Evaluation of New Jersey Crash Data Reported to MCMIS Crash File

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Task D
MCMIS Crash File Evaluation

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16. Abstract

This report is part of a series evaluating the data submitted 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. This report examines reporting from the state of New Jersey.

New Jersey Police Accident Report (PAR) files were matched to the MCMIS Crash file to determine the nature and extent of underreporting. In 2003, there were 10,103 crash involvements in New Jersey that were reportable to the MCMIS Crash file. Of these crash involvements, 8,333 were actually reported, resulting in a reporting rate of 82.5%. In addition, 5.3% of MCMIS cases that were reported do not qualify for reporting. Reporting rates vary by crash severity, crash month, and jurisdiction. Unlike many other states in which reporting rates were greater for more severe involvements, in New Jersey reporting rates were lower for more severe involvements. The reporting rates were 67.4% for fatal involvements, 81.5% for injury involvements, and 83.2% for towaway involvements. Underreporting is also related to the time of the year, indicating delays in providing the data. The month of December had the highest percent of unreported cases (21.7%).

Data quality is also reviewed. The PAR case number contains inconsistent characters such as dashes, question marks, and asterisks. This appears to be a source of duplicate records. The ambulance run number and the hazardous materials placard variables also contain many inconsistent characters.

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1. Introduction

Reporting to the Motor Carrier Management Information System (MCMIS) Crash file is widely acknowledged as incomplete. Nationally, only about two-thirds of reportable 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.

The States are responsible for reporting qualifying crashes, and thus the solution for underreporting must ultimately lie with the individual states. This report is part of a series of evaluations of reporting from each state. Previous reports on Ohio [2], Missouri [3], and Michigan [4] 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. Each state also had problems specific to the nature of its system. Both Missouri and Ohio 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 New Jersey. Compared with other states, New Jersey accounts for a fairly small percentage of fatal truck involvements. For example, in 2002 New Jersey accounted for 1.1% of all fatal truck involvements in the United States.

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

1. The complete computerized police accident report file (PAR file hereafter) from New Jersey was obtained for the most recent year available, which was 2003. This file was processed to identify all cases that qualified for reporting to the MCMIS Crash file.

2. All cases in the New Jersey 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.

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.

New Jersey PAR data from 2003 was used in this analysis. The 2003 PAR data file contains the computerized records of 609,323 vehicles involved in 323,978 crashes that occurred in New Jersey during 2003. The data were obtained from the New Jersey Department of Transportation [5] as raw files in comma delimited format.

2. Data Preparation

Both files required some preparation before the New Jersey records in the MCMIS Crash file could be matched to the New Jersey PAR file. In the case of the MCMIS Crash file, the only processing necessary was to extract records reported from New Jersey and to eliminate duplicate records. The New Jersey PAR file required more extensive work, most of which centered around developing 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 encountered.

2.1 MCMIS Crash file

The MCMIS Crash file as of April 27, 2004 was used to identify records submitted from New Jersey. For calendar year 2003 there were 8,940 cases. An analysis file was constructed using all variables in the file. The file was then examined for duplicate records, which are crash involvements where more than one record was submitted for the same vehicle in the same crash. Twenty-one records were found to be duplicates, giving 21x2=42 records. In addition, two records were found to be triplicates, giving 2x3=6 additional records for a total of 42+6=48 records. Of the duplicates and triplicates only one unique record should be retained for analysis. Thus, twenty-one of forty-two records were flagged as duplicates, and four of six records were flagged from the triplicates, resulting in a total of twenty-five flagged records to be excluded from further analysis. These duplicate records were determined by checking vehicle license numbers and accident dates, and then confirming that these records were duplicates by examining other relevant variables such as time of the crash, location of the crash, and vehicle configuration. After excluding these records from the MCMIS crash file, 8,915 cases remain for study. Duplicate records did not have the same accident numbers, and therefore it would not be possible to identify these records using the accident numbers alone. Since duplicate records are essentially the same, one with the latest change date was retained, if there was any difference.

2.2 New Jersey PAR files

The New Jersey PAR data for 2003 was obtained from the state of New Jersey. The PAR data consists of a collection of five files. The driver, vehicle, pedestrian, and occupant files are dated June 11, 2004. The accident file is dated July 2, 2004. The data contains records for 323,978

crashes involving 609,323 vehicles. Data in the PAR files are coded from the New Jersey Police Accident Report (NJTR-1) [6], included as an attachment at the end of this document. Police officers fill out these reports according to the *Police Guide for Preparing Reports of Motor Vehicle Crashes* [7], which is a manual prepared by the New Jersey Division of Highway Traffic Safety under the New Jersey Department of Transportation. Preparation of the manual is a cooperative effort between police and governmental agencies.

The first step in data preparation is to identify duplicate records. Each record in the New Jersey vehicle file is uniquely determined by a combination of four variables: County, Municipality, Case Number, and Vehicle Number. These variables are used to merge data from the various PAR files. No duplicate records were found in the PAR file based on these four variables. However, an examination of Vehicle Identification Number (VIN), Month of the Crash, Day of the Crash, and Time of the Crash uncovered 1,172 duplicate records. The Case Numbers of these records were then checked. Except for minor data entry errors in the Case Numbers, these appear to be duplicate records.

In many instances the source of duplication is the insertion of a dash in the Case Number. For example, in one record the Case Number appears as 03-1181, and in the duplicate as 031181 (no dash). In other instances duplicate records result from small typographical errors in the Case Number (an S instead of a 5, a 7 instead of a 1, or a 9 instead of a 4). Table 1 below provides examples of pairs of duplicate records. Note that in some cases the VIN even appears to be coded improperly, with embedded parentheses or dashes, yet the coding is consistent among records.

Table 1 Pairs of Duplicate Records Due to Case Number

Case_no	County	Municipality	Veh	VIN	Date	Time
03-1181	Union	4	1	(9)JM1FC331	12-Jan	2347
031181	Union	4	1	(9)JM1FC331	12-Jan	2347
58303-4028	Mercer	11	2	1-2T1AE09B3	8-Jun	1630
S8303-4028	Mercer	11	2	1-2T1AE09B3	8-Jun	1630
03-306-AC	Monmouth	25	2	11FAFP55212	10-May	1418
2003-8934306-AC	Monmouth	25	2	11FAFP55212	10-May	1418
28524-03	Hudson	6	1	11N4EB31F5P	15-Aug	1702
28524?	Hudson	6	1	11N4EB31F5P	15-Aug	1702

In the *Police Guide for Preparing Reports of Motor Vehicle Crashes*, the officer is instructed to enter an Internal Department Number that identifies the report, and not to write any other information in the box. It may be that the method used for assigning Case Numbers could be contributing to the number of duplicates. In some records the Case Number occupies four positions in a character field, in other records five or six, and in some records ten or eleven. As in the MCMIS Crash file, the PAR file also contained some triplicates, and in some instances four or five records were the same, except for the Case Numbers.

We also note that the New Jersey Case Number has no relation to the Report Number in the MCMIS file, which precludes this variable from being used as a candidate in the matching procedure (to be discussed later in this document). The MCMIS Report Number is consistently coded as an alphanumeric variable with a field length of twelve characters. Identifying a crash in the PAR file depends on a unique combination of the County, Municipality, and Case Number variables. As shown in Table 1, the PAR Case Number is not consistently coded, and could be identical to case numbers in other counties or municipalities. The 1,172 duplicate records were removed before the matching process, resulting in 608,151 non-duplicate PAR records. In this situation, the duplicate record with more missing data on potential matching variables to be used in the matching process later on, such as Officer's Badge Number, Driver's Date of Birth, and Vehicle License State, was removed.

The next step in data preparation is to identify records that qualified for reporting to the MCMIS Crash file. To do this it was necessary to develop a set of criteria using the variables in the New Jersey 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 is shown in Table 2.

Table 2 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.

In the supplement to the New Jersey Police Accident Report (NJTR-1), a Vehicle Type variable is available in which officers can make one of twenty-two different selections. Eight of the selections correspond to different truck types, and these were used to define qualifying trucks in this report. Table 3 is a list of the truck descriptions. Although the GVWR or the GCWR cannot be determined from the PAR, these vehicles should match the MCMIS truck criteria fairly well.

Table 3 Qualifying Truck Descriptions

Single unit truck (2 axle, 6 tires)
Single unit truck (3+ axles)
Truck/trailer
Truck/tractor (Bobtail)
Tractor/semitrailer
Tractor/doubles
Tractor/triples
Heavy truck-other

The Vehicle Type variable also contains two bus selections. The first entry defines a bus as a Commercial Vehicle used for transport of passengers (non-school). It includes vehicles registered as an "Omnibus." The second entry defines a School Bus as any school vehicle such as a passenger car, minibus (8-16 passengers), or a full size bus with school registration S-1 or S-2 type plates. Both of these bus types were included in this report as meeting the MCMIS bus criteria.

The final vehicle criterion concerns vehicles displaying a hazardous materials placard. On the PAR form, officers are instructed to check one of the ON BOARD or SPILL boxes if Hazardous Materials were involved in the crash. If the box is checked, the officer is further instructed to enter the 4-digit placard number displayed on the vehicle. While examining these data it was discovered that there were many inconsistent entries in this field, such as "NA," "NO," "UNK," etc. For purposes of this study, a vehicle qualified if a placard number was recorded, and if it was a valid number. Vehicles with a valid placard number represent a very small percentage of qualifying vehicles.

In total, there were 37,153 vehicles identified as trucks, buses, or vehicles with a hazardous materials placard in the New Jersey PAR file (Table 4). The majority of these vehicles are trucks (84.0%) and 15.9% are buses. Note that hazmat placarded vehicles account for only 0.1% of the total.

Table 4 Vehicles Meeting Vehicle Criteria, New Jersey PAR file, 2003

Vehicle type	N	%
Trucks	31,228	84.0%
Buses	5,896	15.9%
Non-trucks with hazmat placard	29	0.1%
Total	37,153	100.0%

Of all qualifying 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. Applying the injury and towed due to damage criteria is not as straightforward as identifying qualifying vehicles. New Jersey uses the KABCO injury scale to characterize

injuries, so it is easy to determine if a crash involved a fatality or an injury. However, there is no reliable method to confirm if an injury was transported to a medical facility for immediate medical attention. There is a box on the New Jersey PAR for an Ambulance Run Number, but according to the *Police Guide for Preparing Reports of Motor Vehicle Crashes*, this entry is no longer necessary, and it is *suggested* that officers enter the Hospital Code Number in this box. In any event, inspection of this field indicates that many entries are blank, or that it contains inconsistent codes.

Since A-injuries are incapacitating and B-injuries imply evidence of injury, occupants in crashes involving these injury severities are plausible candidates for immediate medical attention. A crash involving a C-injury accompanied by a hospital code number also suggests that an injured person was transported for immediate medical attention. In addition, if a hospital code number is entered into the data file, even if crash severity is unknown, it suggests that at least one person was transported for medical attention. Therefore, the strategy employed in this report is to include all fatalities, all A or B-injuries, C-injuries if a hospital code is recorded, or vehicles in crashes in which injury severity is unknown, but a hospital code number is recorded. Based on a previous report, it was also discovered that the state of Michigan submitted cases to the MCMIS Crash file according to similar criteria.

The last MCMIS criterion specifies "vehicles towed due to disabling damage." There is a variable that indicates if a vehicle was towed, but it is not possible to determine if it was towed due to disabling damage. Information is only recorded to indicate if the vehicle was towed or driven away. Including all crashes in which a vehicle was towed for any reason, rather than only those with a vehicle towed due to damage, probably overstates somewhat the number of cases that should be reported to the MCMIS Crash file. Since there is no variable in the PAR file to distinguish disabling damage, any vehicle involved in a crash in which a vehicle was towed is included as a qualifying vehicle.

Table 5 is a cross-tabulation of all 37,153 vehicles meeting the vehicle criteria, tabulated by injury severity and towaway status. The percentage of vehicles involved in fatal crashes in which at least one vehicle was towed was 94.4%. This percentage decreases to 79.6% for A-injury crashes, increases slightly to 82.3% for B-injury crashes, and decreases to 59.2% for C-injury crashes. In crashes involving no injury the percentage is 17.6%, and when injury severity is unknown, the percentage is only 10%, suggesting little or no injury severity when this variable is not known.

Table 5 Vehicles Meeting Vehicle Criteria by Injury Severity and Towaway, PAR file, 2003

	Towed		Not towed		
Injury severity	N	%	N	%	total
Fatal	84	94.4	5	5.6	89
A-injury	156	79.6	40	20.4	196
B-injury	1,024	82.3	220	17.7	1,244
C-injury	2,634	59.2	1,812	40.8	4,446
No injury	5,120	17.6	24,041	82.4	29,161
Unknown	202	10.0	1,815	90.0	2,017
Total	9,220	24.8	27,933	75.2	37,153

In a previous study involving Ohio, all relevant variables were available to match crash severity criteria. Thus, distributions of injury, transported to a medical facility, and towed due to disabling damage could be determined. Treating Ohio as a standard reference distribution, it is possible to allocate New Jersey cases into the "transported to a medical facility" and "disabling damage" categories.

Table 6 is a display of the actual Ohio data cross-tabulated by injury severity, whether the injury was transported to a medical facility, and whether a vehicle was towed due to disabling damage. Based on Ohio data, 76% of A-injuries, 52% of B-injuries, and 28% of C-injuries were transported for medical attention. In addition, 86% of A-injuries were towed due to disabling damage, 72% of B-injuries were towed due to disabling damage, and 45% of C-injuries were towed due to disabling damage.

Table 6 Ohio Data Tabulated by Injury, Transported Status, and Towaway Status

Injury		Towed	%	Not towed	%	Total	%
A	Transported	491	0.6368	97	0.1258	588	0.7626
	Not transported	169	0.2192	14	0.0182	183	0.2374
	Total	660	0.8560	111	0.1440	771	1.0000
B	Transported	1,132	0.3804	404	0.1358	1,536	0.5161
	Not transported	1,019	0.3424	421	0.1415	1,440	0.4839
	Total	2,151	0.7228	825	0.2772	2,976	1.0000
C	Transported	478	0.1422	479	0.1425	957	0.2847
	Not transported	1,041	0.3097	1,363	0.4055	2,404	0.7153
	Total	1,519	0.4519	1,842	0.5481	3,361	1.0000

The figures shown in Table 7 result from applying the Ohio proportions to the New Jersey totals shown in Table 5. For example, of all 37,153 vehicles meeting the vehicle criteria, 196 involved an A-injury, 1,244 involved a B-injury, and 4,446 involved a C-injury. These totals are reported in Table 7, and are allocated into the transported and towed categories according to the Ohio proportions.

Table 7 Results of applying Ohio proportions to New Jersey data

Injury		Towed	%	Not towed	%	Total	%
A	Transported	124.8	0.6368	24.7	0.1258	149.5	0.7626
	Not transported	43.0	0.2192	3.6	0.0182	46.6	0.2374
	Total	167.8	0.8560	28.2	0.1440	196.0	1.0000
B	Transported	473.2	0.3804	168.9	0.1358	642.1	0.5161
	Not transported	426.0	0.3424	176.0	0.1415	601.9	0.4839
	Total	899.1	0.7228	344.8	0.2772	1,244.0	1.0000
C	Transported	632.3	0.1422	633.6	0.1425	1,265.9	0.2847
	Not transported	1,377.1	0.3097	1,803.0	0.4055	3,180.1	0.7153
	Total	2,009.4	0.4519	2,436.6	0.5481	4,446.0	1.0000

The estimated reportable cases based on the Ohio proportions are shown in Table 8. All 89 fatal involvements should have been reported. Using the estimates shown in Table 7, the estimated number of injured and transported for treatment is calculated by adding 149.5, 642.1, and 1,265.9, giving 2,058 (see Table 8).

In addition, the estimated number of towed due to disabling damage is calculated by adding the entries in Table 7 corresponding to the towed and not transported categories (43.0, 426.0, 1,377.1), plus the percent of the no injury (5,120) and unknown (202) categories in Table 5 that were towed due to disabling damage. Data from the National Automotive Sampling System (NASS) General Estimates System (GES) [8] for 2003 were used to estimate the percent of vehicles involved in crashes in which at least one vehicle was towed due to disabling damage. The Manner of Leaving Scene variable in the GES Codebook provides data indicating that in 2003, 91.8% of all towed vehicles were towed due to disabling damage. Applying 91.8% to 5,322, and including the estimated towed and not transported categories, results in 6,732 estimated reportable cases for towaway involvements. Overall, the adjusted reportable cases shown in Table 8 is 8,879.

Table 8 Reported and Estimated Reportable Cases Adjusted to Ohio Data

MCMIS severity class	Actually reported	%	Adjusted reportable cases	%
Fatal	60	0.7	89	1.0
Injured, transported for treatment	2,784	33.4	2,058	23.2
Towaway	5,489	65.9	6,732	75.8
Total	8,333	100.0	8,879	100.0

In total, there is a difference of 546 cases between what was actually reported, and the reportable cases adjusted to the Ohio data. Based on Table 8, it appears that the injured and transported for

treatment category was overreported by 726 cases. This is due to the 76% of A-injuries, 52% of B-injuries, and 28% of C-injuries that were transported for medical attention based on the Ohio data. This represents a fraction of the process which includes all A-injuries, all B-injuries, and C-injuries only if a hospital code number was recorded.

The adjusted numbers in Table 8 are estimates that are aggregated over two variables based on Ohio proportions, so these cases cannot be identified in the original PAR file. The process of including all crashes involving fatalities, A-injuries, B-injuries, and only C-injuries and unknown injury severities with hospital code numbers, along with crashes in which at least one vehicle was towed produces the results shown in Table 9. Using this procedure, 10,103 records in the New Jersey PAR file should have been reported to the MCMIS Crash file. Table 9 displays the distribution of cases identified in the New Jersey PAR file that met the reporting criteria defined, along with the distribution of records actually reported. In 2003, approximately 82.5% of reportable cases in the New Jersey PAR file were actually reported to the MCMIS Crash file.

Table 9 Reportable Records in the New Jersey Par file, 2003

Crash severity	Reportable records in New Jersey PAR file	Records actually reported to MCMIS Crash file	
Fatal	89	60	67.4%
Injury	3,415	2,784	81.5%
Towaway	6,599	5,489	83.2%
Total	10,103	8,333*	82.5%
* Excludes 473 cases not reportable and 109 cases that could not be matched to PAR file			

3. Matching Process

After preparation, records from the New Jersey PAR file were matched to records from the MCMIS file. After removing duplicates, there were 8,915 records from New Jersey available for matching from the MCMIS file, and 608,151 records from the New Jersey PAR file. All records from the New Jersey 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 identifying specific vehicles within an accident. Case Number, which is the crash identifier that is used to uniquely specify a crash in the New Jersey PAR data, is an obvious first choice. Unfortunately, as described earlier, and as shown in Table 1, Case Number is coded inconsistently, and was even shown to be a source of duplicate records. An examination of both the New Jersey PAR file and the MCMIS Crash file revealed that the Vehicle Identification Number (VIN) was a potential candidate for matching. In the MCMIS Crash file the VIN is coded as a character variable with a length of seventeen. In the PAR file the VIN is a

character variable with a length of eleven. After determining that the VIN was not missing a large percentage of data from either file, it appeared that this variable would be appropriate for matching, and the first eleven characters from the MCMIS number were selected. We note that taking the first eleven characters is equivalent to matching the vehicle make, model, and year. Other variables that were considered for matching included County, Crash Month, Crash Day, Crash Time, and Officer's Badge Number. These variables were present in both the PAR and the MCMIS files.

Three separate matches were performed. In each match step, records in either file with duplicate values on the match variables were excluded, along with records that contained missing values on the match variables. The first match included the variables VIN, County, Crash Month, Crash Day, and Crash Time. The VIN proved to be an excellent match variable, helping to account for 8,750 matches in the first step. Since there were 8,915 unique MCMIS cases, the majority of matches were made in the first step. In the second step Crash Time was removed, resulting in 46 additional matches. Finally, although the VIN aided in matching many cases, it also contained some missing and inconsistent entries. In the third match, VIN was removed, and Driver's Date of Birth, Crash Time, and Officer's Badge Number were entered, resulting in 10 additional matches. After the third match, no more attempts were made. See Table 10 for the variables used in each match step, along with the number of records matched.

Table 10 Variables Used in MCMIS-New Jersy PAR File Match, 2003

Match step	Matching variables	Cases matched
Match 1	VIN, County, Crash Month, Crash Day, Crash Time	8,750
Match 2	VIN, County, Crash Month, Crash Day	46
Match 3	County, Crash Month, Crash Day, Crash Time, Driver's Date of Birth, Officer's Badge Number	10
Total cases matched		8,806

Matched records were verified on other variables common to the MCMIS and PAR files as a final check to ensure the matches were valid. The above procedure resulted in 8,806 matches, representing 98.8% of the 8,915 non-duplicate records reported to MCMIS.

Figure 1 shows the case flow during the match. Only 109 (1.2%) MCMIS records could not be matched to the New Jersey PAR file. Of the 10,103 reportable cases in the New Jersey PAR data, 8,333 were actually reported, along with 473 cases that were not reportable. For reportable cases the reporting rate was 8,333⁄10,103=82.5%. Thus, 82.5% of crash involvements that qualified for reporting to the MCMIS Crash file were actually reported in 2003.

Figure 1 Results of MCMIS-New Jersey PAR File Match, 2003

```
┌─────────────────────┐                          ┌─────────────────────┐
│  New Jersey PAR file │                          │ New Jersey MCMIS file│
│   609,323 cases      │                          │  8,940 reported cases│
└─────────────────────┘                          └─────────────────────┘
           │                                                 │
           ▼                                                 ▼
┌─────────────────────┐                          ┌─────────────────────┐
│ Minus 1,172 duplicates│                        │     Minus 25        │
│                      │                          │     duplicates      │
└─────────────────────┘                          └─────────────────────┘
           │                                                 │
           ▼                                                 ▼
┌─────────────────────┐                          ┌─────────────────────┐
│ 608,151 unique records│                        │ 8,915 unique records │
└─────────────────────┘                          └─────────────────────┘
           │              ╲                    ╱        │        ╲
           ▼               ╲                  ╱         ▼         ▼
┌─────────────────────┐     ╲              ╱  ┌──────────────┐ ┌─────────────┐
│ 599,345 not matched │      ▼            ▼   │ 8,806 matched│ │ 109 MCMIS   │
└─────────────────────┘                       └──────────────┘ │ records not │
           │      ╲                                 │    ╲      │  matched    │
           ▼       ▼                                ▼     ╲     └─────────────┘
┌──────────────┐ ┌──────────────┐        ┌──────────────┐ ▼
│ 597,575 PAR  │ │1,770 New Jersey│      │ 8,333 reportable,│ ┌─────────────┐
│ records not  │ │PAR reportable, │      │   matched    │   │473 not reportable│
│ reportable   │ │unmatched records│     └──────────────┘   │  to MCMIS   │
└──────────────┘ └──────────────┘                           └─────────────┘
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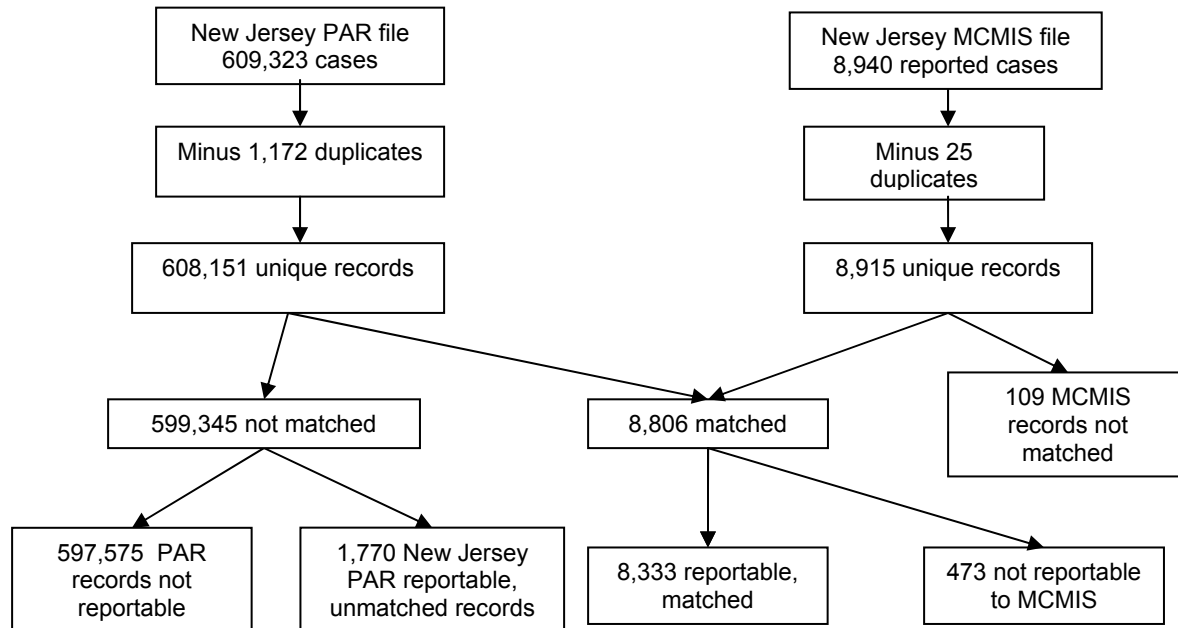
In addition, 473/8,915=5.3% of reported cases should not have been reported. They did not qualify as reportable either because they did not involve qualifying vehicles or qualifying severity. Table 11 shows why these cases did not meet the reporting criteria. The majority of cases (455), were not trucks, buses, or placarded hazmat vehicles, even though 451 involved a fatality, injury, or towaway. Of these 455 vehicles, 454 were classified as Other vehicles, while one vehicle was classified as a Passenger car/Station wagon/Minivan. Eighteen of the vehicles were trucks or buses, but did not qualify due to crash severity. Of these vehicles, seventeen involved a C-injury, and one truck involved no injury. Omitting the 109 cases that could not be matched and the 473 MCMIS cases not considered reportable in the PAR file, 8,333 reportable MCMIS records were matched to the PAR file, which represents 82.5% of the 10,103 cases that should have been reported.

Table 11 Distribution of Non-reportable Cases in MCMIS by Reporting Criteria, PAR File, 2003

Vehicle type	Crash severity				
	Fatal	Transported injury	Tow/disabled	Other crash severity	Total
Truck	0	0	0	13	13
Bus	0	0	0	5	5
Other vehicle (not transporting hazmat)	3	174	274	4	455
Total	3	174	274	22	473

4. Potential Sources of Underreporting

This section explores the sources of underreporting to the MCMIS Crash file. The approach is to compare reported with 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 reportable cases. Therefore, they exclude the 473 MCMIS cases not considered reportable in the PAR file, and the 109 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.

Determining if a case is submitted to the MCMIS Crash file is dependent upon two factors. First, the reporting officer must accurately record vehicle and injury information required for determining if the accident involves a qualifying vehicle and meets the severity criteria. Missing or erroneous data may cause an eligible case not to be submitted. Secondly, the appropriate cases must be extracted from the PAR file and transmitted to the MCMIS Crash file. At this step, errors include delays in transmitting cases, or errors in applying the reporting criteria correctly.

An obvious reason for underreporting could be that all 2003 PAR records have not yet been submitted to the MCMIS Crash file in time for this study. 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. An examination of PAR reporting by accident month seems to confirm the hypothesis that cases at the end of the year were not submitted. Table 12 displays reporting rates by accident month. The reporting rates are very consistent between January and September. The rates then begin to decline in October and November. However, the decline in December to 60.6% is substantial and noticeable. The percent of total unreported cases is about 6% or 7% between January and September, then it increases to greater than 9% in October and November. Of 1,770 PAR cases that should have been reported to MCMIS but were not, 384, or 21.7% were in December. These cases most likely have not yet been submitted as of the date the file was created, which is indicative of a timing problem, and is not necessarily a problem related to applying the MCMIS qualifying criteria properly.

Table 12 Reporting to MCMIS Crash File by Accident Month, PAR File, 2003

Crash month	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
January	768	86.3	105	5.9
February	832	85.3	122	6.9
March	764	84.8	116	6.5
April	789	85.8	112	6.3
May	845	85.8	120	6.8
June	830	84.3	130	7.3
July	854	86.5	115	6.5
August	814	85.3	120	6.8
September	876	87.6	109	6.2
October	929	81.6	171	9.7
November	827	79.9	166	9.4
December	975	60.6	384	21.7
Total	10,103	82.5	1,770	100.0

In previous investigations concerning other states such as Michigan, Missouri, and Florida, reporting rates have been consistently higher for vehicles involved in more severe crashes. In those studies, states were much more likely to report vehicles involved in fatal crashes to the MCMIS Crash file. However, this does not appear to be the case in New Jersey. Reporting rates based on the MCMIS crash severity criteria are provided in Table 13.

Table 13 Reporting to MCMIS Crash File by Crash Severity, PAR File, 2003

Crash severity	Reportable Cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	89	67.4	29	1.6
Injured	3,415	81.5	631	35.7
Towaway	6,599	83.2	1,110	62.7
Total	10,103	82.5	1,770	100.0

In crashes involving at least one injury, or crashes in which at least one vehicle was towed, the reporting rates are very similar to the overall rate of 82.5%. However, the reporting rate for crashes involving a fatality is substantially lower at 67.4%. This contradicts the usual hypothesis that severe crashes are more likely to be reported. It is true that fatal outcomes are rare compared to injury and towed involvements, yet the magnitude of the differences in reporting rates is large. Only 89 fatal outcomes are reportable, and of the 1,770 unreported cases, only 1.6% involve a fatality. Most unreported cases were relatively less serious, with 35.7% involving injury, and 62.7% involving a towed vehicle.

Similar conclusions can be found when crash involvements are considered by the maximum injury severity in the crash. Table 14 shows maximum injury severity in the crash, broken down by towaway status. When at least one vehicle in a crash was towed, the fatal reporting rate is 69.0%, the A-injury rate is 84.6%, the B-injury rate is 88.7%, and the C-injury rate is 87.6%. The reporting rates are much lower for reportable cases that were not towed. For A-injuries that were not towed, the reporting rate is 30%, and for B-injuries that were not towed, the reporting rate is 20%. Of the unreported cases, 876 (49.5%) were vehicles in crashes with no injury and at least one towed vehicle, and 326 (18.4%) were vehicles involved in crashes with C-injury and at least one towed vehicle.

Table 14 Reporting to MCMIS Crash File by Crash Severity, PAR File, 2003

Maximum injury in crash		Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	towed	84	69.0	26	1.5
	not towed	5	40.0	3	0.2
A-injury	towed	156	84.6	24	1.4
	not towed	40	30.0	28	1.6
B-injury	towed	1,024	88.7	116	6.6
	not towed	220	20.0	176	9.9
C-injury	towed	2,634	87.6	326	18.4
	not towed	612	77.8	136	7.7
No injury	towed	5,120	82.9	876	49.5
	not towed	3	0.0	3	0.2
Unknown	towed	202	73.8	53	3.0
	not towed	3	0.0	3	0.2
Total		10,103	82.5	1,770	100.0

When the maximum injury severity in a crash was a C-injury and a vehicle was not towed, 136 cases were not reported, but qualify as reportable because a hospital code number was recorded. Similarly, when the maximum injury severity was unknown and a vehicle was not towed, 3 cases were not reported, but qualify due to the presence of a hospital code number. In addition, when there was no injury in a crash and a vehicle was not towed, 3 cases were not reported. These cases qualify as reportable due to the way in which the maximum injury severity variable is calculated. The maximum injury severity is defined such that no injury is considered more severe than unknown injury. For example, a crash could involve two occupants in which the injury severity for one occupant was no injury, while the injury severity for the other occupant was unknown. The maximum injury severity in this crash would be calculated as no injury, however, if a hospital code number had been recorded for the occupant with unknown injury, then this case would qualify as reportable to the MCMIS Crash file.

Vehicle type is another obvious variable to check for variability among reporting rates. However, the results in Table 15 suggest that reporting rates are very consistent among trucks and buses.

The first four categories do not include trucks or buses, but qualify due to presence of hazardous material placards. There is almost no difference in reporting rates by vehicle type, regardless if the vehicle is a bus, school bus, single unit truck, tractor semitrailer, or other truck type. All reporting rates cluster around the overall rate of 82.5%, with some a little higher, and some a little lower. These small differences are most likely due to chance, or random variability. Bobtail trucks had the highest reporting rate at 86.1%, but this configuration represents a small fraction of reportable cases. Single unit trucks had the highest percent of unreported cases, 35.8%, followed by tractor semitrailers at 24.9%, but theses two configurations represent the largest fractions of reportable cases.

Table 15 Reporting to MCMIS Crash File by Vehicle Type, PAR File, 2003

Vehicle type	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Pass car/ station wagon/ minivan	4	0.0	4	0.2
Taxicab/ limo	1	0.0	1	0.1
Pickup/ sport utility	4	0.0	4	0.2
Van/ step van	2	0.0	2	0.1
Bus	884	80.9	169	9.6
School Bus	518	84.4	81	4.6
Single unit truck	3,902	83.8	633	35.8
Truck/ trailer	1,557	82.1	279	15.8
Truck/ tractor (bobtail)	251	86.1	35	2.0
Tractor semitrailer	2,369	81.4	440	24.9
Tractor with 2 or more trailers	65	84.6	10	0.6
Heavy truck-other	543	79.9	109	6.2
Unknown	3	0.0	3	0.2
Total	10,103	82.5	1,770	100.0

In addition to Crash Month, Crash Severity, and Vehicle Type, there can be differences related to where the crash occurs. Table 16 is a summary of reporting to MCMIS by Road System. The reporting rates are very consistent, except for involvements occurring on private property. All 365 reportable cases involving crashes that occurred on private property were not reported. Even though 365 is a small fraction of reportable cases, it represents the largest percent of unreported cases (20.6%).

Table 16 Reporting to MCMIS Crash File by Road System, PAR File, 2003

Road system	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Interstate	1,345	84.2	213	12.0
State highway	2,740	87.3	348	19.7
State/interstate auth.	1,279	85.3	188	10.6
County	2,232	85.6	321	18.1
Municipal	2,133	84.4	333	18.8
Private property	365	0.0	365	20.6
Other	9	77.8	2	0.1
Total	10,103	82.5	1,770	100.0

According to the *Police Guide for Preparing Reports of Motor Vehicle Crashes*, private property crashes are to be reported in the same manner as crashes occurring on public roadways. This includes crashes in parking lots, on private streets, and on any other location in the State. The 365 cases are in the New Jersey PAR file, but were not reported to the MCMIS Crash file. The *Manual on Classification of Motor Vehicle Traffic Accidents* [9] provides a precise definition of a trafficway. The definition states that "a trafficway is any land way open to the public as a matter of right or custom for moving persons or property from one place to another." It also includes areas with guarded entrances, such as military posts or private residential developments, if the guards customarily admit public traffic. Based on these terms, there is a distinction that many private roads are customarily open to the public. Therefore, the 365 cases are designated as reportable, and a decision can be made by policymakers to determine if these cases qualify as meeting the MCMIS criteria.

Another possibility that was considered is that in-state vehicles might be less likely to be reported to the MCMIS Crash file than vehicles from out of state. The hypothesis 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. However, according to results displayed in Table 17, there is very little difference in reporting rates between vehicles that are owned in or outside New Jersey. However, when the owner state is unknown, the reporting rate is only 12.7%. Clearly, reportable vehicles with unknown state of ownership are seldom reported. The idea that the Unknown cases could have occurred on private property was checked, but only 12 of the 534 or the 466 occurred on private property.

Table 17 Reporting to MCMIS Crash File by Owner State, PAR File, 2003

Owner state	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
New Jersey	6,305	86.1	879	49.7
Other	3,264	87.0	425	24.0
Unknown	534	12.7	466	26.3
Total	10,103	82.5	1,770	100.0

Another variable that is related to Owner State is Vehicle License Plate State. Table 18 shows reporting rates by license plate state. However, it also appears to produce the same kind of distribution observed in Table 17. The reporting rate is again very low when this variable is unknown.

Table 18 Reporting to MCMIS Crash File by License Plate State, PAR File, 2003

Vehicle License Plate State	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
New Jersey	6,676	85.5	965	54.5
Other	2,903	86.8	382	21.6
Unknown	524	19.3	423	23.9
Total	10,103	82.5	1,770	100.0

New Jersey has twenty-one counties and Table 19 is a display of the top ten counties in New Jersey, ordered by the number of unreported cases. Each of these ten counties surrounds one of the two major cities of Newark or Trenton. The top three counties of Bergen, Hudson, and Essex, surround Newark. Of the ten counties, Union had the highest reporting rate, 87.4%. Burlington and Bergen counties had the lowest reporting rates at 75.1% and 76.7%, respectively. Bergen County also had the greatest percent (16.7%) of unreported cases. The top four counties account for 45.1% of unreported cases, and the top ten counties account for 76.4% of unreported cases.

Table 19 Reporting to MCMIS Crash File by County, PAR File, 2003

County	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Bergen	1,265	76.7	295	16.7
Hudson	814	79.0	171	9.7
Essex	1,003	83.3	167	9.4
Middlesex	1,242	86.8	164	9.3
Burlington	507	75.1	126	7.1
Morris	647	84.9	98	5.5
Union	749	87.4	94	5.3
Mercer	446	80.3	88	5.0
Monmouth	418	81.8	76	4.3
Somerset	411	82.2	73	4.1
Sum of top ten	7,502	82.0	1,352	76.4
Total (all counties)	10,103	82.5	1,770	100.0

The only reporting agencies that can be identified from the PAR data file are State Police and police departments. Table 20 shows the top ten reporting agencies with the most unreported cases. These reporting agencies accounted for 37.7% of all unreported cases. The State Police are responsible for the majority of reportable cases (2,906). They also have a reporting rate, 84.8%, that is higher than the total (82.5%). It is not surprising then, that the State Police have the highest percentage of unreported cases, 25%, which is due to the large number of cases that they handle. All other police departments combined account for the remaining 75% of unreported cases, even though individual police departments account for small percentages. Elizabeth and Newark Police Departments had the highest reporting rates at 88.6% and 87.7%, respectively. Bordentown Twp. and Mahwah Police Departments had low reporting rates, but they handle a small fraction of reportable cases. There are over 450 police departments coded in the New Jersey PAR file. Over 200 of these departments have exactly one unreported case. Since this variable is coded as a character variable, it is common for police departments to have duplicate entries (eg. North Bergen, No. Bergen, N. Bergen, etc.).

Table 20 Reporting Rates for Top Ten Reporting Agencies, PAR File, 2003

Reporting agency	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
State Police	2,906	84.8	442	25.0
Jersey City	237	79.3	49	2.8
Newark	326	87.7	40	2.3
Paterson	108	75.9	26	1.5
North Bergen	84	73.8	22	1.2
Elizabeth	175	88.6	20	1.1
Paramus	66	72.7	18	1.0
Bordentown Twp	21	19.0	17	1.0
Mahwah	40	57.5	17	1.0
New Brunswick	48	64.6	17	1.0
Sum of top ten	4,011	83.3	668	37.7
Other departments	6,087	81.9	1,100	62.1
Unknown	5	60.0	2	0.1
Total (all PD)	10,103	82.5	1,770	100.0

5. Data Quality

When recording data, some information has more priority than other information, and some variables are recorded more completely than others. During the data collection process, it is almost certain that there will be missing data with respect to some variables, and methods must be considered for dealing with this situation. It is usually preferable to work with numeric data, but some variables, such as VIN, contain alphanumeric characters, and must be coded as character variables. In this section, some issues related to missing data and data quality in both the New Jersey PAR file and the MCMIS Crash file are examined. In this report, some problems concerning certain variables have already been addressed. For example, due to data entry errors, the Case Number was shown to be a source of duplicate records (Table 1). The Ambulance Run Number, Hazmat Placard Number, and Officer's Badge Number, which are stored as character variables, also suffer from inconsistent coding.

Table 21 lists some of the variables in the MCMIS Crash file, along with percentages of missing data. Overall, missing data percents are very low for most variables reported to the MCMIS Crash file. Most of the variables have less than 5% missing data. The Event One variable has less than 0.1% missing values, but the Event Two, Event Three, and Event Four variables have increasingly higher percents of missing data. It may be that these data are not really missing, but that data is not recorded since these events do not apply. Other variables with fairly high percents of missing data include DOT Number and Body Type. Of 8,940 records in the MCMIS Crash file, 8,936 were recorded as having no hazardous materials placard, yet three records indicate that there was some release of hazardous materials cargo.

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

Variable	Percent unrecorded	Variable	Percent unrecorded
Accident year	0.0	Event one	<0.1
Accident month	0.0	Event two	82.9
Accident day	0.0	Event three	91.9
Accident hour	0.5	Event four	96.9
Accident minute	0.5	Number of vehicles	0.2
Body type	16.4	Officer badge number	0.7
Configuration	7.5	Report number	0.0
County	0.0	Road access	0.7
DOT number *	26.9	Road surface	1.3
Driver date of birth	6.3	Road trafficway	0.5
Driver license number	7.3	Towaway	0.0
Driver licence state	7.1	Truck or bus	0.0
Fatal injuries	0.0	Vehicle license number	2.5
Non-fatal injuries	0.0	Vehicle license state	2.4
Interstate	0.0	VIN	0.7
Light	2.4	Weather	1.8
* Counting cases where the carrier is coded interstate			

	Hazardous materials placard	Hazardous material release of cargo
No	8,936	8,933
Yes	0	3
Missing	4	4
Total	8,940	8,940

The following sets of tables compare the actual data values in the New Jersey 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 the 8,333 matched cases, Table 22 displays the consistency between the Vehicle Type variable as recorded in the original New Jersey PAR file and the coding of Configuration in the MCMIS Crash file. The two variables from these separate files are coded almost the same. The only difference is the bus designation. In the PAR file, buses are classified into two categories: Bus, or School Bus. In the MCMIS Crash file there is only one designation in which a bus is classified as a bus with seats greater than 15, including the driver. The two files agree fairly well with respect to the Vehicle Type variable. Note that the MCMIS Crash file contains some missing data, but the total missing is less than 3%. The MCMIS bus designation appears as a

truck configuration at least once for every PAR truck configuration, except Tractor/triples, however, this only occurs for a few cases.

Table 22 Vehicle Type Coding in New Jersey PAR Compared with MCMIS Crash File, 2003

New Jersey PAR vehicle type variable	MCMIS configuration variable	N	%
Bus	Bus (seats>15, inc dr)	693	8.3
	missing	22	0.3
School Bus	Bus (seats>15, inc dr)	436	5.2
	missing	1	0.0
Single unit truck (2 axles)	SUT, 2axles, 6 tires	2,360	28.3
	Bus(seats>15, inc dr)	3	0.0
	missing	58	0.7
Single unit truck (3+ axles)	SUT, 3+ axles	816	9.8
	Bus (seats>15, inc dr)	3	0.0
	Missing	29	0.3
Truck/ trailer	Truck/ trailer	1,252	15.0
	Bus (seats>15, inc dr)	1	0.0
	missing	25	0.3
Truck/ trailer (bobtail)	Truck/trailer (bobtail)	208	2.5
	Bus (seats>15, inc dr)	1	0.0
	Missing	7	0.1
Tractor/ semitrailer	Tractor/ semitrailer	1,837	22.0
	Bus (seats>15, inc dr)	2	0.0
	missing	90	1.1
Tractor/ doubles	Tractor/doubles	49	0.6
	Bus (seats>15, inc dr)	1	0.0
	Missing	2	0.0
Tractor/ triples	Tractor/triples	3	0.0
Heavy tractor-other	Unknown heavy truck	429	5.1
	Bus (seats>15, inc dr)	2	0.0
	missing	3	0.0
Total		8,333	100.0

Table 23 is a comparison of the number of fatalities in the crash for cases in both the PAR file and the MCMIS file. The files match exactly with respect to this variable. More than 99% of reportable cases that matched between both files are vehicles in crashes involving no fatalities.

Table 23 Total Fatalities Coding in New Jersey PAR Compared with MCMIS Crash File, 2003

New Jersey PAR fatalities	MCMIS fatalities	N	%
0	0	8,273	99.3
1	1	55	0.7
2	2	4	0.0
3	3	1	0.0
Total		8,333	100.0

6. Summary and Discussion

The purpose of the present study was to evaluate the completeness and accuracy of data reported from New Jersey to the MCMIS Crash file. To achieve that goal, the New Jersey PAR file for 2003 was obtained, and the data therein was compared with the data reported to the MCMIS Crash file.

The New Jersey PAR file contains records for 323,978 crashes involving 609,323 vehicles. In this file, 1,172 records were identified as duplicates. Each record in the PAR file is uniquely determined by a combination of four variables: Case Number, County, Municipality, and Vehicle Number. The Case Number variable was found to be coded inconsistently, which appears to be the result of data entry errors. In many instances duplicate records differed by small typographical errors, such as insertion of dashes, or mistaking an S for a 5, for example.

In the MCMIS Crash file, twenty-five records were determined to be duplicates by checking vehicle license numbers and accident dates, and then confirming that these records were duplicates by examining other relevant variables such as time of the crash, location of the crash, and vehicle configuration.

The New Jersey PAR form that police officers use for reporting motor vehicle crashes was a valuable source for identifying cases that are reportable to the MCMIS Crash file. Identifying qualifying vehicles was straightforward. Twenty-two different vehicle types could be identified in the PAR file. Eight different truck types were available for identifying qualifying trucks, and two bus types were available for identifying qualifying buses. Vehicles with a valid hazmat placard could also be identified, and were included. The total number of vehicles meeting the MCMIS qualifying criteria was 37,153.

Applying the injury and towed due to damage criteria was not as straightforward as identifying qualifying vehicles. Several variables needed to identify crashes that meet the crash severity criteria were not available in the PAR file. The MCMIS criteria calls for crashes in which injured persons were transported for immediate medical attention. New Jersey uses the KABCO injury scale to characterize injuries, so it was easy to determine if a crash involved a fatality or an injury. However, there was no reliable method to confirm if an injury was transported to a

medical facility for immediate attention. In addition, the final MCMIS criterion calls for crashes in which at least one vehicle was towed due to disabling damage. There was a variable indicating if a vehicle was towed, but it was not possible to determine if it was towed due to disabling damage.

Consequently, it was necessary to assume that certain injury severities were transported, and that certain towed vehicles were towed due to disabling damage. For the purpose of this evaluation, cases were deemed reportable if the crash included a fatality, an A-injury, a B-injury, a C-injury with a valid hospital code number, or unknown injury with a valid hospital code number. Furthermore, any crash in which a vehicle was towed was included as a qualifying vehicle.

In a previous evaluation using Ohio data, it was possible to match the MCMIS criteria since all relevant variables were available. Based on Ohio proportions, New Jersey totals for injury severity were allocated into the "transported to a medical facility" and "towed due to disabling damage" categories. The resulting counts represent the cases that would be expected if Ohio proportions were treated as a standard reference distribution. Using this procedure, the estimated number of reportable cases is 8,879, which is greater than the 8,333 actually reported. Based on this procedure, it also appears that New Jersey overreported 726 cases qualifying as injured and transported. However, this can be explained by the Ohio proportions of A-injuries (76%), B-injuries (52%), and C-injuries (28%) that were transported for medical attention, which is different than taking all A-injuries, all B-injuries, and C-injuries or unknown injuries with valid hospital code numbers.

Since a valid transport variable is not available in the PAR file, it was necessary to use a surrogate. Taking vehicles in crashes in which there was a fatality, an A-injury, a B-injury, a C-injury or unknown injury with a hospital code number, plus crashes in which at least one vehicle was towed was a reasonable choice. To select the correct cases to submit to the MCMIS Crash file, officials in New Jersey are in the same position as we are, unless they rely on information that is not publicly available. Including all crashes involving a towaway likely only slightly overstates the number of cases truly reportable. Again, unless non-public sources of information are available with respect to towaway status, New Jersey is in a similar position. Using the criteria defined, we can identify 10,103 reportable cases, of which 8,333 were reported, for a reporting rate of 82.5%. The reporting rate for New Jersey was higher than for some other states previously studied, such as Michigan, Ohio, and Florida.

An algorithm for matching records in the PAR file with those in the MCMIS Crash file was used. Three separate matches were performed. The Case Number variable in the PAR file could not be used as one of the matching variables since it has no relation to the Report Number variable in the MCMIS file. However, the Vehicle Identification Number (VIN) was available and was not missing a large percent of data in either file. The first match included the variables VIN, County, Crash Month, Crash Day, and Crash Time. The first match accounted for 8,750 matches. In the

second match, Crash Time was removed, resulting in 46 additional matches. Finally, even though VIN was an excellent match variable, it contained a small percent of missing data and inconsistent entries. In the final match VIN was removed, and Crash Time and Officer's Badge Number were entered, resulting in 10 additional matches. This procedure resulted in 8,806 matches, representing 98.8% of the 8,915 non-duplicate records reported to MCMIS.

Only 109 MCMIS records could not be matched to the New Jersey PAR file. In addition, 473 records are designated as "overreported" since they matched records in the New Jersey PAR file, but did not meet the MCMIS criteria for a qualifying case. Thus, of the 8,806 cases that matched, 8,333 are reportable. In the New Jersey PAR file, 1,770 records are designated as "under-reported" since they did not match any MCMIS records, but did meet the MCMIS criteria for a qualifying case. The overall reporting rate for New Jersey in 2003 was 8,333/10,103=82.5%.

An examination of PAR reporting by accident month seems to confirm the hypothesis that cases at the end of the year were submitted at a lower rate. The reporting rate in December was 60.6%, well below the 82.5% overall rate. Furthermore, 384/1,770=21.7% of unreported cases occurred in December.

In previous evaluations of states such as Michigan, Missouri, and Florida, reporting rates have been consistently higher for vehicles involved in more severe crashes. In those studies, states were much more likely to report vehicles involved in fatal crashes to the MCMIS Crash file. However, this does not appear to be the situation in New Jersey. The reporting rate for crashes involving a fatality was 67.4%, well below the 82.5% overall rate. In crashes involving at least one injury, or crashes involving a towed vehicle, reporting rates were similar to 82.5%.

An examination of reporting rates by road system led to an interesting discovery. None of 365 reportable cases involving crashes that occurred on private property were reported to the MCMIS Crash file. These cases account for 365/1,770=20.6% of unreported cases. It is difficult to determine if these cases should have been reported by New Jersey since many private roads are customarily open to the general public. A decision can be made by policymakers as to whether these cases qualify as meeting the MCMIS criteria.

New Jersey has twenty-one counties. Counties with the largest number of unreported cases are in proximity to Newark City. Bergen County had the highest number of unreported cases (295, 16.7%), and of the top ten counties ordered by unreported cases, a fairly low reporting rate (76.7%). The top four counties accounted for 45.1% of unreported cases, while the top ten counties accounted for 76.4% of unreported cases.

The only reporting agencies that can be identified from the PAR data file are State Police and police departments. The State Police were responsible for roughly 30% of reportable cases. They also had a higher than average reporting rate (84.8%). Since the State Police handled so many cases, they accounted for the largest number of unreported cases (442, 25.0%). More than 450

police departments are coded in the New Jersey PAR file. Over 200 of these departments had exactly one unreported case. Elizabeth and Newark Police Departments had the highest reporting rates at 88.6% and 87.7%, respectively. Bordentown Twp. and Mahwah Police Departments had low reporting rates at 19.0% and 57.5%, respectively, but they handled a small fraction of the reportable cases.

Overall, missing data percents are fairly low for most variables reported to the MCMIS Crash file. Of the event variables, only the First Event variable is coded consistently. Almost all cases are missing data for Event Two, Event Three, and Event Four. The Vehicle Type variable in the PAR file and the Configuration variable in the MCMIS file are coded almost identically. One characteristic of the MCMIS file, however, is that the MCMIS bus designation appears as a truck configuration at least once for every PAR truck configuration, except for Tractor/Triples.

Unlike many other states, it appears that reporting officers play little role in identifying cases for reporting to the MCMIS Crash file. In many states, the MCMIS reporting criteria are reproduced on the PAR and if the reporting officer feels the crash qualifies, he completes the necessary sections. In New Jersey instead, the strategy appears to be to incorporate the MCMIS variables into the NJTR-1, and then select qualifying cases centrally. This strategy probably accounts for the relatively high proportion, in comparison with other states, of reportable cases actually reported to the Crash file. This approach is likely the primary reason why reporting is relatively consistent by crash severity, vehicle type, and vehicle license state for example.

However, the success of the strategy depends crucially on incorporating all aspects of the MCMIS criteria into the PAR, even the details. The lack of a viable means of identifying injuries transported for treatment or vehicles towed due to disabling damage is a significant hindrance to accurately identifying reportable cases. The experience in New Jersey as well as in other states clearly demonstrates that no other variables can identify the appropriate cases with sufficient accuracy. These problems then, probably explain the bulk of underreporting to the MCMIS Crash file. The other primary cause is likely delays in processing cases, i.e., moving cases through the system. Both of these problems can be remedied without drastic changes to the crash reporting system.

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6. 1999 New Jersey Police Accident Report NJTR-1, Revised June, 2001.

7. *Police Guide for Preparing Reports of Motor Vehicle Crashes*, New Jersey Division of Highway Traffic Safety, New Jersey Department of Transportation, revised November, 1999.

8. National Automotive Sampling System (NASS) General Estimates System (GES) 2003 Codebook. Transportation Data Center, University of Michigan Transportation Research Institute, No. 2004-7, October, 2004.

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Appendix 1: Variables Used for New Jersey PAR Data to Identify a MCMIS-Reportable Crash

MCMIS Reporting Criteria	Implementation in New Jersey PAR data
Truck with GVWR over 10,000 or GCWR over 10,000	According to the New Jersey PAR instruction manual, the vehicle type variable defines trucks by eight categories. To comply with the MCMIS criteria, the following codes were used to define qualifying trucks: vehicle_type = 14-Single Unit Truck (2 axles),15-Single Unit Truck (3+ axles),16-Truck/Trailer,17- Bobtail, 18-Semi-trailer,19-Doubles, 20-Triples, 21-Heavy Truck
or **Bus with seating for at least nine, including the driver**	New Jersey has two bus vehicle type codes which were used to define qualifying buses: vehicle_type= 12-Bus, 13-School Bus
or **Vehicle displaying a hazardous materials placard**	New Jersey has a variable indicating if a vehicle was displaying a hazardous materials placard, so this variable was used to define such vehicles: hazmatp = 4-digit placard number
AND	
at least one fatality	New Jersey has an injury severity variable at the accident level reflecting the most serious injury in the crash: severity = F-fatal
or **at least one person injured and transported to a medical facility for immediate medical attention**	New Jersey's physical condition variable was used in conjunction with ambulance run number. phy_con = 0-no injury, 1-killed, 2-incapacitated, 3 - moderate injury, 4-complaint of pain. Ambulance/hospital code-obtained from ambulance personnel.
or **at least one vehicle towed due to disabling damage**	For each vehicle in the New Jersey PAR file there is a variable indicating if a vehicle was towed or driven away. towed = T-towed, D-driven

Appendix 2: New Jersey Police Accident Report Form

PAGE _____ OF _____ | **NEW JERSEY POLICE ACCIDENT REPORT** | ☐ REPORTABLE ☐ NON-REPORTABLE | 28

43 CASE NUMBER | ACCIDENT OCCURRED ON: _____ | 29
☐ 52 ROAD NAME ☐ STREET ADDRESS
44 POLICE DEPARTMENT OF | CODE | ☐ AT INTERSECTION WITH | 53 ROUTE NO. SUFFIX | 54 MILEPOST
☐ FEET ☐ MILES ☐ NORTH ☐ EAST OF:
☐ METERS ☐ Km ☐ SOUTH ☐ WEST
45 STATION/PRECINCT | 55 | 56 | 57
RAMP? ☐ NO | 58 ROAD NAME | 30
☐ YES FROM: _____ ☐ NB ☐ EB TO: _____ ☐ NB ☐ EB
59 (ROUTE NO.) ☐ SB ☐ WB 60 61 (ROUTE NO.) ☐ SB ☐ WB 62

46 DATE OF COLLISION MONTH DAY YEAR | 47 DAY OF WEEK S M Tu W Th F S | 48 TIME (USE 2400 HRS.) | 49 MUNICIPALITY CODE | 50 TOTAL KILLED | 51 TOTAL INJURED | 63 LATITUDE | 64 LONGITUDE | 31 / 32

VEH. NO. 65 POLICY NO. | 66 INS. CODE | VEH. NO. 88 POLICY NO. | 89 INS. CODE | 33

☐ PARKED ☐ PED ☐ BICYCLIST ☐ RESPONDING TO AN EMERGENCY ☐ HIT & RUN | ☐ PARKED ☐ PED ☐ BICYCLIST ☐ RESPONDING TO AN EMERGENCY ☐ HIT & RUN

67 DRIVER'S FIRST NAME INITIAL LAST NAME | 90 DRIVER'S FIRST NAME INITIAL LAST NAME | 34

68 NUMBER AND STREET | 91 NUMBER AND STREET

69 CITY STATE ZIP EXPIRES | 92 CITY STATE ZIP EXPIRES | 35

70 DRIVER'S LICENSE NUMBER | 71 STATE | 72 DOB MO. DAY YR. | 73 EYES | 74 SEX | 93 DRIVER'S LICENSE NUMBER | 94 STATE | 95 DOB MO. DAY YR. | 96 EYES | 97 SEX | 36

75 OWNER'S FIRST NAME INITIAL LAST NAME ☐ SAME AS DRIVER | 98 OWNER'S FIRST NAME INITIAL LAST NAME ☐ SAME AS DRIVER | 37

76 NUMBER AND STREET | 99 NUMBER AND STREET | 38

77 CITY STATE ZIP EXPIRES | 100 CITY STATE ZIP EXPIRES | 39

78 MAKE AND MODEL COLOR | 79 YEAR | 80 PLATE NO. | 81 STATE | 101 MAKE AND MODEL COLOR | 102 YEAR | 103 PLATE NO. | 104 STATE

82 VIN NUMBER | 105 VIN NUMBER

83 VEHICLE REMOVED TO | 84 AUTHORITY ☐ TOWED ☐ DRIVEN | 1 OWNER 2 DRIVER 3 POLICE | 106 VEHICLE REMOVED TO | 107 AUTHORITY ☐ TOWED ☐ DRIVEN | 1 OWNER 2 DRIVER 3 POLICE | 40 a / b

CLOCKPOINT DIAGRAM
12 11 1 10 FRONT 2 9 3 8 REAR 4 7 5 6
13 ROOF
14 UNDERCARRIAGE
15 OVERTURNED
16 TOTALED
17 NONE 18 OTHER ●

87 ACCIDENT DIAGRAM ○ INDICATE NORTH

108 ALCOHOL DATA
TEST GIVEN
DRIV. 1 ☐ NO ☐ YES ☐ REFUSED ☐ BREATH ☐ BLOOD ☐ URINE RESULTS 0.__%
DRIV. 2 ☐ NO ☐ YES ☐ REFUSED ☐ BREATH ☐ BLOOD ☐ URINE RESULTS 0.__%
PED. ☐ NO ☐ YES ☐ REFUSED ☐ BREATH ☐ BLOOD ☐ URINE RESULTS 0.__%

109 HAZARDOUS MATERIAL ON BOARD SPILL PLACARD NUMBER
V1 ☐ ☐
V2 ☐ ☐

110 USDOT CARRIER NO. V1 _____ V2 _____
111 ICC CARRIER NO. V1 _____ V2 _____
112 VEHICLE WEIGHT (GVW) V1 _____ lbs. V2 _____ lbs.

85 AREAS DAMAGED INITIAL PRINCIPAL IMPACT IMPACT
VEH. 1 ☐ ☐
VEH. 2 ☐ ☐

86 POSTED SPEED ☐☐

113 CARRIER NAME V1 _____ V2 _____

114 ACCIDENT DESCRIPTION

NUMBER OF VEHICLE 122

115 DAMAGE TO OTHER PROPERTY

OPER. | 116 CHARGE | SUMMONS NUMBER | OPER. | 117 CHARGE | SUMMONS NUMBER

118 OFFICER'S SIGNATURE | 119 BADGE NUMBER | 120 REVIEWED BY BADGE NUMBER | 121 STATUS ☐ PENDING ☐ COMPLETE

17	18	19	20	21	22	23	24	25	26	27	NAMES & ADDRESSES OF OCCUPANTS–IF DECEASED DATE & TIME OF DEATH
A											
B											
C											
D											
E											

NJTR-1 (R 6/01) | 123 DEP CASE NUMBER (SAFETYNET ONLY)

RECORD BUREAU COPY

Page 2 Overlay

PEDESTRIAN MANEUVER

01 Crossing/Entering Roadway at Intersection
02 Crossing/Entering Roadway Not at Intersection
03 Walking on Road w/Traffic
04 Walking on Road Against Traffic
05 Playing in Road
06 Standing in Road
07 Getting On or Off Vehicle
08 Pushing or Working on Veh.
09 Other Working in Roadway
10 Approaching or Leaving School Bus
11 Coming from Behind Parked Vehicle
12 Other •

TRAFFIC CONTROLS

01 Police Officer
02 R.R. Watchman, Gates, Etc.
03 Traffic Signal
04 Lane Markings
05 Channelization-Painted
06 Channelization-Physical
07 Warning Signal
08 Stop Sign
09 Yield Sign
10 Flagman
11 No Control Present
12 Other •

ROAD SYSTEM

1 Interstate
2 State Highway
3 State/Interstate Authority
4 State Park or Inst.
5 County
6 Co. Auth. Park or Institution
7 Municipal
8 Private Property
9 U.S. Government Property

ROAD CHARACTER

1 Straight and Level
2 Straight and Grade
3 Straight at Hillcrest
4 Curve and Level
5 Curve and Grade
6 Curve and Hillcrest

ROAD SURFACE TYPE

1 Concrete
2 Blacktop
3 Gravel
4 Steel Grid
5 Dirt
6 Other •

SURFACE CONDITION

1 Dry
2 Wet
3 Snowy
4 Icy
5 Other •

WEATHER

1 Clear
2 Rain
3 Snow
4 Fog
5 Other •

OVERSIZE/OVERWEIGHT PERMIT?
(COMM. VEHICLES ONLY)
1 Yes   2 No

VEHICLE TYPE

01 Passenger Car/Station Wagon/Minivan
02 Pass. Car w/Trailer
03 Recreation Vehicle
04 Taxicab/Limo.
05 Motorcycle
06 Moped
07 Pickup/Sport Utility
08 Van/Step Van
09 Fire/Rescue Vehicle
10 Police Vehicle
11 Ambulance
12 Bus
13 School Bus
14 Single Unit Truck (2 axle)
15 Single Unit Truck (3+ axles)
16 Truck/Trailer
17 Truck/Tractor (Bobtail)
18 Tractor/Semi-Trailer
19 Tractor/Doubles
20 Tractor/Triples
21 Heavy Truck-Other
22 Other •

CARGO BODY TYPE

1 Bus
2 Van/Enclosed Box
3 Cargo Tank
4 Flatbed
5 Dump
6 Concrete Mixer
7 Auto Transporter
8 Garbage/Refuse
9 Other •
(i.e. multiple body types)

ROAD DIVIDED BY

1 Guide Rail
2 Concrete Bar.
3 Concrete Isle
4 Grass Med.
5 None
6 Other •

IS ROAD UNDER CONSTRUCTION?
1 Yes   2 No   3 Workers Present

WHICH VEHICLE OCCUPIED?
1 Veh. 1   B Pedalcycle   O Other •
2 Veh. 2   P Pedestrian

POSITION IN/ON VEHICLE

0 Unknown
1 Driver 2 thru 7 Passengers
8 Riding/Hanging on Outside

VICTIM'S PHYSICAL COND.

1 Killed
2 Incapacitated
3 Moderate Injury
4 Complaint of Pain

EJECTION FROM VEHICLE
1 Not Ejected
2 Partial Ejection
3 Ejected
4 Trapped

AGE   SEX

STATE OF NEW JERSEY POLICE ACCIDENT REPORT

• EXPLAIN IN ACCIDENT DESCRIPTION

IF A QUESTION DOES NOT APPLY, ENTER A DASH (–)

IF AN ANSWER IS UNKNOWN, ENTER 0 or 00

LOCATION OF MOST SEVERE PHYSICAL INJURY

01 Head
02 Face
03 Eye
04 Neck
05 Chest
06 Back
07 Shoulder-Upper Arm
08 Elbow/Lower Arm/Hand
09 Abdomen/Pelvis
10 Hip-Upper Leg
11 Knee/Lower Leg/Foot
12 Entire Body

TYPE OF MOST SEVERE PHYSICAL INJURY

1 Amputation
2 Concussion
3 Internal
4 Bleeding
5 Contusion/Bruise/Abrasion
6 Burn
7 Fracture/Dislocation
8 Complaint of Pain
9 None Visible

SAFETY EQUIPMENT

01 None Used
02 Lap Belt
03 Harness
04 Lap Belt & Harness
05 Child Restraint
06 Helmet
07 Passive Restraint
08 Airbag
09 Airbag & Seat Belts
10 Other •

AVAIL   USED   AMBULANCE RUN NUMBER

APPARENT CONTRIBUTING CIRCUMSTANCES
(Human, Vehicle, Environmental Factors)

01 Unsafe Speed
02 Driver Inattention
03 Failed to Obey Traffic Control Device
04 Failed to Yield Right of Way to Vehicle/Pedestrian
05 Improper Lane Change
06 Improper Passing
07 Improper Use of Turn Signals/Failure to Signal
08 Improper Turning
09 Following Too Closely
10 Backing Unsafely
11 Dazzling, Improper, or No Lights
12 Wrong Way, One Way Road
13 Improper Parking
14 Pedestrian's/Bicyclist's Actions
15 Vehicle Defect •
16 Animal's Action
17 Defective Shoulder
18 View/Obstruction/Limited •
19 Water Puddles
20 Obstruction/Debris on Road •
21 Improper/Inadequate Lane Marking •
22 Other Roadway Defects •
23. Traffic Control Device Defective/Missing
24. Failure to Keep Right
25. None
26. Other
27. Cell Phone In Use

PRE-ACCIDENT VEHICLE ACTION

01 Going Straight Ahead
02 Making Right Turn
03 Making Left Turn
04 Making U Turn
05 Starting from Parking
06 Starting in Traffic
07 Slowing or Stopping
08 Stopped in Traffic
09 Parking
10 Parked
11 Changing Lanes
12 Merging
13 Backing
14 Driverless/Moving
15 Other •

SEQUENCE OF EVENTS (Select up to 4 for each vehicle)

Non-Collision
01 Overturn (Rollover)
02 Fire/Explosion
03 Immersion
04 Jackknife
05 Ran Off Road
06 Downhill Runaway
07 Cargo Loss or Shift
08 Separation of Units
09 Other Non-Collision

Collision w/Non-Fixed Object
10 Pedalcycle
11 Pedestrian
12 Railway Train
13 Deer
14 Other Animal
15 MV in Transport
16 MV in Transport, Other Roadway
17 Parked MV
18 Other Object (Non-Fixed)

Collision with Fixed Object
19 Impact/Attenuator
20 Bridge/pier/Abutment
21 Bridge Parapet End
22 Bridge Rail
23 Guide Rail
24 Median Barrier
25 Traffic Sign Post
26 Overhead Sign Support
27 Light Standard
28 Utility Pole
29 Other Post
30 Culvert
31 Curb
32 Ditch
33 Embankment
34 Fence
35 Tree
36 Other Fixed Object
37 Unknown

NUMBER OF AXLES

DIRECTION OF TRAVEL
N 1 / E 2 / S 3 / W 4

LIGHT CONDITION

1 Daylight
2 Dawn or Dusk
3 Dark (St. Lights On)
4 Dark (St. Lights Off)
5 Dark (No St. Lights)

PHYSICAL STATUS

1 Apparently Normal
2 Had Been Drinking
3 Physical Handicaps
4 Illness
5 Fatigued
6 Apparently Asleep
7 Using Drugs   8 Other •

Vehicle 1 Events
Vehicle 2 Events

COLLISION TYPE
(w/Other MV)

1 Same Direction –Rear End
2 Same Direction –Sideswipe
3 Angle
4 Head-On
5 Left Turn
6 Struck Parked Vehicle
7 Other •

TOTAL NUMBER OF VEHICLES INVOLVED IN ACCIDENT

Veh. 1 28
Veh. 2 29
Veh. 1 30
Veh. 2 31
Veh. 1 32
Veh. 2 33
34
Veh. 1 35
Veh. 2 36
Ped. 37
Veh. 1 38
Veh. 2 39
1st 40a
2nd 40b
3rd 40c
4th 40d
1st 41a
2nd 41b
3rd 41c
4th 41d
42
122