Evaluation of Michigan Crash Data Reported to MCMIS Crash File

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MCMIS Crash File Evaluation

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16. Abstract

This is one of a series of papers presenting the results of an evaluation of 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. This report examines the sources of underreporting for the state of Michigan.

In 2003, there were 5,911 crash involvements in Michigan that were reportable to the MCMIS Crash file. 4,926 involvements were reported for that year, for a reporting rate of 73.7%. 303 of the cases reported to the Crash file did not meet the reporting criteria. 92.4% of fatal involvements were reported, 73.1% of qualifying injury crash involvements, and 73.4% of crashes with a towed, disabled vehicle.

Unlike many other states, in Michigan reporting officers are responsible to identify qualifying vehicles (trucks, buses, and vehicles placarded with hazardous cargo), but cases meeting the severity criteria are selected centrally. This system likely partially explains the overall pattern of underreporting.

Underreporting also is related to the time of year, indicating delays in providing the data. Reporting rates also varied by jurisdiction, with larger communities with more cases having higher rates of underreporting.

Data quality is also reviewed. In certain variables, data in the Michigan police report file differed from that in the Crash file for some cases. Some inconsistencies were also noted between cargo body and vehicle configuration in the police report file and in the MCMIS Crash file.

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Introduction

Improvement in the level and quality of reporting to the Motor Carrier Management Information System (MCMIS) Crash file is a significant goal for the Federal Motor Carrier Safety Administration (FMCSA). Accordingly, FMCSA has undertaken a series of evaluations of the data reported by the states. Earlier evaluations have shown substantial underreporting of eligible crashes. About one-third of reportable truck crashes are not reported to the crash file. The proportion of unreported cases rises to 60% for bus crash involvements. [1] (See references at the end of the report.)

Since individual States are responsible for supplying the data for the MCMIS Crash file, it is reasonable to evaluate reporting from individual states as problems originate with the states. Previous reports on Ohio [2] and Missouri [3] showed substantial underreporting due in large part to problems police officers experience in applying the reporting criteria. The problems were more severe in large jurisdictions and police departments. Both 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 Michigan. Overall, Michigan had similar rates of underreporting to Ohio and Missouri, but very little overreporting. On the other hand, Michigan's system for identifying reportable crashes differs from the other states. While in those states, the investigating officer identified crashes that meet the reporting criteria, in Michigan the decision is centralized. As a result, the sources of underreporting are more difficult to identify, but improvements may be easier to implement.

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

1. The complete police accident report file (PAR file hereafter) from Michigan was obtained for one year. We chose 2003 since it is the most recent year available. This file was processed to identify all cases that qualified for reporting to the MCMIS Crash file.

2. All cases in the Michigan 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 Michigan.

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.

The Michigan police accident reporting (PAR) file contains the police-reported data for 392,836 crashes involving 670,620 vehicles that occurred in Michigan during 2003. An algorithm was developed using variables in the Michigan PAR file to identify cases that should have been reported to the MCMIS Crash file. Comparing this group to the set of cases that were actually reported to the MCMIS Crash file allowed the evaluation of the completeness of reporting to the Crash file, and the identification of cases that should not have been reported.

Data Preparation

Both files required some processing before the Michigan records in the MCMIS Crash file could be matched to the Michigan PAR file. This section discusses the methods used to prepare each file and some of the problems uncovered.

MCMIS Crash file

The MCMIS Crash file as of April 27, 2004 was used to identify records submitted from Michigan. All records submitted from Michigan for 2003 were extracted, amounting to 4,926 records. An analysis file was constructed, using all variables in the file. The file was examined for duplicate records, i.e., cases where more than one record was submitted for the same vehicle in the same crash. No such records were found. Accordingly, the file of Michigan MCMIS Crash file records used in the evaluation process consisted of 4,926 records.

Michigan PAR file

The Michigan PAR file for 2003 was acquired. It contains records for 392,836 crashes involving 670,620 vehicles. In Michigan, the PAR form is referred to as the UD-10. An image of the UD-10 is included as an attachment. The primary task in preparing the file for evaluation is to identify the records which should be reported to the MCMIS Crash file. For this purpose, it is necessary to identify variables in the Michigan PAR file that can be used to reproduce the MCMIS Crash file case selection criteria. 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.

The Michigan PAR file includes a vehicle type variable with eleven levels, one of which is "truck/bus." Figure 1 shows the area on the UD-10 used to record vehicle type. Table 2 shows the definitions of the codes from the UD-10 instruction manual.

Figure 1 Vehicle Type Coding on UD-10

Table 2 Vehicle type codes in Michigan UD-10

Code	Definition
PA	Passenger car and station wagon
VA	Van, motor home
PU	Pickup truck
ST	Small truck (under 10,000 lbs.)
CY	Cycle
MO	Moped
GC	Go-cart
SM	Snowmobile
OR	Off road vehicle (ATV type)
Other	Non-registered farm equipment, combine, front end loader
Truck/Bus	Complete the Truck/Bus Section

"Trucks" and "buses" are both included in the same category. The instructions in the UD-10 manual for the truck/bus supplemental section are quite close to the definition of a truck or bus in the MCMIS criteria. (Figure 2 provides an image of the area on the UD-10.) In the instructions for the supplemental information, a truck is defined as "… [a] truck or truck/trailer having a Gross Vehicle Weight Rating (GVWR) of more than 10,000 pounds for the power unit or any other vehicle displaying a hazardous materials placard." This definition is very close to that of a truck in the MCMIS Crash file; though it does not include combinations with a gross combination weight over 10,000 pounds.

Figure 2 Truck/Bus Supplemental Section on UD-10

A bus is defined as "[a]ny bus or school bus designed or used to transport more than 8 people, including the driver. (Note: this includes limousines or courtesy vans)." This definition accurately captures buses for the MCMIS Crash file. However, in addition to the vehicle type variable, another area on the UD-10 potentially identifies buses. In the special vehicles area, buses are identified as one of the special vehicle types.

Note in Figure 1 the instruction to the officer to complete the truck/bus section if the officer identifies a truck or bus in the crash and fills in the proper bubble on the UD-10. There are

actually three vehicle types that qualify for reporting to the MCMIS Crash file, since any vehicle placarded to carry hazardous materials is also to be reported. The instructions in the UD-10 manual correctly include placarded hazardous materials vehicles, including nontrucks, but there is no variable in the UD-10 itself, outside of the truck/bus supplemental section, to record hazardous materials. The only cue to the officer on the UD-10 to fill out the supplemental truck/bus information is in the vehicle type section. Otherwise, there are no directions and he has to rely on his training. Thus, the structure of the PAR itself could result in missing cases in which a light vehicle is carrying hazardous materials.

Accordingly, to identify reportable vehicles, the most plausible rule would seem to be to take vehicles coded as a truck or bus in the vehicle type variable, or coded as a bus in the special vehicle variable, or any vehicle carrying hazardous materials, using the hazardous materials variable from supplemental section. Attachment 1 provides details on the variables and code levels used to identify MCMIS-reportable cases.

The next problem is to identify crashes that meet the severity criteria for reportable vehicles. These are crashes that involve a fatality or injury transported for immediate medical attention or at least one vehicle towed due to disabling damage. In Michigan, the reporting officer is not instructed to fill in the supplemental information based on crash severity, but only based on vehicle type. Given the instructions to officers, the supplemental section is filled out even for vehicles in crashes that do not qualify for the MCMIS Crash file, based on severity. In 2003, at least some information was entered into the truck/bus supplemental section for 14,766 vehicles. But only 5,099 were involved in a qualifying crash for the MCMIS Crash file. In other words, in only about 35% of the times officers fill out the truck/bus supplement is the data actually reportable to the Crash file.

Michigan uses the KABCO injury scale to characterize injuries. There is also a variable that records whether a vehicle was drivable. The information on whether a vehicle was drivable can be used to identify towaway crashes and satisfy that element of the MCMIS crash severity criteria. Identifying crashes that qualify because of transported injuries is more difficult. The UD-10 includes an area where the officer can indicate a code for the ambulance company that was notified and a code for the hospital to which any injured person was taken. In theory, this information can be used to determine if any person was transported for treatment. But the computerized PAR data only includes one case out of 670,000 with a valid ambulance code and no case included a hospital code. Notes supplied by the Michigan Department of State Police indicate that the information is not captured in their computerized data file. Accordingly, it was necessary to use the KABCO injury coding exclusively to identify cases that meet the injury severity criteria. Identifying crashes with fatally injured persons is not a problem. We used A and B-level (incapacitating and not incapacitating but evident) injuries as a surrogate for transportable injuries.

We subsequently learned that Michigan submits cases to the MCMIS Crash file that include a fatality, A or B injury, or C injury with a hospital code. Since hospital code was all missing data in the file acquired by UMTRI for this evaluation, either there is another file in which the hospital variable is coded or the UD-10s are reviewed by hand. In either case, it turns out that the set of rules developed here to identify cases that should be reported in fact identified the set of cases actually submitted by Michigan. All of the cases submitted by Michigan because there were C-injuries where the injured person was transported for treatment also were coded with an

undrivable vehicle, and so were coded as towaways and picked up by the UMTRI algorithm. Table 3 shows that 385 cases that were identified with at least one vehicle coded as undrivable by the UMTRI algorithm were classified as an injury crash in the information submitted to MCMIS.[1]

Table 3 Crash Severity of MCMIS Reported Cases in Michigan

UMTRI-reportable algorithm	Severity in MCMIS	N
Fatal	Fatal	109
Injured	Injured	899
Towaway	Injured	385
Towaway	Towaway	2,964
Total		4,357

To summarize, in total there were 17,220 vehicles identified as trucks or buses in the Michigan PAR file. 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. Crashes involving a fatality or injury can be readily identified in the Michigan data file. The Michigan PAR file includes a variable indicating if the crash involved any fatalities, and another variable specifying if the crash was injury-only, excluding fatal injuries. However, the only variables that could be used to determine if an injured person was transported to a medical facility for treatment were the "ambulance/hospital code" variables on the driver and passenger records. Unfortunately these variables were unrecorded for all but one injured driver and one injured passenger. The hospital or ambulance name may have been written on the PAR form, but it was not entered on the data file used in this study.

The rule used by the state of Michigan to identify cases for the MCMIS file takes all cases with A or B injuries. At first glance, this seems like a reasonable rule, since from the definitions of the injuries, immediate medical attention seems warranted and likely. However, the reality of injury coding may not be so straightforward. In fact, the experience in the neighboring state of Ohio indicates that a substantial percentage of A and B injuries are not transported for treatment. Ohio uses both the same KABCO injury scale as Michigan and also includes a variable that indicates whether the injured person was transported for treatment. In a recent year of crashes, only 76% of A injuries, 52% of B-injuries, and 28% of C injuries were also coded as transported.

Consequently, the practice of taking all A or B injury crashes, 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 Ohio data includes all relevant variables, it is possible to estimate the distribution of cases that would have been submitted from Michigan if the MCMIS crash severity were used more accurately.

An adjusted distribution of Michigan reportable cases based on the Ohio experience was estimated by first determining the number of Michigan PAR cases that would have qualified for the MCMIS Crash file based on vehicle type, and then classified each by the most severe injury in the crash. Then the proportion of such involvements in Ohio in which an injured person was

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[1] The table just includes cases in which we were able to match a record in the Michigan PAR file to a record in the MCMIS Crash file. There were an additional 303 records matched in the MCMIS that were not reportable because they were not trucks nor light vehicles with hazardous materials.

transported for treatment was applied to the number of Michigan involvements to estimate the number of Michigan cases for a given crash severity that would have been transported. For example, in Michigan, there were 422 qualifying vehicles in which the most severe injury was an A injury. Of these, 361 also included a disabled vehicle and so would be taken based on the towaway criterion. In Ohio, in 87% of the involvements with an A injury but no towed vehicle, at least one injury was transported. Applying that percentage to A injury cases in Michigan with no towed vehicle, an estimated additional 53 involvements would qualify, taking 414 of the 422 A injury cases in Michigan. When this adjustment procedure is applied to each injury severity level in Michigan, an estimated 5,658 cases should have been reported to the MCMIS Crash file. The distribution of crash severity for reported cases would be quite different, as Table 4 shows.

Table 4 Reported and Estimated Reportable Cases Based on Ohio Data

MCMIS severity class	Actually reported	%	Adjusted reportable cases	%
Fatal	109	2.5	118	2.1
Injured, transported for treatment	899	20.6	2,275	40.2
Towaway	3,349	76.9	3,265	57.7
Total	4,357	100.0	5,658	100.0

However, for the purposes of this evaluation, it is only possible to use the information that is in the Michigan PAR file. Thus, the subset of PAR cases that can be identified as reportable to MCMIS included the trucks and buses 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, 5,911 records in the Michigan PAR file should have been reported to the MCMIS Crash file, based on the crash severity definition above. Table 5 shows the distribution of cases identified in the Michigan PAR file that met the reporting criteria thus defined, along with the distribution of records actually reported.

Table 5 Reportable Records in the Michigan PAR file, 2003

Crash severity	Reportable records in Michigan PAR file	Records actually reported to MCMIS Crash file	
Fatal	118	109	92.4%
Injury, A or B	1,230	899	73.1%
Vehicle not drivable	4,563	3,349	73.4%
Total	5,911	4,357*	73.7%
* Excludes 303 cases not reportable and 266 cases that could not be matched to PAR file.			

In 2003, about 73.7% of reportable cases in the Michigan PAR file were actually reported to the MCMIS Crash file. The reporting rate was higher for the most severe crashes, that is, those involving a fatality. Injury and towaway crashes both had about the same reporting rate, which was almost 20 percentage points lower.

Matching Michigan PAR file records to MCMIS cases

The MCMIS file with 4,926 records from Michigan was matched against all 670,620 records in the Michigan PAR file. Note that the match was performed with all Michigan PAR records, not just those that qualified as reportable to the MCMIS Crash file. It was decided to match with all records in the PAR file to account for the possibility that non-qualifying cases may have been reported.

The first step in matching two files is to identify data elements that are common to the two files and that uniquely identify records in each. Accident report number is an obvious first choice. This number is recorded in the MCMIS Crash file as the Crash Report Number, using Crash Sequence Number to record multiple reportable vehicles in a given crash. Unfortunately, accident number is recorded inconsistently in the Crash Report Number and Crash Sequence Number. In about three quarters of the records, the accident report number could be found in Crash Report Number, but in the remaining instances, the numbers did not match. Often where more than one reportable vehicle was included, Crash Report Number ended in a letter (A, B, C, and so on) and the number was completely different from the accident report number.

Since accident report number did not consistently agree between the two data sets, even after extensive processing, it was necessary to develop an alternative match algorithm. The algorithm developed consisted of finding common variables that matched at the accident level as well as the vehicle level. A valid match must match specific vehicles within a crash, not just the crash. Accordingly, it was necessary to find variables common between the files that could uniquely identify drivers or vehicles, as well as the time, date, and location of the crash.

After examining all potential match variables common to the two files, there were only a few that could be used for the merge. The UD10 number on the PAR and report number in MCMIS were comparable for about three-quarters of the records, as mentioned above. Another potential match variable at the accident level, officer's badge number, was unrecorded for all MCMIS cases, and not available in the PAR data. At the vehicle level, the only available variable was vehicle license number, since other potential match variables, driver's date of birth, driver's license number, and vehicle identification number (VIN), were essentially unrecorded.

Three separate matches were performed. In each match attempt, records in either file that were duplicates based on the match variables were excluded, along with records that were missing values on the match variables.

The first attempt matched on accident report number, crash month, day, hour, crash county, and vehicle license number. Subsequent match steps eliminated one of those variables. To validate the matches, a subset of matched records was compared on other variables common to the MCMIS and PAR files. The above procedure resulted in 4,660 matches, representing 94.6% of records reported to MCMIS. Figure 3 shows the results of the matching procedure.
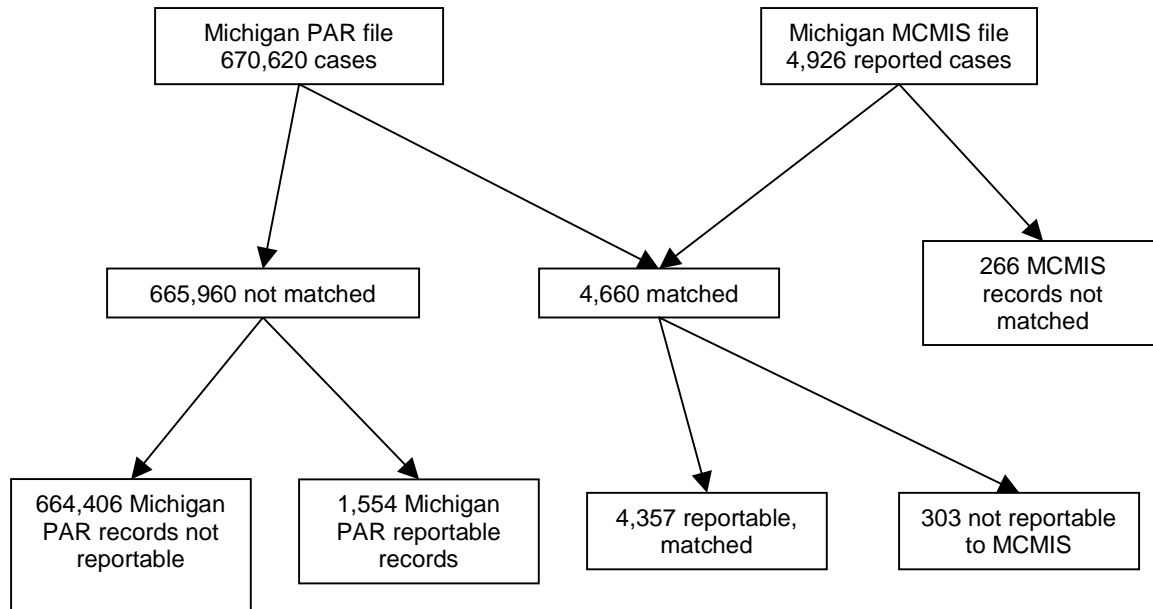
Figure 3 Results of MCMIS-Michigan PAR File Match

Only 266 (5.4%) MCMIS records could not be matched to the Michigan PAR file. This is a reasonable number given the absence of a common case identifier for all records and the limited number of variables available for matching, particularly at the vehicle level. Unrecorded MCMIS values on the only vehicle-level match variable, vehicle license plate number, accounted for 155 of the 266 unmatched cases. In addition, it is not rare for more than one record in a file to share the same values for match variables such as crash date and time, and thus to be excluded from the matching process.

An additional 303 cases (6.2%) were identified in the MCMIS Crash file which, while they matched the Michigan PAR file, did not qualify as reportable either because they did not involve qualifying vehicles or qualifying severity. One hundred-ninety-three of the cases involved a qualifying vehicle (182 trucks and 11 buses) according to the PAR data, but did not meet either the injury or the towaway criteria. All 193 cases were C injuries with no disabled vehicle. It is difficult to determine what proportion of the 193 cases can be considered as "overreported," since the PAR file does not specify if an injury was transported for care. It is possible that a portion of these injury cases were, in fact, transported for medical care and would have been eligible cases.

Omitting the 266 cases that could not be matched and the 303 MCMIS cases not considered reportable, 4,357 MCMIS records were matched to the PAR file, for a match rate of about 88% of the MCMIS Crash file cases. However, only about 73.7% of the cases in the Michigan PAR file that should have been reported actually appeared in the Crash file. (Table 5)

Potential Sources of Underreporting

This section explores the sources of underreporting to the MCMIS Crash file, realizing that the PAR designation of a reportable case is not exact. The approach is to identify possible reasons for underreporting and to further examine the unreported cases compared with the reported cases to search for patterns that might suggest why some cases were reported and others were not. All

tables exclude the 303 MCMIS cases not considered reportable in the PAR file and the 266 MCMIS cases that could not be matched to the PAR file.

It is logical to search for the roots of underreporting in factors related to the vehicle type and crash severity reporting thresholds. The available variables and layout of the Michigan PAR make this a challenge. In the UD-10 itself, the vehicle type variable provides no detail about the truck or bus type, but combines both into a single type, truck/bus. Moreover, 99.4% of unreported cases were identified as truck/bus in this variable. But there is no further detail about the truck or bus and so no way of determining whether certain truck types are more likely to be reported than others.

However, the PAR file provides adequate information about crash severity and other factors that might be related, and those factors will be explored here. Table 6 shows reporting to the MCMIS Crash file by crash severity. The MCMIS severity categories are used. Over 92% of reportable fatal crash involvements were reported to the MCMIS Crash file. Reporting rates were lower for lower severity crashes. Only 73.1% and 73.4% of injury or towaway involvements, respectively, were reported. Most unreported involvements were relatively less serious, with 78.1% of the unreported involvements including only a towed vehicle. It is interesting, however, that the reporting rates for injury and towaway crashes are so similar. One might expect that the relationship between reporting rate and crash severity to be linear, but instead it appears to have two levels, one for fatal involvements and one for all other reportable involvements.

Table 6 Reporting to MCMIS Crash File by Crash Severity, Michigan PAR File, 2003

Crash Severity	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	118	92.4	9	0.6
Injured	1,230	73.1	331	21.3
Towaway	4,563	73.4	1,214	78.1
Total	5,911	73.7	1,554	100.0

There also appears to be a two-level reporting probability when the crash involvements are considered by the most severe injury in the crash. As discussed above, nominally Michigan reports all involvements in which the most severe injury is an A or B injury, C injuries transported for treatment, or no injury if at least one vehicle is disabled. But Table 7 shows that effectively fatal involvements are reported at a high rate (92.4%) and all other crash severities, including involvements in which no one was injured, are reported at rates in a narrow band that ranges from 72% to 76%. The reporting rate for "no injury" involvements is actually slightly higher than for B-injuries, of which all should have been reported under the version of MCMIS reporting criteria implemented by Michigan. The rate for A injuries is slightly higher, at 76.1%, but the difference is not statistically or practically significant.

**Table 7 Reporting to MCMIS Crash File by Maximum Injury in the Crash
Michigan PAR File, 2003**

Maximum injury in crash	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	118	92.4	9	0.6
A-injury	422	76.1	101	6.5
B-injury	808	71.5	230	14.8
C-injury	1,284	73.8	337	21.7
No injury	3,265	73.4	867	55.8
Uncoded and errors	14	28.6	10	0.6
Total	5,911	73.7	1,554	100.0

The completeness of crash reporting does appear to vary by month, and so probably is affected simply by time delays in preparing case submissions to MCMIS. All reportable crash involvements for a calendar year are required to be transmitted to the MCMIS Crash file within 90 days of the end of the year. The MCMIS file used in this evaluation was dated in April, 2004, so in theory, all 2003 cases should have been reported. However, Table 8 shows that crash involvements late in the year are less likely to be reported than those earlier. About 78-80% of reportable cases that occurred in January through May, 2003, were reported to the MCMIS Crash file. Beginning in June, the reporting rate decreases steadily, so that only 59.8% of November involvements were reported, and only 69.1% of reportable involvements in December were reported. Clearly, one contributor to the overall reporting rate of 73.7% is delays in reporting qualifying cases to the MCMIS Crash file. If cases were uploaded to MCMIS in a timely fashion, the reporting rate would be raised. On the other hand, one notes that it appears the reporting rate would increase to only about 80% if cases were reported in accordance with the time requirements.

Table 8 Reporting to MCMIS Crash file by Month, Michigan PAR file, 2003

Crash month	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
January	596	80.4	117	7.5
February	559	78.5	120	7.7
March	473	79.9	95	6.1
April	487	78.2	106	6.8
May	420	78.1	92	5.9
June	418	73.9	109	7.0
July	448	76.6	105	6.8
August	453	68.2	144	9.3
September	489	68.7	153	9.8
October	563	72.1	157	10.1
November	488	59.8	196	12.6
December	517	69.1	160	10.3
Total	5,911	73.7	1,554	100.0

Another possibility that was considered is that in-state vehicles would be less likely to be reported to the MCMIS Crash file than vehicles from out of state. The hypothesis here is that,

since the MCMIS file is a national file maintained by the Federal Motor Carrier Safety Administration, which has regulatory authority over trucks and buses in interstate commerce, it might be thought that reporting is not required for in-state vehicles. Evidence for this hypothesis is ambiguous. As Table 9 shows, reporting occurred for vehicles with Michigan registrations at about the same rate as vehicles with registrations in other states. Note, however, that only 2.2% of reportable records with registration state blank were reported. If these cases are included with the other category, out-of-state vehicles would be reported at a lower rate than in-state vehicles, while the opposite would be expected. Clearly, reportable vehicles with unrecorded states of registration are seldom reported, but it is not known why.

Table 9 Reporting to MCMIS Crash File by Vehicle Registration State
Michigan PAR file, 2003

Vehicle registration state	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Michigan	4,251	76.3	1,006	64.7
Other	1,436	77.1	329	21.2
Blank	224	2.2	219	14.1
Total	5,911	73.7	1,554	100.0

In Michigan determining if a case is eligible for submission to the MCMIS Crash file is a two-step process. The reporting officer decides if the vehicle qualifies as an eligible truck or bus, and marks the vehicle-type bubble on the PAR, which indicates that the truck/bus supplemental portion of the PAR should also be completed. But the application of the accident severity criteria, and the decision as to whether the case is ultimately submitted to the MCMIS Crash file, is made at the state level.

It is the investigating officer's responsibility to determine if the vehicle meets the definition of a truck or bus, and to complete the truck/bus supplemental data section of the PAR. These additional variables collected on trucks and buses are put into a "supplemental record." The supplemental record collects information pertinent to trucks and buses, such as a more detailed vehicle type, cargo body type, gross vehicle weight rating, and information on any hazardous materials transported.

There were 17,168 cases identified as a truck or bus on the vehicle record, but only 14,766 supplemental records. Thus truck or bus-specific variables are missing for 2,402 cases identified as a truck or bus. As indicated above, many of the supplemental records are for crashes that are not reportable to the MCMIS Crash file. Similarly, there is no supplemental record for many reportable crash involvements. It does appear, though, that the presence of a supplemental record increases the probability that a reportable case is in fact reported. All of the 4,357 cases reported to MCMIS had a supplemental truck/bus record. However, of 1,554 non-reported cases, 812 did not have a supplemental record and 742 did (Table 10).

Table 10 Reporting to MCMIS Crash File by Supplemental Truck/Bus Record
Michigan PAR file, 2003

Supplemental record	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Yes	5,099	85.4	742	47.7
No	812	0.0	812	52.3
Total	5,911	73.7	1,554	100.0

It is not clear why cases that qualified by vehicle type, crash severity, and that had the supplemental information filled in, were still not uploaded to the MCMIS Crash file. Yet, since they include additional details about the vehicle, driver, and carrier, this information was explored to determine if any such factors were associated with reporting rates. In the following discussion, the 742 unreported cases with supplemental records are compared with the cases that were reported to determine if features of the truck, carrier, or driver influenced the probability of reporting.

Michigan includes a complex, twenty level vehicle type variable on the supplemental record. In this variable, vehicle types are designated by the type of commercial driver's license (CDL) and the appropriate license endorsements (special qualifications for particular vehicle types) required. Note that not all reportable vehicles require a CDL, such as trucks with a gross vehicle weight rating or gross combination weight rating less than 26,001 pounds not transporting hazardous materials. There did not appear to be any significant variation in reporting rates by vehicle type. However, there was some variation by whether the vehicle was one requiring a CDL. Only about three-quarters of cases with no designated CDL vehicle type, and thus presumably smaller vehicles not requiring a CDL, were reported, compared to 86.6% of vehicles requiring a CDL. This difference is statistically significant, although not large enough to explain the overall reporting rate.

Table 11 Reporting to MCMIS Crash File by Vehicle Type,
Cases with Supplemental Truck/Bus Records Only, Michigan PAR file, 2003

Vehicle type	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
CDL vehicle	4,605	86.6	616	83.0
Blank	494	74.5	126	17.0
Total	5,099	85.4	742	100.0

Several other factors were also reviewed, including cargo body type, whether the carrier was designated interstate or intrastate, whether a DOT number was recorded, and whether a driver had a CDL. There were no significant differences in reporting rates for any of these factors. Accordingly, it does not appear that factors associated with the vehicle, carrier, or driver play a determining role in reporting probability. Vehicle type plays some role, in that non-CDL vehicles are somewhat less likely to be reported. But it has not been found to be the primary explanation of underreporting.

Finally, reporting by county and by the type of agency—state police, county sheriffs, and police departments—was examined. Large counties with a large volume of reports may not be reporting

in a timely fashion, or may have different priorities and responsibilities. There can also be differences in the level and frequency of training or the intensity of supervision. 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.

Reporting rates by county ranged from 40% of reportable cases to 100%, achieved by nine counties with a total of 57 cases. Table 12 shows the top ten counties in Michigan, ordered by the number of unreported cases. All top ten counties listed in Table 12 are in the southern third of the lower peninsula of Michigan, and most are located on or near a major east-west truck route, Interstate 94. Wayne County, which includes the city of Detroit, accounts for almost 30% of the total of unreported cases. The reporting rate for Wayne County is 66.5%, which is significantly below the state-wide average of 73.7%. The only county with a lower reporting rate among the ten is Calhoun County, with a 65.8% rate. There were thirteen counties with lower reporting rates than those listed in Table 12, but they are sparsely populated counties that together accounted for only 87 unreported cases, 5.6% of all unreported cases.

Table 12 Counties with Most Unreported Cases
Michigan PAR file, 2003

County	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Wayne	1,350	66.5	452	29.1
Oakland	612	77.0	141	9.1
Macomb	377	70.8	110	7.1
Kent	361	78.9	76	4.9
Washtenaw	256	76.6	60	3.9
Genesee	204	71.1	59	3.8
Berrien	173	68.2	55	3.5
Kalamazoo	163	69.9	49	3.2
Calhoun	111	65.8	38	2.4
Monroe	193	81.3	36	2.3
Sum of top ten	3,800	71.7	1,076	69.2
Total (all counties)	5,911	73.7	1,554	100.0

Reporting levels by agency type did not vary greatly. Reportable crash involvements covered by sheriff's offices were the most likely to be reported to the MCMIS Crash file at 76.8%, but 74.0% of reportable crash involvements covered by state police were reported, and 71.7% of those covered by police departments were reported. See Table 13. These differences are not statistically significant, nor are they large enough to signal any meaningful differences in how crashes are policed and reported.

Table 13 Reporting to MCMIS Crash File by Reporting Agency Type, Michigan 2003

Reporting agency type	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Sheriff's Office	1,549	76.8	359	23.1
Police Dept.	2,745	71.7	777	50.0
MSP	1,534	74.0	399	25.7
DPS	83	77.1	19	1.2
Total	5,911	73.7	1,554	100.0

However, there are significant differences in reporting rates within the different agency types. Considering all state police posts, reporting rates ranged from 0.0% at one post, which had one reportable case which was not reported, to fourteen posts with 86 reportable cases, all of which were reported. Table 14 shows the top ten state police posts with the most unreported cases. State police covered a total of 1,534 reportable involvements, of which 74.0% were actually reported. The ten state police posts listed accounted for 71.7% of the 399 unreported involvements covered by the state police. Note that the top three are located in the Detroit area, and the fourth is located in Ypsilanti, just west of Detroit on I-94. These four posts are responsible for 36.0% of crashes covered by the state police, which may contribute to the lower reporting rate.

Table 14 Reporting to MCMIS Crash File by State Police Post, Michigan 2003

State Police Post	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
MSP Detroit Freeway	267	71.5	76	19.0
MSP Metro South	188	70.2	56	14.0
MSP Metro North	169	78.1	37	9.3
MSP Ypsilanti	137	75.9	33	8.3
MSP Battle Creek	68	57.4	29	7.3
MSP Rockford	86	80.2	17	4.3
MSP Paw Paw	33	66.7	11	2.8
MSP Bay City	20	55.0	9	2.3
MSP Coldwater	18	50.0	9	2.3
MSP Groveland Team	24	62.5	9	2.3
Sum of top ten	1,010	71.7	286	71.7
Total (all posts)	1,534	74.0	399	100.0

Reporting rates in crashes covered by county sheriffs also varied significantly. Nineteen county sheriffs attained a 100% reporting rate, though again, all were offices that covered relatively few reportable involvements. The nineteen covered a total of 63 crashes, accounting for only 4.1% of crashes covered by country sheriffs. On the other hand, two county sheriffs' offices covered five reportable crashes, none of which were reported to the MCMIS Crash file.

Table 15 lists the top ten county sheriff's offices, in terms of the number of unreported cases. Again, all of these county sheriffs are located in the southern third of the state, along major truck routes that cover most of the reportable crashes covered by county sheriffs. Note that several have reporting rates that are close to or better than the overall rate for county sheriffs, but they

are included in the list because of the volume of crashes they cover. However, these offices are still the primary targets if overall reporting is to be improved.

Table 15 Reporting to MCMIS Crash File by County Sheriff, Michigan 2003

Sheriff's office	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Berrien Co. Sheriff	66	51.5	32	8.9
Monroe Co. Sheriff	149	79.2	31	8.6
Ottawa Co. Sheriff	110	77.3	25	7.0
Kalamazoo Co. Sheriff	66	65.2	23	6.4
Kent Co. Sheriff	91	82.4	16	4.5
Allegan Co. Sheriff	53	71.7	15	4.2
Saint Clair Co. Sheriff	54	72.2	15	4.2
Oakland Co. Sheriff	100	85.0	15	4.2
Macomb Co. Sheriff	58	75.9	14	3.9
Washtenaw Co. Sheriff	54	75.9	13	3.6
Sum of top ten	801	75.2	199	55.4
Total (all sheriffs)	1,549	76.8	359	100.0

Finally, local police departments covered almost half of the crash involvements that should have been reported to the MCMIS Crash file. A total of 287 different police departments covered MCMIS-reportable crashes. Reporting rates ranged from 0.0% for 23 departments that policed a total of 28 reportable cases, to 100.0% for 112 police departments that covered 265 reportable involvements. As would be expected, the extremes of reporting in both directions were accounted for by police departments that covered very few cases.

On the other hand, the ten police departments with the greatest number of unreported cases accounted for 45.7% of all unreported cases covered by police departments. (Table 16) The Detroit P.D. by itself accounted for 28.1% of unreported police-department cases, with a reporting rate of only 49.1%. The Detroit P.D. covered 430 reportable cases, by far the greatest number among police departments. The police department with the next highest number of reportable crashes covered was Grand Rapids, with only 85.

Table 16 Reporting to MCMIS Crash File by Police Department, Michigan 2003

Police department	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Detroit P.D.	430	49.1	219	28.2
Sterling Heights P.D.	64	62.5	24	3.1
Grand Rapids P.D.	85	77.6	19	2.4
Flint Police P.D.	61	73.8	16	2.1
Roseville P.D.	30	50.0	15	1.9
Southfield P.D.	39	66.7	13	1.7
Lansing P.D.	51	74.5	13	1.7
Livonia P.D.	71	81.7	13	1.7
Warren P.D.	69	82.6	12	1.5
Dearborn P.D.	46	76.1	11	1.4
Sum of top ten	946	62.5	355	45.7
Total (all P.D.s)	2,745	71.7	777	100.0

Data Quality Issues

In addition to examining the number of records reported to the MCMIS Crash file, it is informative to look at the quality 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 17 shows the unrecorded rates for some of the most important variables.

Overall, missing data rates are very low for most variables reported to the MCMIS Crash file. Exceptions are the variables driver date of birth, driver license number, driver license state, officer badge number and vehicle identification number (VIN). For vehicles displaying a hazardous materials placard, the three variables referring to the type of materials carried were unrecorded in at least a quarter of the cases.

Table 17 Unrecorded Rates for Selected MCMIS Variables, Michigan MCMIS File, 2003

Variable	Percent unrecorded	Variable	Percent unrecorded
Accident year	0.0%	Interstate	0.0%
Accident month	0.0%	Light	0.8%
Accident day	0.0%	Number of vehicles	<0.1%
Accident hour	3.3%	Officer badge number	100.0%
Accident minute	3.3%	Report number	0.0%
Body type	0.0%	Road access	7.4%
Configuration	1.1%	Road surface	0.6%
County	0.0%	Road trafficway	1.8%
DOT number	21.1% *	Towaway	0.0%
Driver date of birth	99.6%	Truck or bus	0.0%
Driver license number	100.0%	Vehicle license number	3.2%
Driver license state	99.9%	Vehicle license state	3.2%
Fatal injuries	0.0%	VIN	>99.9%
Non-fatal Injuries	0.0%	Weather	0.5%

* Counting cases where the carrier is coded interstate.

Hazardous materials variable	Percent unrecorded
Hazardous materials placard	0.0%
Percentage of placarded vehicles:	
Hazardous cargo release	0.0%
Hazardous materials class (1-digit)	26.6%
Hazardous materials class (4-digit)	25.5%
Hazardous materials name	100.0%

It is also possible to compare coding of comparable variables between the record in the Michigan PAR file and the record in the MCMIS Crash file. The purpose of this comparison is twofold. Programming errors can occur when data are extracted from one file, reformatted, and transmitted to another file, such as exchanging code values or converting valid data to missing data. Another problem can occur when the available levels for a variable in one file do not map one-to-one to the levels in another file. For example, the variable for weather in the MCMIS Crash file has seven levels, while the weather variable in the Michigan PAR file has eight levels. Where possible, variables were checked, including light condition, weather, road condition, cargo body type, and vehicle configuration.

The variables for light condition had identical code levels and matched perfectly between the two files.

Table 18 shows comparative code for weather between the two files. Generally available code levels are comparable, though the Michigan weather variable distinguishes clear from cloudy conditions and combines other and unknown. But the match between the two files is very good. All cases coded clear or cloudy in the Michigan PAR file were coded no adverse conditions in the MCMIS Crash file, which is appropriate.

Table 18 Weather Coding in Michigan PAR and MCMIS Crash File, 2003

Michigan PAR	MCMIS	N	%
[missing data}	[missing data}	20	0.5
Clear	No adverse conditions	2,039	46.8
Cloudy	No adverse conditions	1241	28.5
Fog/smoke	Fog	40	0.9
Rain	Rain	425	9.8
Snow/blowing snow	Snow	557	12.8
Severe wind	Severe crosswinds	3	0.1
Sleet/hail	Sleet, hail	26	0.6
Other/Unknown	Unknown	6	0.1
Total		4,357	100.0

Table 19 shows the comparative coding for road conditions. Generally the match between records in the two files is very good, though there are some exceptions. Note that 247 cases coded with snowy road conditions were coded wet in the MCMIS Crash file. Yet 150 other cases with snowy road conditions in the Michigan PAR data were coded snow in the MCMIS Crash file. Similarly, not all cases coded slushy or debris in the Michigan PAR data were coded slush or other in the MCMIS Crash file. Given the inconsistency in coding of specific levels, it is impossible to speculate on how these differences were introduced.

Table 19 Road Conditions Coded in Michigan PAR and MCMIS Crash File, 2003

Michigan PAR	MCMIS	N	%
[missing data}	[missing data}	23	0.5
Dry	Dry	2,751	63.1
Wet	Wet	813	18.7
Icy	Ice	284	6.5
Snowy	Wet	247	5.7
Snowy	Snow	150	3.4
Muddy	Sand, mud, dirt, oil	6	0.1
Slushy	Slush	43	1.0
Slushy	Unknown	30	0.7
Debris	Other	1	0.0
Debris	Unknown	3	0.1
Other	Unknown	6	0.1
Total		4,357	100.0

Cargo body type is only captured in the truck/bus supplemental data section on the Michigan UD-10. Since this section was designed to capture data for upload to the MCMIS Crash file, it is expected that data elements would be identical and the match would be perfect. However, that did not prove to be the case. Table 20 compares cargo body coding in the Michigan PAR file, the supplemental record specifically, with the coding in the MCMIS Crash file. "[Missing data]" indicates that the variable was blank. While in many cases, coding was the same between the two files, note that all cases with a bus code in the MCMIS Crash file are either missing data, other/unknown, or have a cargo body type coded in the Michigan supplemental data. In all, coding was inconsistent in 26.1% of the cases.

Table 20 Cargo Body Coding in Michigan PAR and MCMIS Crash file, 2003

Michigan PAR	MCMIS	N	%
[missing data}	Bus(seats 9-15,incl.dr)	18	0.4
[missing data}	Bus(seats >15,incl.dr)	46	1.1
[missing data}	Other	966	22.2
Van/enclosed box	Bus(seats 9-15,incl.dr)	13	0.3
Van/enclosed box	Bus(seats >15,incl.dr)	36	0.8
Van/enclosed box	Van/enclosed box	1,558	35.8
Cargo tank	Cargo tank	207	4.8
Flatbed/platform	Bus(seats 9-15,incl.dr)	1	0.0
Flatbed/platform	Bus(seats >15,incl.dr)	2	0.1
Flatbed/platform	Flatbed	503	11.5
Dump	Dump	383	8.8
Concrete mixer	Concrete mixer	27	0.6
Auto transporter	Bus(seats 9-15,incl.dr)	2	0.1
Auto transporter	Bus(seats >15,incl.dr)	4	0.1
Auto transporter	Auto transporter	46	1.1
Garbage/refuse	Garbage/refuse	122	2.8
Other/unknown	Bus(seats 9-15,incl.dr)	17	0.4
Other/unknown	Bus(seats >15,incl.dr)	32	0.7
Other/unknown	Other	374	8.6
Total		4,357	100.0

The instructions for the UD-10 direct officers to give buses an other body type code, but the numerous other inconsistencies indicate there may be other problems as well. One possibility is that the errors are associated with the change in the MCMIS Crash file body type codes. In 2002, an additional code for buses was added, to distinguish buses with 9 to 15 seats from those with more than 15 seats. Programming changes in 2003 may not have fully accounted for the change to the MCMIS variable. However, it should also be noted that these inconsistencies would likely be reduced if the cargo body types available in the truck/bus supplemental section on the UD-10 were the same as those required for the MCMIS Crash file.

A similar problem exists in the data for vehicle configuration. The truck/bus supplemental data section of the UD-10 includes a complex truck type variable that classifies vehicles according to the CDL type and endorsements required to operate it. While this approach may be useful to the state for some other purpose, the codes do not map well to the vehicle configuration variable in the MCMIS Crash file. In fact, there is no vehicle configuration area in the supplemental data that could provide the information required by the Crash file. So the source of the MCMIS Crash file configuration data is not known.

However, one would expect some relationship between the truck type variable in the truck/bus supplemental section, and the MCMIS Crash file configuration. Code levels in the supplemental truck type variable can be combined into more general categories to see how well they match with the information in the MCMIS configuration variable. The truck type codes can be combined to identify trucks with trailers (either tractors or straight trucks), single unit (straight) trucks with no trailers, buses, and other configurations. When compared with the description of the same vehicle captured in the MCMIS Crash file, numerous inconsistencies appear, even though the aggregated categories are quite general. Table 21 tabulates the results. While there are some major categories that are consistent—for example 1,148 cases coded truck with trailer in the supplemental data and tractor-semitrailer in the MCMIS Crash file—there are also many other inconsistencies. In all, there were inconsistencies in the coding of configuration in 26.6% of the cases. The largest groups are the cases coded unknown heavy truck in the MCMIS data but with valid and specific codes in the supplemental data. How these inconsistencies occur is unknown, as is how the information for the MCMIS configuration variable is generated. Information to identify the MCMIS configuration categories does not appear to be available in the PAR data. As in the case of cargo body, this problem could be usefully addressed if the truck/bus supplemental section included the MCMIS configuration variable.

Table 21 Truck Type in Michigan PAR and Configuration in MCMIS Crash file, 2003

Michigan PAR	MCMIS	N	%
[missing data]	[missing data}	10	0.2
[missing data]	Bus, 9-15 seats	5	0.1
[missing data]	Bus, >15 seats	7	0.2
[missing data]	SUT (2-axle,6-tire)	3	0.1
[missing data]	SUT (3+ axles)	2	0.1
[missing data]	Truck/trailer	19	0.4
[missing data]	Tractor/semi	77	1.8
[missing data]	Double	8	0.2
[missing data]	Unk. heavy truck	237	5.4
Truck w/trailer	[missing data}	10	0.2
Truck w/trailer	Bus, 9-15 seats	1	0.0
Truck w/trailer	Bus, >15 seats	5	0.1
Truck w/trailer	SUT (2-axle,6-tire)	9	0.2
Truck w/trailer	SUT (3+ axles)	31	0.7

Michigan PAR	MCMIS	N	%
Truck w/trailer	Truck/trailer	89	2.0
Truck w/trailer	Tractor/semi	1,148	26.4
Truck w/trailer	Double	97	2.2
Truck w/trailer	Unk heavy truck	1,184	27.2
Straight truck	[missing data}	8	0.2
Straight truck	Bus, 9-15 seats	9	0.2
Straight truck	Bus, >15 seats	24	0.6
Straight truck	SUT (2-axle,6-tire)	5	0.1
Straight truck	SUT (3+ axles)	6	0.1
Straight truck	Truck/trailer	129	3.0
Straight truck	Tractor/semi	16	0.4
Straight truck	Double	2	0.1
Straight truck	Unk. heavy truck	557	12.8
Bus	[missing data}	4	0.1
Bus	Bus, 9-15 seats	33	0.8
Bus	Bus, >15 seats	81	1.9
Bus	SUT (2-axle,6-tire)	1	0.0
Bus	Truck/trailer	61	1.4
Bus	Tractor/semi	4	0.1
Bus	Unk. heavy truck	190	4.4
Other	[missing data}	2	0.1
Other	Bus, 9-15 seats	3	0.1
Other	Bus, >15 seats	3	0.1
Other	SUT (2-axle,6-tire)	8	0.2
Other	Truck/trailer	41	0.9
Other	Tractor/semi	13	0.3
Other	Double	2	0.1
Other	Unk. heavy truck	213	4.9
Total		4,357	100.0

Summary

Evaluating the reporting of appropriate cases to the MCMIS Crash file from Michigan presented a number of challenges. The overall approach is to identify reportable crashes in the Michigan PAR data, match cases reported to the MCMIS Crash file with the PAR data, and then identify cases that should have been reported and were not as well as cases that should not have been reported but were. At the outset, identifying the set of reportable cases was a challenge because some variables available in the PAR file did not match well with the MCMIS reporting criteria. On its face, the UD-10 vehicle type variable should cleanly identify all trucks and buses that pass the MCMIS vehicle type criteria, with the exception of light vehicles that carry hazardous materials. Those vehicles should be identifiable using information on hazardous cargoes from the truck/bus supplemental data.

However, the variables available to identify crashes that meet the crash severity criteria are insufficient. The MCMIS criteria calls for crashes in which injured persons were transported for immediate medical attention. The hospital to which an injured person is transported is noted on the UD-10, but that information is not captured in the PAR file, and so cannot be used to identify reportable crashes.

Consequently, it is necessary to assume that certain injury severities will be transported. For the purpose of this evaluation, cases were deemed reportable if the crash included a fatality, A or B injury, or at least one vehicle towed due to disabling damage. After developing this rule, the authors learned that the rule used by the state of Michigan is quite similar and results in the same set of cases being taken, though Michigan must review some cases by hand to determine if an injury was transported. Michigan reports crashes with an A or B injury, or a C injury that was transported.

It should be noted that the crash severity criteria as implemented by Michigan does not match the MCMIS criteria and likely selects a different set of cases for reporting. If reporting fractions for different crash severities in Ohio are applied to Michigan data, the result would be a much lower proportion of crashes identified as towaway, and a higher proportion of crashes reported as injury, transported for treatment.

Since information on transported injuries was not available in the PAR file, it was necessary to choose the closest approximation to identify the set of reportable cases. As a result, 5,911 crash involvements were identified as reportable to the MCMIS Crash file.

A match algorithm was developed to match records in the PAR file with those in the MCMIS Crash file. Nominally it should have been possible to use the UD-10 accident report number to accomplish the match, but that number was available in only about 76% of the MCMIS Crash records. Consequently, the match was performed using date and time, county, and vehicle license number. The total number of matches made was 4,660, or for a match rate of 94.6% of the cases reported to MCMIS. However, 303 of the matched cases did not qualify as reportable and so were "overreported." The remaining 4,357 matched and reportable cases establish an overall reporting rate for Michigan of 73.7%. Thus, of the 5,911 reportable cases, 4,357 or 73.7% were actually reported.

Reporting for fatal involvements was significantly higher than for non-fatal crashes. Overall, 92.4% of fatal involvements were reported, compared with 73.1% of transportable injuries and 73.4% of towaways. The similarity of reporting rate for injury and towaway crashes is interesting. It also turns out that reporting rates are similar for non-fatal crashes even when the severity is measured by the most severe injury in the crash. One might expect that crashes with no injured person would be reported at a lower rate than crashes with an A injury, but the reporting rates are quite similar and not statistically different.

It is likely that the explanation for this two-level reporting rate is the unusual system Michigan uses to identify cases for the MCMIS Crash file. In many other states, the burden is on the reporting police officer to determine that a crash involves qualifying vehicles and qualifying severity. In Michigan, the officer is responsible for identifying trucks and buses, but then the identification of crashes sufficiently severe to be reported is made centrally, likely when the data are processed in Lansing. Thus crash severity by itself does not affect greatly the probability that a reportable case is actually reported, other than for fatal crashes.

Underreporting cases did appear to be related to how recently the crash occurred as well as certain counties, sheriff departments, state police posts, and police departments. Crashes occurring from June to December were significantly less likely to be reported than those earlier in the year. This is likely related to a simple time delay in processing and uploading the cases.

Similarly, large jurisdictions responsible for many cases were more likely to have lower reporting rates than areas with few cases. Overall, the reporting rates for crashes covered by county sheriffs, state police, or local police departments were quite similar. The reporting rate ranged from 71.7% for police departments to 76.8% for sheriff's offices. But areas with many cases typically had lower rates regardless of whether the rates are calculated by county or type of policing agency. Detroit and surrounding areas account for most of the reportable cases and most of the cases that were not reported. Wayne County, which includes Detroit proper, reported at only a 66.5% rate and accounted for 29.1% of all unreported cases. Oakland and Macomb counties are contiguous with Wayne and are part of the metropolitan area. The reporting rates of crashes that occurred in these counties was higher and approximated the overall rate, but the sheer volume of cases that occur in these three counties identify them as a primary opportunity to improve reporting rates.

The quality of the data in Michigan cases reported to the MCMIS Crash file was also considered. This evaluation consisted of a survey of missing data rates and a comparison of the data in the PAR file with that in the Crash file.

Missing data rates were very low for most variables reported to the MCMIS Crash file. For simple variables at the crash level, such as date, time, county, number of injuries, light condition, and so on, missing data ranged from 0.0% to 3.3%. On the other hand, variables that included information that could identify an individual were typically all missing data. And some variables that are difficult to code correctly showed substantial missing data. DOT number was missing for over 20% of carriers which were coded interstate, and which therefore should have had a DOT number. Codes identifying classes of hazardous materials were missing for about a quarter of the cases with hazardous materials. And the name of the hazardous material was missing for all cases coded as displaying a hazardous materials placard.

Coding for comparable variables in the PAR file and MCMIS Crash file were also compared, as an indication of any problems in reformatting the PAR data for the Crash file. Most variables matched perfectly, or showed very reasonable mapping between code levels available in the PAR file to those available in the MCMIS Crash file. For example, the MCMIS weather variable does not distinguish clear from cloudy weather. But all PAR data showing clear or cloudy weather were coded as no adverse conditions in the MCMIS file, which is quite reasonable. On the other hand, there were some odd differences. In the case of road condition, 247 cases in which the road was coded snowy in the PAR data were coded wet in the Crash file, while another 150 snowy roads in the PAR data appeared as snow in the Crash file.

Differences are more substantial in variables descriptive of the vehicles. Neither the UD-10 proper nor the truck/bus supplemental area includes variables that match the MCMIS Crash file variables for cargo body or vehicle configuration. The PAR data does include variables for vehicle type and cargo body type, but the levels have some important differences. And when the coding in the PAR data is compared with the coding in the MCMIS Crash file, the inconsistencies are substantial. For example, 49 cases coded van/enclosed box in the truck/bus supplemental data have a bus body type in the MCMIS Crash file. In the case of cargo body, 26.1% of the cases were inconsistent. With respect to vehicle type, the coding was inconsistent in 26.6% of the cases. In both cases, the problem could be easily resolved if the MCMIS variables were used in the truck/bus supplemental data.

Some of the problems uncovered in Michigan are quite different from those that have been found in Ohio and Missouri. In those states, a primary problem was the misapplication of the MCMIS criteria. In Michigan the problems are subtly different, in part because Michigan relieves the investigating officer of part of the burden of identifying reportable cases. This is a reasonable choice, but it has not, however, solved the problem of underreporting, so much as transferred it. There is still substantial underreporting of cases, and of about the same magnitude as Ohio and Missouri. In addition, there are some substantial inconsistencies between the description of the vehicle in the PAR data and that in the MCMIS Crash file. It is outside the scope of this evaluation to establish the accuracy of the information, but relatively simple changes to the truck/bus supplemental data section could contribute substantially to resolving these problems.

References

1   Blower, D., and Matteson, A., *Evaluation of the Motor Carrier Management Information System Crash File, Phase One.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. March 2003. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

2   Blower, D., and Matteson, A*., Patterns of MCMIS Crash File Underreporting in Ohio.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. August 2003. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

3   Blower, D., and Matteson, A*., Evaluation of Missouri Crash Data Reported to MCMIS Crash File.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. January 2004. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

4   Federal Motor Carrier Safety Administration (FMCSA) Crash File Documentation, March 2000.

5   State of Michigan Traffic Crash Report Form, Michigan Department of State Police, version UD-10(1/99).

**Attachment 1: Variables Used for Michigan PAR Data
to Identify a MCMIS-Reportable Crash**

Truck with GVWR over 10,000 or GCWR over 10,000

Trucks: vehicle type=code 11 (truck/bus) and special vehicle category not "bus"

or Bus with seating for at least nine, including the driver

Buses: vehicle type=code 11 (truck/bus) and special vehicle category=bus, **or** special vehicle category="bus" and vehicle use not "private" or "in pursuit/emergency"

or Vehicle displaying a hazardous materials placard

There was no variable on the vehicle record to define vehicles displaying a hazardous materials placard, but there was such a variable on the supplemental record.

AND

at least one fatality

fatal_crash variable, accident level = 1 or more

or at least one person injured and transported to a medical facility for immediate medical attention

injury_only_crash variable, accident level = 1 or more, defines injury-only crashes. However, the only variable available to indicate if anyone was transported to the hospital was the ambulance/hospital code, which was only recorded for one case. Therefore, after some consideration, transportable injuries were defined as all crashes involving an A or B injury. This was determined by calculating a maximum accident severity variable, based on the driver injury and passenger injury variables.

or at least one vehicle towed due to disabling damage

If any vehicle in the accident met this vehicle-level criteria it was considered a towaway crash: drivable variable (Was vehicle drivable after crash?) = 0 (no)

Attachment 2: Michigan Police Accident Report

Attachment 2: Michigan Police Accident Report

▲ Unit Number

○ 1 ○ 6	
○ 2 ○ 7	
○ 3 ○ 8	
○ 4 ○ 9	
○ 5	

State

Driver License Number

First Name   Middle   Last

Street Address   Phone Number

Unit Type
○ MV ○ P
○ B ○ E (train)

City   State   Zip

Driver Condition ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑨⑨

Interlock ○ Yes ○ No   ○ Refused ○ Not Offered   (Submit Results To FARS When Available)
Alcohol ○ Yes ○ No   Test Type: ○ Field ○ PBT ○ Breath ○ Blood ○ Urine Test Results _____
Drugs ○ Yes ○ No   Test Type: ○ Blood ○ Urine Test Results _____

Date of Birth
| Month | Day | Year |

License Type
○ O ○ CY
○ C ○ F
○ M ○ R

Sex
○ M
○ F

Hazard Action
⓪ ⓪
① ①
②
③
④
⑤
⑥
⑦
⑧
⑨

Position   Restraint   Ambulance/Hospital

Injury
○ K
○ A
○ B
○ C
○ O

Ejected ○ Yes
Trapped ○ Yes

Airbag Deployed
○ Yes   ○ No
○ Not Equipped

Citation Issued
○ Hazardous
○ Other

Total Occup
⓪ ⓪
① ①
② ②
③ ③
④ ④
⑤ ⑤
⑥ ⑥
⑦ ⑦
⑧ ⑧
⑨ ⑨

Vehicle Registration   State   VIN

Vehicle Description (year, make, color)

Insurance   Towed To/By

Location of Greatest Damage
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫

First Impact	Extent of Vehicle Damage	Driveable
	⓪ ① ② ③ ④ ⑤ ⑥ ⑦	○ Yes ○ No

Vehicle Type
○ PA ○ CY ○ OR
○ VA ○ MO ○ Other
○ PU ○ GC ○ Truck/Bus
○ ST ○ SM (Complete Truck/Bus Section)

Vehicle Direction
○ North ○ East
○ South ○ West

Special Vehicles
① ② ③ ④ ⑤ ⑥

Vehicle Use ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪
Vehicle Defect ① ② ③ ④ ⑤ ⑥
Private Trailer Type ① ② ③ ④ ⑤ ⑥ ⑦

PASSENGERS

First Name   Middle   Last

Street Address   Phone Number

City   State   Zip

Date of Birth
| Month | Day | Year |

Sex ○ M ○ F

Injury ○ K ○ A

Pos. Rest. Ambulance/Hospital

Ejected ○ Yes
Trapped ○ Yes
○ K ○ B ○ O
○ A ○ C

Airbag Deployed
○ Yes   ○ No
○ Not Equipped

First Name   Middle   Last

Street Address   Phone Number

City   State   Zip

Date of Birth
| Month | Day | Year |

Sex ○ M ○ F

Injury ○ K ○ A

Pos. Rest. Ambulance/Hospital

Ejected ○ Yes
Trapped ○ Yes
○ K ○ B ○ O
○ A ○ C

Airbag Deployed
○ Yes   ○ No
○ Not Equipped

○ Owner ○ Witness Name   Address   Phone Number   Age Pos. Rest.
○ Uninjured Passenger
○ Owner ○ Witness Name   Address   Phone Number   Age Pos. Rest.
○ Uninjured Passenger

◀ Unit Reported on Front

Action Prior	Sequence of Events
	First Second Third Fourth

⓪①②③④⑤⑥⑦⑧⑨
Most Harmful: Ⓜ Ⓜ Ⓜ Ⓜ

▲ Unit Reported Above

Action Prior	Sequence of Events
	First Second Third Fourth

⓪①②③④⑤⑥⑦⑧⑨
Most Harmful: Ⓜ Ⓜ Ⓜ Ⓜ

↑ North

Crash Diagram and Remarks

Supplemental truck/bus section

TRUCK/BUS INFORMATION

Unit No. ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

Carrier Name

Address

City   State   Zip

Carrier Source
○ Papers ○ Log Book
○ Vehicle ○ Driver

ICCMC

USDOT

MPSC

○ Interstate ○ Intra (MI Only)

GVWR

Driver's CDL Type
○ A ○ H
○ B ○ N
○ C ○ P
○ T
○ None ○ X

CDL Restrictions
○ 28 ○ 35
○ 29 ○ 36
○ 30

Medical Card
○ Y ○ N

CDL Exempt
○ Farm
○ Other

Vehicle Type
○ AA ○ BB
○ AH ○ BH
○ AN ○ BN
○ AP ○ BP
○ AT ○ BX
○ AX ○ CH
○ AY ○ CP
○ AZ ○ CX
○ AL ○ Other

Type & Axles Per Unit
[ ]—[ ]—[ ]—[ ]
First Second Third Fourth

Cargo Body Type ① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Hazardous Material
Placard ○ Y ○ N
Cargo Spill ○ Y ○ N
ID #   Class #

UD-10 SERIAL NUMBER
3138880

Investigated at Scene
○ Y ○ N

Reported Date/Time

Photos By

Investigator Name(s) & Badge # (Print Only)

Do Not Write or Mark On This Side of The Line