Fatal collisions on the road and safety and health

Using narrative data from coroners' files to determine the extent of underestimation of fatal work-related road collisions in the Republic of Ireland

Report submitted to the IOSH Research Committee

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Glossary of acronyms

Frequently used acronyms

Acronym	Meaning
HSA	Health and Safety Authority (Ireland)
RSA	Road Safety Authority (Ireland)
RTF	Road Traffic Fatality
WR-RTF	Work-Related Road Traffic Fatality

All acronyms

Acronym	Meaning
ABS	Australian Bureau of Statistics
BAC	Blood Alcohol Concentration
BT1	Bystander Type 1 Fatality
BT2	Bystander Type 2 Fatality
DfT	Department for Transport
DPP	Director of Public Prosecutions
ESAW	European Statistics on Accidents at Work
ETSC	European Transport Safety Council
GNTB	Garda National Traffic Bureau
HGV	Heavy Goods Vehicle
HSA	Health and Safety Authority
HSE	Health and Safety Executive (UK)
HRB	Health Research Board
IOSH	Institution of Occupational Safety and Health
LGV	Large Goods Vehicle/Light Goods Vehicle
NCIS	National Coroner Information System
NRA	National Road Authority (Ireland)
ORSA	Occupational Road Safety Alliance
OSH	Occupational Health and Safety
PCV	Passenger Carrying Vehicles

Acronym	Meaning
PSV	Public Service Vehicle (bus or taxi)
PIN	Road Safety Performance Index
PRAISE	Preventing Road Accidents and Injuries for the Safety of Employees
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
ROSPA	Royal Society for the Prevention of Accidents
RSA	Road Safety Authority
UCD	University College Dublin
WHO	World Health Organisation

Glossary of terminology

Bystander fatalities	Road traffic fatalities where the decedent is a member of the public who is not working at the time of the collision but the principal other party in the collision is working.
Bystander Type 1 fatalities	Road traffic fatalities in which a work activity or process contributes directly to the bystander' death. In essence work is a primary contributor to the collision.
Bystander Type 2 fatalities	Road traffic fatalities in which the work activity or process does not contribute directly to the bystander's death. In essence work is a secondary contributor to the collision.
Truck	The term 'truck' is used in results to describe vehicles referred to in depositions as lorries / trucks / light, large and heavy goods vehicles, as more often than not, it was not possible, from the evidence provided, to determine the specific type of vehicle involved in such collisions.
Worker fatality	Road traffic fatalities where the decedent is deemed to be working at the time of the collision.

Research team

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Abstract

Background

Work-related road traffic fatalities (WR-RTFs) are an important subset of road traffic fatalities (RTFs) requiring specific prevention, intervention and regulation. This subset has received little attention in road traffic collision research. It is likely that there are identifiable strategies that can be implemented at national level to reduce deaths. Data on WR-RTFs in Ireland are documented by Police at the roadside and provided to district coroners and the Road Safety Authority (RSA). WR-RTFs are notifiable to the Health and Safety Authority (HSA) by employers.

Specific Aim

The aim of this study was to utilise narrative data from coronial road traffic fatality files in the Republic of Ireland to assess the extent of underestimation of WR-RTFs captured through existing national road safety, and health and safety, administrative data systems. The objectives included determining the proportion of RTFs that is work-related, to examine the concordance of WR-RTF data between coroner, RSA and HSA data and to examine driving factors and circumstances in which WR-RTFs occur.

Methods

The study identified all WR-RTFs in coroner files nationwide (44 of 45 districts) for 2008-2011 inclusive. Approval was granted by the Coroner Society of Ireland and the UCD Research Ethics Committee. The available narrative data was examined and categories of fatality delineated. With reference to previous literature and the narrative data gathered, 'Worker', 'Bystander Type 1' and 'Bystander Type 2' Fatalities were distinguished. The distinction is important for reporting, prevention and for *post hoc* intervention strategies.

Results

From 833 RTFs, 193 (23%) were identified as WR-RTFs. Within the 193 WR-RTFs, 29 (15%) were 'Worker'; 45 (23%) were 'Bystander Type 1; and 119 (62%) were 'Bystander Type 2' fatalities. All coroner-identified WR-RTFs were also identified in the RSA data. Only 15 (8%) (15/193) of all WR-RTFs, or 20% (15/74) of 'worker + bystander 1' RTFs were identified in the HSA database.

Conclusion

This comprehensive population-based study of WR-RTFs identifies them as an important subset of RTFs. Coroner data are the most comprehensive, but repeated labour-intensive extraction of these narrative data is not practical. Given that data are fundamental to prevention, intervention and evidence for regulation it is imperative that existing nationwide systems of notification / reporting be improved.

Executive Summary

Introduction

Road traffic injuries and fatalities are a growing global problem, and development of public and occupational health policies, strategies and regulations frequently lag behind. Preparation of comprehensive and standardised documentation and compilation of the evidence surrounding such events takes even longer, let alone research and translation of the evidence into policy and practice. In developed countries, work-related road traffic fatalities are increasingly being recognised as an occupational safety and health issue. With increasing volumes of traffic, including work-related traffic, this is an area of concern to road safety, public health, occupational health and regulatory authorities, but ultimately to all citizens, as work-related fatalities are not confined to workers.

Research in this area is challenged by source limitations and lack of completeness of data, lack of standard definitions of work-related road traffic fatalities (WR-RTFs) and consequent lack of recognition of cases, standardisation of data collection methods and regulations based on findings. Key sources of data generally include Police records, reports to regulatory authorities and narrative data held by coroner information systems as a consequence of their involvement in inquests on these fatalities.

In the UK and Ireland there is no one standard system for documenting WR-RTFs. Statutory agencies rely on Police reports of roadside collisions or on employer reports of work-related fatalities, which are not linked. As a result the extent of the problem is not known.

This study sought to determine the proportion of road traffic fatalities in Ireland that is work-related, to examine the concordance between the data on WR-RTFs from three sources, namely data held by coroners as a consequence of inquests into WR-RTFs, data from the Irish Road Safety Authority (RSA) and data from the Irish Health and Safety Authority (HSA). In addition, driving factors and circumstances of WR-RTFs were examined and the categories of persons involved in WR-RTFs were determined, with a view to providing evidence for national and organisational prevention and intervention strategies.

Methods

The principal component of the study was the identification of WR-RTFs among records held by coroners throughout the country for the four-year period 2008-2011 inclusive. This was followed by a case-by-case review of the complete narrative data (witness depositions and other evidence) for each case. With cooperation from the coroners and their staff, data from all but one coroner district in Ireland (44 of 45) were available for review in their entirety, on-site in each district, to the UCD research team. Study-specific recording instruments were developed to ensure consistent and standardised recording of information, in so far as is possible, from qualitative, narrative data. Results were produced using descriptive statistics.

Results and Discussion

A total of 193 WR-RTFs were identified in coroner records from a pool of 833 road fatalities in the 4-year period. This figure of 23% of RTFs being work-related is in keeping with results from other countries, and is a critically important piece of information for the HSA, the RSA, employers and all concerned with road safety, whether the fatalities are of workers or the non-working population, as the proportion was previously not known. It is of particular note that in just 15% (29/193) the fatality was of a ‘worker’; 85% (164/193) were ‘bystanders’, albeit of two different categories. In the first category the ‘bystander’ died as a result of a collision with a working vehicle where work was deemed to have been a primary contributor to the collision (Bystander Type 1 Fatality); in the second category, the

'bystander' died as a result of a collision with a working vehicle, but in this case work was deemed not to have been a contributory factor to the collision (Bystander Type 2 Fatality). In both bystander categories, the collision is work-related, it is the extent of work-relatedness that differs.

The degree of concordance between the coroner data and data reported to the RSA for WR-RTFs is encouraging but not unexpected. All 193 WR-RTFs identified in the coroner files for the period were also identified in the RSA repository. What differs, understandably, is the nature, extent and quality of the information on each case derived from the review of the coroner data compared with the summary data collected at the roadside. This raises the question of the importance, or not, to preventive and *post hoc* intervention strategies, of detailed information on decedents and 'other parties' to fatal collisions. Collisions have consequences for employees, employers, family members and knowledge of the circumstances is necessary to prevent future similar events.

The degree of concordance between the coroner data and data recorded by the Health and Safety Authority is less encouraging. Notwithstanding the fact that there is no obligation on the part of the Police or employers to notify Bystander Type 2 fatalities as being work-related, and Bystander Type 1 fatalities only in very limited conditions, the degree of concordance for worker deaths was less than optimal (11/29 or 38% for worker deaths; 4/45 or 9% for Bystander Type 1 deaths – for which the Irish equivalent term is *non-worker* and the UK equivalent term is *member of the public*). This calls into question the level of knowledge of employers of the obligation to notify such fatalities, and/or their willingness to do so. On the basis that information is fundamental to intervention strategies, it is imperative that efforts are directed at more complete capture and reporting of such incidents by the statutory agencies.

Data on the circumstances of fatalities (time of day, day of week, road and climatic conditions) were recorded in so far as these were available. Once again such data are critical to preventive strategies. Of particular relevance were notations in the depositions of parties who survived and witnesses to collisions about the circumstances of the collision. The most striking examples are those in which drivers of large vehicles were largely unaware of impacting on a pedestrian or cyclist, continuing on their journey only to be halted by a witness further on. These situations could almost certainly be reduced by measures to increase visibility in and around segments of large vehicles traditionally known as 'blind spots', and pedestrian and cyclist awareness of such blind spots.

Conclusions

This report is the first of its kind to be conducted in Ireland, with virtually complete ascertainment of work-related road traffic fatalities for a four-year period. As such it represents a truly population-based study in which case ascertainment was active. There are important lessons from the methods devised for the study, not least for the recording of these data in the future. It is not reasonable to consider repeated periodic case-by-case review of narrative coroner data, because the method of data collection was time-consuming and labour-intensive. Yet, it is a great pity not to capitalise on the data captured by coroners in the course of their work. Some mechanism for electronic capture of much of the data may be possible, utilising the data collected by Police and provided to Coroners.

The results of this study form a benchmark for both future recording of data on work-related road traffic fatalities and national and employer level strategies for prevention and intervention. In particular, clarity around the categories of WR-RTFs and strengthening identification of work-related cases through reporting to statutory agencies will benefit all road users.

1. Introduction

Securing comprehensive and complete data on work-related road traffic fatalities (WR-RTFs) is problematic for road safety and occupational safety and health agencies and researchers. Road traffic collision data traditionally include a '*purpose of journey*' question, which until very recently did not include 'at work' or 'working' as possible responses. Health and safety legislation requires notification of work-related fatalities, but outside of easily identifiable work-related collisions (involving buses, taxis and trucks) most employers are unaware of this requirement. Thus, the extent and nature of the WR-RTF problem is often not known.

Research using national coroner information systems in other jurisdictions has helped to illuminate this area and to estimate the extent of the problem (Australia and New Zealand). There is no national coroner information system in Ireland or the United Kingdom. However, a pilot study was carried out in a single coroner district in Ireland in 2006,[1] using narrative data from inquest files (witness and Police depositions) and comparing findings to the known work-related fatalities notified to the Irish Health and Safety Authority from the same district. The finding was that work-related deaths were greatly underestimated. However, a single district is not representative, so a national study was deemed the most appropriate way to proceed.

Coroner inquests seek to establish facts about sudden or unnatural deaths, including the cause of death; the intention is not to find fault or to allocate blame. Findings from this study will provide much needed clarity on the extent and the nature of the problem where working persons die in road traffic collisions (workers), or where persons who are not at work at the time die following a collision with a working vehicle (non-workers). Non-workers (referred to as bystanders in the literature) are of particular interest because their deaths come about as a result of an interaction with the work of another party.

The specific aims of this study are to utilise the narrative data in coroner files to determine the degree of underestimation WR-RTFs in Ireland, to determine what proportion of all road traffic fatalities are work-related and to look in particular at bystanders and to identify work factors associated with fatal road traffic collisions. It is expected that the findings will inform policy and allow targeted prevention strategies to be developed.

2. Literature Review

2.1 Introduction

Work-related vehicle safety is the management of the hazards and risks associated with work activities involving vehicles and mobile equipment, and includes the risks to employers, the self-employed, employees and members of the public [2]. It encompasses both workplace transport safety and work-related road safety. Workplace transport safety hazards are normally recognised and the risks managed within organisations, but work-related road safety, i.e. the safety of employees who drive for work and/or who work on the road, is not always recognised or managed. The need for work-related (or occupational) road safety has slowly emerged over the past two decades and is now a key priority for national and international Occupational Health and Safety (OSH) and Road Safety agencies. Work-related road safety in Ireland is defined as:

> "*The management of the hazards and risks to persons engaged in, or affected by, work-related driving or work activities on or near a road*" [2]

Up until the 1990s the problem of work-related road traffic collisions received little attention and, outside of easily identifiable work-related vehicles (such as Heavy Goods Vehicles and Public Service Vehicles), did not feature on either national OSH or road safety agendas. In the last two decades it has become increasingly clear that work-related incidents account for a substantial proportion of the road traffic fatalities and injuries that occur worldwide each year[2-5]. Current estimates suggest that at least one third of all road traffic collisions are work-related [6], however, a combination of factors, such as under-reporting and lack of identification of such cases at initial data collection stage, means that the true extent and impact is still relatively unknown.

There is a dearth of data available specifically on work-related road collisions, both nationally and internationally. However, it would appear that, from the data that are available, work-related vehicle incidents contribute significantly to the totality of work-related fatalities[2, 3, 7]. In Ireland, a work-related fatality is one where an employee or self-employed person dies as a result of an accident at work, within one year of the accident [8] and includes non-workers who die as a result of a work activity. The United Kingdom Health and Safety Executive (UK HSE) defines a work-related fatality as one "*resulting from an incident arising out of or in connection with work*" [within one year of the accident] [8(p.1,3)]

This review aims to assess the available literature on work-related road traffic fatalities, both nationally and internationally, with a focus on Ireland and the UK. It describes what is known about the extent and impact of such work-related vehicle fatalities in Ireland and the UK, and addresses the issue of underestimation of such fatalities. Current methods of estimating and monitoring the extent of work-related road traffic fatalities worldwide are examined with a particular focus on coroner data systems.

This literature review addresses the following questions:

- What is the perceived contribution of work-related road traffic fatalities to overall road traffic fatalities? Are these likely to be underestimated and why?
- What is the perceived contribution of road traffic fatalities to overall work-related fatalities? Are these likely to be underestimated and why?
- What added value do narrative data in coroner files bring to work-related road traffic fatality investigation?

2.2 Search strategy

Databases and journals searched for relevant literature, and accessed through the University College Dublin (UCD) library web portal, included PubMed, Medline, the Cochrane Library, Health and Safety Science, Injury Prevention and Science Direct. Key search terms included: collision, accident, crash, traffic, car, vehicle, motor vehicle, work-related, work-related fatality, road trauma, occupational, workplace, occupational road safety, occupational road risk. As peer-reviewed literature was limited, broader searches using Google Scholar were also conducted and bibliographies of other relevant studies were examined using a snowball approach.

In addition, websites of key relevant organisations were searched to identify relevant up-to-date reports, publications, statistics and datasets. For Ireland, these included the Health and Safety Authority (HSA), the National Roads Authority (NRA), the Road Safety Authority (RSA), the Garda (Police) National Traffic Bureau (GNTB) and the Department of Transport. Websites from the UK included the Department for Transport (DfT), the UK Health and Safety Executive (UK HSE), Royal Society for the Prevention of Accidents (ROSPA) and the Occupational Road Safety Alliance (ORSA). International websites, such as Eurostat, European Transport Safety Council (ETSC) and the World Health Organisation (WHO), were also searched for relevant European and worldwide information.

2.3 Road traffic fatalities

According to the World Health Organisation [9], road traffic fatalities are the eighth leading cause of death globally and the leading cause of death for the 15-29 age group. Approximately 1.24 million people die each year worldwide from road traffic collisions; in addition a further 20-50 million suffer non-fatal injuries as a result of a collision. It is predicted that road traffic injuries will climb to the fifth leading cause of death worldwide by 2030 [9]. Currently the WHO defines a road traffic fatality as:

> *"..any person killed immediately or dying within 30 days as a result of a road injury accident"* [9 (p.8)]

In their 2013 *Global Status on Road Safety* Report, the WHO advocated that this definition be adopted by all countries in a bid to harmonise road traffic fatality surveillance data [9], as the use of different temporal definitions preclude inter-country comparisons. Some progress has been made. In 2013, 92 countries were officially using this definition, an increase on 80 countries in 2008 [9]. France adopted this definition (as opposed to the previous definition of death within 6 days of the collision) in 2005 [10]. The time period of 30 days was chosen based on research that most persons who die as a result of a collision die within that period and the cost-benefit of a marginal difference in data capture versus disproportionate surveillance efforts [9]. Application of this universal definition to road traffic fatalities allows for comparison of figures between countries, reduces inconsistencies in data and provides a truer picture of the extent of the problem. Ireland, since at least 1968 (NRA, personal communication, July 2015) and the UK, since 1954 [7] have both adopted this definition. However, work-related fatalities, in both jurisdictions, are defined as deaths within one year, and a formal work-related road traffic fatality definition has not been put forward.

The European Transport Safety Council (ETSC) provides expert advice on transport safety matters to the European Commission, the European Parliament, and Member States. In 2006, the Council set up the *Road Safety Performance Index (PIN)* programme in response to the European Union's target to halve road deaths between 2001 and 2006. PIN covers 32 countries: the 28 member states of the EU, along with Israel, Norway, the Republic of Serbia and Switzerland. It collects key data on member states' road safety performance and compares and ranks their progress. The aim is to promote best practice by comparing the different successes of each country [11]. PIN covers relevant areas of road safety such as driver behaviour, road infrastructure, vehicles and policymaking. Using results from PIN, the ETSC has reported that the EU is not on track to reach the 2020 target of reducing road

deaths by 50% compared to 2010 levels. A 6.7% year-on-year reduction is needed to achieve this goal; however, the annual average reduction across all participating countries is currently just 4.9% [11]. It confirmed that 2014 was a particularly bad year in terms of road safety, with only 18 of the 32 PIN countries recording a decrease in deaths between 2013 and 2014. There were 25,845 road deaths in 2014 compared with 26,009 in 2013. Ireland and the UK both saw increases in the number of road deaths in 2014, approximately 4% and 2% [11]. The ETSC suggests that the increase in the UK may be due to the abolishment of National Road Safety targets by the 2010-2015 British Government with funding for both road safety campaigns and policing significantly reduced. In 2012, deaths on Irish roads reached the lowest recorded level, with 162 fatalities [12]. This figure increased to 190 in 2013 however, and to 196 in 2014, representing a 3% increase on 2013 [12]. However, this figure decreased to 166 in 2015, the lowest figure recorded since 2012 [13].

2.3.1 Work-related road traffic fatalities

While general road traffic fatality figures are, for the most part, readily available worldwide and considered accurate, this is not the case for work-related road traffic fatality figures. The majority of road traffic fatality research has focused on risk factors, such as fatigue or alcohol / drugs. However, a gap in basic data exists: it is simply not known how many road traffic collisions are work-related, nor how many work-related fatalities occur in road traffic collisions [14] [15]. A number of key risk groups emerge: those who are driving for work, those who work on the side of the road, and non-workers whose deaths occur as a result of a work-related driving activity (also known as bystanders, see section 2.4.3). Attempts have been made to estimate the extent of the problem. Worldwide estimates suggest that between a quarter and a third of all road fatalities involve someone driving for work [5]. Estimated rates in individual countries show great variation: estimates in Finland range from 38% to 63%, in France 40% and approximately 25% in each of UK, Denmark and Sweden [4]. Legal differences in the inclusion or exclusion of persons commuting for work and definitions of work-related fatalities can add to difficulties in making comparisons between countries. While persons commuting for work are not included in the European Statistics on Work-Related Accidents (ESAW) methodology [16], individual countries within the EU may include these data in national statistics. For example, in Ireland and the UK, persons commuting for work are not included in work-related fatalities [2] [17]. Conversely, France and several other European countries include persons commuting for work in work-related accident statistics [10]. Employees in these countries may be entitled to compensation should they be involved in collision while commuting, as it is seen as an occupational injury [10].

Fort et al. [3] argue that road accidents while at work account for between 20 to 40% of all work fatalities in the majority of industrialised countries. The UK Department for Transport considers road traffic accidents while at work to be the single largest type of occupational fatality in the UK [7]. This is also the case in Australia [5]. These figures are likely to be even higher and underestimated due to the lack of recognition of road traffic accidents as an occupational health issue, under-reporting of such fatalities by employers to the correct authorities and cohesiveness of data reporting and data collection methods [5, 18-20].

Much work-related vehicle research has focused on large and obviously work-related vehicles such as trucks, buses and tractors. Brodie [21] reports that the majority of work-related fatalities in Australia are heavy goods vehicle (HGV) drivers. Smaller vehicles have been overlooked even though they account for a large proportion of collisions and are common-place in occupational driving. A UK study, conducted by Clarke et al., [22] using Police data and examining 2,000 work-related collisions, identified six main vehicle types involved in work-related vehicle collisions: company cars, vans, large goods vehicles, 'passenger carrying vehicles' (PCVs), taxis and emergency vehicles.

Van use is increasing in Europe, particularly due to the rise in online shopping home deliveries and city centre restrictions on HGVs [23]. In 2012, there were 3,999 deaths in Europe due to collisions involving vans. In 30% of cases the decedent was a van occupant, compared with 12% in the case of

HGVs. Nineteen percent of deaths in such van collisions were pedestrians, compared with 14% in HGV collisions [23]. The ETSC highlight the vital role played by the employer in setting the organisation's agenda and conditions, and in effectively addressing their safety and the safety of other road users [23]. Under EU Regulations, employers of HGV drivers have strict requirements in relation to employee driving hours; however, this does not apply to van drivers. Legislation regulating van drivers' driving hours has been introduced in the UK, where drivers transporting goods may not drive more than 10 hours per day and are obligated to record hours on a weekly record sheet or on a tachograph [23]. It appears that no such regulations exist in Ireland to date.

A particularly vulnerable group of individuals driving for work are those who drive their own vehicles and receive payment for mileage, also referred to as the '*grey fleet*.' These are not as obvious as other working vehicles, such as liveried delivery vans and trucks and their risks are often not managed to the same extent [24]. Some progress is being made, however, in advocating the importance of implementing occupational road safety and highlighting the significant legal, societal, reputational and financial impacts of work-related collisions on businesses [6]. The PRAISE (Preventing Road Accidents and Injuries for the Safety of Employees) initiative led by the ETSC, is a key EU-wide driving force for change in this area.

2.4 Reporting methodologies and data sources

The reporting of incidents and the data collection systems used are key factors in the estimation of work-related road traffic fatalities. These procedures vary greatly from country to country, even within Europe. Between-country comparisons of data are, therefore, a difficult and complicated process.

In the UK and Ireland, the full extent of work-related road traffic fatalities is not fully captured by existing data systems. The national data sources for work-related road traffic injuries are managed by the Police and OSH agencies:

- Roadside collision data are collected by the Police, using STATS19 in UK and CT68 in Ireland. Data are forwarded to the Department for Transport (UK) and the Road Safety Authority (Ireland) for analysis and research.
- Occupational accident data (excluding road traffic data) are reported by employers in the UK to the UK Health and Safety Executive, via RIDDOR (Reporting of injuries, Diseases and Dangerous Occurrences Regulations) system and in Ireland to the Health and Safety Authority. This is governed by the Safety, Health and Welfare at Work (General Application) Regulations, 1993, Part X. This includes a requirement to report work-related road traffic.
- The situation is similar at international level. Many countries lack a comprehensive, nationwide system for capturing work-related road traffic fatalities, let alone injuries[19, 24, 25]. Data are often fragmented and may be compiled from more than one data source. Data contained in coroner files have been recognised, and used, as a data source for hard-to-capture data, including work-related road traffic fatalities [15 26 27 28].

2.4.1 Police reporting systems

The WHO claim that roadside fatality data collection procedures, carried out by Police for the majority (71%) of countries [9], do not specify whether the decedent was at work at the time of death or if a person at work was involved in the collision. In Ireland roadside collision data are collected by Police using a CT68 form; '*at work'* or *'involved in work activity'* was not specified [15] until 2014 when a '*purpose of journey*' option was added to the CT68 form. A similar field was added to the UK Police report form STATS19 in 2005. Since then the UK experience has been that an average of 75% of entries in the STATS19 '*purpose of journey'* field, are recorded as '*unknown or other*' [29]. Helman [25] notes the uncertainty of accuracy with this particular entry. It is therefore possible that STATS19 (or Irish CT68) data will not add value in the short/medium term.

The situation is similar in France. Police collision data are the only data that cover the entire population. French Police are required to complete a crash report for each collision. Like the recent CT68 and STATS19 forms, there is an option of *'type of journey'* [10]. However, Charbotel [10] notes that, in contrast to other countries, work-related collisions in France may actually be over-estimated because work-related accidents give entitlement to specific compensation.

Overall, the WHO claims that data from Police sources tend to have higher levels of under-reporting than health sector data, particularly in low and middle-income countries, because it can be difficult for Police to follow up on the outcomes of road traffic crash victims [9].

2.4.2 Road safety agencies

Once data collection is completed by Police it is provided to the Department for Transport (UK) and the Road Safety Authority (Ireland). Data are collated for analysis and research purposes and are the key data source for road fatality statistics in each jurisdiction. Each agency publishes a review of road collisions annually: Road Collision Factbooks (Ireland) and the Reported Road Casualties in Great Britain (UK).

The Road Collision statistics published by the RSA annually, include details on all road traffic collisions (excluding collisions on private property) recorded by Police for that year. These details include fatalities, personal injury and material damage. The work-relatedness of the collision can therefore only be captured from the *'purpose of journey'* component on the CT68 form. Specific work-related collisions statistics do not feature in the report. The report also examines trends in road traffic collisions and fatalities [30].

The Reported Road Casualties report (and associated tables) is published annually by the Department for Transport (UK). It provides in-depth statistics on personal injury road traffic collisions and the details surrounding the circumstances of the collision. Similar to the RSA annual report, data are mainly gathered from Police information, however mortality, survey, hospital and traffic data are also included to give a wider context. Again, work-relatedness could be derived from Police data but this is not overtly covered in the report. The report also draws information from the National Travel Survey which provides details on personal travel patterns [31].

2.4.3 Health and safety agencies

A fundamental issue in the estimation and monitoring of work-related traffic collisions is that road traffic collisions can often fall outside the remit of occupational health and safety agencies and can therefore be missed in the statistics [15].

In the UK, the HSE requires employers to report certain injuries to them as part of the RIDDOR system. It obligates employers and self-employed persons to report all deaths and certain specified injuries as a result of certain workplace accidents, occupational diseases and specific dangerous occurrences [32] . RIDDOR requires accidents to be reported only if they are 'work-related', defined as where the work activity itself contributed to the accident. It specifies that an accident occurring on a work premises does not necessarily mean it is work-related, rather the following elements must play a role: the way the work was carried out, the machinery, plant, substance or equipment used and the condition of the site or premises [32]. Should a vehicle-related accident occur on a private site then this must be reported. However, collisions occurring on public roads, regardless of whether it is a working vehicle or not or whether a worker was involved do not need to be reported (http://www.hse.gov.uk/riddor). This is still the case despite a demand for this requirement from IOSH and ROSPA (Jones, 2005) during the consultation process preceding RIDDOR revision in 2013 [33]. The UK Statistics Authority (2013) notes that although this means that the UK deviates from European Statistics on Accidents at Work (ESAW) Regulations, the UK HSE can give Eurostat an

indication through relevant fatalities notified to other authorities (i.e. the Police). The HSE argues that accidents on public roads fall under the jurisdiction of the Police who have responsibility for road safety and the impact assessment on the changes to RIDDOR in 2013 made it clear that there was no intention to widen the scope of the existing RIDDOR requirements into areas where HSE and other enforcing authorities do not have primacy, such as work-related road traffic accidents [33] [32].

In Ireland, unlike the UK, work-related road traffic injuries and deaths are notifiable to the Health and Safety Authority, but it is known that they are greatly under-reported. Until very recently employers have been unaware of or uninformed on the requirements for notification of occupational accidents and fatalities involving their employees. Furthermore, road traffic collisions may simply not be recognised by employers as falling within the terms 'workplace fatality or accident' or 'work-related'. The HSA has recognised the importance of communicating and managing work-related road safety risks, devising its first five-year plan in 2010 to tackle the issue[2] and is currently developing a plan for 2016 to 2020.

Bystanders

In the context of Occupational Safety and Health deaths of persons who are not at work, but whose death comes about as a result of the work activity of another person, are often referred to as non-worker deaths. In Ireland, deaths of persons who die as a result of the work activity are notifiable to the Health and Safety Authority. In the literature the term '*Bystander'* has been used in this context for non-worker deaths[34-36] and has been defined in a number of studies. In Australia Mitchell et al (2004) [35] defined 'Bystanders to work' as…*"Persons who were not working but who were killed as a result of exposure to the work activity of other persons. Road bystanders were persons not working who were fatally injured in motor vehicle crashes on a public road as a result of other people's work (including commuting), where the working vehicle was primarily 'at fault' in the incident".* McNoe (2005) defined bystanders as "*All persons who are killed directly as a result of someone else's work activity, even though the deceased was not working at the time*". In both studies, the incident was only included if the working vehicle was considered '*at fault'*.

However, the argument is made that these 'worker-not-at-fault-deaths' are important from a public health perspective and should not be ignored as there are clearly OSH implications for the working persons exposed to such incidents. In an editorial in *Injury Prevention*, Langley (2004)[37] provides an example of a (OSH) bystander, as a non-working pedestrian who is struck by a falling piece of scaffolding when walking by a building site. This is analogous to a non-worker fatality following a road traffic collision with a working vehicle. In the Irish and UK systems, most of such deaths are notifiable to the health and safety agencies, as prevention measures should clearly be put in place. Langley agrees that this should be included in official statistics, on the basis that there was fault on the part of the employer for not having procedures in place. However, he goes on to argue that where children have wandered into construction sites and been killed the employer has also responsibility. In relation to road traffic collisions where a distracted non-worker driver crosses a centre line and collides with a work truck, though the truck and driver is not at fault, the work processes increases the probability of death. In a 2006 article dedicated to work-related bystander deaths in New Zealand[38], the same academic team, now defined a road bystander as a person "*not working [or commuting] but killed by a working [or commuting] vehicle*"; the example provided then clarifies: "*a road bystander may have been driving and overtaking dangerously on a corner then hitting a truck coming in the opposite direction… the truck driver in this case did not actively contribute to the bystander death however*". Thus the bystander definition is extended from earlier studies to now include cases where the working vehicle is not 'at fault' thus providing new opportunities for injury prevention (the evolution of the terminology is provided in Appendix 2.

2.4.4 Coroner data

The concept that coroner files may be an important source of data for public health issues is emerging[21]. Coroner files contain rich information, which can give researchers an understanding of the circumstances of fatalities, and, in road traffic fatalities, whether the collision was work-related or not. Coroner data can complement routinely collected data [27]. They can provide a broader picture of the events surrounding a fatality and a more in-depth description than quantitative data. They provide a context for the subject in question. All non-natural deaths are reported to coroners, some of which are subsequently investigated through an inquest procedure. Coroner files include a wealth of information in post-mortem reports, toxicology reports, Police reports, depositions and witness statements, and are a valuable source of fatal work-related road traffic data in Ireland and in the UK

There is, however, no standardised data collection or documentation system for coroner data in Ireland. In the absence of a computerised system, determining which road traffic fatalities are work-related is possible only by reviewing narrative data from within coroner paper files [1, 5]. Road traffic collisions are classified as sudden deaths, are not due to natural causes and therefore require a full Coroner inquest with a jury (with exceptions in the case of criminal proceedings).

In Ireland, following a fatal road traffic collision, the Coroner is notified by Police. A completed (C71) form is submitted by Police to the Coroner, which documents the circumstances surrounding the fatality. The form gives basic details of the decedent and the incident although there is no specific area on the C71 form that specifies whether the decedent was at work at the time of death. The only indication could be in the field "*circumstances of the death*", but this may be ambiguous and the purpose of journey is often absent. A post-mortem is carried out and this includes toxicology testing for alcohol and / or drugs if indicated and establishes medical cause of death. In Ireland, if the death is reported to the HSA as work-related (and it is often not reported), a HSA representative may attend the inquest and if so a report is completed and included in the inquest files. A similar system prevails in the UK, with the exception of the requirement to report to the HSE through RIDDOR. Witness depositions are taken and recorded in writing; statements from the last person to see the victim alive can also be taken, and it is often in these statements that the work-relatedness emerges [1]. The coroner holds an inquest, taking account of all of the available information, and a verdict is recorded. This may be accidental death, death by misadventure, or simply road traffic collision. Coroner files in the UK and Ireland, therefore, generate official Police and medical documentation as well as narrative depositions from key parties associated with the collision and the investigation.

Coroner districts in Ireland and in the UK are often at local administrative council level (45 districts in 26 counties in Ireland and 110 local jurisdictions in England and Wales) with coroners appointed by local councils. The system is similar in Northern Ireland. In Scotland there are no coroners, however, suspicious deaths are dealt with by the Procurator Fiscal, while accidental deaths are dealt with by the local sheriff [39].

In Ireland a pilot study which examined individual coroner files to identify work-related road traffic fatalities in one district (Co. Kildare), for the years 2004-2006, identified two worker deaths and six 'bystander' deaths [1]. None of the inquests in Kildare were attended by a HSA representative, and the work fatalities recorded by the HSA for this period did not contain any of the cases identified. It is likely that the HSA was simply not notified. Overall, the study found that official work-related deaths recorded in this small area trebled when work-related road traffic deaths were included.

Researchers in Australia and New Zealand have successfully used high-level coroner data to determine the extent of non-capture of work-related road traffic fatalities through road safety or OSH data collection systems, thus allowing the extent of the problem to be estimated [34 5] and identifying a need for a computerised coroner information system. Australia and New Zealand have developed a

computerised database for coronial information called the National Coroners Information System (NCIS). The NCIS was established in Australia (2000) and New Zealand (2007) following an initiative from Australasian Coroners themselves, with input from academics such as Driscoll and Harrison who had previously published on work-related road fatality data sources. It allows data storage, retrieval, analysis, interpretation and dissemination of coronial information (http://www.ncis.org.au/data-collection), and a detailed data dictionary is available. Prior to its establishment, the primary data source for injury fatalities was the Australian Bureau of Statistics (ABS) Deaths Data Collection. The advantage that the NCIS has over this system is the greater detailed data it provides [34]. The ABS system identified work-related deaths by a category '*working for income'* only. This however, included people commuting to and from work and did not distinguish those '*at work'* at the time of death nor did it specify if the decedent died as a result of someone else's work activity (bystander). The NCIS on the other hand, is more specific. It includes categories for '*work-related*' activity, '*working, including traveling for work*,' '*travelling to or from work (commuting)*' or '*working or unspecified*.' There are a number of other categories or required details (e.g. object variables - cranes and tractors) [34] which further support the identification of work-related fatalities.

Coroners are independent office-holders, and variation exists in the way coroners' districts are structured, and in the management systems in place for discharging their duties, including the formats used for providing central data to overseeing bodies. In Ireland, McGovern & Cusack [26] argue the case for a cost-effective central coronial database following an analysis of coronial records in relation to deaths in nursing homes. They highlight the difficulties in accessing coroner files, conducting nationwide analysis of morbidity and mortality and the inability to share information easily between coroners and researchers. They advocate for a centralised, computerised coroner database to be established in Ireland and in all countries. Similarly in the UK, a study conducted by Pilkington et al [27], exploring the social context of fatal road traffic collisions among young people, promotes the benefits of coroner data for public health research. They praise the rich and in-depth information provided in coroner files, however they recognise the current limitations in accessing such data. They argue that this under-utilisation of coroners' data is a 'missed opportunity for public health' and recommend the UK develop a similar system to the NCIS in Australia.

Narrative data in coroners' files is currently the only single rich, accurate and reliable source of data for work-related road fatality information in the UK and Ireland. Because neither area has a central coroner data information system that holds case-specific data, manual mining of data, including narrative data, in paper case files in individual coroner offices, is necessary to extract the information needed to estimate the extent of the problem.

2.4.5 Data sources summary

Overall, it is clear that a variety of data collection methods exist and are very varied between individual countries. Police reporting systems are the main data source for road traffic collisions in the majority of countries. In order to quantify work-related fatalities however, it is evident that improvements could be made at this initial point by inclusion of a specific work-related field. For countries where '*journey type*' or '*purpose of journey*' is already included, improvements on accuracy could be made as these are often left unspecified.

Links between employers and Health and Safety Agencies need to be enhanced in order to ensure employers are aware of what constitutes a work-related fatality and what steps are required of them. This is particularly relevant to occupational road fatalities as it is known that many employers have not reported fatalities to the HSA (Ireland) due to a lack of knowledge on this particular issue. In the UK arguments for making such reporting a compulsory requirement (as is not currently the case under RIDDOR) were put forward during the RIDDOR 2013 consultation process by safety advocates such as IOSH and ROSPA [33]. Collaboration between Road Safety Agencies and Occupational Health and Safety Agencies could also be improved so that road traffic collisions are adequately recognised as

an occupational health issue. According to Murray[5] these relationships are currently being strengthened in countries such as the US, Finland and the UK; in Ireland, such an arrangement was recommended [15] and since implemented with the setting up of a Work-Related Vehicle Safety Steering Group and Consultative Panel, with a membership representing key stakeholders[40].

While the potential of coroner data as an important data source for public health is only beginning to be explored, it is already clear, from the few studies that have been conducted, that coroner files contain a wealth of information. It is particularly relevant in incidents where quantitative data simply does not capture the true picture, for example work-related road traffic fatalities. It is currently the only complete data source for work-related road fatalities in Ireland and the UK; however, in the absence of a computerised National Coroner Information System, access, cost and the manual task of examining paper files preclude using coroner data as a routine data source.

2.5 What information are recent data providing?

Work-related road traffic collision risk factors have been investigated in a variety of studies in recent years. Known risk factors include age, gender, occupation type, driver fatigue, speed, total time on the road, kilometres driven and driver behaviour [25, 41].

According to the European Transport Safety Council (ETSC), young people have the highest road collision involvement of any other group. Collisions involving young drivers account for 37% of all road deaths[42] . A study conducted by the Belgian Road Safety Council on work-related road traffic collisions (including commuting) showed that while work-related road traffic collisions decrease with age, the severity of work-related road collision outcomes increases with age. Severity was defined as the '*ratio of accidents resulting in the death of a worker or in permanent work incapacity per 1,000 work-related accidents*.' [42].

It is known that the exposure of men to occupational driving is greater than for women. An Australian study [43], linking population data on Police-reported road crashes with hospital admission records found that 53% of work-related car driver deaths and 93% of work-related motorcyclist deaths were male. In France, Police data from the period 1997 – 2006[10] revealed that men were more likely to be involved in a collision than women, particularly while at work, accounting for 84% of all casualties for the period 2003 - 2006.

Other known risk factors include speed, fatigue and alcohol consumption. Charbotel [10] argued that drivers who were working were less likely to have alcohol as a contributory factor than non-worker drivers. Fatigue and speed were also less likely to be contributory factors for worker drivers. Other studies, however, have noted speed and fatigue as a risk factor due to such time pressures [22 4]. A systematic review[41] on work-related road traffic accidents in New Zealand highlighted consistent evidence that fatigue was a contributory factor in work-related collisions and was the most commonly researched risk factor, suggesting that it is a major factor in such collisions. In the UK, Clarke et al.[22], researching work-related road traffic collisions using Police data, ascertained that the main causal factors were speed for company car drivers, observational factors (lack of) for van drivers and fatigue and vehicle defects for Large Goods Vehicle (LGV) drivers. The most common time for the occurrence of work-related road traffic collisions (excluding commuting) was in the morning between 6 and 9 am.

In terms of occupations at risk, Mendeloff [44] reported that in the US and UK the construction sector held the greatest risk. In France, Charbotel [10] found that professional drivers still had the highest relative risk compared with manual workers, while in contrast, Fort et al [3] concluded that the largest group of victims (also in France) were manual workers, nearly a quarter of which worked in the public sector. When they took industrial work as reference, inter-sector comparisons found a high

occupational road accident risk in transport and communications, even after adjustment for road risk exposure.

Overall, conflicting evidence exists as to whether individuals driving for work are more likely to engage in risk driving behaviour. Studies by Mitchell et al [43], using linked population data from Australian Police crash reports and hospital admission records and Newnam et al., [45] surveying individuals (also in Australia) who drove for work, concluded that individuals driving for work were less likely to engage in such risky practices. Conversely, in Ireland, the Road Safety Authority (RSA) recently identified noticeable behavioural differences between motorists driving for work and all motorists, through an as-yet unpublished 2014 Behaviour and Attitudes Survey. Preliminary results of this survey were presented at a (July 2015) European Transport Safety Council PRAISE conference held in Dublin. The results showed that motorists who drove for work were more likely to admit speeding, while trucks, articulated trucks and single-decker buses were more likely to speed on rural roads than cars. Those who drove for work were more likely than non-worker drivers to report that they fell asleep at the wheel (18% vs 11%), that they drove following alcohol consumption (18% vs 11%) but, on a more positive note, that they always use a hands-free phone device (30% vs 12%). Overall, there was a higher incidence of worker drivers than non-worker drivers being involved in a collision (17% vs 8%) and of being involved in a 'near miss' (43% vs 27%) (RSA 2014) [46]

2.6 Conclusion

This review set out to establish the perceived contribution of work-related traffic fatalities to overall road traffic fatalities and assess whether the former were likely to be under-estimated. The exact contribution of work-related road traffic fatalities to overall road traffic fatalities is currently unknown, however research and estimates suggest that they account for a large proportion. Furthermore, figures are likely to be underestimated due to the fact that for the majority of countries a reliable, comprehensive data reporting system for road traffic collisions exists, but a system for work-related road traffic collisions is either non-existent or unsatisfactory. Data sources are often fragmented and do not appropriately cover the extent of the problem. Variations in data sources between countries, along with differences in defining a work-related collision or fatality pose problems in estimating and comparing the extent of the problem internationally. Adopting a universal definition will aid comparisons and provide more realistic estimates.

In Ireland and the UK no single, easily accessible data source exists for work-related road traffic fatalities but work is emerging on improving the system for extracting work-related cases from existing road traffic collision data.

Likewise, the exact contribution of road traffic fatalities to overall work-related fatalities is also unknown due to a number of factors, such as under-reporting to Health and Safety Authorities and lack of recognition of road traffic collisions as an occupational health issue. Yet, research suggests that road traffic collisions may be the leading cause of work-related fatalities. There is no doubt that driving for work is an occupational hazard. The risk is not restricted to one or a few industries or sectors; it covers a variety of contexts and occupations in public and private sectors and among the self-employed. In spite of this, little attention has been given to work-related road traffic fatalities until recent years.

While this area of occupational risk is now emerging as a focus for research, Murray et al.[5], in an international review of sources of data on occupational road collisions, conducted worldwide surveys on occupational road safety and noticed a very obvious gap in responses from mainland Europe. Their further correspondence with the European Transport Safety Council concluded a lack of pan-European research covering occupational road safety. The PRAISE project is attempting to address this gap and to promote information generation and sharing.

The benefits of coronial data for public health research are beginning to be recognised, particularly in relation to road traffic collisions where the circumstances of the event can be explored. Analysis of coroner files has the potential to be an important data source for public health topics that require more in-depth, qualitative data such as work-related road traffic collisions. Nevertheless, a number of limitations exist, such as accessing the data, ethical concerns and the time-consuming task involved with manual mining of paper files.

This study utilises narrative data from individual level coroner data in order to estimate the extent of under-estimation of work-related fatalities in Ireland.

3. Study Design and Methodology

3.1 Study aim and objectives

The aim of this study was to utilise narrative data from coronial road traffic fatality files in Ireland to assess the extent of underestimation of work-related road traffic fatalities captured through existing national road safety, and health and safety, administrative data collection systems.

The objectives were:

- To determine the proportion of road traffic fatalities in the Republic of Ireland that is work-related;
- To determine the extent of concordance, in relation to Irish work-related road traffic fatalities, between three data sources: road traffic collision data, work-related fatality data and coroner inquest data;
- To identify occupations, driving tasks and circumstances associated with fatal road traffic work-related injury;
- To determine the number, type and circumstances of fatalities where non-working persons (bystanders) are fatally injured through involvement in a work-related road traffic incident;
- To identify areas that can be targeted for prevention.

3.2 Study design

In Ireland, a coroner's inquest is an inquiry, held in public. A jury is required where the death resulted from a road traffic accident. The purpose of an inquest is:

- To establish the facts surrounding the death;
- To place those facts on the public record; and
- To make findings on: a) identification of the deceased, b) date and place of death, and c) cause of death.

While the coroner or jury may make a general recommendation designed to prevent similar deaths, they do not decide fault or whether a criminal offence was committed. A verdict is returned in relation to the means by which death occurred. The range of verdicts open to a Coroner or jury include: accidental death; misadventure; suicide; open verdict; natural causes (if so found at inquest) and in certain circumstances, unlawful killing.[47]

Coroner inquest files for road traffic fatalities contain witness depositions, including those of Police and other experts, and details of the incident not available elsewhere, in addition to the verdict of the cause of death. Most inquest files also contain post mortem reports, which can include toxicology reports for the deceased party, and statements from family members / people who last saw the deceased party prior to the collision; previous research has shown that this often contains information that helps determine the purpose of journey.[1, 5, 21]

A retrospective, descriptive study design was used. Data were collected on-site by manual inspection of narrative data in hard copy coroner inquest files, for road traffic fatalities that occurred in the Republic of Ireland during the years 2008 to 2011 inclusive. The years 2008-2011 were selected following consultation with coroners who advised that it is likely that it could reasonably be expected that the majority of inquests for 2011 would be complete and closed, but there would likely be more incomplete inquests for 2012 and beyond.

3.2.1 Definitions

The RSA definition of a road fatality is:

Collisions where: "*at least one person is killed as a result of the collision and death occurs within 30 days."* [48]

The Health and Safety Authority requires notification of work-related fatalities where:

"…..any accident occurs at a place of work as a result of which any person carrying out work at that place of work dies, or …… in the case of any person who is not at work but who as a result of an accident related to a place of work or a work activity dies……" (Safety, Health and Welfare at Work (General Application) Regulations 1993, part X.)

In these regulations, worker deaths, including road traffic deaths are notifiable, but deaths of persons not at work in road traffic collisions are confined to a small set of circumstances (Appendix 1).

The above are national administrative definitions, but there are also definitions for the terms used in the literature, in particular the term 'bystander' which is used instead of non-worker. Terminology from the literature used to inform this study is provided in Appendix 2.

3.2.2 Approval for the study

Approval and support for the study was sought and granted from the President of the Coroner Society of Ireland (January 2015) (Appendix 3) following a meeting of the Council of the Society. Full ethical approval for the study was granted from the UCD Human Research Ethics Committee in March 2015 (Appendix 4). Permission for access to local files was a matter for each district coroner, and was sought and granted on an individual coroner basis, following the Society's approval.

3.2.3 Study population

From an epidemiological perspective, random, systematic and cluster sampling were considered at the planning stage, but because the unit of analysis was road traffic fatality cases, which could be distributed in any pattern across the administrative units in which data are recorded (coroner districts), it was decided to identify all work-related road traffic fatality cases. Sampling by coroner district (established for local authority governance purposes) could result in bias. Reviewing all available files also permitted checking for agreement against RSA and HSA data for the same period.

The primary sources of data to identify work-related road traffic fatalities were all available coroner files for deaths in 2008-2011 inclusive. Secondary data sources, which were used to check for concordance and to confirm and/or exclude individual cases, included: a) the anonymised work-related fatality case summaries published in the HSA annual statistics reports[49] and the associated anonymised HSA dataset of work-related fatalities (2008 -2011) and b) the anonymised RSA dataset of road traffic collisions (fatal, serious and minor) (2008 – 2011). The anonymised data were provided by the HSA and the RSA respectively.

HSA fatality case summaries reports included a number of incidents involving vehicles, on farms and construction sites, however, the focus of this study was narrower than work-related vehicle fatalities, and was confined to work-related road traffic fatalities.

The HSA resource is designed to record all work-related fatalities, including work-related road traffic fatalities (WR-RTFs). In the time period of the study, 202 work-related fatalities were recorded, which included 17 WR-RTFs. The summary information provided included an entry on the work environment in which the fatality took place as: roads or motorways, public roads, public areas, or public thoroughfare, e.g. roads, parking areas; and included accident circumstances such as:

a) run over, struck, crushed, or injured by collision with [vehicle], or
b) [vehicle] overturned, went off road, being driven, or
c) road traffic accident, or
d) by road.

The number of road traffic fatalities that take place annually is known and transmitted, along with details of the collisions, from the Police to the Road Safety Authority. The RSA analyse the data and publish road collision statistics routinely [48]. Published RSA data recorded 915 road traffic fatalities nationwide in the period 2008 – 2011; this was the maximum number of files anticipated for review in the coroner files.

3.3 Data collection: planning and arrangements

The past President and the Secretary of the Coroner Society were consulted about record keeping processes in coroner districts. Both offered access to their individual district's records for the process of piloting the study documentation (decision form, data collection case report form, and summary paperwork).

The Irish Health Research Board (HRB), which collects data on drug-related deaths from coroner files on an annual basis, provided useful advice about arrangements and the logistics of setting up appointments in coroner districts. Every effort was made to avoid contemporaneous visits to individual districts by fieldworkers from the HRB and the present study. The HRB entered a (new) arrangement with the RSA in 2015 (following approval of this study) to collect data on road traffic fatalities during their annual visits to coroners. The HRB's database variables were made available to this study, and following review, a small number of variables were added to the draft study-specific case report form.

In June 2015, initial contact was made with all coroners through an introductory letter, sent by post and by email, which notified coroners of the study, outlined its rationale, and requested permission to access relevant road traffic fatality files for deaths that took place in their district in the period of interest. A copy of road fatality statistics for each county and an article published on a previous pilot study[1] were included for context. This was followed by an email in mid-July 2015 and thereafter each site visit was arranged for a time that suited the district.

3.3.1 Design and pilot of study documentation and survey instrument

A study-specific decision form was designed to document the preliminary review of each road traffic fatality case, and to document the basic facts leading to the decision on its work-relatedness (Appendix 5). No further data were collected on cases deemed not work-related. A study-specific case report form (CRF) was designed to collect data on work-related cases, i.e. individual road traffic fatalities, deemed after the decision process to be work-related. The initial draft CRF included questions deemed relevant to the study by the research team, based on the study aim and objectives, team experience, on studies reported in the literature, and road traffic data being collected by the RSA through the HRB.

Piloting of the paperwork and the data collection process took place in April and May 2015. The fieldwork process was initially piloted in two coroner districts. The first visit aimed to determine: a) the extent of data available and the format of the paperwork in a typical file; b) the availability of the data that had been identified as desirable for collection; and c) what data were not relevant to the study aim and objectives. This identified the types of paperwork present in coroner files and the information that could potentially be available (taking account of potential variability by coroner district).

A second visit provided an opportunity to test the documentation on actual cases and to identify changes required. Time required to review files and collect data was estimated.

Key potential sources of data within relevant inquest files included:
a) the coroner verdict form;
b) the coroner certificate;
c) the Police report (C71) form;
d) post-mortem and toxicology reports; and
e) Police forensic collision reports (Garda Unit report); and
f) witness depositions.

Changes were made to both the study-specific decision form and CRF following piloting. The final case report form comprised 48 stem questions arranged in four sections (Appendix 6):
a) Administration and collision data
b) Demographic data about the deceased party and the principal other party (if relevant)
c) Driving and vehicle data and work-related factors
d) Collision summary information.

In general the collision summary information comprised a fieldworker's summary description of the circumstances of the collision and key points, highlighting the work-related factor(s), and including, if present, any relevant recommendations from the jury or the coroner. If relevant, short key statements within deposition statements from collision witnesses or persons who had last seen the decedent were transcribed *verbatim* in order to facilitate the decision making process.

During fieldwork, aspects of the form were modified in minor ways as the data collection process progressed, as the level of information that was available in the majority of coroner files became more evident.

A data dictionary based on the final case report form variables was created to standardise decision-making and data entry.

3.4 Data collection process

Data collection commenced in July 2015. When setting up arrangements an estimate of the number of relevant files that might be present in each district was provided to each coroner office with their introduction letter. This was based on the number of fatal collisions recorded by the RSA for the relevant county in the same period. RSA data are based on place of collision and coroner inquests take place in the county of death, so an exact match by county was not expected. However, the RSA data provided a reasonable estimate for planning purposes.

In the field, in a number of counties a mismatch existed between the numbers of cases expected based on RSA data and the numbers identified. The most important reason for this was because in a collision which took place in one county, the death took place in a hospital just across a county border, and hence the inquest was held in the second county. A summary of expected-versus - ascertained cases for each county is provided in Appendix 7.

3.4.1 Fieldwork

As there is no national coroner file case numbering system, different systems were used in individual coroner offices. A study-specific case identification system was devised. The case labelling system is described in detail in Appendix 8.

For safety and space restriction reasons at least two, and a maximum of three, fieldworkers attended each district. To ensure consistency and continuity, the project fieldwork co-ordinator was present at every data collection session.

Coroners retain files for relevant deaths that take place in their district. In 28 districts fieldworkers were provided with access to all coroner files for the district (files with no inquest, files with no-jury inquests and files with jury inquests) or with access to all inquest files. In these districts a preliminary examination of each individual file was carried out and full review, decision-making and data collection took place only for road traffic files identified. In 15 districts road traffic files were pre-identified by coroners' office staff, and were provided directly to fieldworkers for review and data collection.

The inquest verdict did not always reveal that a case was a road traffic fatality. While in many cases the verdict identified the road traffic relatedness of death (e.g. road traffic collision / road traffic accident / motor vehicle collision / motorcycle accident) verdicts for road traffic fatalities also included 'accidental death, misadventure, and open verdict'. Details of the procedures for file identification prior to data collection are provided in Appendix 9.

Case ascertainment

In 43 of the 45 coroner districts, road traffic fatality files were available to the study team; one coroner, in a district within a multi-district county, confirmed that no road traffic fatalities had taken place in that district in the period under study. In just one district, which covered a small county, the coroner was unable to facilitate access; RSA fatality statistics recorded 20 road traffic fatalities in the district in the time period. Thus, the number of cases available to the study, based on 44 districts and RSA data for the 44 districts, was 98% both by district (44/45) and by count (895/915).

Table 3.1 summarises coroner-ascertained cases as a proportion of RSA-recorded road traffic fatalities (RTF) by year and in total.

Table 3. 1 Coroner road traffic fatality case ascertainment as a proportion of all RSA road traffic fatalities

Year	RSA- recorded road traffic fatalities	Road traffic fatalities ascertained in coroner files	% of RSA recorded road traffic fatalities ascertained in coroner files
	n	n	%
2008	279	256	91.8
2009	238	222	93.3
2010	212	193	91.0
2011	186	162	87.1
RSA 44 districts (n = 895)	915	833	93.1

In total, 833 coroner road traffic fatality files were available through the coroner system. The achieved sample was 93% of expected and representative of the national road traffic fatality population.

In the field, there are a variety of reasons why not all coroner WR-RTF files may be available. These include:

- Cases where the inquest has yet to take place (e.g. pending decisions associated with criminal prosecution or other legal investigation, such as a Police Ombudsman investigation);
- Cases that resulted in a criminal trial, following which it was deemed unnecessary for a coroner's inquest to proceed; and
- A small number of individual files may be out of storage for various routine administrative reasons.

3.4.2 Data collection: work-related decision-making

The process for reviewing each case file began with a decision on work-relatedness. Cases were classified as work-related only if direct evidence in the files so indicated; in cases where there was no evidence of work-relatedness, the case was deemed not work-related. This included many collisions involving vans where no indication was given whether the van was a work vehicle or was participating in a work activity. Unless there was overt reference to work, such cases were treated as not work-related. It is also possible that grey fleet fatalities (i.e. workers driving their own car for work) were not identifiable as work-related. A brief description of the reason for decision was recorded in every case. No further data were collected from non-work-related cases.

In cases where fieldworkers were undecided about work-relatedness, or in a small number of cases, whether the case should even be classified as a road traffic fatality, the CRF was completed in the field, and the case decision was made later following a review by the full research team, often having sought additional information (e.g. from HSA or RSA datasets or from conversation with the Coroner). One example of such a decision was a fatal incident involving a tractor on a private road within a farm; when followed up, the case was not in the RSA dataset and therefore it was determined that the RSA had not considered the case to be a road traffic fatality, but it was included in the HSA dataset because the HSA had been notified, and had recorded the case as a work-related farm incident. Such cases were not included in this study.

For cases deemed to be work-related, a work-related road traffic fatality (WR-RTF) study ID was allocated, and the CRF was fully completed, collecting available demographic data on the deceased party and, where relevant, the principal 'other party', including available data on the circumstances of the collision, the purpose of each party's journey, weather conditions, road conditions, medical outcome, toxicology, verdict, vehicle type, etc. The focus was to identify work-relatedness.

Cases excluded

The following case-types were excluded as road traffic fatalities (both for road traffic collision denominator purposes and for work-related data collection purposes), either in the field or following a team review (exclusion criteria):

a) Off-road deaths, i.e. traffic fatalities that were not road traffic fatalities. Examples included deaths where the collision, or a vehicular (including work-related vehicle) death occurred on roadways or other parts of private land or work-sites, e.g. beaches, farms, construction sites, quarries or other off-road work premises, including construction sites that were clearly delineated as a work-site on an otherwise busy road;
b) Cases where the death occurred in 2012, even if the collision occurred in 2011. This study was based on deaths that occurred in 2008, 2009, 2010 or 2011, not on collisions that occurred within that period;
c) Cases where deaths occurred in 2008, 2009, 2010 or 2011, in which the collision occurred more than one year prior to the death; e.g. a case that was not included involved a collision in 1998 where the death subsequently occurred in 2009 - although the death was within the study time frame, it did not occur within one year of the collision and was therefore outside of the scope of the Irish HSA *work-related* death definition;

d) Cases where (despite being available to fieldworkers as a road traffic fatality, and involving a vehicle) the inquest outcome recorded a medical reason for death and did not make reference to a vehicle or to a road traffic collision or a road traffic accident. Such cases were few, but included cases where post-mortem examination determined that the decedent had suffered a heart attack or a stroke in the seconds or moments before the collision, and the cause of death as the illness and not the collision;
e) Cases where, although the collision involved a vehicle on a public road, the inquest verdict was that of suicide and not a road traffic collision or accident; and
f) Cases where work was taking place on a road construction site, (e.g.) cases where a normally functioning road was completely closed to traffic and was effectively a construction site; and cases where a new road was still under construction and was only open to construction vehicles.

Cases included

g) All road traffic fatalities occurring on public roads where the evidence provided to the inquest, and / or the documentation available, made it clear that the case involved a road traffic fatality;
h) Road traffic fatalities where the death occurred in 2008, 2009, 2010 or 2011. This included cases where the collision occurred in 2007 but the death occurred in 2008 (provided the death was within one year of the collision). It also included cases where the inquest was not held until 2014.
i) Road traffic fatalities where either a worker died, or where the death was associated with the work activity of a party to the collision, or where the other party was deemed to be at work; and
j) Cases where work was being carried out on a road were included if the road was a functioning road at the time of collision (e.g. repairs or road markings on a busy road with bollards erected to separate the traffic from the worker).

3.4.3 Terminology

In national reports or Irish work-related fatality statistics the terms 'worker' and 'non-worker' are used. During the process of data collection and analysis, two categories of non-worker fatalities emerged: a) non-workers who died in collisions where the principal other party was a worker and in which a work activity, process or vehicle was a contributory factor to the collision, and b) non-workers who died in collisions where the principal other party was a worker but there was no or insufficient evidence that a work activity, process or vehicle was a contributory factor to the collision, so the work activity was secondary.

The term '*non-worker'* (used in HSA statistics reporting) can be confusing because many of that category (not at work at the time of collision) were in fact workers. The term '*member of the public'* (used in statistics reports of the HSE in the UK) was considered, but was cumbersome in reporting and in labelling categories, and did not distinguish *'persons affected by a work-activity'* collisions from other types of collision. In previous research carried out in this area in Australia and New Zealand, the term *bystander* is used in place of '*non-worker*'. Bystander is defined in dictionaries as '*persons who are present for an event but do not take part in it'* – in this context, it is not the work activity on their part that is associated with the collision; they are bystanders to the work. For study purposes the term '*bystander'* appeared to be most suitable,

Two categories of bystander were identified. In order to distinguish between the two groups, definitions for each were devised, taking account of the classification criteria in previous research (appendix 1).

Worker fatalities: road traffic fatalities where the decedent is deemed to be working at the time of the collision.

Example: a worker (such as truck or bus driver, a farmer or a vet) who was working (in, with or without a vehicle) on the road at the time of collision.

Bystander fatalities: road traffic fatalities where the decedent is a member of the public who is not working at the time of the collision but the principal other party in the collision is working.

- **Bystander Type 1: collision is directly work-related**: the work activity or process contributes directly to the bystander's death. In essence work is a primary contributor to the collision.

  Example 1: Members of the public who, with or without a vehicle, were in a collision with a truck or bus when located within one of the vehicle driver's 'blind spots' and the collision resulted in the death of the member of the public.

  Example 2: Road users who died when a working vehicle, driving on the wrong side of the road, was involved in a head-on collision with the decedent.

- **Bystander Type 2: collision is not directly work-related**: the work activity or process does not contribute directly to the bystander's death. In essence work is secondary to the collision.

  Example 1: Members of the public who, with or without a vehicle, moved unexpectedly and/ or inexplicably (fell, staggered) into the path of a worker driving for work, and following a collision, died.

  Example 2: Road users whose vehicle was on the wrong side of the road and who died following a head-on collision with a working vehicle.

In cases where both parties were working at the time of collision and where the collision resulted in the death of one or both parties, any deaths were classified as worker deaths [36].

Bystander fatalities are not classified into any such categories in any national system, so this classification was carried out as part of the work of the study. Categorising cases as worker or bystander fatalities was straightforward. The final decision as to whether a case was classified as a Bystander Type 1 (work contributed), or Bystander Type 2 (work did not contribute) was made based on Police and coroner evidence in the narrative data. It never states in coroner files who may have been at fault; this is neither the purpose of an inquest nor the purpose of categorisation in this study. However, in W-R cases the facts of a case generally made it clear which party's activity was the primary contributor to the collision. A preliminary decision was made in the field, but every case was ultimately classified in consultation with the full study team. When data collection was complete, following consultation, and review of all cases with the HSA advisor, three cases were changed from Bystander Type 2 to Bystander Type 1. In 19 cases there was insufficient information to conclude which party's activity was the primary contributor to the collision. In these cases the Bystander Type 2 category was, in keeping with the definition, used as the default category (10%).

3.4.4 Data management and security

Data collected in the field were entered onto hard copy study documentation, and kept in the possession of fieldworkers until returned to University College Dublin (UCD). In UCD, all hard copy data sheets (district summary sheets, decision forms, CRFs) were stored in a locked filing cabinet in an office that was either manned or securely locked.

The data dictionary was used to set up variables for data entry into SPSS. All quantitative data from the CRFs were entered into IBM SPSS Statistics version 20. Qualitative data was entered into a password-protected excel spreadsheet.

All soft-copy data were stored in a password-protected shared drive to which access was available only to members of the research team. Selected individual electronic documents were also password protected, e.g. preliminary and summary results, drafts of reports, etc.

3.4.5 Data analysis

Using key variables, including day of week, date, time and location of collision, county of death, gender, age, type of vehicle, type of collision and any other available details, coroner cases identified as work-related were matched against data provided in SPSS or Excel by both the RSA (road traffic collision data from 2008 – 2011) and the HSA (work-related fatalities from 2008 – 2011). Data source concordance / agreement was assessed based on manual data matching between a) the coroner-ascertained data and road safety (RSA) data, and b) coroner-ascertained data and health and safety (HSA) data. This process was carried out by two researchers; the exercise was carried out twice, two weeks apart. No changes were made.

The extent of national underestimation of work-related fatalities in HSA data was calculated using the following formula, where expected is the number already collected.

$$\frac{Observed - Expected}{Expected} * 100$$

Work-related road traffic fatality rates presented are crude rates. They were calculated a) from a road traffic perspective, using national statistics for million registered vehicles[50] and b) from a safety and health perspective by 100,000 workers, using labour force statistics[51]. Because of seasonal variations labour force statistics are produced by quarter, so for each year the average labour force for the full year was calculated. Crude rates were not standardised because the 4-year period chosen a) was too short for trend analysis and b) fell within an intercensal period (census years 2006 and 2011), therefore c) there were negligible population shifts in this time period which would require adjustment to rates for the purposes of comparison.

Descriptive statistics were used to determine proportions and to describe:

- Collision characteristics.
- Decedent and, where relevant, other party demographic characteristics;
- Work-related factors including the driving context and behavioural factors; and

In the majority of coroner files (63%), the nationality or ethnicity of decedents was not noted. Among these, many decedent's names appeared, from a language perspective, to be of a particular nationality, e.g. Irish or European, however neither nationality nor ethnicity could be assumed based on an individual's name, and no analysis was carried for this variable. While a standard form was used to collect data, data were not present in files in a standard format, and in files where there was no Police or forensic collision report, witness depositions did not always contain full details of the driving or environmental circumstances. As a result much of the collision data were collected on the basis of whether a factor (e.g. speeding) was mentioned or not, however it could not be assumed that lack of mention meant that no one was speeding.

Analysis of some descriptive results is based on small, but national, numbers and results achieved for subgroups may be subject to random variation.

3.5 Methods: summary

This section identified the study aim and objectives, explained the study design and logistic arrangements, including approval from the Coroner Society of Ireland and ethical approval from University College Dublin. It describes the study population and provides the rationale for effectively carrying out a census and review of RTF inquests for the study period (2008 to 2011). The planning and logistics of data collection are provided, addressing case ascertainment and inclusion and exclusion criteria. Terminology emerged as an important factor in categorising cases and the concept of referring to non-workers who die in collisions as bystanders was introduced, and two categories of bystander were created: Bystander Type 1 and Bystander Type 2.

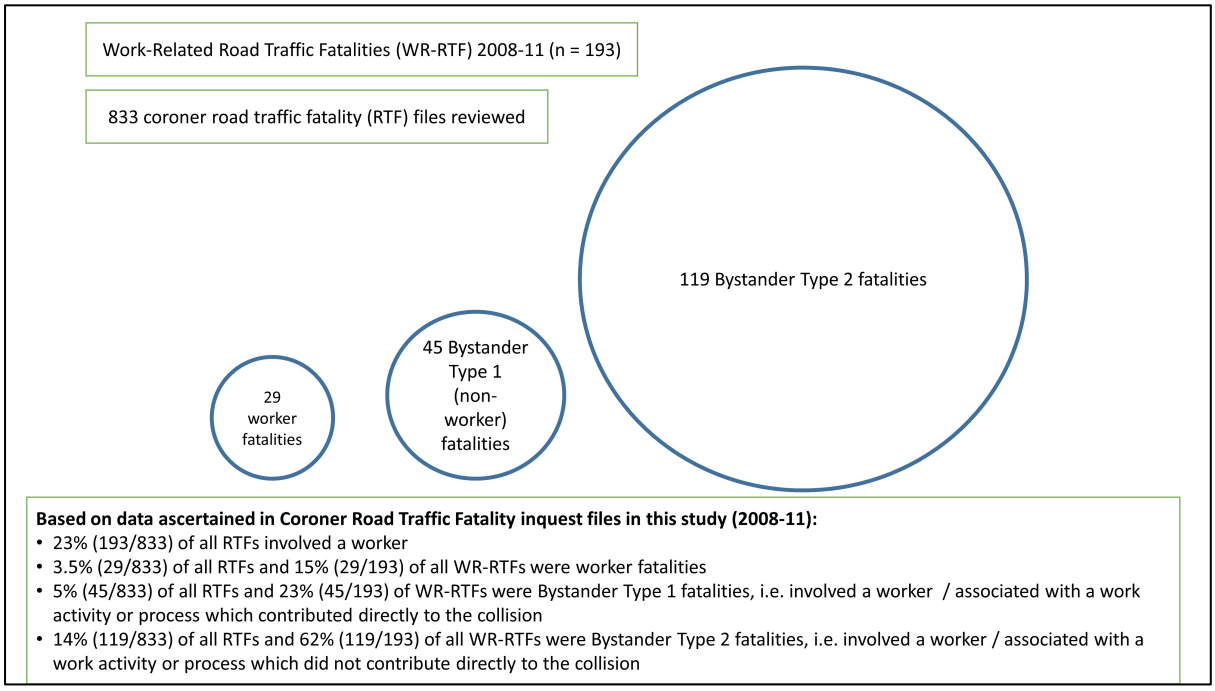
4. Findings and results: work-related road traffic fatalities in Ireland 2008-2011, overview

In this section, the key outcomes from review of coroner-identified WR-RTFs are presented. The categories of fatality are clarified and key findings are summarised. The extent of concordance between coroner data and existing HSA and RSA data is described and the extent to which WR-RTFs and work-related fatalities are being underestimated is calculated. Summary statistics providing a profile of all of the decedents of WR-RTFs are provided. A more detailed examination of each category of fatality is provided in the following sections (5 and 6).

4.1 Work-related road traffic fatalities: cases in coroner and other data sources

Within the 833 coroner case files reviewed, 193 (23%) fatalities were identified where either the decedent or the principal other party to the collision was at work, whether they were a driver, passenger or a vulnerable road user (Figure 4.1).

Figure 4. 1 Work-related road traffic fatality cases identified in Coroners



RTF = Road Traffic Fatality WR-RTF = Work-related Road Traffic Fatality

- 29 were fatalities of people who were working at the time of collision (15% of all coroner WR-RTFs, and 3.5% of all RTFs). These were *worker* deaths.

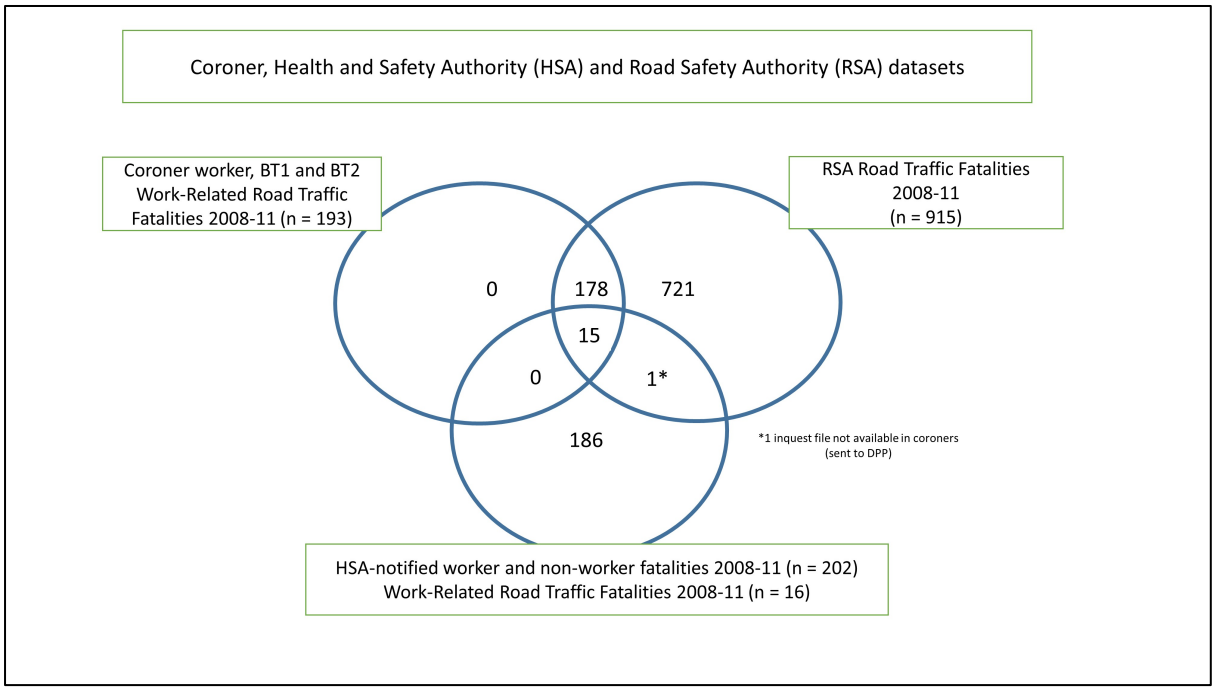
- 45 cases were Bystander Type 1 fatalities (23% of all WR-RTFs and 5% of all RTFs). Some of these cases would be notifiable to the HSA as non-worker deaths under current legislation (section 3.2.1 and appendix 1).
- 119 cases were Bystander Type 2 fatalities (62% of all WR-RTFs and 14% of all RTFs).

4.1.1 Agreement between datasets

The Road Safety Authority (RSA) recorded 915 RTFs between 2008 and 2011. With the exception of collisions overtly involving work vehicles, such as Public Service Vehicles (PSVs) (i.e. buses, taxis) and Light or Heavy Goods Vehicles (LGVs / HGVs), hereafter all referred to as trucks, it is not known how many of the fatalities were work-related.

Figure 4.2 illustrates the number of coroner-identified cases as they relate to RSA and HSA RTF cases for the study period (2008 – 2011).

Figure 4. 2 Work-related Road Traffic Fatalities: agreement between the three data sources



BT I = Bystander Type 1 BT 2 = Bystander Type 2

All 193 coroner-identified WR-RTFs were matched with cases in the RSA dataset (100% agreement). The breakdown of coroner-identified cases by category (section 4.1) is shown in table 4.1.

Table 4. 1 Work-related road traffic fatalities identified in coroner inquest files by year of death

	2008		2009		2010		2011		2008-11	
	n	%	n	%	n	%	n	%	n	%
Worker	11	13.9	7	14.0	5	16.1	6	18.2	29	15.0
Bystander Type 1	16	20.3	12	24.0	12	38.7	5	15.2	45	23.3
Bystander Type 2	52	65.8	31	62.0	14	45.2	22	66.7	119	61.7
Total	79	100	50	100	31	100	33	100	193	100

The Health and Safety Authority (HSA) was notified of 202 work-related fatalities between 2008 and 2011, of which 178 (88%) were workers and 24 were non-workers (12%).[49] All '*workers*' in the HSA dataset were engaged in a work activity at the time of the incident. All '*non-workers*' died following

incidents where the principal other party (e.g. in a road traffic collision, the driver of the other vehicle) was a worker and in which a work activity or process was a contributory factor to the incident.

Table 4. 2 Work-related fatalities (all) notified to the HSA by year of death

	2008		2009		2010		2011		2008-11	
	n	%	n	%	n	%	n	%	n	%
Worker	51	89.5	36	83.7	42	82.5	49	90.7	178	88.1
Non-Worker	6	10.5	7	16.3	6	12.5	5	9.3	24	11.8
Total	57	100	43	100	48	100	54	100	202	100

Only 15 the coroner-identified WR-RTFs (n = 193) were present in the HSA dataset. One additional case in the HSA data did not have a coroner inquest file, due to an incomplete inquest. Within the 15 coroner-identified cases found in the HSA dataset, 11 were worker deaths (73%) and 4 were non-worker deaths (27%).

Table 4. 3 Work-related road traffic fatalities notified to the HSA by year of death

	2008		2009		2010		2011		2008-11	
	n	%	n	%	n	%	n	%	n	%
Worker	3*	60.0	3	100	3	60.0	3	100	12	75.0
Non-Worker	2	40.0	0	0	2	40.0	0	0	4	25.0
Total	5	100	3	100	5	100	3	100	16	100

** One 2008 inquest file was not available in coroner files*

The HSA data accident notification regulations currently do not require reporting of all 'non-worker' road traffic deaths, and confines the notification requirement of non-worker road traffic deaths to the circumstances described in section 3.2.1 and appendix 1. Pending legislation may change that requirement to include most of the categories discussed below, however in the meantime, none of the cases categorised as *Bystander Type 2,* and only some of the *Bystander Type 1* cases, could be expected in the HSA dataset. The HSA is aware that the number notified does not reflect the full extent of the issue and one of the objectives of this study was to determine the extent of underestimation.

4.2 Work-related road traffic fatalities: extent of underestimation

Coroner data identified 193 WR-RTFs comprising 29 workers, 45 Bystander Type 1 cases and 119 Bystander Type 2 cases. In one case in the HSA dataset an inquest had not yet taken place as the file was with the DPP.

The extent of underestimation is calculated below initially for worker and Bystander Type 1 groups individually and combined in order to collectively capture cases where a work activity or process contributed to the collision.

It is also calculated based on worker, Bystander Type 1 and Bystander Type 2 fatalities combined, in order to get a sense of the underestimation should every road traffic fatality involving a worker as a principal party be included and to consider the impact on work. Figure 4.3 shows the overlap in cases between HSA and coroner data.

4.2.1 Worker and Bystander Type 1 (non-worker) road traffic fatalities

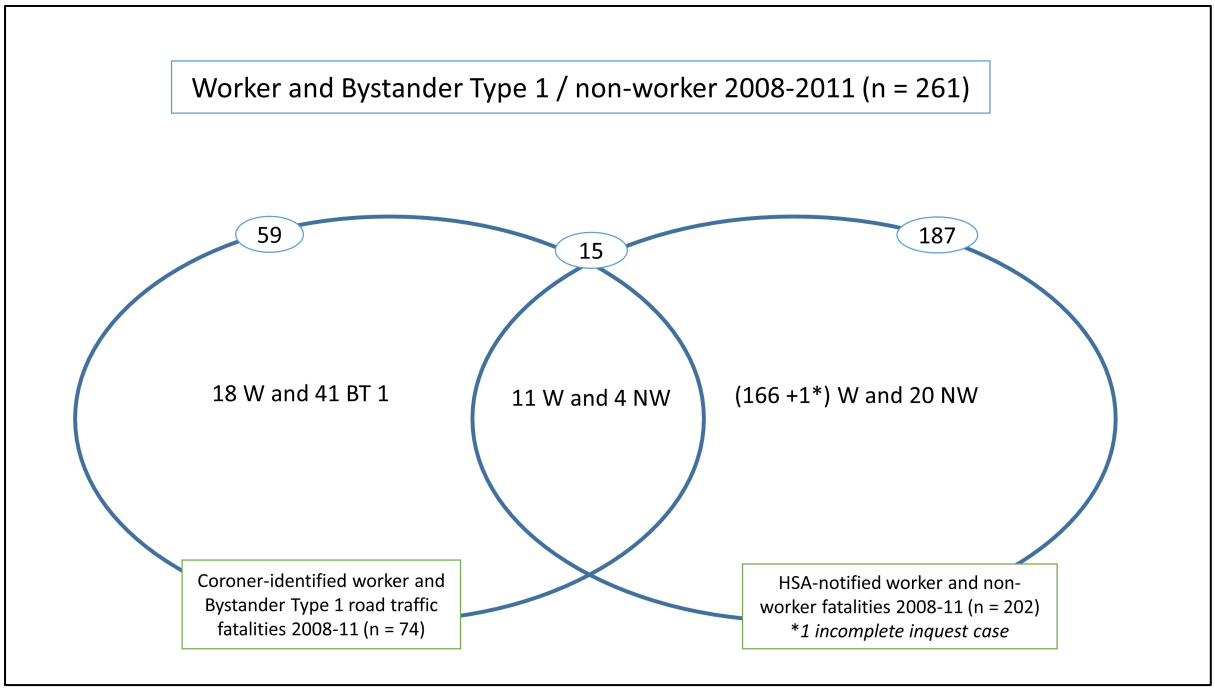
The HSA was notified of 12 of the coroner-identified 29 'worker' WR-RTFs (41%); the corollary of this is that it was not aware of 59%. The degree of underestimation for workers, expressed in relative terms (using the formula from page 32: ([29-12]/12)*100), was 142% (or WR-RTFs in which work

contributed to the collision are under-estimated by a factor of 1.4). This means, when taking account of worker and Bystander Type 1 fatalities, that there are nearly one and a half times as many worker RTFs than were notified.

The HSA was notified of 4 of 45 coroner-identified 'non-worker / Bystander Type 1' deaths (9%); the corollary of this is that it was not aware of 91%. If all non-worker / Bystander Type 1 RTFs were notifiable, then the degree of underestimation for non-workers / Bystander Type 1, expressed in relative terms, was 1025% (or WR-RTFs in which work contributed to the collision are under-estimated by a factor of 10). This means, when taking account of worker and Bystander Type 1 fatalities, that there are nearly 10 times as many non-worker / Bystander Type 1 RTFs than were notified.

Putting these together, and again taking into account that all non-worker / Bystander Type 1 fatalities should be notified, the HSA was notified of 16 of 75 (75 coroner, plus one not in coroners) worker and non-worker WR-RTFs (21%); the corollary of this is that it was not aware of 79%. The degree of underestimation for workers and Bystander Type 1, expressed in relative terms, was 368% (or WR-RTFs in which work contributed to the collision are under-estimated by a factor of 3.7). This means, when taking account of worker and Bystander Type 1 fatalities, that there are nearly four times as many WR-RTFs than were notified.

Figure 4.3 Work-related fatalities: coroner-identified and HSA-notified worker and non-worker / Bystander Type 1 cases



W = worker NW = Non-worker BT 1 = Bystander Type 1

4.2.2 Worker, Bystander Type 1 and Bystander Type 2 road traffic fatalities

If one was to ignore notification legislation, simply to estimate the size of the problem, we find that the HSA was notified of 16 of 194 worker, Bystander Type 1 and Bystander Type 2 WR-RTFs (8%); the corollary of this is that it was not aware of 92%. The degree of underestimation for workers, Bystander Type 1 and Bystander Type 2, expressed in relative terms, was 1113% (or WR-RTFs in general were under-estimated by a factor of 11). This means, when taking account of worker, Bystander Type 1 and Bystander Type 2 fatalities, that there are 11 times as many WR-RTFs than were previously known.

4.3 All work-related fatalities: extent of underestimation

The above findings have implications for the national overall work-related fatality toll. The HSA was notified of 202 work-related fatalities. Adding coroner-identified WR-RTFs for both worker and Bystander Type 1 cases increases the total to 261, and including Bystander Type 2 cases further increases the work-related fatality total to 380. While in this section, the extent of underestimation of all work-related fatalities is calculated, readers should note that the following estimates do not take account of underestimation of work-related fatalities from any other cause.

4.3.1 All worker and non-worker (Bystander Type 1) fatalities

The HSA was notified of 202 of 261 worker and non-worker (Bystander Type 1) fatalities (77%); the corollary of this is that it was not aware of 23%. The degree of underestimation of work-related fatalities for workers and Bystander Type 1, expressed in relative terms, was 29% (or work-related fatalities in which work contributed to the incident are under-estimated by a factor of 0.3). This means, when taking account of worker and Bystander Type 1 fatalities, that there were a third more work-related fatalities than were previously known.

4.3.2 All worker, Bystander Type 1 and Bystander Type 2 fatalities

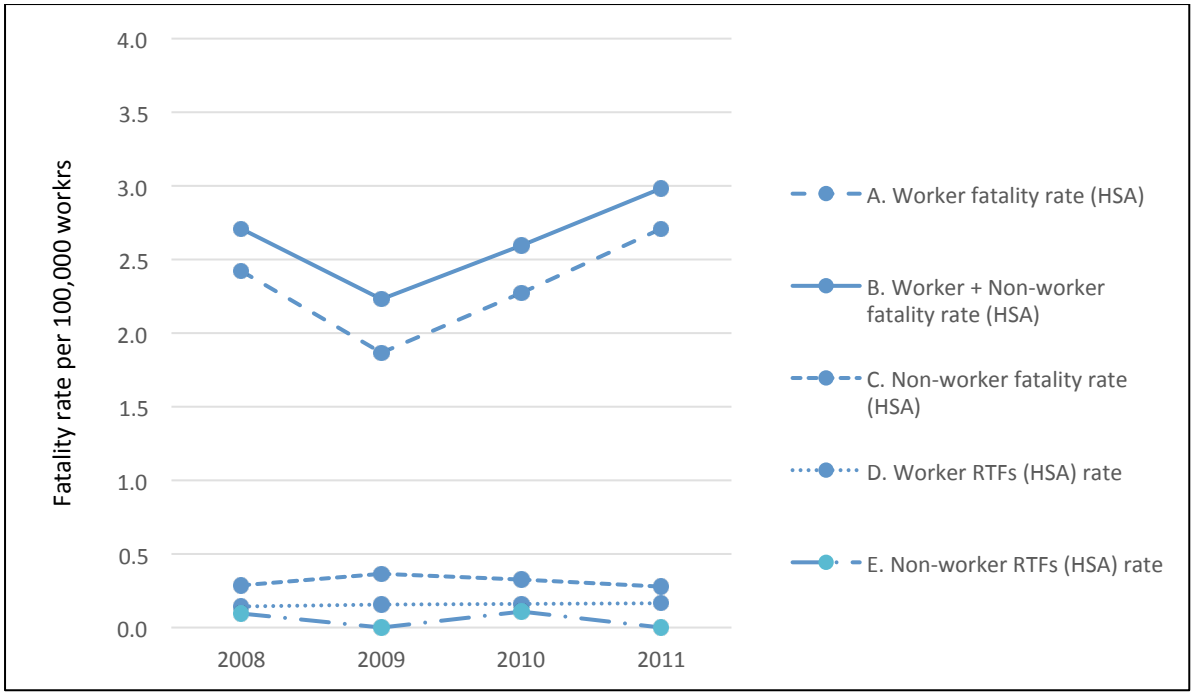
The HSA was notified of 202 of 380 worker and non-worker (Bystander Type 1) and Bystander Type 2 fatalities (53%); the corollary of this is that 47% were known. The degree of underestimation for workers, Bystander Type 1 and Bystander Type 2, expressed in relative terms, was 88% (or work-related fatalities in which work was involved in a manner that directly contributed or did not contribute directly to the incident were under-reported to the HSA by a factor of 0.9). This means, when taking account of worker, Bystander Type 1 and Bystander Type 2 fatalities, that there are nearly twice as many work-related fatalities than were previously known.

4.4 Work-related road traffic fatalities: rates

Appendix 10 provides the WR-RTF rates in numeric format. It places the coroner-ascertained WR-RTF data into the context of work, and shows the distribution of crude fatality rates for all possible categories per 100,000 workers over the period of the study, as well as illustrating the magnitude of the problem for the categories relative to one another.

The graphs that follow examine parts of the overall picture separately.

Figure 4. 4 Work-related fatalities: HSA notified worker and non-worker rates per 100,000 workers

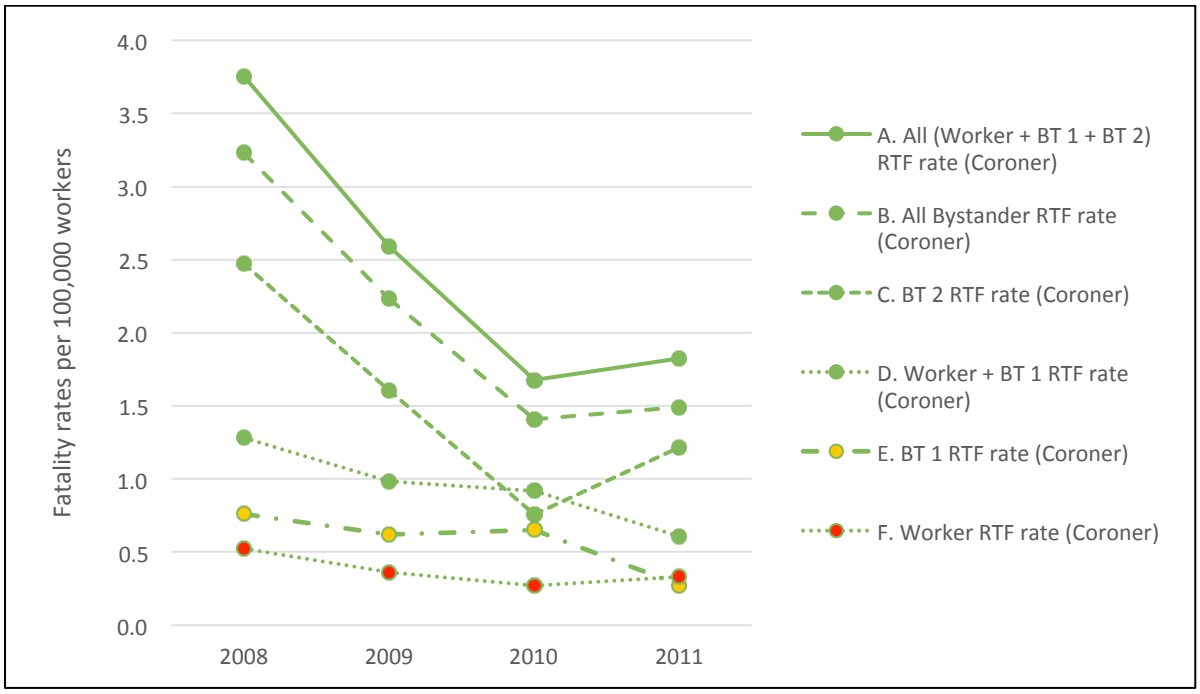


RTF = Road Traffic Fatality

The rates per 100,000 workers for HSA-ascertained worker and non-worker fatalities and the rates for the work-related road-traffic fatality subset are shown in Figure 4.4. While the overall worker fatality rates rise between 2009 and 2011 (A and B), the road traffic fatality rates pattern is flatter (D and E).

Coroner-ascertained WR-RTF rates per 100,000 workers influenced by the Bystander Type 2 group (A, B, C in Figure 4.5) show a sharp downwards pattern from 2008 to 2010. The rates for coroner-ascertained worker and Bystander Type 1 RTFs (D, E and F) follow a flatter downwards pattern from 2008 to 2010, more similar to that of the HSA fatality rates.

Figure 4. 5 Work-related fatalities: Coroner-ascertained worker and bystander RTF rates per 100,000 workers

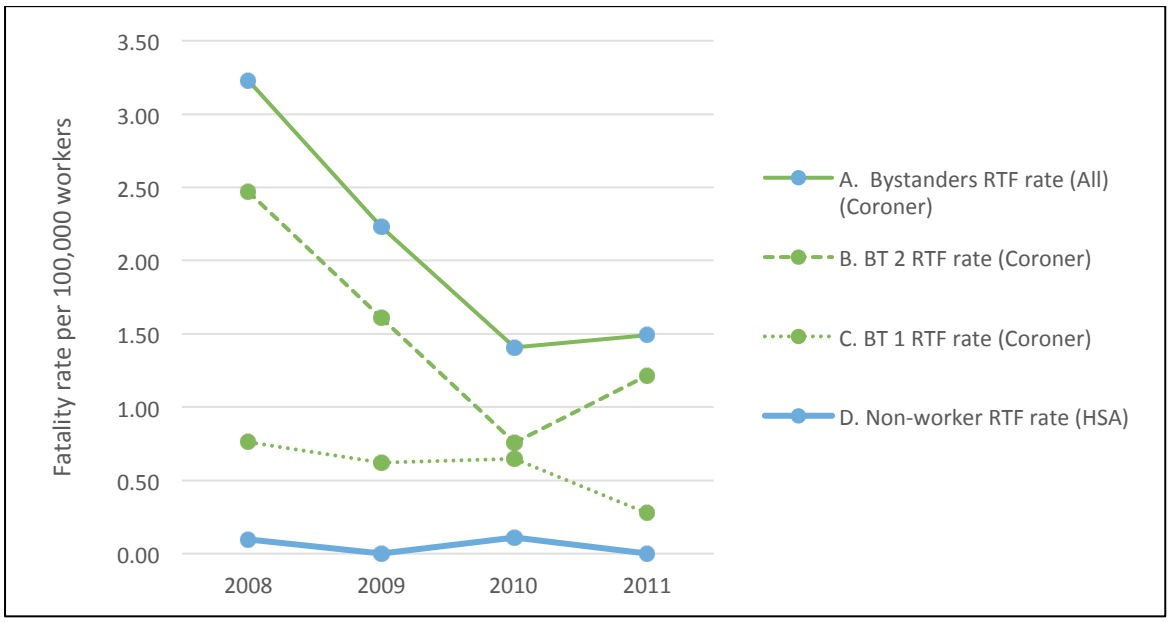


BT 1 = Bystander Type 1 BT 2 = Bystander Type 2

Figure 4.6 presents rates for road traffic fatalities for all non-workers / bystanders using both coroner-ascertained data (A, B and C) and HSA-notified non-worker fatalities. Note that the HSA term '*non-worker'* limits reporting of WR-RTFs to persons not at work who die following a road traffic collision involving a worker under a limited set of circumstances (section 3.2.1). 'Non-worker' notification is narrower than coroner-ascertained Bystander Type 1 fatalities, which ascertains deaths of persons not at work who died in a RTF where the work activity or process of the other party contributed to the collision.

The Bystander Type 2 category used in this study includes all circumstances in which persons not at work die following a road traffic collision in which the other party was working, even though work was not considered a contributory factor to the collision. Bystander Type 2 fatalities are not currently, and are possibly unlikely ever to be, notifiable to the HSA. Figure 4.6 illustrates the impact of work on road-traffic fatalities and the impact of road-traffic fatalities on work, by showing the rates for each of the non-notified categories individually and collectively relative to the non-worker RTF fatalities notified to the HSA.

Figure 4. 6 Work-related fatalities: non-worker / bystander rates per 100,000 workers

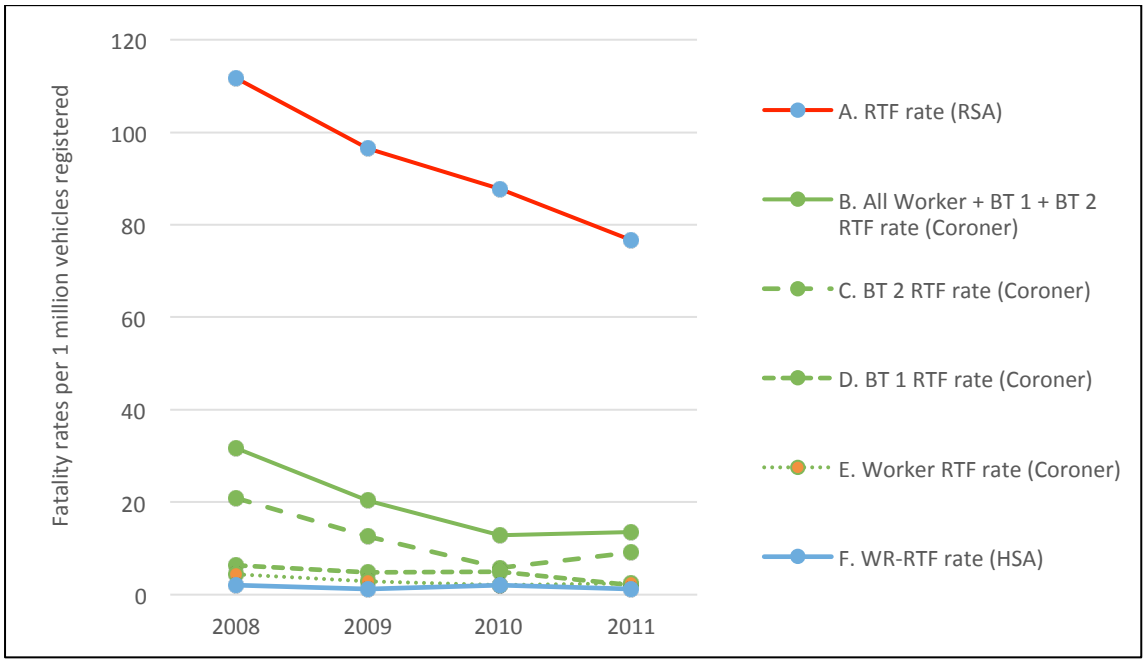


BT 1 = Bystander Type 1, BT 2 = Bystander Type 2, RTF = Road Traffic Fatality

In Figure 4.7, rates are put into the context of RTFs using fatality rate per million vehicles registered. Appendix 11 provides relevant WR-RTF rates per million vehicles registered in numeric format. The figure below illustrates the WR-RTFs rates per million vehicles registered for the different categories

of coroner-ascertained WR-RTFs (B, C, D and E) relative to the HSA-notified WR-RTFs for worker and non-worker combined (F) and to the national RTF rate (A). Again, the impact of work on the road traffic fatality toll is evident.

Figure 4. 7 National RTF, coroner WR-RTF and HSA WR-RTF rates per million vehicles registered



BT 1 = Bystander Type 1, BT 2 = Bystander Type 2, RTF = Road Traffic Fatality

4.5 Work-related road traffic fatalities: a profile of cases

In this section results are presented to provide a profile of collisions and victims of WR-RTFs in the study period regardless of the role of the decedent in the collision. Sections 5 and 6 profile workers and bystanders separately.

4.5.1 Collisions (n = 175)

The 193 WR-RTFs, comprising worker and bystander fatalities, occurred following 175 collisions, which were predominantly multiple vehicle collisions (66%). There were 15 multiple fatality collisions; one with four fatalities, one with three and the remainder with two fatalities, totalling 33 deaths.

The months in which most collisions took place were January and February (both 10.3%), followed by July (9.7%). The most common day of the week was Thursday (22%), followed by Monday (19%) and Friday (15%).

The vast majority of collisions took place on two lane roads (national, regional or local) (96%); 2% took place on motorways.

Weather conditions at the time of the collision were described as dry in half (50%) of all collisions; otherwise conditions were described as wet in 30%, frosty or icy in 5%, 2% in fog and 1% in snow.

4.5.2 Fatalities (n = 193)

The vast majority of decedents (91%) died on the day of the collision.

Decedents were predominantly male (78%). More than a third were married / co-habiting (36%), but most were single, separated or widowed (64%), perhaps reflecting the age profile. The mean age was 41 years (SD 23), with a range of 0 to 91. More than a quarter of decedents were vulnerable road users from an age perspective, i.e. children aged 15 or under, or else elderly aged 66 years or over. Six percent were professional drivers by occupation (truck or PSV) and more than half were otherwise employed. From a road-user perspective, nearly a third of decedents were vulnerable road users, i.e. pedestrians or cyclists (32%); 37% were the drivers of cars, jeeps or vans, 17% were passengers in vehicles, and professional PSV or truck drivers accounted for 6%.

A purpose of journey was ascertained for 144 decedents (74%). Among these, 20% were at work, either driving for a work purpose or working on the road (14% of all decedents); 10% were commuting to or from work (8% of all decedents); and 62% were travelling for social reasons (46% of all).

Toxicology reports showed that nearly a quarter (24%) of those who died had a positive alcohol result, with Blood Alcohol Concentrations (BAC) ranging from 10mg/100ml to 465mg/100ml; overall 22% of decedents tested positive for drugs or medications (5% overall were positive for recreational drugs, e.g. cannabis or heroin, and 16% of all decedents tested positive for prescription or over the counter drugs; some were resuscitation drugs).

In 5% of all collisions, there was no '*other party'*, so for example a decedent's vehicle may have lost control and collided with a tree. As well as those who died, note was taken of the '*other party'* in all relevant cases. In cases where a worker died, the '*other party'* was a member of the public, who may or may not have been working at the time. In cases where bystanders died (bystander types 1 and 2 together comprising 85% of decedents) the '*other party'* was always a worker, otherwise the case could not have been considered work-related. Overall, truck drivers comprised half (50%) and PSV (bus/taxi) drivers 18% of '*other parties'*. No worker '*other party'* who was tested for alcohol or drugs (either recreational or therapeutic) tested positive.

The most common verdicts were accidental death / road traffic accident (84%), with 8% misadventure verdicts, which means an unintended consequence of a voluntary act.[52]

4.6 Work-related road traffic fatalities: summary

This section identified that coroner data and RSA data were matching, but that, due to current legislative constraints on notification, coroner and HSA bystander fatality data cannot be expected to match. Notwithstanding the constraints, while worker deaths are legally notifiable, only 12 of the 29 worker deaths identified in coroner data had been notified to the HSA (41%).

WR-RTFs were found to be underestimated as follows: worker deaths by a factor of 1.4, worker and Bystander Type 1 fatalities by a factor of 10, and all WR-RTFs by a factor of 3.7. This had a knock-on effect to the national work-related fatality rate, which could be underestimated by a factor of 0.3 when counting worker and non-worker / Bystander Type 1 fatalities, and underestimated by a factor of 0.9 if all work-related road traffic fatalities are taken into account; this is effectively a doubling of currently observed work-related fatalities.

Viewing crude fatality rates for all categories per 100,000 workers and per 100,000 registered vehicles shows the distribution over time and illustrates the categories relative to national rates, revealing WR-RTFs to comprise a substantial minority of all RTFs.

Whether involved in collisions as decedents or as the '*other party'* to a collision, the involvement of work activity in RTFs is substantial. While this section provides a brief profile of decedents as a group, and a briefer profile of the other parties to collisions (i.e. the working party), these preliminary results for 175 collisions and 193 fatalities make it clear that the sub-categories of worker, Bystander

Type 1 and Bystander Type 2 need to be examined independently of one another. The next three sections examine each category of decedent in detail.

5. Findings and results: worker fatalities

Twenty-nine of the RTFs identified in coroner files related to persons who were engaged in a work activity when the collision occurred. This section provides a descriptive profile of worker road traffic fatalities (RTFs) in Ireland in the period 2008 to 2011. It should be noted that while these are national results, because the numbers are small, while of important practical relevance, for statistical purposes random variation for collision results, such as day of week, etc. cannot be out-ruled.

Findings associated with workers who died are presented by a) collision characteristics and b) fatality characteristics. Unless otherwise stated, results are provided as a proportion of all workers (n = 29), in order to include the cases where information, for certain variables, was either not collected through the coroner process or not available.

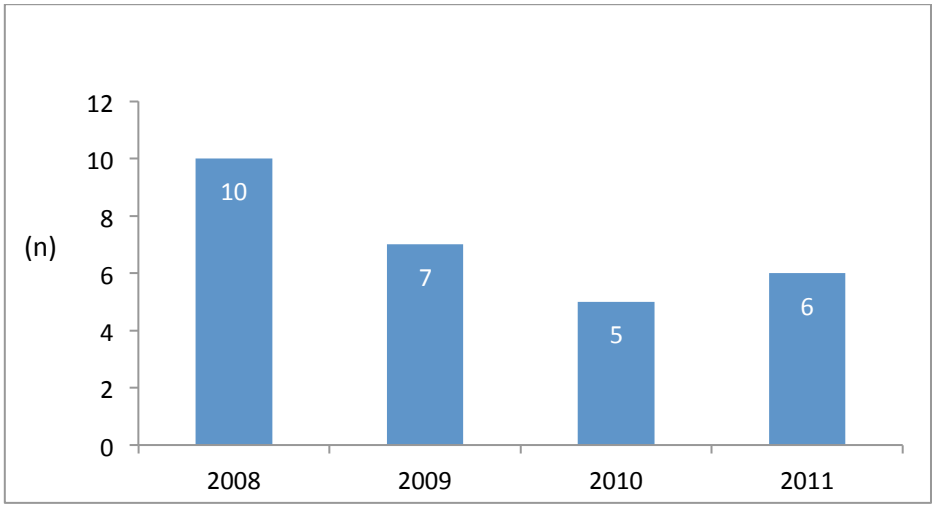
5.1 Worker fatalities: collision characteristics

The 29 worker fatalities occurred following 28 collisions; in one collision, two occupants in the same vehicle died and both were workers.

5.1.1 Worker fatalities: collision temporal factors

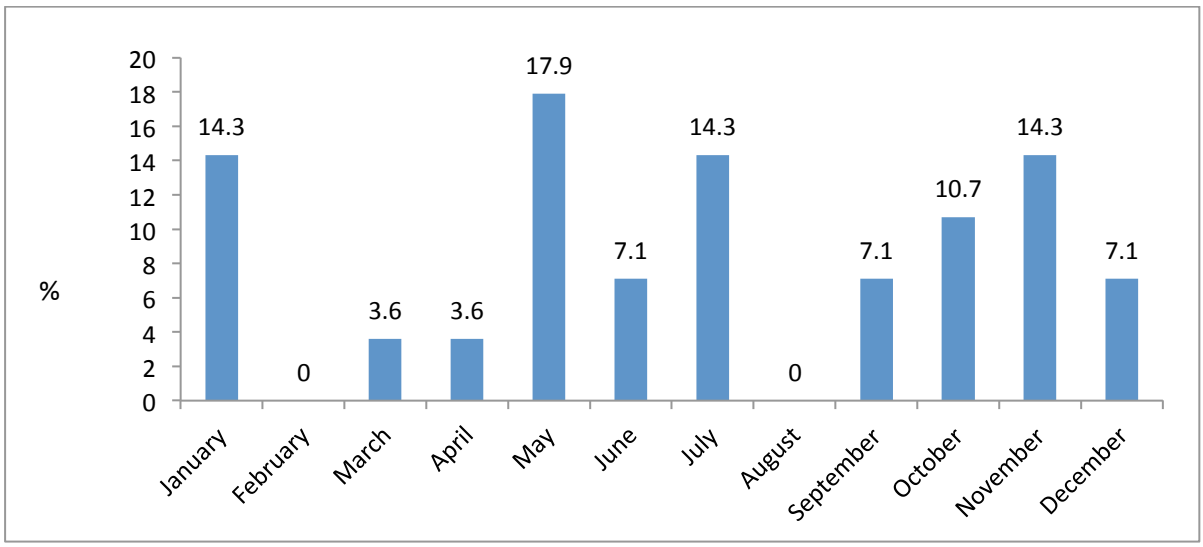
Temporal factors show the distribution of the 28 worker fatality collisions, by year, month and day of the week (Figures 5.1, 5.2 and 5.3). The highest number of worker fatality collisions took place in 2008; the distribution by year declines between 2008 and 2010 and rises in 2011, a pattern more reflective of national work-related fatalities than RTFs for the same period, however the numbers are small.

Figure 5. 1 Worker fatalities: collision temporal factors: no. of collisions per year



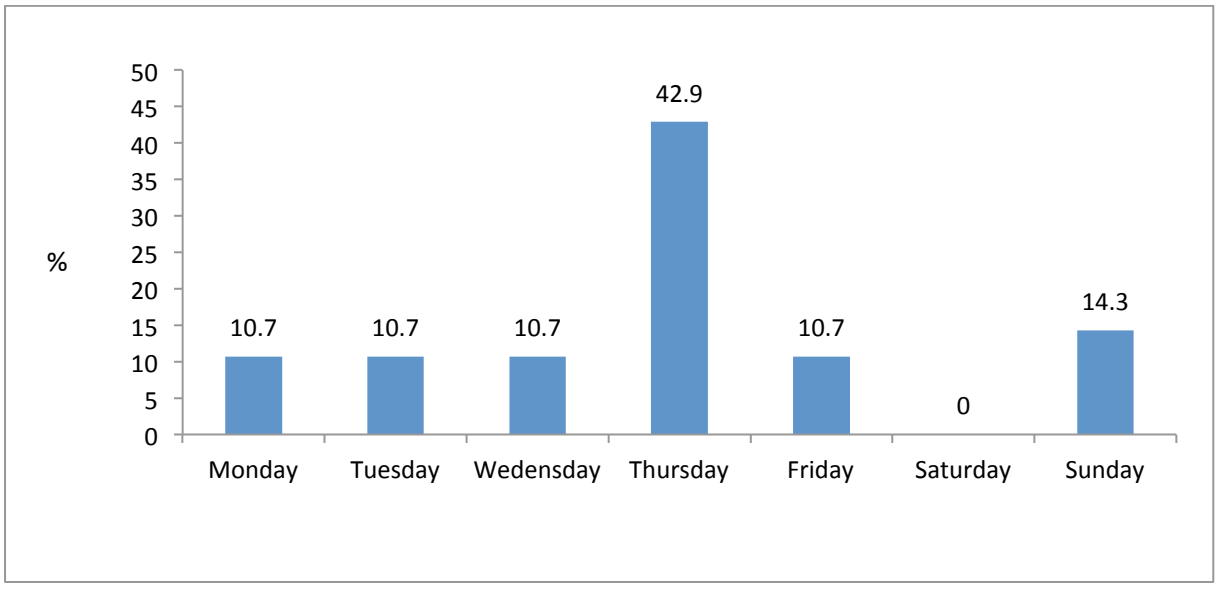
The largest number of collisions occurred in May, with five collisions in which workers died (18%). There were four worker fatality collisions on the road in each of the winter months of January and November with a similar peak in July (Figure 5.2).

Figure 5. 2 Worker fatalities: collision temporal factors: proportion of collisions per month



Thursday was by far the commonest day of collision (43%), with no fatal collisions taking place on Saturdays.

Figure 5. 3 Worker fatalities: collision temporal factors: proportion of collisions by day of week



The vast majority of worker collisions (79%) took place during 'working day' hours, 06:00 to 18:00, with the highest proportion taking place between 10:00 and 12:00 noon (18%) (Figure 5.4). If collision times were evenly distributed throughout the 24 hour clock, then each 2-hour period would be expected to have 8.3% of collisions. Colour coding in the table overleaf is presented as Green < 8.3%, Amber 8.4 – 12.4% (up to one and a half times expected distribution) and Red = ≥ 12.5% (more than one and a half times the expected distribution).

Figure 5. 4 Worker fatalities: collision temporal factors: proportion of collisions by time of day

Time of day	Fatal Worker Collisions (%)
00:01 - 02:00	7.1
02:01 - 04:00	0
04:01 - 06:00	7.1
06:01 - 08:00	14.3
08:01 - 10:00	10.7
10:01 - 12:00	17.9
12:01 - 14:00	10.7
14:01 - 16:00	10.7
16:01 -18:00	14.3
18:01 - 20:00	7.1
20:01 - 22:00	0.0
22:01 - 00.00	0

Green = < 8.3%, Amber = 8.4 – 12.4%, Red = ≥ 12.5%

5.1.2 Worker fatalities: collision vehicle and road factors

Nearly all workers, who died in this four-year time period, died on the day of collision (90%). The majority (57%) of worker fatality collisions involved multiple vehicles, and 88% (14/16) of multiple vehicle collisions involved two vehicles. Single vehicle collisions comprised 43% of worker fatalities. These included three collisions where the worker who died on the road was not in a motor vehicle; in all three cases the decedent was in a collision with a vehicle in which the driver was also at work. Within the remaining 25 worker fatality collisions (where it was a vehicle occupant that died) the majority (n = 22, 88%) were travelling alone and therefore the worker who died in the collision was the vehicle driver. Four vehicles had passengers at the time of the collision, and in two of those collisions the worker who died was a passenger.

Table 5. 1 Worker fatalities: collision characteristics 1

		n	%
Collision type	Single vehicle	12	42.9
(n = 28)	Multiple vehicle	16	57.1
No. of vehicles involved	1 vehicle	12	42.9
(n = 28)	2 vehicles	14	50.0
	3 vehicles	1	3.6
	4 vehicles	1	3.6
	Total	28	100
Passengers in worker's vehicle at time of collision (n=25) (3 pedestrian/cyclists)	0 passengers	22	88.0
	1 passenger	2	8.0
	2 passengers	0	0
	3 passengers	1	4.0
	> 3 passengers	0	0
	Total	25	100

Table 5. 2 Worker fatalities: collision characteristics 2

		n	%
Decedent's role at time of collision (n = 29)	Driver	24	82.8
	Passenger	2	6.9
	Cyclist	1	3.4
	At work on the road	2	6.9
Type of road on which collision occurred (n = 28)	Road	26	92.9
	Motorway	1	3.6
	Roundabout	1	3.6
Weather conditions recorded (n = 28)	Wet	12	42.9
	Dry	7	25.0
	High winds	2	7.1
	Fog/mist	1	3.6
	Frost/ice	1	3.6

The majority of worker collisions (93%) took place on roads (i.e. local, national or regional routes) as opposed to motorways or roundabouts; all were on two-lane roads.

Weather conditions were noted in 22 collisions. Wet conditions were mentioned most frequently (43%), followed by dry conditions (25%). In individual cases the evidence included statements such as '*bright wet road surface'* (n = 1), '*roads wet and slippy'* (n = 1), and '*strong sun*' (n = 1). Winter conditions, such as ice, snow or fog/mist were rarely noted, and when noted it was apparent that they were a factor in the collision.

In half of worker collisions (14/28) another worker was involved in the collision. The '*other party'* to the collision (i.e. the driver of the vehicle in the case of road worker deaths, or the driver of the other vehicle in the case of multiple vehicle collisions) was also a worker.

- The '*other party'* vehicle involved in the 17 multiple vehicle collisions included 8 trucks and a farm vehicle, whose drivers were working at the time, and three vans (of which 2 were recorded as working at the time).
- In the single multiple vehicle collision that involved four vehicles and resulted in the death of one worker driver, all four vehicles were working vehicles.
- In the single collision that involved two worker fatalities in the same vehicle, the driver of the other vehicle involved in the collision was also at work.
- None of the 'other party' workers died in the relevant collisions, and it was not necessarily noted whether they were injured or not.

Four of the worker collisions involved multiple fatalities and the worker was not the only party who died.

5.2 Worker fatalities: fatality characteristics

Individual characteristics provide a profile of those who died on the road whose reason for being there was in the course of their work.

5.2.1 Worker fatalities: demographic characteristics

Table 5.3 shows the demographic characteristics of workers who died. The vast majority were male (97%). The mean age was 41 years (SD 13), median 37 years, with a range from 22 to 73 years. The

majority (97%) were within what may be considered the 'normal' working age (16 – 64 years). The highest risk group was aged 36 – 45 years (38%). There was no record of any medical incident arising at the time of collision for any of the workers who died. From a social perspective, the majority (59%) of workers who died were either married or cohabiting.

Table 5. 3 Worker fatalities: gender, age and marital status

		n	%
Gender (n = 29)	Male	28	96.6
	Female	1	3.4
Age ranges (n = 29)	0-10	0	0
	11-15	0	0
	16-25	3	10.3
	26-35	6	20.7
	36-45	11	37.9
	46-55	4	13.8
	56-65	4	13.8
	≥ 66	1	3.4
	Total	29	100
Marital status	Married/cohabiting	17	58.6
(n = 29)	Single	8	27.6
	Not recorded	4	13.8

5.2.2 Worker fatalities: driving context

From the perspective of deceased workers as road users, the majority (83%) were drivers at the time of collision, driving trucks (28%) vans (28%) or another type of vehicle (car, tractor, PSVs etc.). The remaining workers who died were passengers, road workers or cyclists.

Table 5. 4 Worker fatalities: driving context

		n	%
Road user type (n = 29)	Driver van	8	27.6
	Driver truck	8	27.6
	Driver car or jeep	3	10.3
	Driver other (2 tractors and plant)	3	10.3
	Driver PSV	2	6.9
	Pedestrian	2	6.9
	Passenger	2	6.9
	Cyclist	1	3.4

5.2.3 Worker fatalities: occupational context

More than a third were professional (truck / PSV) drivers (34%), and the remainder were in roles where driving would be part of, but ancillary to, their job; i.e. they would drive as part of their job, but they did not drive for a living. The purpose of journey for all worker decedents was for work or working on or near a road.

Table 5. 5 Worker fatalities: job characteristics

		n	%
Occupation (n = 29)	Truck driver	8	27.6
	Skilled trades	4	13.8
	Farmer	4	13.8
	Postman	3	10.4
	Van driver	3	10.3
	Other employed	3	10.4
	Emergency services	2	6.9
	PSV driver	2	6.8

5.2.4 Worker fatalities: behavioural factors

In most collisions (75%) all parties to the collision were driving on their correct side of the road at the time of collision, however in 14% of collisions in which workers died, the worker's vehicle was on the wrong side of the road, either in an overtaking manoeuvre or through loss of control of the vehicle (one was a single vehicle collision). The principal other vehicle involved in the collision was on the wrong side of the road (for similar reasons) in 7% of cases; in two of these cases criminal proceedings were taken against the *other party*.

Four workers who died tested positive for alcohol at post-mortem (14%), however, none were over the legal limit for that year. In three worker fatality collisions (10%), the *other party* to the collision tested positive for alcohol (one was 3 times over the limit and for the other two the result was simply provided as positive).

Five workers who died (17%) tested positive for either prescription medications or over the counter drugs; one tested positive for cannabis (a driver). Driving with the presence of cannabis in Ireland is not illegal unless it impairs driving, however legislation to change this is pending. None of the '*other parties'* involved in worker fatality collisions tested positive for therapeutic or recreational drugs.

Table 5. 6 Worker fatalities: behavioural factors

		n	%
Side of road on which vehicle was being driven (n = 28 collisions)	Worker on wrong side of road	4	14.3
	Other party on wrong side of road	2	7.1
	Correct side of road	22	75.0
Drug and alcohol testing (n = 29)	Alcohol test positive for worker	4	13.8
	Alcohol positive for other party	3	10.3
	Drug result positive for worker	5	17.2
	Recreational drug - worker	1	3.4
	Prescription or OTC drug - worker	4	13.8

While use of safety or protective equipment was noted when it was mentioned in statements (e.g. use of seat belts or helmets) in most cases such use was not mentioned at all; however, absence of information is likely to indicate that the worker was using the protection, as non-use would be more noteworthy. For example, seatbelt wearing was noted for the driver in seven worker deaths, but non-wearing of seat belts was not mentioned in any cases, suggesting that non-wearing of seat-belts was

not a factor in these collisions. However, in one case where seatbelt is not mentioned, the driver was actually ejected from the vehicle, which suggests that a seatbelt was not worn or perhaps not properly worn. There was no mention of the use of high visibility clothing for the road workers. It was mentioned in one deposition that the cyclist was not wearing a helmet.

Similarly, note was made in eight worker deaths that the deceased worker had a full driving licence. It is possible that all relevant drivers had correct licences in place if no note was made of it or it may have been that having a licence was a moot point for decedents.

5.2.5 Worker fatalities: work factors

For a very small number of workers, work factors were recorded. It was found that very few work details were available for workers who died, and this may have been because they were deceased, and the work component was not uppermost in people's minds. Witness depositions tended to focus on when the decedent was last seen or why they were travelling, but mostly did not contain detail on work factors. In the very few files which did, mention was made of unfamiliarity with the road (n = 2), unfamiliarity with the vehicle (n = 1) and work vehicle factors (n = 1), a defective part.

Tasks being carried out at the time of worker fatality collisions included expected duties, such as transporting a load or transporting passengers or a truck driver checking a load. However, with the exception of a single incident of a worker travelling in a circumstance that appeared to be occasional rather than regular, remaining decedents were all carrying out work where driving is a necessary part of the job: emergency services work, making deliveries, travelling between jobs (skilled trades), in a vehicle carrying out road maintenance work, or driving a tractor or plant on the road.

Individual examples where work factors were overtly mentioned included:

- A worker driver who died in a single vehicle collision who had phoned a co-worker 15 minutes before the collision to say he was running late, and his wife testified that he had been working long hours and was under an enormous amount of pressure at work.
- A worker driver, observed to be speeding, who lost control on a bend in a single vehicle collision; there was an unfinished text found on the mobile phone.
- Single vehicle collisions included a small number of individual cases in which the worker who died was noted to have been rushing, driving very fast or speeding - either above the speed limit, or too fast for the conditions; lost control of the vehicle due to ice or in foggy conditions, or for no known reason; texting while driving, or noted to be a new driver.
- On the other hand some depositions indicated factors over which the worker would have had limited control, such as colliding with a vehicle that was driving dangerously, e.g. *other party* on the wrong side of the road or a vehicle that pulled out in front of the working vehicle from a side road without any warning.

5.2.6 Worker fatalities: coroner verdicts

The coroner verdict in most worker fatalities was either a) accidental death (52%) or b) road traffic accident (38%); 7% had a verdict of misadventure – misadventure is defined in Ireland as the unintended outcome of an intended action.[52]

Table 5. 7 Worker fatalities: coroner verdict

		n	%
Coroner verdict	Accidental death	15	51.7
	Road traffic accident	11	37.9
	Road traffic collision	1	3.4
	Misadventure	2	6.9
	Total	29	100

5.3 Worker fatalities: types of fatality

An attempt was made to categorise 'types of collision' which might help to prioritise areas for prevention. The following were the main types of collision identified for the 29 worker fatalities, and the extent of involvement of workers as the *other party* in collisions is also noted:

- In eleven fatalities in which workers died (38%), the worker lost control of their vehicle. Nine of these cases were single vehicle collisions and no one else was injured; in the other two cases the *other party* to the collision was at work at the time. Factors that were raised in depositions included icy conditions (1), driving too fast (3), driving around a bend (3), driver new to the company (1), and unfinished text on phone (1). No criminal proceedings arose out of any of these cases for the *other party* to the collision, and clearly none arose for the decedent.
- In three fatalities (10%), the worker's vehicle was on the wrong side of the road when the collision occurred. One of these was a single vehicle collision; in the other two, the *other party* to the collision was working at the time.
- In two fatalities (7%), the worker's vehicle stopped or braked suddenly and the *other party* could not avoid colliding with the worker's vehicle.
- In one fatality, the worker failed to stop at a junction, and in another a defective work vehicle was identified. In both of these cases, the *other party* to the collision was at work at the time.

- In three fatalities (10%) the worker was working on the road when they were struck by a vehicle driven by the *other party*. In two of the cases criminal proceedings were taken against the *other party* or their employer. In all three cases the *other party* to the collision was working at the time.
- In seven fatalities (24%), the *other party* to the collision was on the wrong side of the road, either as part of an overtaking manoeuvre or they swerved into the path of the vehicle of the worker who died. In two of these cases criminal proceedings were taken against the *other party*. In two of these cases the *other party* was working at the time.

- The final worker fatality was a case involving two vehicles and no witnesses, in poor weather conditions, and in which both worker and *other party* died. The deceased *other party* was driving a van but was included in the study as a bystander as there was no evidence that he/she was working at the time.

5.4 Worker fatalities: summary

The 29 worker fatalities occurred in 28 collisions, most frequently in May and on Thursdays, and during normal daytime work hours. Half were multiple vehicle collisions involving two vehicles. The vast majority of decedents were driving the working vehicle and were travelling alone when the collision occurred on a road. Four collisions involved multiple fatalities, and in half of the collisions, the *other party* was also a person at work.

The workers who died were predominantly men (97%) and the average age was 41 years. More than half were the drivers of vans or trucks and just 7% were working on the road. Just over a third were professional drivers. Alcohol was not a feature of most worker fatalities, either on the part of the decedent or the *other party*. Very few details about work were recorded, possibly because work was not the focus of the investigation.

In 62% of worker cases the decedent was on the wrong side of the road, lost control or stopped unexpectedly. With the exception of one case, in the remaining cases the worker was either working on the road, or the *other party* to the collision was on the wrong side of the road.

6. Findings and Results: bystander fatalities

This section presents a profile of bystander road traffic fatalities (RTFs) in Ireland in the period 2008 to 2011. The different types of bystander fatalities were defined in section 3.4.3 as follows:

Bystander fatalities: road traffic fatalities where the decedent is a member of the public who is not working at the time of the collision but the principal other party in the collision is working.

Bystander Type 1: collision is directly work-related: the work activity or process contributes directly to the bystander's death. In essence work is a primary contributor to the collision.

Bystander Type 2: collision is not directly work-related: the work activity or process does not contribute directly to the bystander's death. In essence work is secondary to the collision.

One hundred and sixty four of the RTFs identified in the coroner files related to bystanders.

- In 45 fatalities work was considered a primary factor (Bystander Type 1).
- In 119 fatalities there was no, or insufficient, evidence work contributed to the collision; in essence work was a secondary factor (Bystander type 2). In 16 of the 119 (13%) Bystander Type 2 cases, it was not possible to determine whether work was a primary or secondary contributor to the collision. Because there was insufficient evidence to be considered Type 1 fatalities, they were included by default into Bystander Type 2 category.

Findings associated with bystander fatalities are presented below by a) collision characteristics and b) fatality characteristics. A brief profile of the entire bystander group is provided and then results are presented by each bystander category. It should be noted that while of important practical relevance, for statistical purposes some of the numbers in sub-groups are small and random variation cannot be out-ruled.

6.1 Bystander fatalities: collision characteristics

In total, 164 bystanders died in 147 collisions. All Bystander Type 1 collisions had a single fatality. In Bystander Type 2 fatalities, 119 people died in 102 collisions, i.e., in 17 Bystander Type 2 collisions (14%) there was more than one fatality.

6.1.1 Bystander fatalities: collision temporal factors

Figures 6.2, 6.3, 6.4 and 6.5 show the distribution of fatal collisions, in which bystanders died, by year, month, day and time of day for all bystanders and for each category of bystander. The distribution by year for the same period for all RTFs is shown for comparison purposes.

Figure 6. 1 Fatal road traffic collisions: temporal factors: year of collision (RSA data)

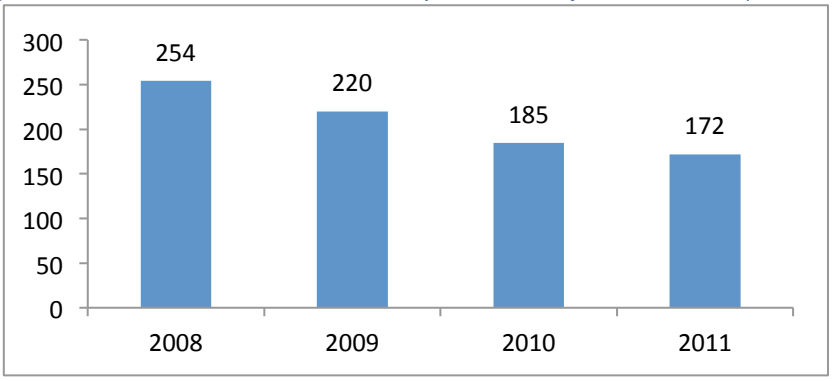
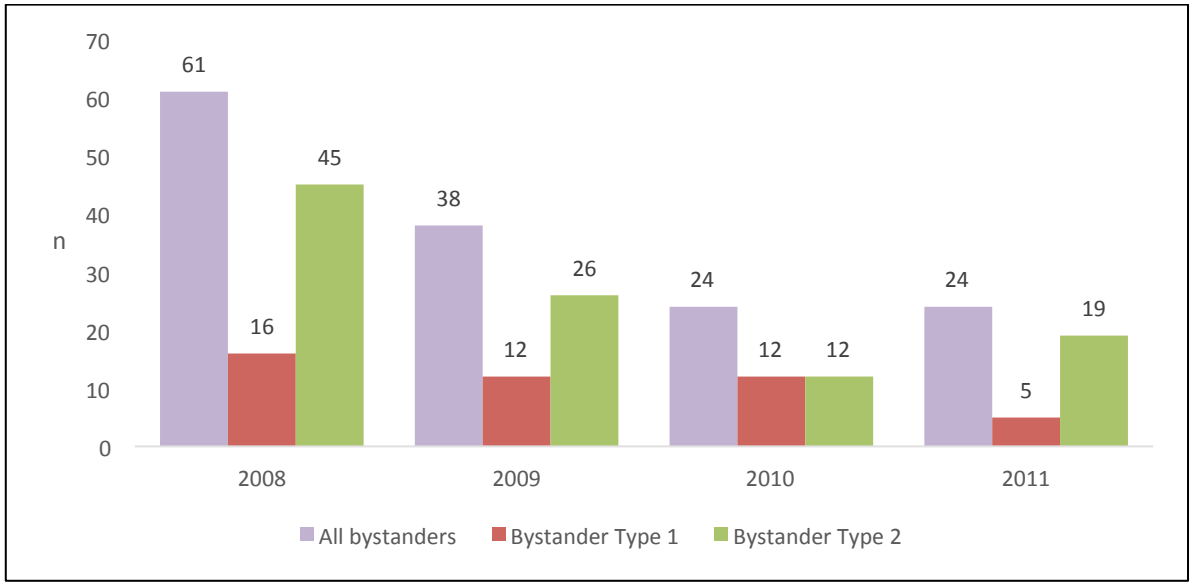
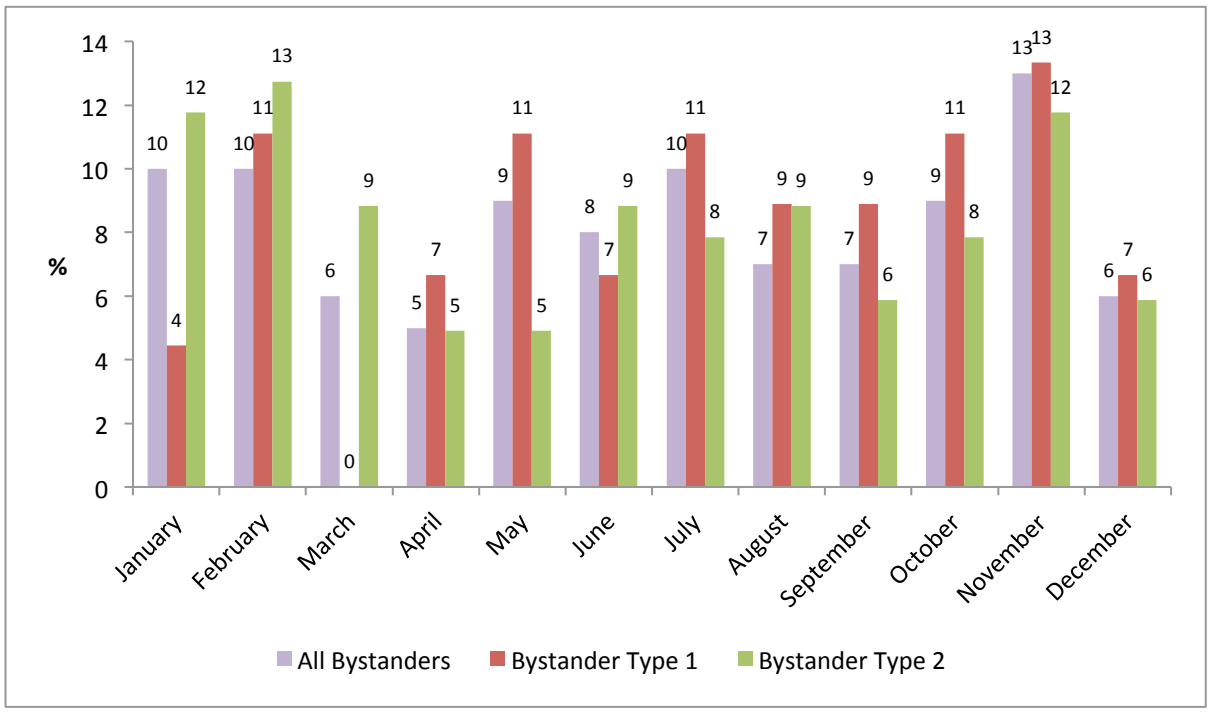


Figure 6. 2 Bystander (all, Type 1 and Type 2) collisions: temporal factors: number per year



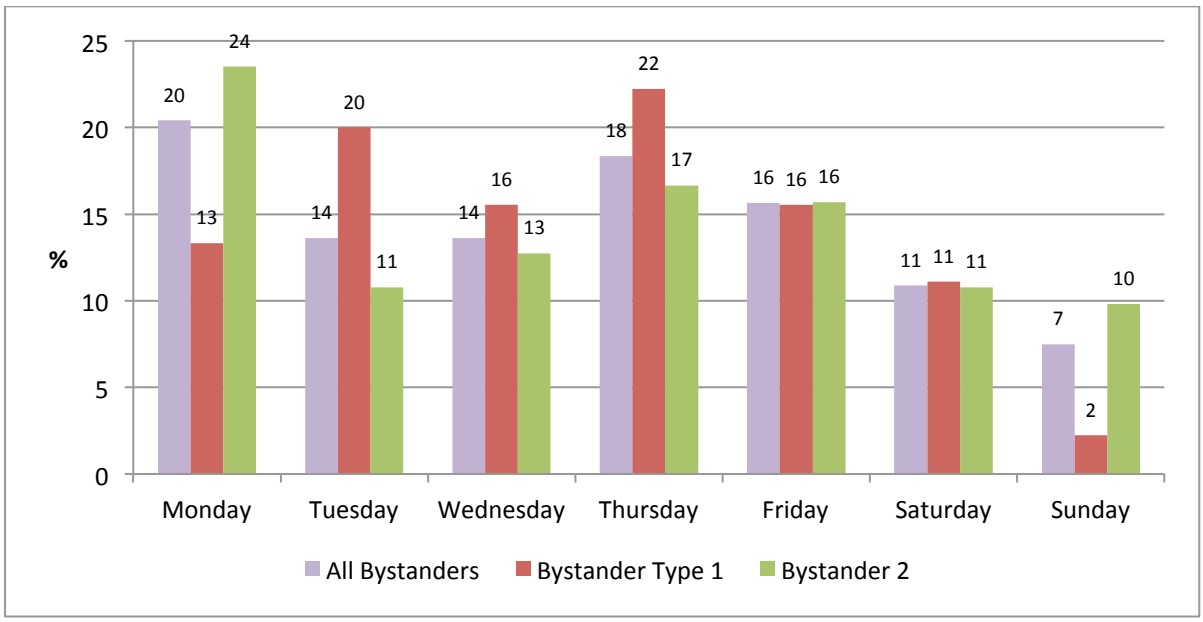
The highest number of collisions took place in 2008, and for the Bystander 1 group, the numbers reduced over the following three years. Bystander Type 2 collisions also decreased between 2008 and 2010 but increased in 2011.

Figure 6. 3 Bystander (all, Type 1 and Type 2) fatalities: temporal factors: proportion by month of collision



Bystander collisions were most prevalent during winter months, with a relative reduction in both bystander categories during December. Bystander Type 1 collisions also peaked in May and July.

Figure 6. 4 Bystander (all, Type 1 and Type 2) collisions: temporal factors: proportion by day of collision



While overall Monday and Thursday were the commonest days for bystander collisions, there are differences between the Bystander categories. In Bystander 1 collisions, where work is a primary factor in the collision, Thursdays were the most common day (22%) followed by Tuesday (20%); recall that worker collisions also peaked on Thursdays (43%). In Bystander Type 2 collisions, where work is a secondary factor to the collision, the most common day was Monday (24%) followed by Thursday (17%) and Friday (16%).

Figure 6. 5 Bystander (all, Type 1 and Type 2) collisions: temporal factors: proportion by time of collision

Time	Workers (%)	All Bystanders (%)	Bystander Type 1 (%)	Bystander Type 2 (%)
00:01 - 02:00	7.1	4.1	2.2	4.9
02:01 - 04:00	0	3.4	0	4.9
04:01 - 06:00	7.1	3.4	0	4.9
06:01 - 08:00	14.3	9.5	11.1	8.8
08:01 - 10:00	10.7	8.2	6.7	8.8
10:01 - 12:00	17.9	14.3	31.1	6.9
12:01 - 14:00	10.7	18.4	17.8	18.6
14:01 - 16:00	10.7	13.6	13.3	13.7
16:01 -18:00	14.3	9.5	8.9	9.8
18:01 - 20:00	7.1	8.2	4.4	9.8
20:01 - 22:00	0.0	4.1	0.0	5.9
22:01 - 00.00	0	3.4	2.0	2.9

Green = < 8.3%, Amber = 8.3 – 12.5%, Red = ≥ 12.6%

While overall bystander collisions predominantly occurred between 06:00 and 18:00 (73%), the pattern for bystander collisions was somewhat different between the groups. A large majority (91%) of Bystander Type 1 collisions (work a primary factor) took place between 06:00 and 18:00, while a much smaller majority (66%) of Bystander Type 2 fatalities (work a secondary / non-contributory factor) took place within those general working hours. The worker pattern is provided for comparative purposes.

6.1.2 Bystander fatalities: collision vehicle and road factors

As with workers, the vast majority of bystanders died on the day of collision (91%); this held true for each category Bystander Type 1 (100%) and Bystander Type 2 (87%).

Overall 32% of bystander fatalities occurred following single vehicle collisions, however, they were not evenly distributed between the categories: 56% of Bystander Type 1 (work a primary contributor) and 22% of Bystander Type 2 fatalities (work a secondary factor) involved just one vehicle. This reflects the predominance of pedestrians among bystanders in Bystander Type 1 collisions. (Recall 43% of worker collisions were single vehicle).

Recall that 83% of workers were driving when their collision occurred. In contrast bystander deaths show a greater prevalence of vulnerable road users. In Bystander Type 1 collisions (work a primary contributor) the majority (51%) of decedents were pedestrians, followed by drivers (27%), passengers and cyclists in that order. In Bystander Type 2 fatalities (work a secondary contributor) the majority of bystander decedents were drivers (54%), followed by passengers, pedestrians and cyclists in that order. Overall, the largest group of bystanders who died were driving cars or jeeps (32%), followed by pedestrians (29%). Less than 10% were motorcyclists.

When the vulnerable road users (n = 54; pedestrians and cyclists) are not included, the majority of bystanders were alone in their vehicle when the collision occurred (66%). This held true across both types.

Table 6. 1 Bystander fatalities: collision characteristics 1

		Bystander 1		Bystander 2		All bystanders	
		n	%	n	%	n	%
Collision type	Single vehicle	25	55.6	22	21.6	47	32.0
	Multiple vehicle	20	44.4	80	78.4	100	68.0
	Total	45	100	102	100	147	100
No. of vehicles involved	1 vehicle	25	55.6	22	21.6	47	32.0
	2 vehicles	19	42.2	72	70.6	91	61.9
	3 vehicles	1	2.2	8	7.8	9	6.1
	Total	45	100	102	100	147	100
Passengers in the bystander vehicle at time of collision	No passengers	12	66.7	49	65.3	61	65.6
	1 passenger	4	22.2	17	22.7	21	22.6
	2 passengers	0	0	5	6.7	5	5.4
	3 passengers	1	5.6	1	1.3	2	2.2
	4 passengers	1	5.6	3	4.0	4	4.3
	Total	18	100	75	100	93	100
	Ped/Cyclist (n/a)	*27*		*27*		*54*	
Decedents role at time of collision	Driver	12	26.7	64	53.8	76	46.3
	Passenger	5	11.1	26	21.8	31	18.9
	Pedestrian	23	51.1	23	19.3	46	28.0
	Cyclist	5	11.1	6	5.0	11	6.7
	Total	45	100	119	100	164	100

Table 6. 2 Bystander fatalities: collision characteristics 2

		Bystander 1		Bystander 2		All bystanders	
		n	%	n	%	n	%
Type of road on which collision occurred	Road	100	98.0	142	96.6	42	93.3
	Motorway	1	1.0	3	2.0	2	4.4
	Roundabout	1	1.0	2	1.4	1	2.2
	Total	102	100	147	100	45	100
Weather conditions	Dry	49	48.0	79	53.7	30	66.7
	Wet	35	34.3	40	27.2	5	11.1
	High winds	5	4.9	9	6.1	4	8.9
	Frost / ice	7	6.9	8	5.4	1	2.2
	Snow	2	2.0	2	1.4	0	0.0
	Fog / mist	2	2.0	2	1.4	0	0.0

The vast majority of bystander collisions took place on local, national or regional roads (> 97%). Only 5 bystander collisions took place on motorways or roundabouts. Detail was not always provided on whether a road was a single or dual carriageway but no one-way streets were noted.

Weather conditions were dry in two thirds of Bystander Type 1 collisions and nearly half of Bystander Type 2 collisions; it was wet in 11% of Bystander Type 1 and 34% of Bystander Type 2 collisions. As with workers, fog, ice or snow was present in very few cases, but where noted it was relevant.

6.2 Bystander fatalities: fatality characteristics

Individual characteristics provide a profile of bystanders who died on the road in association with the work of another person. In all bystander cases, while the bystander died, it should be noted that being on the road exposed the worker in the collision to that risk.

6.2.1 Bystander fatalities: demographic characteristics

Table 6.3 shows the demographic characteristics of bystanders. The majority were male (74%) and that held true for both Bystander 1 and Bystander 2 categories (67% and 77% respectively). (Recall 97% of worker fatalities were male).

The bystander age distribution was much wider than that for workers who died, because bystanders came from the full population spectrum of ages. The youngest person who died in a collision in which the *other party* was a worker was aged less than one year, and the eldest was aged 91 years. The mean age for all bystanders was 41.5 years (SD 24), and the median 34 years. The mean age for the Bystander 1 group was higher (47 years, SD 27) than the Bystander 2 group (39 years, SD 22).

In the full bystander group just over two thirds (69%) were within normal working age (16 – 65 years), however, among Bystander Type 1 fatalities, just over half (53%) were within working age range because 11% were children aged 10 or under. The 36% who were 65 years of age or over reflected the large number of elderly pedestrian fatalities in this age group. In Bystander Type 2 fatalities, 74% of victims were within working age (16 – 65 years); 6% were children and 19% were aged ≥ 66 years.

Overall, more than half of bystanders were single, separated or widowed (63%), consistent with the proportion of children and elderly who died (nearly a third). As with workers, for the majority of bystanders, the nationality or ethnicity was not noted.

Table 6. 3 Bystander fatalities: gender, age and marital status

		Bystander 1		Bystander 2		All bystanders	
		n	%	n	%	n	%
Gender	Male	30	66.7	92	77.3	122	74.4
	Female	15	33.3	27	22.7	42	25.6
	Total	45	100	119	100	164	100
Age ranges	0-10	5	11.1	6	5.0	11	6.7
	11-15	0	0	1	0.8	1	0.6
	16-25	7	15.6	36	30.3	43	26.2
	26-35	5	11.1	25	21.0	30	18.3
	36-45	4	8.9	13	10.9	17	10.4
	46-55	4	8.9	7	5.9	11	6.7
	56-65	4	8.9	7	5.9	11	6.7
	> = 66	16	35.6	23	19.3	39	23.8
	Not recorded	0	0.0	1	0.8	1	0.6
	Total	45	100	119	100	164	100
Marital Status	Married/cohabiting	13	28.9	33	27.7	46	28.0
	Single	23	51.1	66	55.5	89	54.3
	Separated	0	0.0	2	1.7	2	1.2
	Widowed	5	11.1	8	6.7	13	7.9
	Not recorded	4	8.9	10	8.4	14	8.5
	Total	45	100	119	100	164	100

There was no record of any medical factors at the time of collision for Type 1 Bystanders. Among Bystander Type 2 cases (which included a number of cases where the decedent fell or otherwise inexplicably arrived into the path of a working vehicle) six cases recorded that decedents were suffering from medical conditions (including poor eyesight, stroke, diabetes and mental health issues including depression).

6.2.2 Bystander fatalities: driving context

Recall that 83% of workers who died were driving. From the perspective of the bystander decedent's road user role, just under half (46%) of all bystanders who died were the driver of their vehicle; 28% were pedestrians. However, when reviewed by category this did not hold true in Bystander Type 1 fatalities (work a primary contributor) where 51% of decedents were pedestrians and 11% were passengers.

Table 6. 4 Bystander fatalities: road user type

		Bystander Type 1		Bystander Type 2		All bystanders	
		n	%	n	%	n	%
Road user type	Driver car or jeep	7	15.6	46	38.7	53	32.3
	Driver van	1	2.2	6	5.0	7	4.3
	Driver other	1	2.2	1	0.8	2	1.2
.	Motorcyclist (driver)	3	6.7	11	9.2	14	8.5
	Pedestrian	23	51.1	23	19.3	46	28.0
	Passenger	5	11.1	26	21.8	31	18.9
	Cyclist	5	11.1	6	5.0	11	6.7
	Total	45	100	119	100	164	100

6.2.3 Bystander fatalities: occupational context

The age pattern of bystanders was also reflected in their employment status.

Table 6. 5 Bystander fatalities: job characteristics

		Bystander 1		Bystander 2		All bystanders	
		n	%	n	%	n	%
Employment status	Working	20	44.4	56	47.1	76	46.3
	Retired / unable to work	12	26.7	18	15.1	30	18.3
	Housewife/husband	4	8.9	3	2.5	7	4.3
	Unemployed	2	4.4	16	13.4	18	11.0
	Students	2	4.4	12	10.1	14	8.5
	Not applicable	5	11.1	4	3.4	9	5.5
	Not recorded	0	0	10	8.4	10	6.1
	Total	45	100	119	100	164	100
Purpose of journey	To or from work	5	11.1	10	8.4	15	9.1
	Social	25	55.6	64	53.8	89	54.3
	Other	2	4.4	9	7.6	11	6.7
	Not recorded	13	28.9	36	30.3	49	29.9
	Total	45	100	119	100	164	100

Among all bystanders nearly half were part of the national workforce; 9% were students and 11% unemployed. The remainder were home workers, retired or unable to work. Bystanders who were employed came from the spectrum of occupations. There was a higher proportion of retired persons in the Bystander Type 1 group than the Bystander Type 2 group (27% versus 15%).

Purpose of journey was not known in nearly a third of bystander cases (30%). The majority of bystanders in each of Bystander 1 and 2 groups (56% and 54% respectively) were travelling for social purposes, but it was noted that a minority in each group (11% and 8% respectively) were travelling to or from work (commuting). No mention was made of any work-related factors that may have been relevant to these collisions. In many European countries commuter death statistics are collected along with work-related death statistics, however in Ireland OSH statistics do not require notification of commuter deaths.

Despite many of the bystanders being workers, no note was made of any work-related factors that may have been a factor in the collision.

By definition, the purpose of journey for the *other party* in all bystander collisions was 'for work'. In one Bystander Type 1 case and one Bystander Type 2 case, the *other party* (the worker) was noted to be unfamiliar with the vehicle, and in one Bystander Type 1 case the *other party* was unfamiliar with the road. In eighteen cases (13% of Bystander Type 1 and 10% of Bystander Type 2) the *other party* (the worker) was recorded as having been driving for more than two hours without a break. Vehicle factors associated with the worker's vehicle were noted in 2 Bystander Type 2 cases (2%) and 8 Bystander Type 1 cases (18%); example issues included problems with mirrors (n = 4), brakes (n = 1), freewheeling vehicle (n = 1), and poor trailer control (n = 1).

6.2.4 Bystander fatalities: behavioural factors

Recall that the vehicle of 14% of workers who died were on the wrong side of the road when the collision occurred. No Bystander Type 1 cases involved a decedent driving on the wrong side of the road when the

collision occurred; however, the *other party* (the worker) was noted to be on the wrong side of the road in four Bystander Type 1 collisions (9%). A third of Bystander Type 2 decedents (33%) were driving on the wrong side of the road when the collision occurred, either in an overtaking manoeuvre or through loss of control, sometimes coming around a bend too fast.

Table 6. 6 Driving behavioural factors

	Bystander 1		Bystander 2		All bystanders	
	n	%	n	%	n	%
Bystander on wrong side of road	0	0	34	33.3	34	23.1
Worker (other party) on wrong side of road	4	8.9	0	0.0	4	2.7
Neither on wrong side of road	41	91.1	68	66.7	109	74.1
Total	45	100	102	100	147	100
Alcohol positive for bystander	6	13.3	36	30.3	42	25.6
Alcohol positive for other party (worker)	0	0	0	0	0	0
Drug test positive for bystander	10	22.2	27	22.7	37	22.6
Drug test positive for other party (worker)	0	0	0	0	0	0

Recall that 14% of workers who died tested positive for alcohol (although none were over the legal limit) and 10% of the other parties involved also tested positive. The legal limit for driving with alcohol in Ireland was a blood alcohol concentration (BAC) level of 80mg/100ml during the period of the study – it has since been lowered to 50mg/100ml. Overall 26% of bystanders tested positive for alcohol at post-mortem, but there was a difference between the two bystander groups (13% vs 30%). Six Bystander Type 1 decedents tested positive for alcohol (13%); the range was from 21mg/100ml to 205 mg/100ml (BAC) and the mean reading was 85mg/100ml (BAC). All but one of the positive alcohol readings in Bystander Type 1 cases were for pedestrians and the final one case was a passenger. Among Bystander Type 2 fatalities (work not a contributor), 36 decedents tested positive for alcohol (30%); the range was from 13mg/100ml to 465mg/100ml BAC and the mean reading was 191mg/100ml; 18 were drivers, 12 were pedestrians or cyclists, and 8 were passengers. Twelve of the 18 drivers were over the legal limit of 80mg/100ml.

Thirty seven bystanders tested positive for drugs, which could be either recreational or medications (23%). This proportion held true for both groups. Ten Bystander Type 1 decedents tested positive (22%); of these 2 were drivers and 8 were pedestrians, and of the two drivers, one had taken cannabis. Among the 27 Bystander Type 2 decedents who tested positive (23%), 21 were drivers (6 recreational drugs), 5 were pedestrians or cyclists (no recreational drugs). Therapeutic drugs included a wide range of drugs, some of which could impair judgement, however the effect of such drugs cannot be assumed.

While alcohol testing using a breathalyser was not recorded as routine for the *other party* in multiple vehicle collisions, if the circumstances of the collision required it, such a test could be carried out on the *other party* to collisions (in bystander cases this is the worker). While 39 bystander cases recorded breathalyser testing being carried out on the *other party* (i.e. workers) (n = 39), all tested negative. In 8 cases the *other party* (worker) was tested for drugs and the results were all negative.

As with workers, in relation to use of safety equipment, e.g. helmet or seat belt wearing, absence of information is likely to indicate that that the bystander was wearing the safety equipment, as non-wearing would be more noteworthy.

- Of the 9 drivers for which safety equipment was recorded in Bystander Type 1 collisions, 6 were not wearing seatbelts (66%); 7% (8/28) of drivers in the Bystander Type 2 group were not wearing seatbelts at the time of collision.
- All 11 motorcyclists (from both categories) were wearing helmets. Three of the four cyclists Bystander Type 1 cyclists were wearing helmets. None of the 6 Bystander Type 2 cyclist fatalities were recorded as wearing helmets.
- Only one bystander decedent (Bystander Type 1), a cyclist, was noted to have been wearing high visibility clothing. No motorcyclists or pedestrians were wearing hi-visibility gear. In fact, reference was made in witness statements in a number of pedestrian and cyclist cases of the lack of high visibility wear, and indeed wearing of dark clothing.

More than a third (38%) of Bystander Type 1 decedents were in vehicles when the collision occurred as either drivers (26%) or passengers (12%), but the majority were pedestrians or cyclists (62%).

6.2.5 Bystander fatalities: work factors

There was little reference to work in documentation for any of the bystander fatalities, most likely because none were driving for work (or they would not have been categorised as bystanders), and work was not foremost in the minds of those investigating the collision.

6.2.6 Bystander fatalities: coroner verdict

The majority of verdicts in bystander deaths were accidental death or road traffic accident (collectively ~80%). In less than 10% of cases in each category, the verdict was misadventure.

Table 6. 7 Bystander fatalities: coroner verdict

		Bystander Type 1		Bystander 2		All bystanders	
		n	%	n	%	n	%
Coroner Verdict	Accidental death	16	35.6	44	37.0	60	36.6
	Road traffic accident	20	44.4	50	42.0	70	42.7
	Road traffic collision	2	4.4	5	4.2	7	4.3
	Misadventure	4	8.9	9	7.6	13	7.9
	Motor vehicle collision	0	0	2	1.7	2	1.2
	Motor cycle accident	0	0	1	0.8	1	0.6
	Open Verdict	0	0	3	2.5	3	1.8
	Adjourned	0	0	1	0.8	1	0.6
	Not available	3	6.7	4	3.4	7	4.3
	Total	45	100	119	100	164	100

6.3 Bystander fatalities: the other party

Bystanders' demographic and social profile is relevant only from a public health perspective and identifying vulnerable road user groups in the driving for work domain. The profile of the *other party* to the collision (the workers involved) is also relevant.

Table 6. 8 Bystander fatalities: demographic characteristics of other party

		Bystander Type 1		Bystander 2		All bystanders	
		n	%	n	%	n	%
Gender	Male	44	97.8	114	95.8	158	96.3
	Female	1	2.2	4	3.4	5	3.0
	Not recorded			1	.8	1	.6
	Total	45	100.0	119	100	164	100
Age Group	16-25	2	4.4	5	4.2	7	4.3
	26-35	4	8.9	13	10.9	17	10.4
	36-45	7	15.6	14	11.8	21	12.8
	46-55	4	8.9	14	11.8	18	11.0
	56-65	5	11.1	7	5.9	12	7.3
	>=66	2	4.4	1	.8	3	1.8
	Not recorded	21	46.7	65	54.6	86	52.4
	Total	45	100.0	119	100	164	100

The workers involved in bystander fatalities were predominantly male and drivers in Bystander Type 1 fatalities had a slightly higher age profile. About three quarters of each group were professional drivers by occupation and were engaged in that capacity as a road user at the time of collision. About 10% of the workers in Bystander Type 2 fatalities were farmers.

Table 6. 9 Bystander fatalities: demographic characteristics of the other party (i.e. the worker)

		Bystander 1		Bystander 2		All bystanders	
		n	%	n	%	n	%
Occupational group	Truck driver	26	57.8	56	47.1	82	50.0
	Van driver	1	2.2	7	5.9	8	4.9
	Bus driver	6	13.3	15	12.6	21	12.8
	Taxi driver	0	0.0	12	10.1	12	7.3
	Other employed	12	26.7	29	24.4	41	25.0
	Total	45	100	119	100	164	100
Road user type	Driver Car	1	2.2	4	3.4	5	3.0
	Driver Van	5	11.1	14	11.8	19	11.6
	Driver Truck	27	60.0	58	48.7	85	51.8
	Driver Other	5	11.1	16	13.4	21	12.8
	Road worker	1	2.2	0	0.0	1	0.6
	Driver PSV (Bus / Taxi)	6	13.3	27	22.7	33	20.1
	Total	45	100	119	100	164	100
Criminal proceedings	Yes	9	20.0	5	4.2	14	8.5
	No	36	80.0	114	95.8	150	91.5
	Total	45	100	119	100	164	100

Alcohol and drug testing was carried out for a third of *other party* drivers (workers) in Bystander Type 1 cases and 20% in Bystander Type 2. All tested negative. Criminal proceedings were taken against 20% of workers who were the *other party* involved in Bystander Type 1 cases (either against the individual or the company).

6.4 Bystander fatalities: types of collision

An attempt was made to categorise or characterise 'types of bystander collision' in order to identify areas for prevention.

6.4.1 Bystander Type 1

In Bystander Type 1 cases, despite work being a contributory factor in the collision, some but not all cases are notifiable to the HSA under current Irish OSH legislation.

The following were the main types of fatalities identified among the 45 Bystander Type 1 fatalities; none of the decedents was at work at the time of the collision.

- Twenty five of the 45 Bystander Type 1 cases (56%) related to pedestrians or cyclists who were within a blind spot on: a truck (n = 20), bus or mini-bus (n = 2) or other vehicle (n = 2). In most cases the term '*blind spot'* was actually used in the narrative or else it was inferred, i.e. the forensic collision report stated that the worker could not possibly have seen the decedent. Three decedents in this category were children; 12 were elderly; and 4 were cyclists. In one of these Bystander Type 1 cases that involved a cyclist in a collision with a truck, criminal proceedings were taken against the truck driver who failed to remain at the scene. None of the other 'blind spot' fatalities resulted in a criminal prosecution against the worker or the company. The manoeuvres being undertaken at the time were: taking off (n = 13) turning left (n = 4), turning right (n = 2), turning (n = 1), reversing (n = 2), and exiting (n = 1). Only the one worker driver was prosecuted among all of these cases. Inquest juries made recommendations in 7 of these cases. Four recommendations related to mirrors on trucks, including recommendations that fitting of Cyclops and front mirrors be obligatory for new and existing vehicles. Three coroners had made direct contact with politicians or the RSA on this issue. Other jury recommendations included a need for: a) awareness campaigns for cyclists on the issue of blind spots that exist around vehicles, b) assessment of the roadway where the collision occurred from a safety perspective or changes to the road traffic system, c) examining the possibility of cycle tracks through junctions, and d) timing of pedestrian lights.
- In eight cases (18%) the *other party* (the worker) either lost control of the vehicle, drove into the path of the decedent's vehicle, or was on the wrong side of the road when the collision occurred.
- Four cases (9%) involved side of the road / hard shoulder incidents. In one case a pedestrian was knocked down by a working van; in another case a large vehicle reversed into a gateway on an unlit road – witnesses stated that the working vehicle was barely visible. Two cases were working vehicles which had been temporarily parked in a dangerous position, which the decedents could not have anticipated coming around a corner, and so collided with the parked vehicles. One of these was a tractor.
- Other farming cases (n = 5) included two related to farmers with farm animals on the road, and three cases involved tractors on the road. In all cases the farming activity contributed to the collision.
- The remaining 3 cases (7%) are not easily categorised but all involved an aspect of dangerous driving on the part of the worker.

The 'blind spot' cases were characterised by physical or psychological shock on the part of the working drivers, as well as forensic collision reports supporting the assertions that the drivers could not possibly have seen the decedent and that no fault could be attributed to the driver. One worker's statements referred to '*going numb'* and '*having flashbacks.'* Most workers stated they did not know where the pedestrian / cyclist had come from and that they had checked their mirrors. In many cases witnesses also testified that there was no possibility that the driver could have seen the decedent. In one case the company had subsequently fitted all of its trucks with cameras allowing viewing from the front of the cab.

6.4.2 Bystander Type 2

Because work was not considered to be a contributory factor in the collision in Bystander Type 2 fatalities (due to no or insufficient evidence), this type of case is not notifiable to the HSA, and is therefore not captured in national work-related statistics.

The following were the main types of fatalities identified for the 119 Bystander Type 2 fatalities:

In 16 Bystander Type 2 fatalities (13%) there was insufficient evidence to make a decision on whether work contributed to the collision or not (3 pedestrian and 5 motorcyclist deaths).

In the remaining 103 cases:

a) There were 20 pedestrian fatalities (17%). In three cases the pedestrian came out unexpectedly from behind a parked vehicle. In two cases the decedent was in the middle of the road (in one of these cases, lying in the middle of the road); in the remaining cases the pedestrians were described as falling, staggering, jumping, appearing suddenly, darting or running out in front of the worker vehicle. Alcohol consumption on the part of the decedent was a factor in at least 8 cases.
b) Six fatalities involved cyclists (5%). Lack of high-visibility clothing in dark conditions were noted in three cases. Note was made of the cyclists pulling, wobbling, veering and weaving out unexpectedly into the path of the worker vehicle. Alcohol consumption on the part of the decedent was a factor in only one of these collisions.
c) Six fatalities were deaths of motorcyclists (5%). In these cases the decedents were described as being on the wrong side of the road due to overtaking or being out of control of their vehicle, or making a turn. Alcohol consumption on the part of the decedent was a factor in two of these cases.
d) In 37 (31%) fatalities (in 28 collisions) the decedent's vehicle was described as being on the wrong side of the road. In 10 fatalities (9 collisions) the worker was described as taking evasive or warning actions (blowing horn, flashing, driving into embankments, pulling in to the left) but could not avoid the collision. In other cases it appeared events happened too fast for evasive action. Descriptions included possible reasons why decedents were on the wrong side of the road and they included speeding, alcohol, attempting to turn suddenly, swerving, and overtaking. In one collision the decedent driver was thought to have fallen asleep, and in at least five cases either alcohol or sedative drugs on the part of the decedent were likely to have played a role.
e) In 13 fatalities (11%) (in 11 collisions) the decedent's vehicle was described as being out of control. Speeding, alcohol/cocaine use, underinflated tyres, stolen car and swerving to avoid an animal on the road were decedent risk factors that arose in inquests for some of these cases.
f) In 12 fatalities (10%) (in 12 collisions) the decedent's vehicle was described as having pulled out in front of the worker vehicle, often from side roads, and in seven cases resulted in side impact.
g) The remaining 9 fatalities (8%) (in 8 collisions) included decedent vehicles that were described as driving too fast around bends, skidding in icy conditions, or driving or veering into the path of the working vehicle.

Review of the evidence, in nearly all of the 103 Bystander Type 2 fatalities summarised above, suggested or concluded that, from the worker drivers' perspective, these collisions were almost unavoidable, and there was no evidence that any aspect of work activity contributed to the collision; this view was supported by witnesses and / or Police collision investigators. However, criminal proceedings were initiated against worker drivers arising out of five Bystander Type 2 fatalities and also against one driver of the vehicle in which the decedent was a passenger.

6.5 Bystander fatalities: summary

Bystanders dichotomised into two discrete groups, both of which comprised persons who were not working at the time of the collision, but in all cases the *other party* to the collision was working. In all Bystander Type 1 fatalities the work of the *other party* contributed to the collision whether that be a function of the working vehicle or the working activity. There were some differences in profiles of each group.

- Temporal differences were minor. Single vehicle collisions and pedestrian victims were more common in Bystander Type 1 cases reflecting the large number of blind spot incidents.
- Bystanders' social profile is relevant only from the perspective of prevention. Differences in age profiles of victims reflected the majority status of elderly victims and children in Bystander Type 1 cases in which blind-spot cases predominated. There were no differences in the social or work status profiles between the two bystander groups.
- Bystander Type 2 cases included many cases where the decedent fell, staggered, or wobbled into the path of the worker and so it comprised a substantial minority of pedestrians or cyclists. They also included more cases where the decedent was driving a vehicle, reflecting this group having a substantial minority where the decedent was on the wrong side of the road or the vehicle was out of control at the time of the collision.

The workers involved in bystander collisions were predominantly men in their middle years, and three quarters of both groups were professional drivers by occupation. About 70% of each group was driving a truck or PSV at the time of the collision. Where testing took place, none were found positive for alcohol of drugs, however criminal proceedings were taken against either the driver or their company in 20% of Bystander Type 1 cases, while only in 5% of Bystander Type 2 cases.

7. Discussion

This study set out to explore narrative data from coronial road traffic fatality files in the Republic of Ireland to assess the extent of underestimation of work-related road traffic fatalities captured through existing national health and safety, and road safety, administrative data collection systems.

This discussion is framed around the study objectives:

- To determine the proportion of road traffic fatalities in the Republic of Ireland that is work-related;
- To determine the extent of concordance, in relation to Irish work-related road traffic fatalities, between three data sources: road traffic fatality data, work-related fatality data and coroner inquest data;
- To identify occupations, driving tasks and circumstances associated with fatal road traffic work-related injury;
- To determine the number, type and circumstances of fatalities where non-working persons (bystanders) are fatally injured through involvement in a work-related road traffic incident;
- To identify areas that can be targeted for prevention.

Coroner data provided information that allowed the extent of WR-RTFs in the years 2008 to 2011 to be estimated.

7.1 Work-related road traffic fatalities: as a proportion of road traffic fatalities

Coroner inquests are held for unnatural deaths, including RTFs. In 833 RTF inquest files, during the study period (2008-2011), 193 work-related road traffic fatalities were identified. These comprised 29 worker fatalities and the deaths of 164 persons who were not at work, but whose collision was related, to a greater or lesser extent, to someone else's work. The rates' graphs clearly illustrate that these fatalities comprise a substantial sub-set of all RTFs. Overall between a fifth and a quarter (23%) of all road traffic fatalities in Ireland in that period involved a person who was at work at the time as a key party to the collision. While this proportion is broadly in keeping with expectations from the literature[4, 5], this is the first time that it has been ascertained for Ireland. However, the extent of work-relatedness depends on what we want to include in the term '*work-related'*. Work-relatedness has not been clearly defined in this context on these islands. Do we, as OSH professionals, want to capture (and prevent) only the deaths of workers and those whose death follows a collision with a working vehicle on the road that directly contributed to the collision? Or do we want to capture and prevent any road fatality where a worker's risk exposure (i.e. including as the *other party* in a fatal collision) was as a result of his/her work driving activity? In the latter case, the impact on work must be substantial, and notwithstanding the fact that many of the collisions seemed unavoidable from the perspective of the worker, some OSH-focused, employer-led risk management is possible.

Clearly worker deaths are work-related. While it was known that not all worker RTFs are notified to the HSA, it would be expected that all deaths involving trucks and PSVs be notified, because this aspect of occupational road safety is well developed with engagement of key stakeholders in road safety management at national level. Yet coroner data revealed that not all such worker deaths were notified, suggesting a need for greater employer awareness of the notification requirements or an alternative means of ascertaining the data.

Bystander Type 1 cases were highly characterised by '*blind spot'* incidents. In almost all blind spot cases, witnesses and / or Police collision investigators agreed that the worker could not possibly have seen the decedent. That doesn't mean that work-based preventive action is impossible, as inquest's noted that many large vehicles had not fitted the full range of appropriate mirrors and / or cameras

that could have mitigated the risk (http://www.rsa.ie/en/Utility/News/2011/HGV-and-Class-VI-mirrors/ accessed 30/04/16).

Some might argue that Bystander Type 2 cases should not be considered work-related, with worker involvement a chance occurrence, where workers happen upon circumstances that any road user could be unlucky enough to encounter (for example, a collision in which a vehicle driver, under the influence of alcohol, veers into the path of a working vehicle and dies following the collision). However, such a view does not take account of the increased risk exposure both in terms of frequency and duration for a) those who drive for a living, and b) those for whom driving is an important part of their work role, albeit ancillary to the purpose of their job, e.g. self-employed electrician. Not only is the *other party* (i.e. the worker) in all Bystander Type 2 cases a participant in a serious collision (following which they may have physical injuries, which should be an occupational safety concern), but they are also likely to be psychologically traumatised by the experience, and have to live with the memory of it. Apart from the wider societal or individual psychological impact, as a minimum, assuming the potential for both vehicle and driver to be at least temporarily unable to work, involvement in such a collision will have a negative impact on business, which is currently immeasurable.

Employer notification of fatalities is one issue, but prevention through risk management is another, so, from all perspectives, this study confirms that WR-RTFs comprise a substantial proportion of all road traffic fatalities, and a large enough proportion to warrant especial OSH risk management attention at national and organisational level. While fault is not apportioned either by the coroner system or the study team, even if one considers cases where work was not a primary contributor to the incident, workplace risk management strategies, such as advanced driver training, could mitigate the risks facing workers and / or reduce the prevalence of such fatalities. From public health and road safety perspectives, safety awareness campaigns particularly in the risks associated with blind spot for any vehicle, let alone large vehicles would also help to reduce the risk.

7.2 Work-related road traffic fatalities: concordance between data sources

The second study objective was to determine the extent of concordance or agreement between coroner data and other data sources, specifically the RSA road traffic fatality and the HSA work-related fatality datasets.

The 100% match between the coroner and RSA data is not surprising as the Police supply data to both the coroner and the RSA (Appendix 12). However, it is important because it means that the Police and the RSA, have, or potentially have, access to the data (depositions or witness statements taken by the Police for the inquest and Police collision investigation reports) that were examined in this study, with the possible exception of post-mortem results, and, until after the inquest, a verdict. Unfortunately manual extraction of the data from witness depositions is work-intensive, so that is not a practical or sustainable method of data collection. However, recent developments should begin to show value. Since 2005 in the UK and 2014 in Ireland, inclusion of a '*for work'* entry in the '*purpose of journey / trip'* field in data collected following all serious and fatal collisions by Police, will allow workers to be identified in Police data and issues interrogated in data analysis. However, while revealing that about 16% of journeys in fatal collisions are for work, the UK experience has shown that about 77% of responses to this question are recorded as unknown[7], so under-reporting is a strong possibility. Emphasis in training for Police on the importance of this information for prevention purposes would be of value and with raised awareness may then follow through to the areas explored when witness statements are collected. In addition, in Ireland, the Health Research Board, an agency which currently reviews coroner files annually as part of a drug fatality project, have recently (2015) entered an arrangement with the RSA, and added data collection on RTFs (all, not just work-related) to their brief, so it should be possible to identify and highlight work-related cases in this system if RTF data continues to be collected in this way.

Only 8% of cases in the coroner data were matched in the HSA dataset. This is not unexpected, given the constraints of current notification legislation. Thus we should expect to find no Bystander Type 2 cases and a limited number of Bystander Type 1 cases. More importantly though, only 11 of the 29 (notifiable) worker deaths were notified, which suggests either lack of knowledge or fear of the notification requirement among employers. The profile of cases identified by this study will fill some of the knowledge gaps, however, it is clear that employer notification clearly cannot be relied upon, possibly because having already liaised with the Police, they consider the matter reported, and self-employed workers may even be the decedent in such a collision. HSA and Police collaboration includes a Memorandum of Understanding between the two agencies which ensures that Police inform the HSA when a road traffic collision is work-related[15]; an emphasis on this arrangement in training of Police who collect data at the roadside may improve data capture, and changing responsibility for notification of the HSA notification from employers to Police may be more effective at ensuring full data capture. The work of the HSA Work-Related Vehicle Safety Program, which encompasses work-related road traffic collisions, and includes collaboration nationally at the most senior levels with Police and the RSA, has contributed hugely to an improvement in work-related road safety in the past 10 years and its work should continue to be supported.

7.3 Work-factors

Gathering work-factor data revealed that detailed work circumstances were rarely available for worker deaths, most likely because the decedent could not provide it. Witness statements naturally focused on the circumstances of a collision rather than on the decedent's work. However, it was ascertained that decedents drove trucks (28%), vans (28%), tractors (7%) and public service vehicles (7%), so targeted prevention could potentially have reached 70% of workers who died.

The vast majority of worker decedents had no passengers in their vehicle, so statements from co-workers were rare, and if the employing organisation gave a deposition (rare), it tended to focus on when the decedent was last seen and where they were going to rather than what they were doing or whether they may have been rushing or under pressure. While driving too fast for the conditions arose in a small number of cases, and the actions of the other road user was a factor in some collisions, it is also possible that boredom, distraction or phone use is greater among drivers who travel alone, leading perhaps to loss of control of the vehicle or ending up on the wrong side of the road. While such supplementary information was not possible to determine through the data, driving alone was identified as a high risk activity for worker drivers. This information should be factored into risk assessment by employers of drivers.

More than a third of the worker decedents were professional drivers who drive for a living, i.e. truck and bus drivers, and the remainder were all employees who may not drive for a living, but drive frequently as part of their job, e.g. electricians, plumbers, etc. Not unexpectedly, their road-user role at the time of the collision was predominately that of driver (83%). At national level there are good road risk management strategies available for professional drivers, so this raises the question whether those who drive as an ancillary activity to their primary job are afforded the same protection, whether the driving part of their work is fully recognised as a hazard in employer risk assessments, and whether appropriate training and information on the risk is provided.

A key limitation in determining work-related factors for worker deaths lies in the fact that the worker is deceased. Very little information was available about work circumstances. Development of a standardised form with work-related questions that could be asked by those taking witness statements in relevant cases may put more focus on any relevant work factors that might be explored in future inquests.

7.4 Bystanders

Study definitions for the terms '*worker'* and '*bystander'* were based on definitions used by OSH data collection agencies and definitions used in the literature[2, 34-38] (Appendix 2) Strong definitions are essential in determining inclusion or exclusion criteria and their application to individual cases. This study's definitions for the sub-categories of bystander (informed by Langley et al)[38] allowed inclusion of an otherwise potentially hidden cohort of road traffic victims, i.e., workers who were the *other party* in fatal collisions, whose work did not contribute to the collision but whose own risk exposure was created by their work. It is possible that in many of these cases the worker was probably lucky to emerge alive or uninjured, however, the extent of physical and / or psychological injury is not known, as injuries of *other parties* are not subject to investigation in inquests and psychological trauma may be delayed by time.

One hundred and sixty four bystanders died in 147 collisions and two separate categories emerged from the data, with some evident differences between the groups. Vulnerable road users comprised a large minority, and children and the elderly featured among the victims. The vast majority of drivers of *other party* vehicles in fatal collisions were driving trucks (52%), public service vehicles (20%), or vans (12%), so this provides a reminder to target prevention at sectors where we know there is increased risk of involvement in road traffic collisions.

A lot of work-related lessons can be learned from bystander cases, because a) the *other party* was a worker in all cases, b) in Bystander Type 1 cases work was a contributory factor to the collision, and c) in most cases the *other party* survived and gave a detailed statement. More than half of the 45 Bystander Type 1 decedents were pedestrians or cyclists who were within the *blind spot* of a truck or other large working vehicle when the collision occurred. The issue of blind spots is well known in the road haulage and transport business, and safety developments since the end of the study period will have already helped reduce this risk to bystanders (e.g. retrofitting mirrors to existing vehicles, and cameras improving driver visibility) but clearly more work at population level is needed in educating all road users about blind spots, which are present in all vehicles, but most importantly in this context with large working vehicles, and perhaps some creativity will be needed in getting the message out to parents of toddlers and to elderly members of the public. Key public health and road safety messages, such as: '*if you can't see me in my mirror, then I can't see you*' would help raise awareness for pedestrians and cyclists. Apart from the trauma to decedents and their families in blind spot incidents, a key work issue arising out of these tragic cases (and in Bystander Type 2 cases) is the trauma visited on the workers involved. In most blind spot cases the driver was alerted by other pedestrians, or the working vehicle had moved on with an oblivious driver who was flagged down at the next stopping point. Depositions contained statements of bewilderment from workers following the incident: '*I checked my mirrors'*, '*I don't know where he/she came from',* '*…at no time did I see the man/lady'*. Depositions in many Bystander Type 2 cases included witness statements about profoundly shocked and distressed drivers, and many suggested an impact on the driver's ability to work and possibly some degree of post-traumatic stress. The data did not reveal whether workplace tertiary prevention measures, such as Employee Assistance Programmes were available to drivers in these circumstances.

7.5 Work-related road traffic fatalities: areas for prevention

The final objective of this study was to identify areas that can be targeted for prevention strategies. To do this an attempt was made to find 'types of collision' within the fatal collision categories or to establish what '*characterised*' sub-groups of fatalities.

A simplistic view could be that there are two types of work-related collision: those where the precipitating activity came from the worker's vehicle and those where the precipitating activity came from the *other party's* vehicle. However, the situation was a lot more complex. In the majority of

worker collisions the driver was alone in the vehicle, so what actually happened is not known. While forensic collision reports gave great insight into the circumstances leading to some cases, they are not carried out for all collisions and in many cases, particularly single vehicle collisions where the driver died, it was simply not possible to establish why a driver might have lost control of a car. One cannot assume that a temporary factor might not have caused distraction or caused a driver to swerve (a spilled coffee, a ringing phone, a dog or a sheep on the road), especially in collisions with no or few witnesses and where the distraction may literally have gone away by the time the collision has taken place [38]. The extent of complexity of work-relatedness within the cases reviewed included situations where:

a) One or both of the deceased party and the *other party* are working at the time of the collision (captured),
b) workers witness collisions (evident from depositions from workers who provided witness statements but were not actually involved in the collision and often not even injured), and
c) workers are injured in collisions (not captured).

The extent of involvement of workers in fatal collisions is now known to a certain extent, but the extent of worker involvement in serious injury collisions, and the number of workers on the road is not known at all. However, what is known is that workers are a key stakeholder in just less than a quarter of all fatal collisions in Ireland, and that multiples of those numbers are likely to be involved to some degree in non-fatal work-related collisions and the aftermath. In addition to the human and social impact, there must be business and economic impacts also, which could not be explored in this study.

Prevention of RTFs is managed by the RSA and the Police in collaboration with many other agencies and stakeholder groups. In the OSH context, the emergence of two bystander categories helps to identify that prevention is a multi-faceted activity, and requires targeting and tailoring existing interventions from the overlap between the three domains of road safety, public safety and occupational safety. Work vehicle design contributed to the 'blind spot' Bystander Type 1 fatalities, mostly affecting pedestrians and cyclists. The study time period was from 2008 - 2011, and many developments are taking place in recent years with safety devices including, window size, mirrors and cameras to improve visibility, and which are being included in all newer vehicles and retrofitted in some. Development of automatic alerts when vehicles a) approach an obstacle during reversing and b) cross the centre line of the road are also beginning to emerge. In the remaining Bystander Type 1 fatalities the factors that brought the worker driver to the wrong side of the road or caused the vehicle to be out of control are not known, but in those cases the work activity of driving or being on the road contributed to the collision. Work-related road risk management strategy awareness clearly has a role to play in preventing future similar collisions. In Bystander Type 2 fatalities (with the exception of the 13% of cases where it really could not be determined where the balance of contribution lay), from the worker perspective, almost every collision appeared to be unavoidable; and yet the potential trauma to the worker and consequent impact on their workplace is not frequently raised as an issue.

A clear picture emerges of an overlap between road safety management and OSH management for any organisation with workers who regularly drive or are passengers in a working vehicle. From a road safety perspective every driver on the road is responsible for his or her driving practices and from an OSH perspective the employer is responsible for providing safe systems of work, which includes compliance with all relevant legislation, carrying out road risk assessment, developing policies, raising awareness, providing information, training drivers and ensuring that the equipment they use in the course of their work is provided, used and maintained in a safe manner.

Targeted worker fatality prevention is addressed at national level in Ireland primarily by the HSA, but in collaboration with the RSA and Police, and a wide range of agencies such as freight transport associations, insurers, and worker representative groups. Employers and employees have responsibilities, but these responsibilities must be effectively communicated so that all parties

understand their role and the risks, particularly where driving is not necessarily seen as part of the worker's role in situations where they are not professional drivers. Prevention of Bystander Type 1 fatalities, where work was a primary direct contributor, is within the purview of employers, in ensuring the work equipment (the vehicle) has all necessary risk reduction measures (e.g. mirrors and cameras), workers are trained and educated about road safety matters, are compliant with legislation and know the risks they face as well as the risks they pose to members of the public. While the safety management system in this domain is not new, it needs to be applied by worker drivers who are not within the professional driver grouping, such as self-employed tradesmen. Recent UK-based initiatives, such as FORS accreditation (Fleet Operator Recognition) Scheme [53], which includes safety as a key indicator, and CLOCS (Construction Logistics and Cyclist Safety) which sets industry standards for work-related road safety, including collision reporting and analysis standards, could be developed and encouraged in all sectors.

The Haddon Matrix[54] is used as a framework for RTF prevention. Using the findings of this study, cells of the Haddon Matrix can be used to position prevention interventions relative to one another, and to identify prevention leaders, with the focus on national road safety and occupational safety pre and post-crash (primary and tertiary prevention) interventions, while incorporating in-company OSH prevention and control measures. Table 7.1 below summarises some of the many existing preventative strategies in this context. A key prevention message coming from this study is that national leaders work together to ensure that prevention strategies are communicated to all relevant at-risk groups, and that employer responsibilities are clearly communicated to employers, self-employed, and employees through employer and employee representative bodies.

Table 7. 1 Potential prevention interventions

	Human factors	**Vehicle factors**	**OSH national and organisational factors**	**Environmental and road safety factors**
Leaders	HSA, employer groups, unions and employers, OSH Professional Bodies. Public and Road Safety agencies.	HSA, RSA, Transport Infrastructure Ireland, transport and sector stakeholder groups and employers	HSA, employer groups, unions and employers, OSH Professional bodies	HSA, RSA, Transport Infrastructure Ireland, local authorities, Police
Primary Prevention	Participation in and compliance with OSH management strategies Training Awareness of road risks Awareness of vehicle blind spots Safe driving policies and behaviours Use of safety equipment and gear	Vehicle road-worthiness Lighting Braking Blind spot mirrors and cameras Speed reduction in risk situations Reflective strips Risk Assessment	Health surveillance Fitness to drive Pre-identification of relevant medical conditions Road safety events Risk assessment information Fleet management Enforcement	Preparation and adaptation for weather conditions Road design Speed limits Visibility at pedestrian crossings / junctions Public awareness of blind spots Enforcement Data collection Research
Tertiary prevention	Accident / collision investigation Post-traumatic stress risk assessment	Accident / collision investigation	Accident / collision investigation Employee assistance programmes Sick leave and rehab Risk assessment	Data collection Research

In Ireland, as elsewhere in Europe, much of the credit for reduction in road traffic fatalities in recent years is given to such a multi-faceted approach, including establishment of the Irish Road Safety Authority in 2006, enforcement, education, better roads, safer vehicles, strict standards for driver training and penalty points [55]. Recent developments in Ireland include introduction of roadside intoxication impairment testing, which enables Police to assess cognitive impairment. Most recently the proposed introduction in Ireland of legislation permitting roadside drug testing by Police (Road Traffic Bill 2016 [55]), which will look for intoxication, whether by alcohol or drugs (although it should be noted that worker driver intoxication was not found in this study).

Thus key areas for prevention identified in figure 7.3 are already in place, however, more emphasis needs to be put into applying them specifically to the occupational setting, particularly by the employers of non-professional drivers and the self-employed, where driving for work is essential to getting the job done, but driving is not the job in itself. The interventions that are available, however, may not be in use within many at-risk organisations; these at-risk groups should be made aware of them by relevant national bodies (identified in the leader row of the matrix), and guidance or regulation should be used to ensure that at-risk groups use them. While it was not possible in this study to explore the extent of tertiary prevention available, it is likely that small organisations do not have a system for post-traumatic risk management in place, and despite good intentions, employers many not be providing adequate support for workers involved as the '*other party*' in Bystander collisions.

From an OSH perspective, the HSA oversees a suite of legislation that requires the application of safety management principles to all hazards and risks and that needs little adaption to be applied to the risks associated with work-related vehicle safety. The HSA initiated a Work-Related Vehicle Safety 5-year plan in 2010, and reducing WR-RTFs is a key factor in that plan. As a result, in recent years, recognition of the risks associated with driving for work has increased among employers, however a means for identifying and highlighting non-professional drivers will need to be a focus in future. The forthcoming plan for 2015-2020 is pending.

Setting and monitoring a consultative Road Safety strategy is key to prevention. A high level national collaborative group was set up in 2010 in which the HSA, the RSA and the Police work together and consult on a regular basis for information sharing, preventive planning and research agenda setting with relevant stakeholders (employer and employee representative bodies, construction, agriculture, transport sectors, insurers professional driver bodies, including those focusing on freight and logistics issues, with national injuries board and researcher input). This arrangement of relevant stakeholders getting the message out to their constituents using the most appropriate road safety message for each group, whether public or occupational, is most likely to achieve the desired outcome of continuing to reduce the frequency of all collisions and a reduction in risk for workers. A comprehensive and growing range of free resources, including sector-specific and vehicle-specific, on-line materials which are downloadable, and live seminars held nationally, targeted at employers and employees have been developed since 2010.

7.6 Strengths and limitations of the study

Strengths

- This is the first time that population-based coroner data has been interrogated in Ireland or the UK, through complete review of hard copy narrative data and witness statements over a period of years, in order to identify and examine the extent of the problem of WR-RTFs.
- The methodology used to carry out this study is robust and transferrable and likely to be relevant to any small jurisdiction with similar road safety, occupational safety and coroner systems.

- National coverage of 98% of coroner districts and 98% of RTF inquest files was achieved.
- In keeping with findings in the literature, the data identified different categories of WR-RTFs where the decedent was not at work at the time of the collision.
  - Bystander Type 1 was found to be a different concept to 'non-workers' and for this group, prevention solutions and management lie primarily with the employer and the HSA, working with relevant other stakeholders, including the RSA and the Police.
  - Bystander Type 2 was identified as an important and possibly heretofore unrecognised group in Ireland within work-related road traffic collisions, and even more so the (other party) workers involved in these collisions.
- This study identifies the importance of the role of employers in a) recognising road traffic activity as a hazard, b) including duration and frequency of exposure as part of risk assessment and designing appropriate controls, and c) providing tertiary interventions, such as employee assistance programmes, for traumatised workers.

Limitations

- While the methodology used was robust and replicable, the time-consuming nature of data collection would not be sustainable.
- There was minimal loss of data (one small district; one relevant inquest from the study period was not complete and data therefore not available; and a small number of cases were likely to have been subject to criminal proceedings and no inquest held), however we know we achieved review of 93% of all national fatalities in the time period.
- Small numbers in certain categories precluded in-depth analysis.
- Coroner files contained a wealth of information, but it was not always consistently available. Not all inquests contained forensic collision reports. While a standard form was used for collecting the data, the information was not available in a standard format, and while information, such as whether the incident took place on a straight road or a road with a bend, was mentioned in some depositions, absence of that information did not necessarily mean there was no bend in a road. RSA data was more complete in this regard.
- Even when work-relatedness was overt, witness depositions rarely addressed the work-related perspective of individual cases. RTFs involving workers driving their own vehicle for work or non-liveried fleet vehicles were probably not identified.
- In 16 Bystander Type 2 cases it was not possible to determine whether it was the working party's activity or that of the *other party* that contributed directly to the collision, due to insufficient information.
- It is hoped, because this is a retrospective study, that the data is in fact out of date and that the situation on the road has improved since 2011, however this study provides useful baseline data for future comparison.
- This study only examined the fatality part of the WR-RTF triangle; worker drivers and passengers are also exposed to the risk of the trauma of witnessing and / or being involved in serious injury collisions.

7.7 Conclusions

Work-related road traffic fatality is a significant risk for workers who drive for a living or as part of their work. The previously unidentified cases obviously increase the total work-related fatality burden, but the corollary of that is that risk reduction measures targeted at the driving-for-work population as drivers (via the RSA) or workers (via the HSA) should significantly reduce the national road traffic fatality toll. Thus many of the messages emerging from this study are not new, because the issues are known, and prevention strategies already exist within occupational safety, road safety and / or public safety domains, however, work-related road traffic fatalities will not be prevented by OSH

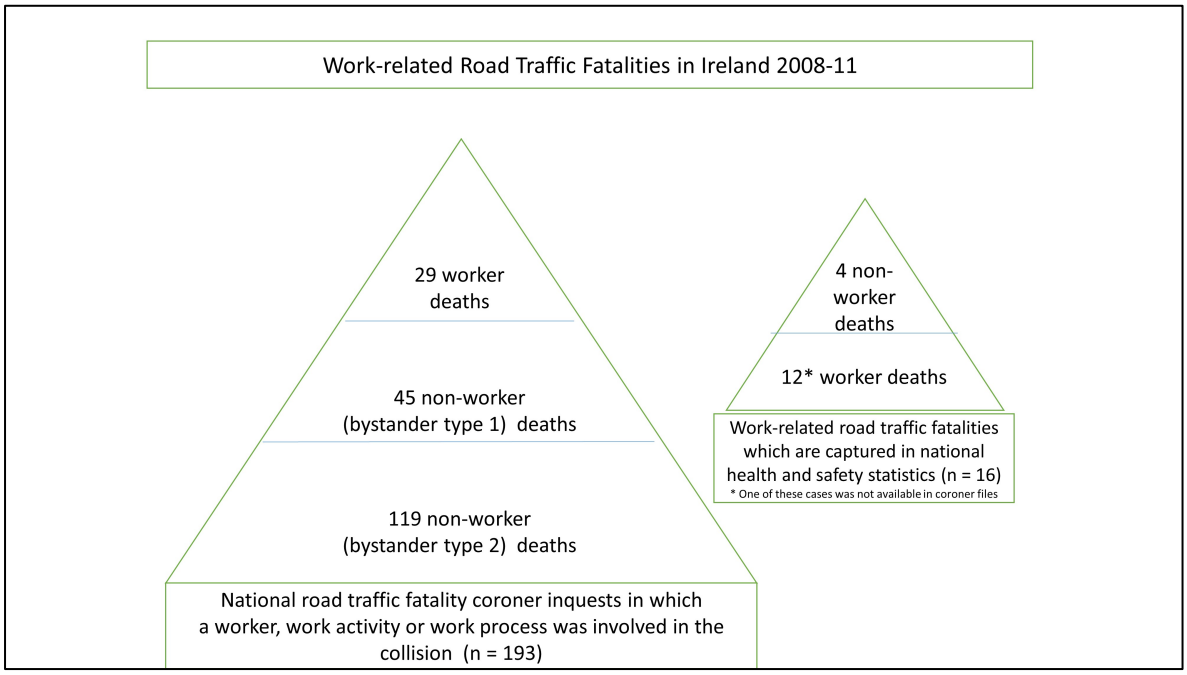
approaches alone and continuation and further development of a collective and consultative joint approach is necessary for success of any interventions in this domain..

Understanding each category of WR-RTF and its characteristics could be the key to administering prevention strategies in a way that recognises and acknowledges workers as being at risk of dying as a result of a fatal road traffic collision or of their work contributing to the death of a member of the public. Reducing the risks associated with work-related driving will contribute to collision prevention for all road users. Existing prevention strategies can be targeted specifically at persons who drive for work and at relevant vulnerable road users. They can be delivered and promoted through the appropriate agency or a combination of agencies (HSA, RSA, Police, employer and employee representative groups and road transport stakeholders).

The Bystander Types 1 and 2 categories identified in this study are important from a health and safety perspective, in terms of primary prevention of collisions (i.e. through road and public safety campaigns, such as blind spot awareness campaigns directed at the public, and advanced driving skills for drivers through employers) as well as tertiary prevention in raising awareness of the risk, and having in place arrangements for providing structured support for a traumatised and possibly injured worker. Bystander Type 2 deaths involve a sub-set of the general population at risk of road death and are currently not notifiable under OSH legislation. In addition, the '*other parties'* to these collisions, i.e. the workers, are a group that has been almost hidden in terms of the risk of both physical and psychological trauma.

This study has confirmed work-related road safety as a serious issue that needs to continue to be addressed at national and organisational level. It did not measure the societal or work-related impact of worker involvement in road traffic collisions. However, the narrative data in coroner inquest files has added to existing knowledge that, in terms of fatality notification through the HSA, WR-RTFs in Ireland were underestimated by a factor of 1.4 for workers, a factor of 10 for Bystander Type 1 fatalities, and a factor of 3.7 for both combined. Bystander Type 2 fatalities were largely not classified or captured under the current occupational system, outside of the general road traffic collision statistics.

Figure 7. 1 Work-related road traffic fatalities 'triangles'



Work-related road traffic fatalities could be depicted in an accident triangle pattern (Figure 7.1), with worker deaths at the tip (n = 29), Bystander Type 1 deaths in the middle (n = 45) and Bystander Type 2 deaths at the base (n = 119). If we follow the same metaphor, fatalities represent only the tip of a work-related road traffic collision triangle, with serious and minor injury patterns for workers remaining unknown. The current nationally collected fatality data presents in an inverse pattern, with worker deaths outnumbering non-worker deaths, and clearly does not represent the risk. Coroner data has proved to be a previously untapped, valuable source of information on work-related collisions and fatalities, but identifying and interrogating the data is time-consuming and is not likely to be a sustainable means of researching or monitoring the problem. RSA data, if the *'purpose of journey'* question for all parties is rigorously collected by Police, and possibly provided to the HSA for analysis, may be able to provide answers to create a more complete risk profile in the future.

7.8 Recommended areas to target for prevention and further research

1. Relevant agencies should agree a definition of work-relatedness in this context and put in place arrangements a) for the HSA to be informed of all worker deaths and the deaths of persons not at work but where work contributed to their deaths, and b) for the HSA to receive and / or publish WR-RTF fatality and serious injury statistics.

- As a minimum, every effort should be made to ensure that worker and Bystander Type 1 cases be captured in OSH statistics. The HSA should consider the pros and cons of including Bystander Type 2 data in any '*work-related'* definition and / or published statistics. Worker drivers and passengers are exposed to the risk of being involved in Bystander Type 2 collisions, and inclusion in statistics would provide data that would inform risk management. Bystander Type 2 cases also highlight the heretofore hidden psychological risks to worker drivers.
- The HSA and the Police should review the Memorandum of Understanding between the two organisations and explore the practical and legal differences between informing, reporting and notifying. The Police are at the scene of every road traffic fatality and should be able to inform the HSA of all work-related fatal collisions, so that the HSA may apply their investigation policy in the same manner as to any other work-related fatality. Consideration might be given to the legal implications of moving or sharing responsibility for notification of WR-RTFs from employers to Police; it is clear that many employers do not realise that they have primary responsibility to notify the HSA of WR-RTFs, but this may be because they or someone from their organisation has already provided Police with the relevant information.
- The Police should ensure that officers are trained: a) to understand the importance of, and b) to complete the '*purpose of journey'* question for key parties in all fatal and serious injury collisions, so that work-related cases can be identified and counted. This single piece of information could be the key to allowing the work-related subset of collisions to be identified in road safety statistics.
- The possibility of the HSA receiving anonymised WR-RTF and serious injury data should be explored. Police data is provided to the RSA for road traffic collision analysis on a routine annual basis, and the work-related sub-set of this data could be provided to the HSA either by the Police or the RSA. Alternatively, the RSA may develop a work-related section to the annual national road safety collision analysis already being carried out and published. A third possibility, if the HRB continue to collect WR-RTF data from coroners, is that this WR-RTF data be analysed and published.

2. The successful collaboration at senior level nationally on work-related road safety, initiated in 2010, by the HSA, RSA and Police should continue to be supported. Relevant agencies should continue current joint activities and priority setting, and add targeted work-related road safety campaigns to address issues highlighted by this study. The existing HSA Work-Related Road Safety programme will be key to reducing the risk, particularly in areas of driving for work and working on or near the road highlighted in the coroner data.

- The RSA, HSA and Police should continue their work with other stakeholders to raise public (particularly cyclists, elderly and parents of children) awareness of blind spots in all vehicles, particularly in large vehicles.
- All relevant stakeholder groups should continue to promote the installation of appropriate mirrors, other safety features and injury mitigation measures on large vehicles, in order to reduce the risk in general but to vulnerable road users in particular.
- Key messages from the study should be communicated by the HSA to employers in all sectors, so that risk factors may be included in work-based risk assessment. Such messages include: a) recognising cars and vans (and not just trucks) as mobile workplaces in risk assessment, and promoting appropriate controls through both HSA and RSA, b) highlight driving alone as a high risk activity, c) communicating risks to drivers who are the *other party* in collisions and the availability of post-trauma support, d) raising awareness for employer and the self-employed of existing mandatory requirements, such as Professional Certification for drivers and operators, as well as schemes for voluntary safety standards and accreditation. Much of this could be achieved through continuing and further developing existing activities, such as annual seminars, competitions, etc.

3. The business case should be made to employers and financial duty holders to address work-related road safety risk management.

- A combination of positive and economic risk message campaigns to employers should be further developed and possibly targeted at financial or business advisors. The cost of WR-RTF and serious injury should be disseminated at every opportunity to employers or their financial advisors in terms they understand and prioritise (economic cost). Apart from the impact of a death, within a company or associated with the work of a company, the costs to a business (time off work for injured parties and/ or witnesses, on the day of the accident, during the investigation, for ongoing sick leave, rehabilitation, and post-traumatic stress, in addition to repair, decommissioning and/or replacement of vehicles, insurance and other costs, including legal costs) was not overt and not measurable in our data, but it was evident when reviewing witness depositions in a collective manner. Existing positive-message campaigns such as the successful *European Transport Safety Council Business Case* [6] and the *IOSH Life Savings* [56] campaigns, have provided the business case for good risk management in work-related vehicle safety, and new cases will keep the issue live. Case study cost analyses of historic fatal incidents have already provided and could continue to provide additional impetus for employers who do not have a robust work-related road risk management system in place to take the issue seriously. OSH professional body campaigns should continue to highlight issues to OSH professionals, and work-related road safety risks should be included in curricula of education programmes for OSH professionals.

4. Further research in this area should be carried out to further identify any work issues contributing to collisions, so that prevention strategies can be identified and implemented.

- Research in this area may not need to be costly as the routinely collected Police data can be used to address particular research questions. Data matching between coroner and RSA cases was a relatively simple task, and this suggests that if the '*purpose of journey'* question was fully administered, and the 75% 'unknown' response history in the UK avoided, then the RSA dataset will yield very valuable information, which was not consistently present in coroner files. This includes complete data on weather conditions, type of road (number of lanes, straight or on a bend), action being taken by a driver, etc. Data collected by the HRB on road traffic fatalities from coroners may also identify work-relatedness and link data to existing road traffic collision data, subject to ethical approval.
- Identify the extent of employer (and self-employed tradesperson) preparedness in terms of primary, secondary and tertiary prevention measures.

8. Dedication

The first recorded road traffic fatality in the UK and Ireland was in 1869 in Co. Offaly, Ireland [57], when Mary Ward, a passenger, died after falling out of an automobile as it went around a bend. In 1896, Bridget Driscoll was struck by an automobile in the grounds of Crystal Palace, and died; the first pedestrian fatality. Both vehicles were accused of travelling at reckless speed (4 mph).

Bridget Driscoll's death was work-related; she was a bystander [58]. She was killed in a collision with a demonstration vehicle being driven by a salesman, engaged in a work activity. We know this because her death was investigated by a Coroner. The worker driver had been driving for three weeks and had not been instructed on what side of the road to drive on. The jury returned a verdict of accidental death. The coroner told Mrs. Driscoll's inquest that he hoped hers would be the last death in this sort of accident.

Unfortunately it wasn't.

This study is dedicated to the victims of work-related road traffic fatalities, their families and the coroners who investigate their untimely deaths.

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Appendices

Appendix 1: Safety, Health and Welfare at Work Legislation

Safety, Health and Welfare at Work (General Application) Regulations, 1993. Part X.

Regulation 59. Notification of Accidents and Dangerous Occurrences

(1) Where—

(*a*) any accident occurs at a place of work as a result of which any person carrying out work at that place of work dies or is prevented from performing his normal work for more than three consecutive days, excluding the day of the accident but including any days which would not have been working days, or

(*b*) in the case of any person who is not at work but who as a result of an accident related to a place of work or a work activity dies or suffers any injury or condition as a result of an accident which results in the person requiring treatment from a registered medical practitioner or treatment in a hospital as an in-patient or an out-patient, or

(*c*) there is a dangerous occurrence, the responsible person shall—

(i) in the case of a death, supply the Authority by the quickest practicable means with the name of the deceased, brief particulars and the location of the accident, and

(ii) as soon as practicable send a written report in the approved form to the Authority of the death, injury, condition, accident, or dangerous occurrence.

(2) Where as a result of an accident at work an employee or a self-employed person sustains an injury or suffers a condition which is required to be reported under this Regulation to the Authority, and as a result of that accident the employee or self-employed person dies within a year of the accident, the responsible person shall, as soon as possible after the death comes to his knowledge, inform the Authority in writing of the death, whether or not the accident has been reported under paragraph (1).

(3) In the case of a responsible person who is a self-employed person, it shall be sufficient compliance with paragraph (1) if the self-employed person makes arrangements with some other person for that other person to make the notification or report required by that paragraph on behalf of the self-employed person.

(4) (*a*) Where an accident which is noticeable under paragraph (1) occurs and causes loss of life to a person no person shall disturb the place where it occurred or tamper with anything thereat before—

(i) that place has been inspected by an inspector, or

(ii) the expiration of three clear days after notification, in accordance with paragraph (1), of the accident.

(*b*) Nothing in this Regulation shall prohibit the doing of anything by or with the consent of an inspector.

(*c*) In any proceedings taken in respect of a contravention of this paragraph consisting of the doing of any act, it shall be a defence to prove that the doing of the act was necessary for securing the safety or health of any person.

61. Application of this Part

(1) The provisions of Regulation 59 relating to a death, injury or condition do not apply to a person who, at the time death occurs or injury is sustained or a condition is suffered, is a patient undergoing treatment in a hospital or in a doctor's or dentist's surgery and is not undergoing treatment for an accident at a place of work or for an injury due to a dangerous occurrence, unless the cause of death or injury is unrelated to the patient's pre-existing medical condition or the treatment being provided.

(2) The provisions of Regulation 59 relating to the death, injury or condition of a person as a result of an accident shall, in the case of an accident arising out of or in connection with the movement of a vehicle on any public road, apply only if that person—

(*a*) was killed or suffered an injury as a result of driving or riding a vehicle in the course of work, or

(*b*) was killed or suffered an injury or condition as a result of exposure to a substance or injury from an article being conveyed by a vehicle,

(*c*) was either himself engaged in, or was killed or suffered an injury or condition as a result of the activities of another person who was at the time of the accident engaged in, work connected with the loading or unloading of any article or substance onto or off a vehicle, or

(*d*) was either himself engaged in, or killed or suffered an injury or condition as a result of the activities of another person who was at the time of the accident engaged in, work on or alongside a road, being work concerned with the construction, demolition, alteration, repair or maintenance of—

(i) the road or the markings or equipment thereon;
(ii) the verges, fences, hedges or other boundaries of the road;
(iii) pipes or cable on, under, over or adjacent to the road; or
(iv) buildings or structures adjacent to or over the road.

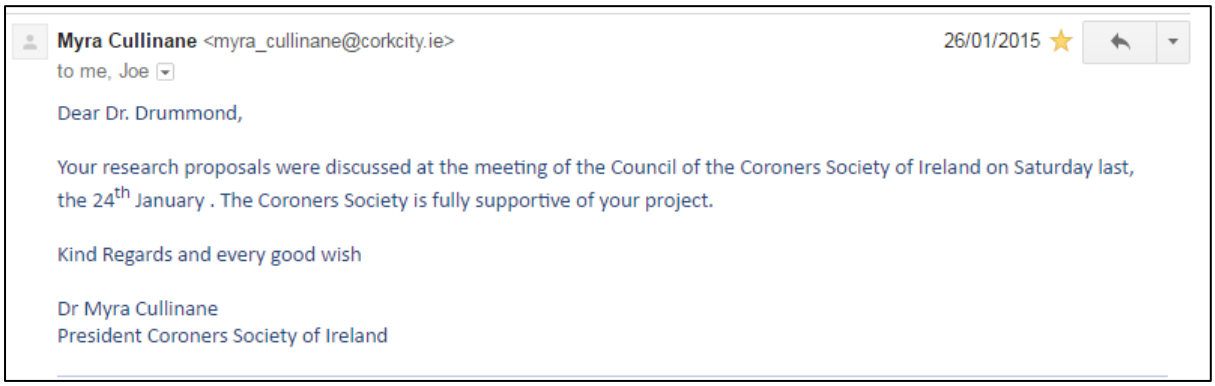
Appendix 2: Study terms and definitions: literature sources

Term used and source	Extract from original text	Equivalent term used in this study
Work-Related Fatality Case	A person who suffered a traumatic death that occurred in the Republic of Ireland in 2008, 2009, 2010 or 2011, that involved a traffic vehicle, to which workplace exposures contributed as a necessary factor to the death, and which can be attributed to those exposures	Case
Traffic vehicle	A conveyance in which, any person or property may be transported on a public road	Vehicle
Worker McNoe et al, 2005, p.2[36]	Persons who work for pay, profit or payment in kind, in a job, business or on a farm, and persons who worked without pay in a family business or on a farm Persons who work in an official volunteer capacity for an organisation.	Worker
Worker death HSA, 2010, p7[2]	Deceased person was engaged in a working activity at the time of death, either as a driver, a passenger, a cyclist or a pedestrian	Worker
	This includes persons who work on the side of the road, and persons in vehicles whose journey would not normally be considered routine commuting, and who, in the course of their work duties, died while travelling directly from home to work, work to home, or between two jobs.	
	This includes driving for work, i.e. the use of commercial vehicles, such as large goods vehicles (LGVs), vans and buses, local government, utility and emergency vehicles. It also includes the use of cars, bikes and motorcycles for work purposes, which covers driving on the road for work purposes. The scope includes load security when travelling on the road. It does not include the ordinary commuting of staff to/from a workplace except where the employee's journey starts from their home and they are travelling to a work location that is not their normal place of work	
Bystander Driscoll et al, 2003, p. 35[34]	Other work-related fatal injury involves **bystanders**—*non-workers who are fatally injured as a direct result of the work activity of others* (such as a crane toppling onto a person walking past a construction site)……. bystanders in motor vehicle incidents on public roads in which the working vehicle was primarily 'at fault'.	Not used as not a road traffic definition
Road Bystanders Driscoll et al, 2003, pp. 36-37[34]	…non-working persons killed in motor vehicle incidents involving working vehicles. Where the working vehicle is 'at fault' in such an incident, it is appropriate to consider these as work-related, and the NCIS definition for the Work-related variable explicitly includes them. However, where the working vehicle is not at fault, the incident is probably best regarded not as a work-related incident. Again, the NCIS definitions for the Work-related variable explicitly exclude such incidents. Therefore, for the current analysis, bystander deaths involving motor vehicle incidents on public roads were only included if the working vehicle was considered primarily 'at fault' in the incident, based on the information in the police report and/or the Finding.	Bystander Type 1

Term used and source	Extract from original text	Equivalent term used in this study
Bystanders to work Mitchell et al (2004) p. 852[35]	Persons who were not working but who were killed as a result of exposure to the work activity of other persons. Road bystanders were persons not working who were fatally injured in motor vehicle crashes on a public road as a result of other people's work (including commuting), where the working vehicle was primarily 'at fault' in the incident. Examples included pedestrians or persons in vehicles hit by a semi-trailer whose driver had lost control of the vehicle, and pedestrians or persons in vehicles struck by a police car involved in a high speed chase. Persons who were travelling as passengers in the cabin of a working vehicle at the time of the incident also met the study definitions of a road bystander and were included as such in this analysis.	Bystander Type 1
Bystander Langley (2004), p. 193[37]	Motor vehicle crashes on public roads raise particular problems. For example, consider the situation where a member of the public is driving their car, is distracted, wanders over the centre line and has a head on crash with a logging truck. In this case, some would argue that this should not be considered work related as there was no fault arising from the work process. Alternatively one could argue that this situation should be considered work related on the grounds that work processes have increased the probability of death given there is collision between two vehicles on the road.	Bystander Type 2
Bystander McNoe et al (2005) p. 1[36]	…when bystanders to work (a person who is killed as the direct result of someone else's work activity) are included, these figures are likely to increase further. Definition of a bystander: "All persons who were killed directly as a result of someone else's work activity, even though the deceased was not working at the time".	Bystander uncategorised
Road Bystander Langley et al, 2006, p. 2[38]	Road-bystander: not working or commuting but killed by a working or commuting vehicle. Persons who were working were not considered bystanders even if they were killed as the result of the work activities of another worker. These deaths were considered "working" deaths... The person in the working or commuting vehicle did not necessarily have to make an active contribution to the crash for the death to be counted as a case. For example, a 'road bystander' may have been driving and overtaking dangerously on a corner then hitting a truck coming in the opposite direction—thus resulting in the 'bystander' death. The truck driver in this case did not actively contribute to the 'bystander' death, however. For all deaths, we determined whether the working vehicle or the bystander vehicle was the primary contributor to the crash according to the police or coroner. We did not seek to determine fault *per se*, primarily because such a specific determination was often not explicitly made when the driver of a heavy vehicle was deemed by the police not to be at fault. In most of these situations the police suggested that the bystander contributed to the incident but rarely did they say he/she was at fault. We suspect this is because there is little point in pursuing this line with any rigor	Includes Bystander Types 1 and 2 (but in this study commuters were not included) Bystander Type 2

Term used and source	Extract from original text	Equivalent term used in this study
	given the bystander is deceased. The inability to interview the deceased also obviously hinders attempts to rule out all other external factors. For example, the bystander's behaviour may have been due to some factor (unwitnessed by others) such as swerving to avoid a dog and crossing the centre line into the path of truck.	
Commuter McNoe (2005) p.3[36]	People who satisfied the work definitions, but died as a result of a collision that occurred while travelling directly from home to work, work to home, or between two jobs. NB If the incident occurred while the person was travelling in the course of their work duties, the person was not classified as a commuter but as a worker	Commuters were not included in this study

Appendix 3: Coroner Society of Ireland support



Myra Cullinane <myra_cullinane@corkcity.ie> 26/01/2015

to me, Joe

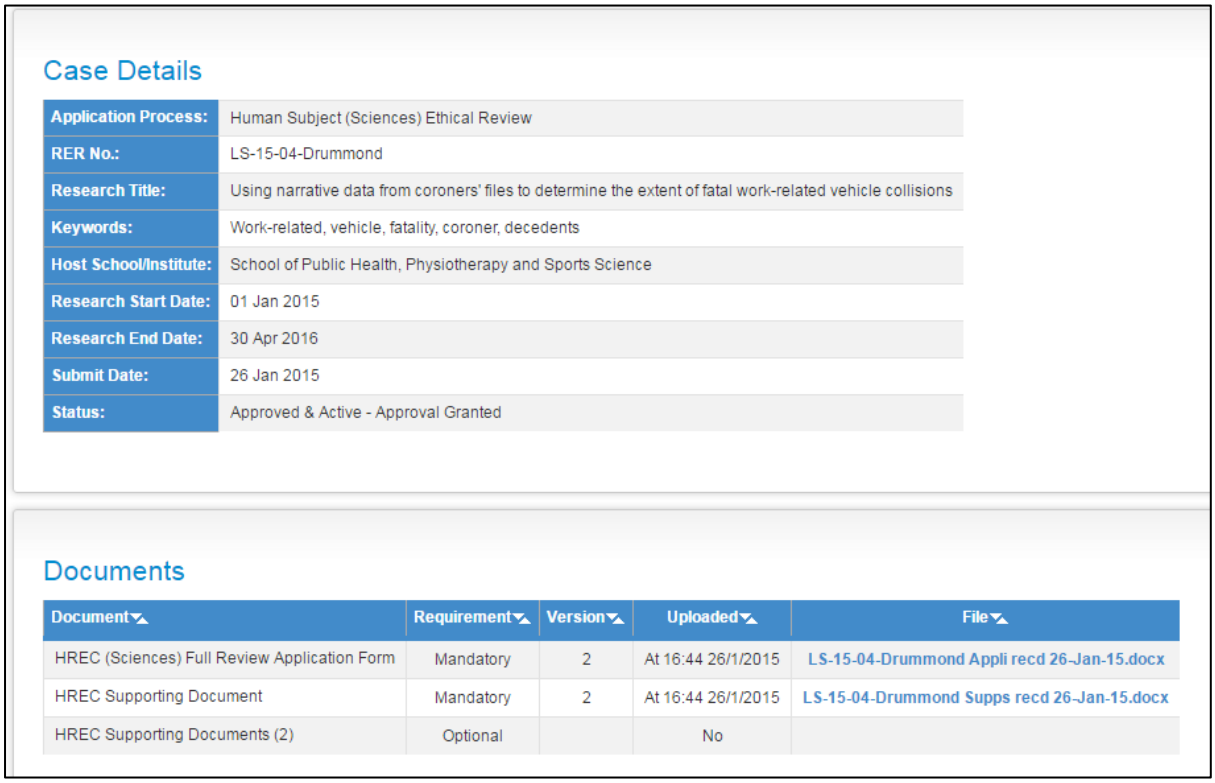
Dear Dr. Drummond,

Your research proposals were discussed at the meeting of the Council of the Coroners Society of Ireland on Saturday last, the 24th January . The Coroners Society is fully supportive of your project.

Kind Regards and every good wish

Dr Myra Cullinane
President Coroners Society of Ireland

Appendix 4: Ethical approval for the study



Case Details

Application Process:	Human Subject (Sciences) Ethical Review
RER No.:	LS-15-04-Drummond
Research Title:	Using narrative data from coroners' files to determine the extent of fatal work-related vehicle collisions
Keywords:	Work-related, vehicle, fatality, coroner, decedents
Host School/Institute:	School of Public Health, Physiotherapy and Sports Science
Research Start Date:	01 Jan 2015
Research End Date:	30 Apr 2016
Submit Date:	26 Jan 2015
Status:	Approved & Active - Approval Granted

Documents

Document	Requirement	Version	Uploaded	File
HREC (Sciences) Full Review Application Form	Mandatory	2	At 16:44 26/1/2015	LS-15-04-Drummond Appli recd 26-Jan-15.docx
HREC Supporting Document	Mandatory	2	At 16:44 26/1/2015	LS-15-04-Drummond Supps recd 26-Jan-15.docx
HREC Supporting Documents (2)	Optional		No	

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IOSH is the Chartered body for health and safety professionals. With more than 46,000 members in over 120 countries, we're the world's largest professional health and safety organisation.

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