A critical evaluation of data collection on tractor rollover accidents in Italy

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Abstract

Tractor accidents represent a key issue for safety in agriculture because tractor is the leading cause of fatality in farming due to both its widespread use and the high number of rollovers per year. To estimate the impact of these events statistical studies are considerably important. The availability and reliability of data are essential to understand the problem and its causes, and therefore to devise strategies to reduce risks for agricultural operators.

Such an intensely agricultural country as Italy is definitely a case of great interest in this type of research, especially since in recent years, as in other European countries, there has been the approach to complement the institutions collecting data for insurance purposes with observatories monitoring injuries.

The comparison of data from different sources and the assessment of their level of reliability becomes important for the type of information required in order to choose the most suitable. A critical approach is particularly appropriate in evaluating tractor rollover accidents; in fact, official statistics related to work insurance are in Italy, as well as in many European countries, coded according to the European Statistics on Accidents at Work (ESAW) methodology that does not provide a precise definition of the dynamics of the rollover accidents thus making it very difficult to assess the event. Furthermore it does not details the existence of the protection devices, rollover protection structures and seat belts, and their correct installation and use when the accident occurred. In addition tractor rollover concerns largely retired and hobbyists who are neglected by the estimates related to insurance coverage.

The different databases have different aims and, consequently, different data, and none covers the full range of accidents necessary for a complete characterization of the issue, focusing mainly on matters of interest to the specific institutions. Combining data from different sources is necessary to obtain basic information such as the percentage of overturn fatalities compared to total tractor overturns. The goal of the work was to evaluate the data contained in Italian accidents archives. The results could suggest a methodology for comparing information from different sources to provide a procedure that can be useful for any country adopting a data collection system based on the combination of insurance institutions and observatories.

Keywords: agriculture, fatal farm injuries, data reporting system, tractor, rollover.

1. Introduction

Agriculture is one of the most hazardous sectors in both developing and industrialized countries with a rate of mortality higher than other economic sectors (ILO, 2000; Mammone, Metruccio, Vida, Moretto, 2007). In Italy, despite a reduction in the risk of accidents both in terms of severity and in the number of events recorded in recent years (Bartoli & Bartoli, 2011a) agriculture continues to be the area with the highest risk of injuries, with values about double than other productive fields (Bartoli & Bartoli, 2011b). Moreover the trend of decrease
in accidents tends to be stabilized (Bena, 2009). Differences are larger as more serious are the consequences of the accident; also considering only permanent disabilities and the fatalities, the risk in agriculture, in the period 2005-2009, is about three times with respect to the other fields. (Bartoli & Bartoli, 2011b).

Farm tractors are the major cause of occupational fatalities in agricultural areas (Stallones, 1990; Lee et al., 1996); these fatalities typically result by tractor crushing due to rollover (Erlich, Driscoll, Harrison, Frommer, Leigh 1993; Browning, Westneat, Truszczynska, Reed, McKnight, 1999; Bernhardt & Langley, 1999).

The Statistics Service of Italian Workers Compensation Authority (INAIL) is the main source data of work-related injuries and diseases in the different economic sectors, including agriculture. This Institution collects injury data and processes them statistically by aggregating according to several criteria: time, localization, event, age and gender of injured person etc. The employers are obliged to report electronically to the insurance institution within 48 hours an injury resulting in absence from work for over 3 days. INAIL adopted the encoding of accidents according to the European Statistics on Accidents at Work system (ESAW), that allows to compare European accident statistics. This encoding, however, concerns only the injuries involving workers covered by compulsory accident insurance and, in particular, the reported injuries, if compensated.

The traditional data on the incidence of occupational injuries are notoriously underestimated due to heterogeneous recording and notification systems (Mammone et al., 2007; Arana et al., 2010) and in the agriculture the injuries under-reporting is even more pronounced (Pickett, Hartling, Brison, Guernsey, 1999). The problem of the weakness of injury statistics data in agriculture affects many countries where the workers compensation statistics do not include, for example, unpaid farm family workers, occasionally workers, children involved in accidents, illegal workers and the self-employed workers not included in the insurance lists. Furthermore the information contained in the traditional databases not always are sufficient to characterize adequately the cause of injury and the agents involved (O'Connor, Gordon, Barnett., 1993). A study by Murphy, Seltzer, and Yesalis (1990) found an underestimation of approximately 20% of data about agricultural occupational fatalities in the American National Traumatic Occupational Fatality Surveillance System (NTOF, USA) with respect to the results of interviews of family members of casualties. The underestimation was due to the fact that the victims non included were under 16 years old or because the victims were employed in agriculture as secondary occupation. Arana et al. (2010) found that the official Spanish records of the fatal farms injuries only account for 60% of the deaths.

To overcome this gap in the data in many countries, national surveillance systems to track agricultural injuries were organized (O'Connor et al., 1993).

Recently in Italy an international data reporting system has been developed to integrate the accident data evaluated by the Local Health Units (ASL) with INAIL archives. Moreover a data observatory based on the collection of accidents from the web and the local newspapers has been implemented to complete the information related to fatalities connected to the use of agricultural machines.

Several studies have been carried out to evaluate data quality on injuries in agriculture to better examine farm-work related deaths so as to have high quality information on the magnitude and nature of agricultural injuries. A number of subjects have attempted to assess agricultural injuries at a local level by means of farm family surveys (Gunderson et al., 1990; Stallones, 1990). Many researchers have carried out studies starting from the analysis of data obtained from the Local Health Units (Swanson, Sachs, Dahlgren, Tinguely, 1987; Pickett, Brison, Hoey, 1995; Franklin & Davies, 2003). Studies have been based on the information collection of accidents appeared in the newspapers and on the web (Arana et al., 2010). Other authors have applied the technique of narrative text analysis based on the analysis from various datasets to identify factors contributing to occupational injuries. Bunn, Slavova, and Hall (2008) for example have applied the narrative text analysis in 69 farm fatalities where tractor was involved finding that in almost half of the fatalities injured persons were not wearing seat belts when the fatal accident occurred and over half of the tractors were not equipped with a Roll Over Protection Structure (ROPS).

Because of the complexity of the INAIL database and the difficulties associated with encoded injuries it is often difficult to identify accidents involving tractors. In addition to understand the
causes and the dynamics of the accidents seems important to get information concerning the circumstances leading to injury and the existence of safety devices (ROPS, cab, seat belt). The aim of the work was a critical comparison of the information recorded by different Italian data reporting systems on injuries involving the agricultural tractor. In particular, the main goals were to evaluate the databases collection systems by a comparison and check the quality of information provided to characterize the event in terms of mode of occurrence, parties involved and mechanical characteristics of the vehicle involved (rollover protection structures and seat belts and their correct installation when the accident occurred).

2. Data sources

In order to compare different data reporting systems, various data sources were considered. The INAIL statistics reporting cases of occupational injuries are available on line, in addition the statistic service of INAIL provides customized tables of data. Many detailed explanation on the INAIL methods were obtained by means of personal communications. Tractor rollovers data were obtained by a report available on line (Iotti, 2008) and implemented by personal communications.

The national surveillance system data of the Local Health Units are reported in the dedicated INFORMO web tool.

Data from the observatory on are obtained from INAIL by means of personal communications.

3. Report systems comparison

In Italy INAIL is the main source data of work-related injuries and diseases in the different economic sectors and is engaged in the insurance of workers.

Table 1: Injuries and fatalities in agriculture.

<table>
<thead>
<tr>
<th>Year</th>
<th>Injuries</th>
<th>Fatalities</th>
<th>Tractor related injuries</th>
<th>Tractor related fatalities</th>
<th>Tractor rollovers related injuriesa</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>85,618</td>
<td>163</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2001</td>
<td>80,532</td>
<td>159</td>
<td>318</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>73,515</td>
<td>167</td>
<td>3,664</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>71,379</td>
<td>128</td>
<td>5,758</td>
<td>22</td>
<td>335</td>
</tr>
<tr>
<td>2004</td>
<td>69,263</td>
<td>175</td>
<td>5,753</td>
<td>23</td>
<td>366</td>
</tr>
<tr>
<td>2005</td>
<td>66,467</td>
<td>141</td>
<td>4,817</td>
<td>20</td>
<td>274</td>
</tr>
<tr>
<td>2006</td>
<td>63,082</td>
<td>124</td>
<td>4,705</td>
<td>17</td>
<td>280</td>
</tr>
<tr>
<td>2007</td>
<td>57,205</td>
<td>105</td>
<td>3,524</td>
<td>17</td>
<td>205</td>
</tr>
<tr>
<td>2008</td>
<td>53,354</td>
<td>125</td>
<td>1,790</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>52,665</td>
<td>128</td>
<td>1,871</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>50,121</td>
<td>115</td>
<td>1,619</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>65,746</td>
<td>139</td>
<td>4,704</td>
<td>19</td>
<td>314</td>
</tr>
</tbody>
</table>

aEstimated values (Iotti, 2008)

The INAIL archives are the most complete and the current coding of injuries has been aligned to the European official statistics within the project of harmonization of European Statistics on Accidents at Work, ESAW. Eight variables describe causes and circumstances of accidents: working environment, working process, specific physical activity, deviation, contact and mode of injury, material agent of the specific physical activity, material agent associated with the deviation and the material agent associated with the contact. In particular de-
Deviation means the last event differing from the norm and leading to the accident. Unfortunately the coded options for these variables do not include rollover. It is only possible to have an estimate indirectly obtained on the basis of some characteristics of the accidents, as suggested by Iotti (2008) such as “loss of control” to characterize the deviation, “tractor” as agent associated and “crushed under” as contact. Obtaining such data, however, is rather difficult because it is necessary to access to all encoded accidents in the archives, but these are not all available online and a certain skill is required to deduce them because INAIL does not publish these rollover estimates but simply the number of accidents involving tractors and, furthermore, these data are often not complete. Moreover in recent data a certain number of accidents in agriculture are reported without any classification.

On the basis of INAIL archives Table 1 shows injuries and fatalities in agriculture and tractor related injuries and fatalities for the period 2000-2010. Tractor rollovers estimated by Iotti (2008) are added, regardless accident outcome. Bold data refer to incomplete or uncertain information, ignored in calculations.

Comparing averaged data, 7% of injuries in agriculture are related to tractors and rollovers accounts for 7% of accidents involving tractors. Focusing on fatalities, it is noticeable that accidents with fatal injuries connected to tractor represent only the 14%.

Obtaining the outcome of rollover is very difficult due to the lack of information about rollovers, while it is certainly easier to get data of accidents generically related to tractors. The percentage of tractor related fatalities is 0.4% of the total tractor injuries. Assuming that all tractor fatalities are due to rollovers, the percentage of rollover fatalities become 6%. Therefore the fatal effect of rollover seems very low, even if much higher than the percentage of fatalities in agriculture referred to total injuries (0.2%).

These results are quite surprising especially when compared to those of other European countries showing that tractor accidents are frequently involved in agricultural fatality (Day,
A partial explanation is due to the fact that a certain number of persons engaged in agricultural activities is not included in insurance lists thus they are not considered by INAIL archive especially after the Italian Law 243, July 1993, that excluded from compulsory insurance self-employed workers when farming is not their prevalent activity thus causing INAIL dealing exclusively with professional workers. This resulted into a dramatic decrease of the injuries data. In fact, considering the data of 1992 and 1994 there is a reduction of 40% of accidents in agriculture and even 53% of fatal accidents (Figure 1 and 2).

To provide a more realistic picture of injury statistics a supplementary surveillance systems was established. In 2002 the national surveillance system of fatal accidents was established involving regions, autonomous provinces and INAIL under the coordination of Ministry of Health. The goal of the system is the surveillance of work-related fatalities, aimed at detailing accidents causes. Operators of the department for prevention and safety at the workplace of Local Health Units reconstruct the accidents and enter the information into a national archive. The technicians cooperate in police investigations to recognise causes and responsibilities in the event of the accident at work, therefore dealing mainly with professional workers fatalities.

Table 2: Data reporting systems comparison.

<table>
<thead>
<tr>
<th>Monitored subjects</th>
<th>OPERATIONAL ARCHIVES</th>
<th>SURVEILLANCE SYSTEM</th>
<th>OBSERVATORY SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>only professional workers</td>
<td>mainly professional workers</td>
<td>the whole population involved in agricultural activities</td>
<td></td>
</tr>
<tr>
<td>Institution involved</td>
<td>INAIL</td>
<td>INAIL, ASL, regions, autonomous provinces</td>
<td>VIII functional unit of the Department of Technologies and safety of INAIL</td>
</tr>
<tr>
<td>Protective devices</td>
<td>not described</td>
<td>described</td>
<td>probably described but not published</td>
</tr>
<tr>
<td>Aggravating circumstances</td>
<td>not described</td>
<td>described</td>
<td>probably described but not published</td>
</tr>
<tr>
<td>Fatalities in Agriculture</td>
<td>considered</td>
<td>considered</td>
<td>probably considered but not published</td>
</tr>
<tr>
<td>Non fatal injuries in Agriculture</td>
<td>considered</td>
<td>non considered</td>
<td>non considered</td>
</tr>
<tr>
<td>Fatalities related to Tractors</td>
<td>considered</td>
<td>considered</td>
<td>considered</td>
</tr>
<tr>
<td>Non fatal injuries related to tractors</td>
<td>considered</td>
<td>non considered</td>
<td>non considered</td>
</tr>
<tr>
<td>Rollover definition</td>
<td>non considered</td>
<td>considered</td>
<td>considered</td>
</tr>
</tbody>
</table>

Following a process of backward reconstruction in use in legal procedures, factors that led to the event and those influencing its severity are identified, thus specifying for example the use of protective structures as ROPS and seatbelts. Data where rollovers are defined are available online but still remain the problem of excluding almost all the non-professional workers, representing a large amount of people working in agriculture. Therefore since 2007 an observatory on accidents at work was organised at the eighth functional unit of INAIL to collect information about fatalities in agriculture related to the use of agricultural machinery from the major media and ASLs and INAIL reports.
Despite the description of the accidents includes rollover as an option, the use of ROPS or seatbelt is not necessarily specified due to the fact that information is often achieved by newspapers and other media, not only by official reports and investigations. The main characteristics of Italian data reporting systems are summarized in Table 2.

4. Conclusions

In order to design effective security policies oriented to reducing tractor related injuries and fatalities it is essential to carry out statistical studies to understand the actual circumstances that led to the operator injuries. The Italian traditional source of data for injuries in agriculture, INAIL operational archives, seems not so exhaustive to correctly quantifying the rollover rates due to the restricted number of monitored workers, causing an evident underestimation. In addition the code system doesn’t enable an unambiguous estimation of rollovers. Moreover no information is provided about tractor protective systems.

To overcome these critical aspects two new data reporting systems were established, a surveillance system and an observatory, both regarding only work related fatalities. However to compare the data from these three different sources could led to a wrong evaluation due to a different approach and field application of the data reporting systems. At the same time none of them provides the necessary data to obtain reliable basic information such as the percentage of rollover fatalities and the percentage of rollovers in agricultural accidents.

5. References


