITRS fatal collisions, 31,848 were matched. Among the matched collisions, 2,133 (6.7 percent) had some kind of cell phone use indicated in either database. 73 percent of these collisions showed cell phone usage only in the FARS database, while 17 percent showed it only in the SWITRS database. That leaves just 10 percent of collisions where the databases agreed on cell phone involvement. Obviously, since these are matched crashes the differences between the cell phone related variables is not related to differences in safety and is likely to be associated with coding related discrepancies.

## DISCUSSION

The figures and analysis in the previous section demonstrate that patterns in crash data regarding cell phone use are not aligned with safety and are heavily influenced by inconsistencies among jurisdictions in recording cell phone involvement in the 555 collision report form. There are a few potential sources of inconsistencies errors beyond those previously mentioned.

A first potential source is training. The reports for these 11 years of data were filed by 374 unique jurisdictions. Training among jurisdictions is not consistent. In general, CHP officers have the best training for completing traffic-related reports because their primary role is enforcement of traffic laws. On the other hand, local law enforcement agencies also deal with property, violent, and other crimes, and cannot be trained at the same level of familiarity with paperwork related to traffic collisions. Further, officers may be reassigned out of traffic periodically, so new officers with less experience are assigned to collision investigations. This plays an important role since officers responding to the scene of a traffic collision are also tasked with keeping the peace, diverting traffic, and making sure first responders can

1 help victims. Moreover, with two locations on the form to enter cell phone usage, officers who do not  
 2 complete the form frequently are less likely to understand the nuance between the variables for coding or  
 3 may only enter the cell phone information in the narrative.

4 A second potential challenge is that since cell phone usage is a pre-crash factor, it is more  
 5 difficult to identify at the scene of a collision unless the investigator is looking for evidence of it. Unless a  
 6 witness suggests or a driver admits cell phone involvement, law enforcement officers may not prioritize  
 7 seeking evidence. Additionally, this may depend on direction from commanding officers on whether  
 8 identifying cell phone use is a priority. HF cell use is legal for drivers 18 and over in California, so many  
 9 officers may not see the importance of recording it on the 555 form. The high rate of reporting by  
 10 Sacramento CHP may be explained by directives from commanding officers to record all types of cell  
 11 phone usage, better training, and more awareness.

12 These differences are also shown to be carried over and amplified across the way it is captured in  
 13 FARS. The difference in the coding options at the state and federal levels suggests the varying viewpoints  
 14 about what behaviors are unsafe. Researchers generally identify three types of distraction involved with  
 15 cell phone use, visual, manual, and cognitive distraction. In California, state law prohibits HH cell phone  
 16 use for all drivers. As indicated in Table 1, HF phone use is primarily a cognitive distraction because  
 17 drivers can theoretically keep their eyes on the road and hands on the wheel. In contrast, HH phone use  
 18 along with being a cognitive distraction requires the use of at least one hand (manual) and may also be a  
 19 visual distraction. By allowing HF cell phone usage, the State is implicitly suggesting that HF is safer,  
 20 ignoring cognitive distractions. In the case of FARS data, all three behaviors are cognitive distractions  
 21 and could be manual distractions, but the greater distinction is between whether they are visual  
 22 distractions. Both talking on a HH and HF cell phone are categorized identically.

23  
 24 TABLE 1. Cell phone coding in SWITRS and FARS

Code	Database	Type of Distraction		
		Visual	Manual	Cognitive
Cellphone Handheld	SWITRS	x	X	X
Cellphone Hands-free				X
Talking or listening	FARS		x	X
Dialing		X	X	X
Cellular phone related		x	x	X

25  
 26 The higher rate of cell phone involvement indicated in collisions in the FARS database suggests  
 27 that either the coding options in FARS capture more potential cell phone behaviors or that cell phone  
 28 involvement is recorded more frequently in the narrative than in the coding on the 555 form.

## 29 CONCLUSION

30 This paper describes some of the limitations in data on cell phone involvement in collisions in California.  
 31 The data presented here suggests that in its current state, cell phone collision data are not collected in a  
 32 sufficiently consistent manner to be suitable for any analyses that seeks to study associations between cell  
 33 phone use and safety.

34 While addressing the challenge of collecting quality cell phone data for collisions requires further  
 35 investigation, this study has shown that the data would benefit from greater consistency in coding  
 36 between jurisdictions, states, and at the national level. In California, the distinction between cell phone  
 37 usage that is or is not inattention-related seems to create more confusion than clarity. Cell phone  
 38 involvement should be entered in a single part of the 555 form, and should not require judgment from the  
 39 officer on whether it was a distraction. Additionally, once the form is clarified, law enforcement  
 40 personnel throughout the state should receive consistent training and direction on the importance of  
 41 completing the form fully.  
 42

1           Research using simulators, naturalistic driving data, collision investigations, and surveys exposes  
2 the implications of cell phone use on attention and crashes. Researchers commonly use crash data to study  
3 how these implications are realized in the field. Unfortunately, it is shown here that analyses of cell phone  
4 involvement that are based on California crash data are unlikely to capture trends and influences that are  
5 associated with safety. Regardless, the existing research provides reason for concern that justifies  
6 attention to the matter and underscores the need to strengthen the clarity and consistency of cell phone  
7 related data in crash reports. In the meantime, it is not recommended that existing data on cell phone  
8 involvement in collisions be used for any analyses to evaluate policy or driver behavior.  
9

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12

## 13 **REFERENCES**

- 14 1. Insurance Institute for Highway Safety (IIHS). "Cellphones and texting: July 2014."  
15 <http://www.iihs.org/iihs/topics/laws/cellphonelaws?topicName=distracted-driving>. Accessed July  
16 31, 2014.
- 17 2. Mynatt, M., and G. Radja. "Precrash Data Collection in NHTSA's Crash Databases" *The 23rd Enhanced*  
18 *Safety of Vehicles Conference Proceedings*, 2013. [http://www-nrd.nhtsa.dot.gov/pdf/esv/esv23/23ESV-](http://www-nrd.nhtsa.dot.gov/pdf/esv/esv23/23ESV-000371.PDF)  
19 [000371.PDF](http://www-nrd.nhtsa.dot.gov/pdf/esv/esv23/23ESV-000371.PDF). Accessed July 31, 2014.
- 20 3. National Safety Council (NSC). "Crashes Involving Cell Phones: Challenges of Collecting and  
21 Reporting Reliable Crash Data" 2013.  
22 [http://www.nsc.org/safety\\_road/Distracted\\_Driving/Documents/NSC-Under-Reporting-White-](http://www.nsc.org/safety_road/Distracted_Driving/Documents/NSC-Under-Reporting-White-Paper.pdf)  
23 [Paper.pdf](http://www.nsc.org/safety_road/Distracted_Driving/Documents/NSC-Under-Reporting-White-Paper.pdf). Accessed July 31, 2014.
- 24 4. National Highway Traffic Safety Administration (NHTSA). "Distracted Driving 2012" *Traffic*  
25 *Safety Facts: Research Note*, DOT HS 812 012, 2014.
- 26 5. California Highway Patrol. *Collision Investigation Manual: HPM 110.5*, 2003. [http://www.nhtsa-](http://www.nhtsa-tsis.net/statecatalog/states/ca/docs/CA_CHP555_Manual_2_2003_ch1-13.pdf)  
27 [tsis.net/statecatalog/states/ca/docs/CA\\_CHP555\\_Manual\\_2\\_2003\\_ch1-13.pdf](http://www.nhtsa-tsis.net/statecatalog/states/ca/docs/CA_CHP555_Manual_2_2003_ch1-13.pdf). Accessed July 31,  
28 2014.
- 29 6. McCartt, A.T., L.A. Hellinga, L.M. Strouse, and C.M. Farmer. "Long-term Effects of Handheld  
30 cell Phone Laws on Driver Handheld Cell Phone Use," *Traffic Injury Prevention*, 11:2, 2010,  
31 133-141.