

Evaluation of Illinois Crash Data Reported to MCMIS Crash File

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MCMIS Crash File Evaluation**

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16. Abstract <p>This document is part of a series of reports evaluating the data reported to the Motor Carrier Management Information System (MCMIS) Crash file undertaken by the Center for National Truck and Bus Statistics at the University of Michigan Transportation Research Institute. Earlier studies showed that reporting to the MCMIS Crash file was significantly incomplete in other states. This report evaluates reporting to the MCMIS Crash file from the state of Illinois.</p> <p>MCMIS Crash file records were matched to the Illinois Police Accident Report (PAR) file to determine the nature and extent of reporting. Overall, Illinois submitted 43.0% of its reportable crash involvements to the MCMIS Crash File in 2003. Reporting rates varied by vehicle type, crash severity, and reporting agency. Reporting rates are 71.0% for fatal crashes, 42.3% for injury cases, and 42.6% for tow/disabled accidents. Single unit trucks are reported only 25.6% of the time, while tractor semitrailers and tractors without trailers each have reporting rates over 52%. Buses are only reported 4.3% of the time. The state police reported 61.8% of cases they covered compared with 32.7% for the local police. The Chicago area accounts for a large proportion of the unreported cases.</p> <p>Although Illinois' data collection system is comprehensive, it appears that issues connected with identifying the target vehicle as a commercial vehicle (CV) is preventing all MCMIS-eligible vehicles from being identified. Officers are less likely to recognize smaller vehicles as CVs, and thus do not record those variables for these cases. Evidence suggests that failure to fill out the CV section of the PAR form results in such cases not being submitted to the MCMIS Crash file.</p>					
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Evaluation of Illinois Crash Data Reported to MCMIS Crash File

1. Introduction

It is essential to assess the magnitude and characteristics of motor carrier crashes so that effective safety measures can be designed to prevent such crashes. For this purpose, the Motor Carrier Management Information System (MCMIS) Crash file was developed by the Federal Motor Carrier Safety Administration (FMCSA) to serve as a census file of traffic crashes involving trucks and buses. Its usefulness depends upon individual states transmitting a standard set of data items on all trucks and buses involved in traffic crashes that meet a specific severity threshold. However, the MCMIS Crash file is known to be incomplete. Nationally, only about two-thirds of qualifying truck involvements are reported. The reporting rate for buses is even lower, at about 40%.^[1] (See references at the end of the report.) Reporting is more complete for severe crashes, with about 90% of truck fatal involvements and 65% of bus fatal involvements appearing in the file, but rates are much lower for less severe crashes.

Since the states are responsible for reporting qualifying crashes, the solution for underreporting must ultimately reside with the individual states. This report is part of a series of evaluations of reporting from each state. Previous reports on a number of states showed substantial underreporting due in large part to problems police officers experience in interpreting and applying the reporting criteria [2, 3, 4, 5, 6, 8]. The problems were more severe in large jurisdictions and police departments. Each state also had problems specific to the nature of its system. Some states also had substantial overreporting of cases, often due to technical problems with duplicate records.

In this report, we focus on MCMIS Crash file reporting by Illinois. In recent years Illinois has ranked among the top 15% of states with the greatest number of truck and bus fatal involvements. Accordingly, improving reporting to the MCMIS Crash file from this state would contribute significantly to the goal of making that entire file more complete and accurate.

The method employed in this study is similar to previous studies:

1. The complete police accident report file (PAR file hereafter) from Illinois was obtained for the most recent year available, 2003. This file was processed to identify all cases that qualified for reporting to the MCMIS Crash file.
2. All cases in the Illinois PAR file—those that qualified for reporting to the Crash file as well as those that did not—were matched to the cases actually reported to the MCMIS Crash file from Illinois.

3. Cases that should have been reported, but were not, were compared with those that were reported to identify the sources of underreporting.
4. Cases that did not qualify but which were reported were examined to identify the extent and nature of overreporting.

Police accident report (PAR) data recorded in Illinois' statewide files as of April 29, 2005, were used in this analysis. The 2003 PAR file contains the computerized records of 824,174 vehicles involved in 437,289 crashes that occurred in Illinois. Excluding 885 cases from 518 accidents with 2002 crash dates, the Illinois PAR data had records on 823,289 vehicles for 2003.

2. Data Preparation

The Illinois PAR file and MCMIS Crash file each required some preparation before the Illinois records in the MCMIS Crash file could be matched to the Illinois PAR file. In the case of the MCMIS Crash file, the only processing necessary was to extract records reported from Illinois and to eliminate duplicate records. The Illinois PAR file required more extensive work, primarily to develop means of identifying cases that should have been reported to the MCMIS Crash file. This section discusses the methods used to prepare each file and some of the problems uncovered.

2.1 MCMIS Crash File

The 2003 MCMIS Crash file as March 14, 2005, was used to identify records submitted from Illinois. For calendar year 2003 there were 5,571 cases. An analysis file was constructed using all variables in the file. The file was then examined for duplicate records (those involvements where more than one record was submitted for the same vehicle in the same crash; i.e., the report number and sequence number were identical). Only one pair of such duplicate records was found. However, upon further examination, the accident days and times were different, as were vehicle identification number (VIN), license plate number, driver name and driver date of birth. It appears that report number may have been mis-entered. Thus, these records were not considered to be duplicates, and were left in the file.

In addition, records were examined for identical values for accident date, time, crash county, crash city, officer badge number, vehicle identification number, and driver's date of birth, even though their case numbers were perhaps different. One would not expect all of these variables to be identical between two cases. Two duplicate pairs were found. In the first pair, since upload and change dates were the same, and all but a few fields were identical, it appeared to be a duplicate record. The member of the pair not appearing on the PAR file was excluded. In the second pair of duplicates all variables were the same except crash-street had a minor difference, and vehicle number also differed. Perhaps the second record had been a correction for the earlier one, since upload/change dates differed between the two records. The member of the pair with

the earliest dates was excluded. After eliminating the two duplicate records identified above, the resulting MCMIS file contained 5,569 records.

2.2 Illinois PAR File

The Illinois PAR file for 2003 (dated April 29, 2005) was obtained from the state of Illinois. This file contains records for 436,771 crashes involving 823,289 vehicles. Data for the PAR file are coded from the Illinois Traffic Crash Report Form SR 1050 completed by police officers [11].

A search for records with identical case numbers and vehicle numbers found no such instances. In addition, inspection of report numbers verified that they were recorded in a consistent format, so there was no reason to suspect duplicate records based on similar, but not identical, case numbers (such as 030127435 and 03-127435, for example). However, cases were also examined to determine if there were any records that contained identical time, place and vehicle/driver variables, even though their case numbers were perhaps different. Two cases would not be expected to be identical on all variables. To investigate this possibility, records were examined for duplicate occurrences based on the variables accident date, hour, minute, county, city, vehicle identification number (11-digit VIN), and driver date of birth. (Route number was not included as a location variable, as it was unrecorded in 57.7% of the cases). A total of 739 duplicate instances were found, representing 367 unique occurrences of the examined variables.

Duplicate pairs were examined more closely for any patterns that might explain why they were occurring. These records could be grouped into two categories: those where Crash_ID differed, and those where Crash_ID were identical. In the first group (all duplicates, except for two cases of triplicates and one quadruplicate), where crash time, location, VIN and driver date of birth was the same but Crash_ID differed, one explanation could be that a vehicle was involved in two accidents at the same place and virtually at the same time. Once crash events are stabilized, subsequent crashes are reported as new crashes. If a vehicle is reported as being in a second crash after the first one has stabilized, one would expect accident date, location, vehicle and driver information to be identical, but accident time to vary by a couple of minutes or longer. However, in the case of these records, accident hour and minute are identical, suggesting they are in fact duplicate records.

The second group of cases were identical on crash time, location, VIN, and driver date of birth, and also had identical Crash_IDs. In all instances vehicle number differed, suggesting the possibility that these could be two different vehicles in the same accident. However, with VIN and driver date of birth both recorded and identical among the two records, this is unlikely. These cases were also designated as duplicate records.

Thus, the pairs identified above were considered to be duplicates and one (or more) member(s) of each pair was excluded. Since there was no variable indicating a date the record was updated

or processed, the first member of each pair was kept and subsequent members excluded, resulting in deletion of 372 records. The resulting PAR file has 822,917 records.

The next step in data preparation is to identify records that qualified for reporting to the MCMIS Crash file. It was necessary to develop a set of criteria using the variables in the Illinois PAR file to identify records that should have been reported. The purpose of the criteria is to approximate as closely as possible the reporting threshold of the MCMIS file. The MCMIS criteria for a reportable crash involving a qualifying vehicle are shown in Table 1.

Table 1. Vehicle and Crash Severity Threshold for MCMIS Crash File

Vehicle	Truck with GVWR over 10,000 or GCWR over 10,000, or Bus with seating for at least nine, including the driver, or Vehicle displaying a hazardous materials placard.
Accident	Fatality, or Injury transported to a medical facility for immediate medical attention, or Vehicle towed due to disabling damage.

There are two primary ways states may identify eligible cases for MCMIS: (1) The officer is expected to understand the MCMIS reporting criteria and, for cases that qualify, is instructed to fill out a separate form or a designated area on the crash report itself. (2) All criteria are incorporated into the crash report form, so that state officials can then determine which cases should be submitted to the MCMIS Crash file.

Unlike several other states, Illinois does not have a separate form that the officer is expected to fill out if the crash meets the MCMIS criteria. Instead, there is a commercial vehicle (CV) section on the main form to capture information about crashes involving a commercial vehicle. The accident-level crash severity criteria are found elsewhere on the form. Thus, in Illinois it appears that the state makes the final determination of which cases are submitted to the MCMIS Crash file.

Illinois's instructions for filling out the crash report form indicates that if a commercial vehicle is involved in the crash, the commercial vehicle section of the form must be completed. A commercial vehicle is defined as:

A commercial motor vehicle is any self-propelled or towed vehicle used on public highways in interstate or intrastate commerce to transport passengers or property when (a) The vehicle has a gross vehicle weight rating (GVWR) or gross combination weight rating (GCWR) of 10,001 or more pounds; or (b) The vehicle is designed to transport more than 15 passengers, including the driver; or

(c) The vehicle is used in the transportation of hazardous materials in a quantity requiring placarding under regulations issued by the Secretary of the U.S. Department of Transportation under the Hazardous Materials Transportation Act.¹

This definition corresponds to the vehicle criteria for the MCMIS Crash file. It appears that officers are responsible for determining which vehicles require filling out the CV box on page 2 of the crash form. Failure to complete the CV section may result in a case not being submitted to MCMIS. This hypothesis could not be tested directly, as none of the CV-specific variables were present on the PAR file (with the exception of variables pertaining to hazardous materials transport, which would apply to very few vehicles.)

Illinois officials do not have to rely on recording of variables in the CV section to determine if a case should be submitted. Except for presence of a hazardous materials placard, variables used to determine if a case qualifies for MCMIS submission (i.e. vehicle type, injury, transported to medical facility, and towed status) reside elsewhere on the crash form. However, since the CV variables are among those required by MCMIS, not completing this section results in missing data elements in the Crash file.

Variables available in the Illinois PAR data only permit the MCMIS Crash file criteria to be applied at a gross level. The vehicle type variable contains broad categories of trucks, but it is not clear how the code levels are defined (Table 2). Since there was no explanation in the instruction manual for the crash report of the meanings of these vehicle codes, codes were interpreted for their typical meaning. Eligible vehicles such as doubles combinations were not identifiable. It was not clear what vehicles were included in the “other vehicle with trailer” code level. Vehicle type was unrecorded or coded “unknown” in 3.8% of cases. Although gross vehicle weight rating (GVWR), vehicle configuration, and cargo body type are variables in the commercial vehicle section of the accident report, they are not included in the PAR file. The vehicle use variable was considered as a method of identifying additional eligible trucks, however in many instances it was inconsistent with vehicle type. Thus, identification of eligible trucks was limited to the vehicle type codes shown in bold in Table 2.

Buses could be identified using two vehicle type codes, those with 15 passengers or less and those with greater than 15 passengers (Table 2, codes in italics). It is also possible that some other vehicles, such as vans, could qualify as buses. They would qualify if they have seats for nine or more passengers and are used for transporting passengers, and not personal transport.

¹ Illinois Department of Transportation, Division of Traffic Safety, *Illinois Traffic Crash Report SR 1050 Instruction Manual*, January 1998, p. 21.

However, since number of seats was not available and a description of vehicle use did not appear to be reliable, the decision was made not to include any other vehicles as qualifying buses.

Table 2. Illinois PAR File Vehicle Type Variable Used to Identify Eligible Vehicles

Vehicle type code	Description
1	Passenger
2	Pickup
3	Van/mini-van
4	<i>Bus up to 15 passengers</i>
5	<i>Bus over 15 passengers</i>
6	Truck – single unit
7	Tractor w/semi-trailer
8	Tractor w/o semi-trailer
9	Farm equipment
10	Motorcycle (over 150cc)
11	Motor driven cycle
12	Snowmobile
13	All-terrain vehicle (ATV)
14	Other vehicle with trailer
15	Sport utility vehicle (SUV)
16	Other
99	Unknown/NA

Note: Codes in italics were used to identify eligible buses, and those in bold identify trucks.

Since the only variable on the main crash form regarding hazardous materials related specifically to spillage, and not placarding, the commercial vehicle section of the crash form [11] was used for defining the third group of eligible vehicles. According to the crash form instructions [10], “if a unit carrying hazardous materials or a commercial vehicle was involved in the crash, the commercial vehicle section of the form must be completed.”¹ This brings it into conformity with the MCMIS criteria. If the definition was applied correctly, then variables in the CV section should be recorded for vehicles less than 10,001 lbs. with a hazardous materials placard. For this study, placarded vehicles were then identified using the Hazmat Placard variable from this area of the crash report. Appendix A includes a complete discussion of the variables used to identify qualifying vehicles.

In total, there were 38,072 vehicles meeting the vehicle criteria in the Illinois PAR file (Table 3). These represented 4.6% of all vehicles in the PAR file, which was within the range of corresponding percentages for other states that have thus far been evaluated (ranging from 2.6% to 6.1%).

¹ Illinois Department of Transportation, Division of Traffic Safety, *Illinois Traffic Crash Report SR 1050 Instruction Manual*, January 1998, p.7, item 4.

Table 3. Vehicles Meeting MCMIS Vehicle Criteria, Illinois PAR File, 2003

Vehicle type	N	%
Trucks	31,304	82.2
Buses	6,245	16.4
Non-trucks with hazmat placard	523	1.4
Total	38,072	100.0

Of these vehicles, those in a crash involving a fatality, an injury transported for medical treatment, or a vehicle towed due to disabling damage should have been reported to the MCMIS Crash file. Injuries can be readily identified in the Illinois PAR file. The PAR occupant file and “other file,” which represents non-passengers such as pedestrians and pedalcyclists, include the usual crash injury severity variable identifying fatal, incapacitating (A injury), non-incapacitating (B injury), and reported, not evident (C injury). There was also a “none” code level.

In addition, the PAR form contains an area to enter the treatment facility name and name of the emergency medical service agency that transported the injured person. Although these variables appeared on the PAR file for the driver, occupants and non-occupants involved in the crash, all were unrecorded for more than 98% of the cases. Thus, it was not possible to directly identify injured persons who were transported for medical care. Therefore, an alternative method of distinguishing transported from non-transported injured persons was developed. The method will be discussed fully below.

The last MCMIS criterion specifies “vehicles towed due to disabling damage.” The Illinois PAR form (revision 1/99) contains a towaway variable indicating if the vehicle was towed due to damage or towed for another reason. This variable was simplified on crash form revision 12/01, to “towed= yes or no”. On the PAR file this information is contained in the Vehicle Towed Damage Indicator variable (0=not stated, 1=yes, 2=no). All vehicles with a “yes” were assumed to be towed due to disabling damage, although in some cases it is uncertain whether damage was disabling, due to the lack of detail in the current crash form.

Since it is not known if an accident involved a transported injury, the decision was made to use A and B injuries as a surrogate for injured transported. This seems like a reasonable rule, since from the definitions of the injuries, immediate medical attention is warranted or likely. However, the reality of injury coding may not be so straightforward. In fact, experience with Ohio and North Carolina indicates that a substantial percentage of A and B injuries are not transported for treatment. North Carolina uses the KABCO injury scale, which is similar to Illinois’s injury categories, and also includes a variable that indicates whether the injured person was transported for treatment. In a recent year of crashes, 89% of A injuries, 71% of B-injuries, and 39% of C injuries were also coded as transported.

Consequently, the practice of including all involvements in which the most severe injury was A or B, regardless of whether anyone was actually transported, can result in a different set of cases

selected for the MCMIS Crash file and a different distribution of crash severity. Since the North Carolina data includes all relevant variables, it is possible to estimate the distribution of cases that should have been submitted from Illinois if the PAR data had included the transported variable.

Note, however, that the proportion of injured persons transported for care can vary between states. Accordingly, any estimate using another state's experience can only provide an approximation of the true proportion. The Illinois estimates below, using North Carolina data as a standard reference distribution, should be regarded as an attempt to arrive at approximate figures using the best available data. The identification of reportable cases that are analyzed in the body of this report are not based on these estimates, but on the surrogate definition of transported injury cases described below.

The number of Illinois reportable cases using the North Carolina data as a reference distribution was estimated by first determining the number of Illinois PAR cases that would have qualified for the MCMIS Crash file based on vehicle type, and then classifying each by the most severe injury in the crash. Then the proportion of such involvements in North Carolina in which an injured person was transported for treatment was applied to the number of Illinois involvements to estimate the number of Illinois cases for a given crash severity and tow status that would have been transported (Table 4). For example, in Illinois there were 900 qualifying vehicles in a crash in which the most severe injury was an A injury, and at least one vehicle in the crash was towed due to disabling damage. In North Carolina, 91.6% of these involvements had at least one transported injury. Applying that percentage to A-injury, towed cases in Illinois, an estimated 824 A-injury crashes with a towed, disabled vehicle would have been transported. Similarly, North Carolina proportions of transported injuries were applied to Illinois numbers for A, B, and C injuries that were not towed. The results were summed to generate an estimated 3,707 injured, transported cases for Illinois. The remaining non-transported, but towed figures were added to the number of Illinois non-injured, but towed cases to arrive at an estimated number of towed, disabled vehicles, 6,985.

Table 4. Estimated Reportable Illinois Cases Based on North Carolina Proportions of Transported Injuries

Injury severity	Illinois figures	North Carolina % transported	Illinois estimates	
			Injured, transp.	not transp, towed
Fatal injury	193			
A injury				
towed *	900	91.6	824	76
not towed	183	64.3	118	
B injury				
towed	1,968	75.9	1,494	474
not towed	709	40.6	288	
C injury				
towed	1,374	46.3	636	738
not towed	1,355	25.6	347	
No injury				
towed	5,697			5,697
not towed	25,693			
Total eligible vehicles	38,072			
Estimated injured, transported			3,707	
Estimated towed due to disabling damage				6,985

* Note: In this table 'towed' means 'towed due to disabling damage.' Shaded figures represent estimated reportable cases.

When this adjustment procedure is applied to each injury severity level in Illinois, an estimated 10,885 cases should have been reported to the MCMIS Crash file. After the matching process (discussed below) cases that were actually reported to the MCMIS crash file could be determined (Table 5). As shown, the distribution of crash severity for reported cases is similar to that of estimated reportable cases.

Table 5. Reported and Estimated Reportable Illinois Cases Based on North Carolina Data

MCMIS severity class	Actually reported	%	Estimated reportable cases	%
Fatal	137	2.9	193	1.8
Injured, transported for treatment	1,591	33.6	3,707	34.1
Tow, disabled	3,009	63.5	6,985	64.2
Total	4,737	100.0	10,885	100.0

However, for the purposes of this evaluation, it is only possible to use the information that is in the Illinois PAR file. Thus, the subset of PAR cases that can be identified as reportable to MCMIS included the trucks, buses, and vehicles with a hazardous materials placard defined above, in conjunction with one of the following conditions: fatal accident, all injury-only A and B severity accidents (based on maximum accident severity), and towaway accidents (based on whether the accident included a vehicle not drivable after the crash). Using this procedure (surrogate definition), 11,024 records in the Illinois PAR file should have been reported to the MCMIS Crash file. This number may in fact be conservative, since it was not clear where certain

truck configurations such as a straight truck pulling a trailer, or a tractor double combination, would have been coded. It is entirely possible that the number of cases determined to be reportable excludes these truck types, and thus is an underestimate of the number of reportable cases.

Table 6 shows the distribution of cases identified in the Illinois PAR file that met the reporting criteria thus defined, along with the distribution of records actually reported.

**Table 6. Reportable Records in the Illinois PAR File
by Crash Severity, 2003**

Crash severity	Reportable records in Illinois PAR file	%	Actually reported	% Reported
Fatal	193	1.8	137	71.0
Injury, A or B	3,760	34.1	1,591	42.3
Tow, disabled	7,071	64.1	3,009	42.6
Total	11,024	100.0	4,737	43.0

Note that the distribution of reportable records by crash severity based on the surrogate definition (Table 6) is very similar to the distribution of estimated reportable cases based on North Carolina proportions (Table 5). While there may be differences in identifying individual cases that should be reported, the two methods of determining reportable cases yield similar results at the aggregate level.

Appendix A provides details on the variables and code levels used to identify MCMIS-reportable cases for the interested reader.

3. Matching Process

The next step involved matching records from the Illinois PAR file to corresponding records from the MCMIS file. After removing duplicates, there were 5,569 Illinois records from the MCMIS file available for matching, and 822,917 records from the Illinois PAR file. All records from the Illinois PAR data file were used in the match, even those that were not reportable to the MCMIS Crash file. This allowed the identification of cases in the MCMIS Crash file that should not have been reported.

Matching records in the two files requires finding common variables that match at the accident level as well as match specific vehicles within an accident. Case Number, which is the crash identifier used to uniquely identify a crash in the Illinois PAR data, and Report Number in the MCMIS Crash file, are obvious first choices. However, there did not appear to be any correspondence between the two numbers. Case Number in the Illinois PAR file is a nine-digit numeric value, while in the MCMIS Crash file, Report Number is stored as a 12-character alphanumeric value, a combination of alphabetic characters and numbers. It appears that the report number in the MCMIS Crash file is constructed as follows: The first two columns contain the state abbreviation (IL, in this case), followed by three zeros, then by seven digits. Since these

seven digits were not among the nine digits of the PAR Case Number, this variable could not be used for the match. However, another variable on the PAR titled Form Number (seven digits) corresponded with MCMIS Report Number for a sample of cases examined. Since Form Number was unrecorded in only 0.3 % of cases, it appeared to be a useful match variable. Thus, the last seven digits of the MCMIS Report Number were extracted and these two variables were used in the match.

Other variables that were available for matching at the accident level included crash month, day, hour, minute, and crash county. A variable designating “city” could not be used, as the PAR file contained a numeric code, but city code on the MCMIS file was unrecorded. Another variable often used for matching at the accident level, officer badge number, appeared on the MCMIS file, but no corresponding variable was present on the PAR file.

Variables in the MCMIS file that could distinguish one vehicle from another within the same accident included vehicle license plate number, driver license number, vehicle identification number (VIN), driver date of birth, and driver last name. However, only vehicle identification number (VIN) and driver date of birth were available on the PAR file. Since the PAR file contained only eleven digits of the VIN, the MCMIS VIN was truncated from 17 to eleven digits for the matching process. In most cases, eleven digits should be sufficient to distinguish among vehicles in a particular accident.

Six separate matches were performed using the available variables. In each match step, records in either file with duplicate values on the match variables were excluded, along with records that were missing values on the match variables. The first match included the variables accident number, crash month, day, hour, minute, crash county, VIN, and driver birthdate. The second match step dropped minute and county (county was unrecorded in almost one-third of MCMIS cases), and matched on accident number, month, day, hour, VIN, and driver birthdate. The third match step matched on accident number, month, day, hour, and driver birthdate. After trying various combinations of variables, the fourth match just used accident number, month, day, and VIN. Another match was identical to the first, except excluding accident number, yielded several more matches. At this point 88% of the MCMIS records had been matched. To improve the match rate even further, a final match was performed using the procedure described below.

See Table 7 for the variables used in each match step along with the number of records matched at each step.

Table 7. Variables Used in MCMIS-Illinois PAR File Match, 2003

Match step	Matching variables	Cases matched
Match 1	accident number, crash month, day, hour, minute, crash county, VIN, and driver birthdate	1,497
Match 2	accident number, crash month, day, hour, VIN, and driver birthdate	821
Match 3	accident number, crash month, day, hour, and driver birthdate	2,363
Match 4	accident number, crash month, day, and VIN	224
Match 5	crash month, day, hour, minute, crash county, VIN, and driver birthdate	11
Match 6	accident number and sequence number	359
Total cases matched		5,275

To remedy the problem of non-matches due to unrecorded or mis-recorded values among the match variables (such as a “1” in a PAR VIN and an “I” in a MCMIS VIN) consideration was given to using Form Number in conjunction with Vehicle Sequence Number on the PAR file and corresponding Report Number and Sequence Number on the MCMIS file. Both the PAR and MCMIS sequence numbers represent a number for a particular vehicle within the accident. However, PAR sequence number is assigned sequentially to all vehicles involved in the accident, while the MCMIS number is assigned sequentially only to the qualifying vehicles. So if the PAR file included three vehicles in the crash, sequence number would be assigned sequentially as follows: truck 1, passenger car 2, and another truck 3. In MCMIS, the first truck would be assigned 1 and the second truck would have a sequence number of 2. Thus, this variable could not *directly* be used to match vehicles across the two files. However, by first selecting qualifying vehicles from the PAR file, then assigning a sequential number to these vehicles within the accident, a file comparable to the MCMIS file would be produced. Such a file was used for the sixth match attempt. Cases that could not be matched on variables previously used could potentially be matched by only using accident number with sequence number.

Matched records were verified using other variables common to the MCMIS and PAR file as a final check to ensure the match was valid. In addition, fifty of the 359 matched records from the sixth match attempt were individually verified. In only two of these cases was it difficult to determine if the PAR and MCMIS records represented the same vehicle within the accident. In the other cases it was apparent that differences in a digit of the VIN or in a portion of the birthdate, e.g., had prevented previous matches, but they were in fact the same cases. The above procedure resulted in 5,275 matches, representing 94.7% of the 5,569 non-duplicate records reported to MCMIS.

Figure 1 shows the case flow during the match. There were 294 (5.3%) MCMIS records that could not be matched to the Illinois PAR file. Of the 11,024 (6,287+ 4,737) reportable cases in the Illinois PAR data, 4,737 were actually reported, along with 538 cases that were not

reportable, but nevertheless were reported. Thus, the reporting rate for reportable cases was $4,737/11,024=43.0\%$. Precisely 43% of crash involvements that qualified for reporting to the 2003 MCMIS Crash file were actually reported.

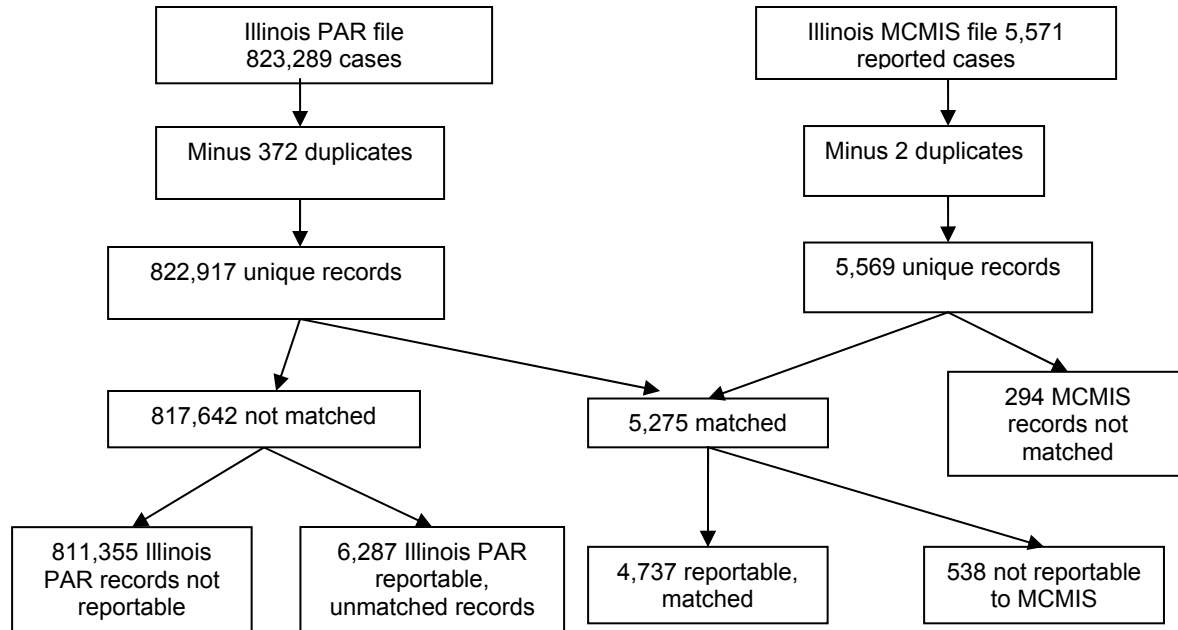


Figure 1. Results of MCMIS-Illinois PAR File Match, 2003

In addition, 538, or 9.7%, of reported cases should not have been reported. They did not qualify as reportable because they did not involve either qualifying vehicles or qualifying severity. Table 8 shows why these cases did not meet the reporting criteria. Over three-quarters of the cases, 437, were trucks or buses, of which 284 involved no injuries or towed vehicles and thus were definitely not reportable cases. The remaining 153 cases were C injuries (reported, but not evident), with no towed vehicle. Based on North Carolina proportions, approximately 26% of these cases could have been transported, and therefore would qualify for MCMIS reporting. However, there is no way to determine in the Illinois PAR data if these injuries included a person transported for care.

Table 8. Distribution of Non-Reportable Cases in MCMIS by Reporting Criteria, Illinois PAR File, 2003

Vehicle type	Crash severity				Total
	Fatal	A or B injury	Tow/disabled	Other crash severity	
Truck	0	0	0	420	420
Bus	0	0	0	17	17
Other vehicle (not transporting hazmat)	5	30	56	10	101
Total	5	30	56	447	538

An additional 91 (5+30+56) cases were involvements in which the crash met the severity test, but the vehicles were not trucks, buses, or a vehicle transporting hazmat. Finally, ten cases were neither serious enough nor did they involve qualifying vehicles.

Omitting the 294 cases that could not be matched and the 538 MCMIS cases not considered reportable in the PAR file, 4,737 reportable MCMIS records were matched to the PAR file, or 43.0% of the 11,024 cases that should have been reported. The analysis that follows will investigate why the remaining 57% of cases were not reported.

4. Sources of Underreporting

This section explores the sources of underreporting to the MCMIS Crash file. The approach is to compare reported and unreported cases across several dimensions to search for patterns that might suggest why some cases were reported and others were not. All tables include only matched, reportable cases. Therefore, they exclude the 538 MCMIS cases not considered reportable in the PAR file and the 294 MCMIS cases that could not be matched to the PAR file. The reporting rate shown in the following tables is the number of reported cases per 100 reportable cases.

Delays in transmitting cases may account partially for the incompleteness of the MCMIS Crash file. The next section will explore this issue.

4.1 Case Processing

The time lag in extracting and submitting reports to the MCMIS Crash file might explain some portion of the unreported cases. All reportable crash involvements for a calendar year are required to be transmitted to the MCMIS Crash file within 90 days of the date of the crash. The MCMIS file used in this evaluation was dated March 14, 2005, so all 2003 cases should have been reported by that date. An examination of reporting by accident month (see Table 9) shows that 34.9 % to 49.6 % of reportable cases are submitted in any given month, with a clear *upward* trend from the beginning to the end of the year. This pattern has not been observed in any other state evaluated to date.

Table 9. Reporting to MCMIS Crash File by Accident Month, Illinois PAR File, 2003

Crash month	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
January	883	34.9	575	9.1
February	835	36.5	530	8.4
March	860	41.7	501	8.0
April	868	43.5	490	7.8
May	929	39.7	560	8.9
June	899	44.5	499	7.9
July	957	41.6	559	8.9
August	927	49.6	467	7.4
September	983	43.3	557	8.9
October	1,049	42.7	601	9.6
November	905	47.1	479	7.6
December	929	49.5	469	7.5
Total	11,024	43.0	6,287	100.0

Table 10 shows the average latency in case submission by month, where latency is the number of days between crash date and the date the case was uploaded to the MCMIS Crash file. Cases are typically submitted about a month after the crash date, well within the 90-day grace period. It appears that late case submission is not the reason for the large number of unreported cases.

Table 10. Average Latency (in days) in Reporting to the MCMIS Crash File, Illinois Reported Cases, 2003

Crash month (in 2003)	Avg. latency (in days) * for reported cases
January	26
February	32
March	27
April	24
May	29
June	33
July	29
August	33
September	37
October	37
November	27
December	37
Average	31

4.2 Reporting Criteria

As discussed above, the officer is instructed to complete the commercial vehicle section of the crash report if a commercial vehicle is involved in the crash, regardless of crash severity. Thus, the section should be completed whenever a commercial vehicle, as defined, is involved in a

crash, not just crashes that are reportable to the MCMIS Crash file. The MCMIS crash-severity and vehicle-type criteria, with the limitations discussed above, are available for all cases. Cases reported to MCMIS are identified at the state level. These cases could be identified using the crash-severity and vehicle type data available for all cases. On the other hand, completing the commercial vehicle section could be used as a trigger to identify reportable cases. In this section, reporting rates by the selection criteria will be examined to determine the source of underreporting.

Illinois's overall reporting rate for trucks is 51.4%, with larger trucks more likely to be reported than smaller trucks (Table 11). Single unit trucks are only reported 25.6% of the time, while tractor semitrailers and tractors without trailers are reported at rates of 67.0% and 52.4%, respectively. In other words, the type of truck has a significant affect on the probability of reporting, with large trucks such as tractor-semitrailers much more likely to be reported than smaller trucks. Buses are virtually ignored, with only 0.6% of small buses and 5.4% of larger buses reported. In addition, although Illinois states that the CV section should be filled out for any vehicles with a hazardous materials placard, none of the non-truck hazardous placarded vehicles were reported. Improving reporting rates for single unit trucks would have the largest impact on the total number of unreported cases, since 39.0% of unreported cases involve a single-unit truck.

Table 11. Reporting to MCMIS Crash File by Vehicle Type, Illinois PAR File, 2003

Vehicle type	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Truck-single unit	3,297	25.6	2,453	39.0
Tractor w/semitrailer	5,430	67.0	1,794	28.5
Tractor w/o semitrailer	370	52.4	176	2.8
Bus up to 15 pass.	319	0.6	317	5.0
Bus over 15 pass.	1,130	5.4	1,069	17.0
Passenger, haz. placard	358	0.0	358	5.7
Pickup, haz. placard	44	0.0	44	0.7
Van/minivan, haz. placard	30	0.0	30	0.5
Other vehicle, haz. placard	46	0.0	46	0.7
total	11,024	43.0	6,287	100.0

These reporting patterns suggest that completing the commercial vehicle section is used as a trigger for reporting crashes, since they are consistent with the hypothesis that officers are less likely to recognize smaller vehicles as CVs, perhaps because they perceive the GVWR requirements are not being met. It is not clear why buses are not reported, as they are included in the Illinois definition of a commercial vehicle. The state's definition of a bus stating "the vehicle is designed to transport more than 15 passengers, including the driver" is out-of-date, as current MCMIS criteria include buses with seating for nine or more, including the driver. However, use of this older definition would still not account for the large number of unreported buses, as most reportable buses have over 15 passengers.

Although Illinois specifies that intrastate as well as interstate commercial vehicles are to be included, officers may nevertheless underreport intrastate vehicles. Unfortunately this hypothesis cannot be tested directly, since there is no variable in the Illinois PAR file that would indicate if the vehicle is used in interstate or intrastate operations. Although vehicle license plate state, Department of Transportation (DOT) number, Interstate Commerce Commission (ICC) number, and commercial carrier state are recorded on the crash report form, they are not included in the PAR file.

In addition to identifying qualifying vehicles, the final step in determining reportable cases is to apply the crash severity criteria. More severe crashes may be easier to recognize as reportable to the Crash file and thus the officer may be more likely to complete the commercial vehicle section of the PAR. Consistent with this hypothesis, Table 12 shows that more severe crashes in Illinois are more likely to be reported. Only 42.3% of injury cases and 42.6% of towaway involvements were reported, compared with 71.0% of crashes involving a fatality. Note that the reporting rates for towaway and injury crashes are essentially identical. This is unexpected and not consistent with the hypothesis. It is not known why reporting of fatal crashes should be so much higher, but nonfatal crashes are reported at the same, albeit lower rate, regardless of severity. Of all unreported cases, 56 (0.9%) involved a fatality, 2,169 (34.5%) were injury cases, and 4,062 (64.6%) cases involved a tow/disabled vehicle.

Table 12. Reporting to MCMIS Crash File by Crash Severity, Illinois PAR File, 2003

Crash severity	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	193	71.0	56	0.9
Injured	3,760	42.3	2,169	34.5
Towaway	7,071	42.6	4,062	64.6
Total	11,024	43.0	6,287	100.0

4.3 Reporting Agency and Area

Beyond the application of the reporting criteria, there can be differences related to where the crash occurs or the type of agency that covered the crash. More densely populated areas with a large number of traffic accidents may not report as completely as areas with a lower work load. The level and frequency of training or the intensity of supervision can also vary. If there are such differences, they may serve as a guide to focus resources in areas and at levels that will produce the greatest improvement. The next set of tables examines areas of the state to see if there are inconsistencies in reporting patterns.

Reporting rates for Illinois' 103 counties (including a separate "county" for Chicago) ranged from 28.6% of reportable cases (Edgar) to 88.5% (Cumberland), excluding those with fewer than ten reportable cases. Table 13 shows reporting rates for the ten largest Illinois counties, based on

the most reportable cases. Together, these ten counties account for 79.7% (5,012) of the total unreported cases in Illinois for 2003, and the two counties of Chicago and Cook represent 53.8% (3,385) of unreported cases. Although Cook County has a large number of unreported cases, its reporting rate is slightly above the statewide average. All of the ten counties have reporting rates near or above the statewide average, with the exception of Chicago having a lower reporting rate of 29.1%.

Table 13. Reporting to MCMIS Crash File by County, Illinois PAR File, 2003

County	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Chicago	2,889	29.1	2,049	32.6
Cook	2,381	43.9	1,336	21.3
DuPage	753	45.7	409	6.5
Will	554	50.9	272	4.3
Lake	515	43.3	292	4.6
Kane	337	40.7	200	3.2
Madison	243	50.2	121	1.9
St. Clair	224	42.9	128	2.0
Winnebago	191	40.8	113	1.8
McHenry	173	46.8	92	1.5
Sum of top ten	8,260	39.3	5,012	79.7
Total (all counties)	11,024	43.0	6,287	100.0

It is also possible that reporting rates could be related to the level of reporting agency. Here, agency type may be taken as an indicator of the focus and training of the department. The Illinois PAR file identifies three types of reporting agencies: Illinois State Police (ILSP), county sheriff's offices, and local police departments.

In Illinois during 2003 the ILSP was responsible for 32.5% of all reportable cases (Table 14), and police departments covered 58.3% of cases. The reporting rate for the ILSP was 61.8%, compared with only 32.7% for local police. Clearly, reporting rates vary significantly between the three agency types, with state police having the highest rate and local police departments having the lowest rate. These differences may be the result of differences in focus, training, and supervision. Local police agencies were responsible for 4,330 (68.9%) of cases not reported to the MCMIS Crash File, so improved reporting from such agencies would contribute the most to improving reporting from Illinois.

Table 14. Reporting to MCMIS Crash File by Reporting Agency, Illinois PAR File, 2003

Reporting agency	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Illinois State Police	3,585	61.8	1,369	21.8
Sheriff's offices	1,009	41.7	588	9.4
Local police departments	6,430	32.7	4,330	68.9
Total	11,024	43.0	6,287	100.0

Table 15 shows reporting rates by agency type and crash severity. The state police are more consistent than sheriff's offices and local police in reporting similar proportions of fatal, injury, and towaway cases. In fact, sheriff's and local police each report injury and towaways at about half the rate of fatal crashes. It appears that these officers do not proceed to fill out the CV section of the crash report for qualifying trucks involved in less serious crashes.

Table 15. Reporting to MCMIS Crash File by Reporting Agency and Accident Severity, Illinois PAR File, 2003

Reporting agency	Reporting rates (%) by crash severity			
	Fatal	Injured	Tow, disabled	All
Illinois State Police	71.7	65.6	59.6	61.8
Sheriff's offices	83.9	43.4	38.3	41.7
Local police departments	61.2	30.7	33.4	32.7
Total	71.0	42.3	42.6	43.0

Reporting rates by vehicle type also vary among reporting agencies. For all vehicle types the ILSP completes CV data for a larger proportion of qualifying trucks and buses than police departments or sheriff's offices (Table 16). However, all agency types report larger trucks at a significantly higher rate than single unit vehicles (SUTs). Buses are essentially overlooked by all agencies, and none of the non-truck hazardous placarded vehicles are reported.

Table 16. Reporting to MCMIS Crash File by Reporting Agency and Vehicle Type, Illinois PAR File, 2003

Reporting agency	SUT	Tractor semitrailer	Tractor w/o trailer	Bus	Other haz. plac veh.	All
Illinois State Police	33.1	69.7	60.2	18.2	0.0	61.8
Sheriff's offices	27.8	66.3	51.9	4.0	0.0	41.7
Local police departments	23.3	63.7	48.4	3.5	0.0	32.7
Total	25.6	67.0	52.4	4.4	0.0	43.0

The section below will examine reporting by police departments in more detail. One might expect there to be differences in reporting rates by specific department, with agencies in more densely populated areas not following through to complete the CV area of the form as often, resulting in fewer cases being reported.

Since there is no variable on the PAR file specifying individual police agencies, crash city was used to identify local police departments. In 2003, police agencies in 430 Illinois cities covered MCMIS-reportable crashes. (There were 411 reportable cases for police departments where crash city was unknown.) Table 17 shows the top ten police agencies with the most reportable cases. They accounted for 49.0% of all unreported cases covered by the police. The city of Chicago represents almost 40% of the statewide unreported cases, due in part to a low reporting rate of only 22.4%. The Peoria agency also reported less than a quarter of reportable cases.

Table 17. Reporting Rates for Top Ten Police Agencies, Illinois PAR File, 2003

Local police agency	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Chicago	2,226	22.4	1,728	39.9
Peoria	94	23.4	72	1.7
Rockford	89	27.0	65	1.5
Aurora	70	41.4	41	0.9
Joliet	64	42.2	37	0.9
Cicero	61	34.4	40	0.9
Elgin	61	26.2	45	1.0
Naperville	55	34.5	36	0.8
Springfield	51	29.4	36	0.8
Elk Grove Village	50	58.0	21	0.5
Sum of top ten	2,821	24.8	2,121	49.0
Total (all PDs)	6,430	32.7	4,330	100.0

Since the vast majority of unreported cases originate in the Chicago area, Table 18 compares reporting rates by vehicle type for Chicago versus all other police agencies in Illinois. Although the average reporting rate for non-Chicago police departments is only 38.1%, it is even lower for Chicago at 22.4%. Chicago police are reporting all vehicle types at a lower rate than other agencies, although the pattern is the same as other police departments and in fact the same as all reporting agencies. Perhaps heavy workloads, in conjunction with not recognizing that smaller trucks are reportable, contribute to the large number of unreported cases.

Table 18. Reporting to MCMIS Crash File by Vehicle Type, Chicago vs. Other Agencies, Illinois PAR File, 2003

Local police agency	SUT	Tractor semitrailer	Tractor w/o trailer	Bus	Other haz. plac veh.	All
Chicago	17.7	56.1	35.7	2.3	0.0	22.4
All other cities	26.2	66.3	54.2	4.8	0.0	38.1
Total (all PDs)	23.3	63.7	48.4	3.5	0.0	32.7

Similarly, Chicago local police officers are consistently reporting fewer eligible cases across all severity categories when compared with city police in the rest of the state (Table 19).

Table 19. Reporting to MCMIS Crash File by Accident Severity, Chicago vs. Other Agencies, Illinois PAR File, 2003

Local police agency	Fatal	Injured	Tow/disabled	All
Chicago	40.0	18.3	24.9	22.4
All other cities	70.6	38.7	37.4	38.1
Total (all PDs)	61.2	30.7	33.4	32.7

There are also differences in reporting rates by the Illinois State Police by the district covered. Based on county, cases covered by the ILSP could be mapped into 21 State Police Districts. District 15 represents crashes occurring on toll roads. (See Attachment C for an explanation of the districts.) Table 20 shows the ILSP districts ordered by the most reportable cases. Across the districts reporting rates ranged from 52.0% for District 23 (Chicago) to 91.7% for District 14. The two state police districts with the most unreported cases include the Chicago area (Cook County) and the toll roads (in the Chicago vicinity and westward). Together they represent 807 unreported cases, 58.9% of all unreported ILSP cases.

Table 20. Reporting Rates for State Police Districts, Illinois PAR File, 2003

ILSP District	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
23 (Chicago)	1,051	52.0	505	36.9
15 (toll roads)	772	60.9	302	22.1
5	272	64.3	97	7.1
11	237	59.9	95	6.9
12	176	76.7	41	3.0
10	140	68.6	44	3.2
6	122	72.1	34	2.5
13	121	69.4	37	2.7
2	115	53.9	53	3.9
9	103	74.8	26	1.9
21	78	80.8	15	1.1
17	75	73.3	20	1.5
7	62	75.8	15	1.1
18	58	58.6	24	1.8
8	47	59.6	19	1.4
19	34	61.8	13	0.9
22	34	73.5	9	0.7
20	27	81.5	5	0.4
14	24	91.7	2	0.1
1	19	57.9	8	0.6
16	18	72.2	5	0.4
All Districts	3,585	61.8	1,369	100.0

From the analyses of local police and state police agencies above, it is clear that the Chicago area represents the most unreported cases. The reporting rate for the Chicago local police department

is 22.4%, among the lowest for any city agency. While the Chicago state police have a better rate of 52.0%, it is the lowest of all state police districts. The fact that Chicago area departments have lower reporting rates than other areas of the state is likely due to the fact that, as a group, they are not completing the CV section of the crash report form as often. This may be due to differences in training and understanding of when the CV section of the crash report needs to be completed, and to the extremely heavy workloads associated with large cities.

5. Data Quality Issues

In addition to examining the number of records reported to the MCMIS Crash file, it is important to evaluate completeness of data reported. Missing data rates are important in evaluating the utility of a data file, since records with missing data cannot contribute to an analysis. Table 21 shows the unrecorded rates for required variables. For many variables, the recording rate for Illinois is less than 100%. Missing data rates are higher for body type, county, configuration and crash events two through four. The event variables may be difficult to record, contributing to their high numbers of unrecorded values. In addition, there are a large number of towaway cases which may have had only one catastrophic event. For the 104 vehicles displaying a hazardous materials placard, two of the related variables were recorded in 100% of the cases; however, the one-digit materials class and the name of the hazardous material were always omitted.

Table 21. Unrecorded Rates for Selected Variables, Illinois MCMIS File, 2003

Variable	Percent unrecorded	Variable	Percent unrecorded
Accident year	0.0%	Event one	2.0
Accident month	0.0	Event two	12.5
Accident day	0.0	Event three	74.7
Accident hour	0.0	Event four	92.4
Accident minute	0.0	Number of vehicles	0.0
Body type	40.8	Officer badge number	1.1
Configuration	17.7	Report number	0.0
County	32.4	Road access	5.4
DOT number	4.8 *	Road surface	0.1
Driver date of birth	1.7	Road trafficway	8.5
Driver license number	1.7	Towaway	0.0
Driver license state	1.1	Truck or bus	0.0
Fatal injuries	0.0	Vehicle license number	1.5
Non-fatal Injuries	0.0	Vehicle license state	0.6
Interstate	0.0	VIN	1.2
Light	0.2	Weather	0.1

* Counting cases where the carrier is coded interstate.

Hazardous materials variable	Percent unrecorded
Hazardous materials placard	38.3%
Percentages of placarded vehicles only:	
Hazardous cargo release	1.0%
Hazardous materials class (1-digit)	100.0%
Hazardous materials class (4-digit)	0.0%
Hazardous materials name	100.0%

The following set of tables compares the actual data values in the Illinois PAR file with the values in the MCMIS Crash file to determine if the data are consistent between the two datasets. It is possible that errors of translation and formatting can occur when the data are prepared for submission to the MCMIS crash file.

For most variables, it appears there are some differences in coding between the PAR data and the MCMIS Crash file for the 4,737 matched cases. For example, although the majority of cases were exactly consistent for the Light variable, twelve cases coded daylight in PAR were coded as other lighting conditions, including dark-lighted and dark-not lighted, in MCMIS. Overall, for the Light variable a total of twenty cases were coded differently. Thirty-one cases had different code levels between the two files for the Weather variable; there were 38 discrepancies for the Road Surface Condition variable. The Total Fatals variable was coded more consistently, with only three discrepancies. Table 22 displays the consistency between the vehicle type variable as recorded in the Illinois PAR file and the coding of configuration in the MCMIS Crash file. There are several inconsistencies, undoubtedly due to the fact that the PAR file does not have as detailed code levels for trucks as the MCMIS file requires. The MCMIS configuration variable also has a high unrecorded rate. Forty-five vehicles coded as buses in the PAR file have configuration unrecorded in MCMIS. For PAR single-unit trucks, 355 cases have configuration unrecorded in MCMIS, one case is coded as a bus, and thirteen cases are coded as tractors. Tractor semitrailers in the PAR file also have a high unrecorded rate in MCMIS, with 341 cases missing a configuration code. Additionally, 825 tractor semitrailers are coded as SUTs or truck trailers in MCMIS. Tractor/no semitrailer in the PAR file are all miscoded in MCMIS as other truck types, or are unrecorded. Excluding unrecorded cases, overall 1,033 cases (21.8% of the 4,737 cases) were inconsistently coded on the vehicle type variables in the two files.

Table 22. Vehicle Type Coding in Illinois PAR Compared with MCMIS Crash File, 2003

Illinois PAR vehicle type variable	MCMIS configuration variable	N	%
Bus - up to 15 pass.	Unrecorded	1	0.0
	Tractor/semitrailer	1	0.0
	Total	2	0.0
Bus - over 15 pass.	Unrecorded	44	0.9
	Bus (seats 9-15,incl dr)	12	0.3
	Bus (seats >15,incl dr)	3	0.1
	SUT, 3+ axles	1	0.0
	Tractor/semitrailer	1	0.0
	Total	61	1.3
Truck - single unit	Unrecorded	355	7.5
	Bus (seats >15,incl dr)	1	0.0
	SUT, 2-axle, 6-tire	287	6.1
	SUT, 3+ axles	188	4.0
	Truck tractor (bobtail)	1	0.0
	Tractor/semitrailer	12	0.3
	Total	844	17.8
	Tractor/semitrailer	Unrecorded	341
SUT, 2-axle, 6-tire		59	1.2
SUT, 3+ axles		739	15.6
Truck trailer		27	0.6
Truck tractor (bobtail)		31	0.7
Tractor/semitrailer		2,390	50.5
Tractor/double		49	1.0
Total		3,636	76.8
Tractor w/o semitrailer	Unrecorded	46	1.0
	SUT, 2-axle, 6-tire	11	0.2
	SUT, 3+ axles	117	2.5
	Tractor/semitrailer	20	0.4
	Total	194	4.1
Total		4,737	100.0

Another variable that had a large number of discrepancies between the PAR and MCMIS files is Number of Injuries in the accident. Table 23 displays the number of cases coded consistently and inconsistently between the two files. Overall, 810 cases (17.1%) were inconsistently coded on Number of Injuries between the PAR and MCMIS files. There were 423 cases (8.9%) where one or more injuries were indicated in the PAR file, but the MCMIS file specified zero injuries in that crash. This would affect any analysis that categorizes crashes by injury severity. In addition, in 162 cases (3.4%), the MCMIS injury count differed from the PAR count by more than one injury. For example, for cases where the PAR file indicated 3 injuries, the MCMIS file specified either 0,1,5, or 6 injuries in a total of 38 of the 136 cases (27.9%).

Table 23. Injuries Coding in Illinois PAR Compared with MCMIS Crash File, 2003

PAR/MCMIS injuries	N	%
Injury coding consistent	3,927	82.9
Injury coding inconsistent	810	17.1
Total	4,737	100.0

Coding of the variable indicating a vehicle displayed a hazardous materials placard is shown in Table 24. The PAR variable indicates that 61 vehicles displayed a placard, while the MCMIS file indicated that 92 were placarded. Only fifteen of these cases were coded “yes” in both files. The remaining cases were coded “yes” in one file, but “no” or “unrecorded” in the other.

Table 24. Hazardous Placard Coding in Illinois PAR Compared with MCMIS Crash File, 2003

IL PAR hazardous placard variable	MCMIS hazardous placard variable	N	%
Not stated	Unrecorded	22	0.5
	No	17	0.4
	Yes	1	0.0
Yes	Unrecorded	13	0.3
	No	33	0.7
	Yes	15	0.3
No	Unrecorded	1,720	36.3
	No	2,840	60.0
	Yes	76	1.6
Total		4,737	100.0

From the analysis above it appears that Illinois has some data quality problems with respect to cases transmitted to the MCMIS Crash file. Several MCMIS variables have a substantial number of unrecorded values, as well as discrepancies in code values assigned between the corresponding PAR and MCMIS variable. In particular, one of the most essential variables, vehicle configuration, has a high rate of unrecorded values and many inconsistencies when compared with the PAR vehicle type variable.

6. Summary and Discussion

The purpose of the present study was to evaluate the completeness of data reported from Illinois to the MCMIS Crash file. To accomplish that goal, the Illinois PAR file for 2003 was obtained, and these data were compared with the data reported to the MCMIS Crash file.

The state of Illinois does not have a separate form the officer is expected to complete if a crash meets the MCMIS criteria. Instead, there is a commercial vehicle (CV) section on the main crash form that is supposed to be completed for all crashes involving a commercial vehicle, regardless of severity. Variables that can be used to identify cases that meet the MCMIS crash severity and vehicle type criteria are completed for all crashes. Thus, all information that can be used to identify reportable crashes are recorded on the crash report.

Illinois' crash form instructions indicate that if a commercial vehicle is involved in a crash, then the CV section of the form must be completed. The Illinois definition of a commercial vehicle is consistent with MCMIS criteria for trucks, and agrees with the bus criteria (except it omits a recent FMCSA update including buses with 9-14 passengers, including the driver). The Illinois CV definition also includes vehicles with a hazardous materials placard. Thus, officers should be filling out the CV section of the crash form for vehicles reportable to MCMIS. Using crash severity criteria recorded elsewhere on the form in conjunction with the CV information, state officials can then determine cases eligible for submission to the MCMIS Crash file.

Determining reportable trucks and buses for this evaluation was based on the variables available. Since the vehicle type variable consisted of broad categories with no further explanation of the individual codes, eligible trucks could not be precisely defined. The three categories of single unit truck, tractor semitrailer and tractor w/o semitrailer were used to approximate MCMIS criteria. Buses could be more accurately determined since they all fell into two categories. Since the only variable indicating "hazardous materials placard" resided in the CV section of the crash report, it was used to define those qualifying vehicles.

The PAR data also include the standard injury severity variable for each passenger and non-passenger involved in the accident. However, whether or not an injured person was transported for care could not be determined. Although variables that could identify the transport of an injured person appear on the crash report form, all were essentially unrecorded in the PAR file. Thus, for this evaluation, A and B injuries were used as a reasonable surrogate for the injured and transported MCMIS reporting criteria. While this method yields a reasonable estimate of the overall magnitude of reportable cases, it is not necessarily accurate for individual cases, and consequently patterns of underreporting are harder to identify. To address the towaway criteria, the "vehicle towed damage indicator" variable was used, although available documentation did not indicate if the level of damage indicated was "disabling."

Thus, it appears that Illinois has made its data collection system consistent with MCMIS reporting requirements, although for many variables the crash report instruction manual does not contain precise definitions. In addition, the criteria for "towed due to disabling damage" cannot be exactly determined. Further examination of the PAR file identified some duplicate records, although the number was very small and accounted for only 0.05% of cases. In addition, Illinois has some data quality problems concerning cases submitted to the MCMIS Crash file. Several MCMIS variables have a substantial number of unrecorded values, and many inconsistencies exist between code values of comparable PAR and MCMIS variables.

Overall, Illinois submits 43.0% of its reportable cases to the MCMIS Crash file. Evaluations of other states previously found reporting rates ranging from 24% to 82.5% [2, 3, 4, 5, 6, 7, 8]. As with other states, Illinois reports fatal crashes at a higher rate (71.0%) than injury cases (42.3%) and towaways (42.6%). Of 6,287 unreported cases, 4,062 (64.6%) are towaway cases. Improving

the reporting of vehicles involved in these less serious crashes would greatly improve the overall reporting rate for Illinois.

Responsibility for determining which cases should be submitted to MCMIS ultimately lies at the state level. In addition to errors in applying the reporting criteria, there can be delays in transmitting cases. However, an analysis of reporting rates by month showed that the average delay in case reporting for crashes occurring in 2003 was 31 days, well within the 90-day allowable period.

Given that cases were submitted in a timely manner, other variables were examined for their potential relationship to case underreporting. In applying the MCMIS criteria it is crucial to identify eligible vehicles correctly; hence the vehicle type variable was compared between reported and unreported cases. Overall, Illinois trucks are reported 51.4% of the time. Only 25.6% of single unit trucks are reported, while tractor semitrailers and tractors without trailers are reported at rates of 67.0% and 52.4%, respectively. Buses are mostly ignored, with a reporting rate of 4.3%, and none of the non-trucks with hazardous placards were reported. Since the state is likely identifying eligible vehicles based on data items in the CV section, it is crucial the officers understand which vehicles require this additional information.

It was hypothesized that reporting rates might be lower in more densely populated areas. The average reporting rate for the top ten counties with the most reportable cases was 39.0%, only slightly lower than the statewide average of 43.0%. With the exception of Chicago these ten counties had high numbers of unreported cases because they had large caseloads, not because of unusually low reporting rates.

Reporting rates for the various reporting agencies were also examined to determine if the application of reporting requirements differed by agency. The ILSP reports an average of 61.8% of their cases, compared with the statewide average of 43.0%. The overall reporting rate for local police agencies is 32.7%. The Chicago police department represents almost 40% of the unreported cases of local police, with a reporting rate of only 22.4%. Heavy workloads may contribute to the low reporting rate for this major city.

In summary, Illinois reported 43.0% of reportable cases to the MCMIS Crash file in 2003. In addition, 9.7% of the cases reported did not qualify for reporting. Although Illinois's data collection system and definition of a commercial vehicle are generally consistent with MCMIS reporting requirements, less than half the eligible cases are being submitted. Smaller trucks are reported at a lower rate than large trucks, and over 95% of eligible bus cases are ignored. Nonfatal crashes covered by local police departments and sheriffs offices are reported less often than fatal crashes.

It appears that reporting to MCMIS is based on filling out the CV section of the crash report. That is, it is likely that a case has to be recognized as involving a commercial vehicle before it is

subjected to the MCMIS vehicle type and crash severity criteria. In fact, virtually all trucks and buses that meet the MCMIS vehicle type criteria are used for commercial purposes. Moreover, all do meet the definition as presented in the Illinois PAR instruction manual. But reporting officers at the scene are filling out the CV section at a lower rate for smaller trucks and less severe crashes, and very seldom fill it out for buses. This problem is much exacerbated in big cities, and for local police departments, where case load, training, and policing focus may all contribute to low reporting rates. Helping officers to understand that they need to complete the CV section for all vehicles that meet MCMIS requirements, and accurately record injury severity and towaway status, would likely go a long way in solving Illinois' underreporting problems.

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9. Federal Motor Carrier Safety Administration (FMCSA) MCMIS Crash File Documentation, April, 2005.
10. Illinois Department of Transportation, Division of Traffic Safety, *Illinois Traffic Crash Report SR 1050 Instruction Manual*, January 1998.
11. *Illinois Traffic Crash Report Form SR-1050*, revision December 2001.

Appendix A: Variables Used for Illinois PAR Data to Identify a MCMIS-Reportable Crash

MCMIS Reporting Criteria	Implementation in Illinois PAR Data
<p>Truck with GVWR over 10,000 or GCWR over 10,000</p>	<p>Although GVWR, vehicle configuration, and cargo body type were variables included in the Commercial Vehicle section of the crash report, they were not included in the PAR file.</p> <p>Vehicle Type was the only other variable available for selecting trucks meeting the MCMIS criteria. In cases where the vehicle type variable was vague, such as code levels ‘Other vehicle with trailer’ or ‘Other’, an attempt was made to incorporate the Vehicle Use variable. However, Vehicle Use did not correspond well with Vehicle Type, implying that coding errors may exist. For example, there were tractor semitrailers ‘used’ as school buses, mass transit, taxis, etc. It was decided to identify eligible trucks as follows:</p> <p>Vehicle_type = 6 (Truck-single unit) 7 (Tractor w/semi-trailer) 8 (Tractor w/o semi-trailer)</p>
<p>or Bus with seating for at least nine, including the driver</p>	<p>The following codes were used to identify eligible buses:</p> <p>Vehicle_type = 4 (Bus up to 15 pass) 5 (Bus over 15 pass)</p> <p>It is also possible that some other vehicles, such as vans, could qualify as buses. They would qualify if they have seats for nine or more passengers and are used for transporting passengers, and not personal transport. However, since number of seats was not available and a description of vehicle use did not appear to be reliable, the decision was made not to include any other vehicles as qualifying buses.</p>
<p>or Vehicle displaying a hazardous materials placard</p>	<p>Variables pertaining to transporting hazardous materials were included in the commercial vehicle section of the crash report. According to the crash form instructions, if a unit carrying hazardous materials was involved in the crash, the commercial vehicle section of the form must be completed. This is consistent with the MCMIS criteria. If the definition was applied correctly, then variables in this CV section should be recorded for vehicles less than 10,001 lbs. with a hazardous materials placard. For this study, placarded vehicles were then identified using the Hazmat Indicator variable from this area of the crash report.</p> <p>Thus, vehicles displaying a hazardous materials placard were defined as:</p>

MCMIS Reporting Criteria	Implementation in Illinois PAR Data
	Hazmat_indicator =1
AND	
at least one fatality	<p>At the driver, occupant, and non-occupant levels, the Illinois PAR file includes an injury severity variable coded as follows:</p> <p>Injury_severity = code 0 (None), code 1 (incapacitating injury), code 2 (non-incapacitating injury), code 3 (reported, not evident), and code 4 (fatal injury). A fatal accident was defined as any person in the accident with:</p> <p>Injury_severity= code 4 (fatal)</p>
or at least one person injured and transported to a medical facility for immediate medical attention	<p>The Injury Severity variable defined above was used to identify injury accidents. However, from the available variables it was not possible to determine if an injured person was transported for medical care. The PAR form contains an area to enter the treatment facility name and name of the emergency medical service agency that transported the injured person. Although these variables appeared on the PAR file for the driver, occupants, and non-occupants involved in the crash, all were unrecorded for greater than 98% of the cases.</p> <p>Thus, it was not possible to directly identify injured persons who were transported for medical care. Therefore, an alternative method of distinguishing transported from non-transported injured persons was used. Since persons with Type A or B injuries would likely require medical treatment, accidents involving an A or B-injured individual were considered to be “injury, transported” accidents.</p> <p>Thus, an injury/transported accident was defined as a crash with at least one person with:</p> <p>Injury_severity = Code 1 (incapacitating injury, Type A) or code 2 (non-incapacitating injury, Type B.)</p>
or at least one vehicle towed due to disabling damage	<p>The Illinois PAR form (revision 1/99) contains a towaway variable indicating if the vehicle was towed due to damage or towed for another reason. This variable was simplified on crash form revision 12/01, to “towed= yes or no”. On the PAR file this information is contained in the Vehicle Towed Damage Indicator variable (0=not stated, 1=yes, 2=no). All vehicles with a “yes” were assumed to be towed due to disabling damage, although in some cases it is uncertain whether damage was disabling, due to the lack of detail in the current crash form. After consulting with a state DOT official, all vehicles with a “yes” are assumed to be towed due to disabling damage. Accidents involving such a vehicle were considered tow/disabled.</p>

Appendix C: Illinois State Police Districts

District 1 Counties Served: Carroll Lee Ogle Whiteside
3107 E. Lincolnway Sterling, Illinois 61081-1712
Telephone: (815) 632-4010

District 2 Counties Served: DeKalb DuPage Kane Lake McHenry
777 S. State St. Elgin, Illinois 60123-7689
Telephone: (847) 931-2405

District 3 & District 4: Not Listed

District 5 Counties Served: Grundy Kendall Will
16648 S. Broadway Lockport, Illinois 60441-9546
Telephone: (815) 726-6377

District 6 Counties Served: De Witt Livingston McLean
800 Old Airport Road Pontiac, Illinois 61764-0498
Telephone: (815) 844-1500

District 7 Counties Served: Henry Knox Mercer Rock Island
800 Hillcrest Rd. East Moline, Illinois 61244-1161
Telephone: (309) 752-4915

District 8 Counties Served: Marshall Peoria Stark Tazewell Woodford
1265 Lourdes Rd. Metamora, Illinois 61548-7710
Telephone: (309) 383-2133

District 9 Counties Served: Cass Christian Logan Mason Menard Morgan Sangamon
3780 E. Lake Shore Dr. Springfield, Illinois 62712-8609
Telephone: (217) 786-7107

District 10 Counties Served: Champaign Coles Douglas Edgar Macon Moultrie Piatt
Shelby Vermilion
P.O. Box 110 Pesotum, Illinois 61863-0110
Telephone: (217) 265-0050

District 11 Counties Served: Bond Clinton Madison Monroe St. Clair
1100 Eastport Plaza Dr. Collinsville, Illinois 62234-6116
Telephone: (618) 346-3990

District 12 Counties Served: Clark Clay Crawford Cumberland Effingham Fayette Jasper
Lawrence Marion Richland
401 Industrial Ave., Suite A Effingham, Illinois 62401-2835
Telephone: (217) 347-2711

District 13 Counties Served: Franklin Jackson Jefferson Perry Randolph Washington
Williamson
1391 S. Washington Street DuQuoin, Illinois 62832
Telephone: (618) 542-2171

District 14 Counties Served: Fulton Hancock Henderson McDonough Warren
1600 North Lafayette Street Macomb, Illinois 61455-9194
Telephone: (309) 833-4046

District 15 Note: District 15 coverage is Tollways only.
2700 Ogden Ave. Downers Grove, Illinois 60515
Telephone: (630) 241-6800 Ext. 5030

District 16 Counties Served: Boone Jo Daviess Stephenson Winnebago
16450 West State Rd. Pecatonica, Illinois 61063-9206
Telephone: (815) 239-1152

District 17 Counties Served: Bureau La Salle Putnam
2971 E. 350th Road La Salle, Illinois 61301
Telephone: (815) 224-1171

District 18 Counties Served: Calhoun Greene Jersey Macoupin Montgomery
102 Illinois Route 16 Litchfield, Illinois 62056-1574
Telephone: (217) 324-4900

District 19 Counties Served: Edwards Gallatin Hamilton Saline Wabash Wayne White
919 Illinois Route 14 Carmi, Illinois 62821-2309
Telephone: (618) 382-4606

District 20 Counties Served: Adams Brown Pike Schuyler Scott
P.O. Box 32 Pittsfield, Illinois 62363
Telephone: (217) 285-2034

District 21 Counties Served: Ford Iroquois Kankakee
P.O. Box 147 Ashkum, Illinois 60911
Telephone: (815) 698-2395

District 22 Counties Served: Alexander Hardin Johnson Massac Pope Pulaski Union
1154 Shawnee College Rd. Ullin, Illinois 62992
Telephone: (618) 845-3740

Chicago District Counties Served: Cook
9511 W. Harrison St. Des Plaines, Illinois 60016-1562
Telephone: (847) 294-4400