

# The Rural Economy Research Centre

## Working Paper Series

Working Paper 10-WP-RE-13

### Occupational fatalities amongst farm workers in Ireland, 1992

– 2008

D. Meredith<sup>1</sup>, J. McNamara<sup>2</sup>, J. Grant<sup>3</sup>

<sup>1</sup>Rural Economy Research Centre, Teagasc, Kinsealy Campus, Dublin 17, <sup>2</sup>Teagasc, Kildalton College,

Piltown, Co. Kilkenny, <sup>3</sup>Applied Physics and Statistics, Teagasc, Kinsealy Campus, Dublin 17.



**For More Information on the RERC Working Paper Series**

**Email:** [Cathal.odonoghue@teagasc.ie](mailto:Cathal.odonoghue@teagasc.ie),

**Web:** [www.tnet.teagasc.ie/rerc/](http://www.tnet.teagasc.ie/rerc/)

**RERC**

**Background** Whilst occupational fatalities amongst farm workers have been studied internationally little research has been published concerning farm fatalities or the demography farm fatalities in Ireland.

**Aims** 1) To establish the incidence of farm fatalities during the 1992 – 2009 period in Ireland, 2) to explore the changing age profile of those experiencing fatal injuries on farms in Ireland.

**Methods** An official dataset containing the details of every fatal farm accident during the 1992 – 2009 period is used to evaluate changes in the number and age profile of farm fatalities in Ireland.

**Results** There were 304 deaths on farms during the 1992 – 2009 period in Ireland. The average number of annual fatalities is declining having fallen by 16% from 18 to 16 per year during this time. The fatality rate has however increased from 15 to 22 per 100,000 workers. This has been driven by a reduction in the number of workers employed on farms and, it is hypothesised, rapid ageing of the farm workforce. The demographic profile of those killed on farms changed significantly over the period. There are fewer deaths amongst younger cohorts. Older farmers, those over 55 years of age, now account for the vast majority of all fatal accidents.

**Conclusion** These findings highlight the changing nature of fatal farm incidents over the 1993 – 2009 period in Ireland. The increasing number of fatalities amongst older farmers suggests that Ireland's Farm Safety Partnership needs to place greater emphasis of raising awareness amongst older farmers of fatality risks.

**KEY WORDS:** farmers; fatalities; demography.

## **Introduction**

It is widely recognised that farming constitutes a dangerous occupation resulting in high levels of work-related injuries and fatalities [1-3]. A review of literature concerned with occupational health of farm workers and farm fatalities found that there is a growing body of research covering the incidence and cause of injury and death amongst farm populations [4-10]. Relatively little direct consideration has, however, been given to the demography of fatalities [11, 12]. It was also established during the literature review that little empirical research has been published concerning farm fatalities in Ireland [13]. Where the demographic structure of fatalities has been considered it is largely limited to the deaths of younger workers and children on farms [4, 5, 14-21] [15, 20, 22]. Whilst the emphasis on child injuries and deaths is not unsurprising, a major gap in our understanding of the age structure associated with farm fatalities persists in relation to older workers. This is a particular issue in many industrialised countries where workforces are rapidly ageing [23].

The aim of this research, using data made available from Ireland's Health and Safety Authority (HSA) covering the period 1993 - 2009, is to analyse the relationship between age and farm fatalities. In the course of undertaking the analysis the paper establishes the context of farm fatalities in Ireland. Data is presented describing the number of fatalities during the period and assessing how this has changed. The occupational fatality rate is then reported per 100,000 workers. The analysis moves to considering whether there is a relationship between age and fatal accidents. Finally, the paper evaluates whether the age structure of fatalities has changed during the 1993 – 2009 period.

## **Methods**

A retrospective study of occupational fatalities on farms in Ireland was undertaken for the period January 1993 to December 2009. In the Republic of Ireland the Safety, Health and Welfare at Work Act (1989) was introduced to modernise safety, health and welfare legislation and extend it to cover all work sectors including agriculture. It also provided a means of implementing the EU framework directive on occupational health and safety (89/391/EEC) and subsidiary directives along with secondary legislative instruments by means of regulation and codes of practice. This legislation, which was modernised in 2005, makes it mandatory that all fatal workplace accidents are reported to the HSA. The HSA is the national body with responsibility for overseeing health and safety at work. Their remit covers every type of workplace and every kind of work. On being notified of a fatality the HSA initiate a comprehensive investigation. Part of this process sees the collection of detailed incident data. Farm workplace fatalities of all ages are included in this data provided the injury was linked to the workplace or work activity. Fatalities on public roads related to farm vehicle use are included but those related solely to public road use are excluded. The fatality investigation records the circumstances of the fatality, who was involved, including information on their age, gender and activity at the time of the incident, and the cause of the fatality.

Part of the HSA's remit is to undertake or facilitate research that will assist in the improvement of their understanding of health and safety issues in the workplace. In line with this remit the HSA made available data relating to fatal incidences on farms to the authors. The dataset contains the gender and age of those killed in farm accidents and the year and cause. In accordance with data confidentiality standards no

information that would facilitate the personal identification of an individual was released.

These data were analysed using descriptive statistics to establish the incidence of farm fatalities in Ireland and how these have changed in recent years. As the number of fatalities is subject to considerable year-to-year fluctuations a five-year moving average is applied to the data. This smoothes out such variation and allows the overall trend for the period to be discerned. Two subgroups, based on the age of the victim, were defined. Myers' [11] definition of older farmers as those over 55 years of age was used to divide the fatalities into their respective groups. Chi square tests were used to explore if fatalities are more common amongst older farmers. The odds and relative risk of experiencing a fatality were calculated. These analyses facilitated an assessment of whether the age profile of those dying in farm accidents has changed significantly during the 1993 – 2009 period.

## **Results**

In the period 1993 – 2009 there were 304 fatal accidents on farms in Ireland. The number of deaths varies widely from year to year with 1995 recording the highest and 2009 the lowest at 25 and 11 fatalities respectively. In the course of 12 months the number of fatalities went from 25 in 2005 to 13 in 2006. An analysis of the five-year moving average indicates that the number of deaths has consistently declined since the late 1990s (Figure 1). Comparative assessment of the change in the average number of fatalities from the highest level, 1997 – 2001, to the lowest, 2005 – 2009, indicates that fatalities have declined by 25%. This change took place against the backdrop of significant reductions in the numbers working on farms. Analysis of

Census of Population data finds that the number of persons employed in the agricultural sector fell from 133,969 to 89,277, a decline of 33%, between 1996 and 2006. The number of persons employed in this sector continues to decline and at the end of 2009 stood at 87,000 [24]. These developments impacted on the fatality rate. In 1996 the rate stood at 15 per 100,000 workers but this increased to 22 per 100,000 by 2009.

Assessment of the age profile of those dying in farm accidents indicates a bi-modal distribution. Fatalities are split between youth, those under 15 years of age, and those over 15 years of age (Figure 2). It is apparent from these data that there is a relationship between age and fatalities. Analysis establishes that fatalities are significantly, at 0.01, positively correlated with age ( $P=0.687$ ). It is evident that the number of youth fatalities distorts this relationship. If those under 15 years of age are excluded from this assessment, on the grounds that they are unlikely to be actually working on the farm, the correlation is more strongly correlated, ( $P=0.837$ ).

Analysis was undertaken evaluating whether significant changes in the demography of those dying on farms between 1993 and 2009 has occurred. The data covers a period of 17 years. This is divided, on the basis of the total number of fatalities, between 1993 – 2000 and 2001 and 2009. Period 1 (1993 – 2000) accounts for 156 or 51% of all deaths whilst Period 2 (2001 – 2009) accounts for the remaining 148 fatalities. Deaths of those less than 55 years of age accounted for 65% (97) of all fatalities in the first period. In the second period the proportion of fatalities accounted for by those less than 55 years of age fell to 45% of all deaths. A formal test of these

changes facilitates an evaluation of whether the proportions of deaths in the two time periods are significantly different for the two age groups.

Odds ratios were calculated to establish whether the chance of experiencing a fatality changed for the two groups between Period 1 and Period 2. The results of this assessment indicate that, during Period 1, those under 55 years of age were twice (2.16) as likely to experience a fatal accident than the older cohort. The confidence interval here is significant, as it does not include 1. An odds ratio of 1 indicates that the factors are independent of each other. The relative, as opposed to the odds, risk of fatalities occurring amongst the younger cohort was found to be 1.47 times greater than the risk for the older cohort during Period 1. This fell to 0.68 in the second period. Both of these numbers are significant at  $P=0.05$  as the 95% confidence intervals do not include 1. The result establishes that the risk of a fatality increased for farmers over 55 years of age between Period 1 and Period 2.

## **Discussion**

There were 304 fatalities on farms in Ireland during the period between 1993 and 2009. The number of deaths recorded annually has declined from an average of 20 in between 1997 – 2001 to 16 during 2005 – 2009. The fatality rate has, however, increased from 15 to 22 per 100,000 workers. This compares to two fatalities per 100,000 in all other industrial sectors in Ireland [25]. Whilst the absolute number of fatalities in Ireland is small by comparison to the other countries the fatality rate is comparable to those of Canada, the USA, Australia and New Zealand. A review of fatal farm injuries levels undertaken by Maltais [26] indicates that in Canada had a rate per 100,000 workers per year between 14.9 and 25.6 during the period 1991 to

1995, which compares with a rate of 18.4 and 19.4, respectively, for the United States and Australia over the same period [27]. Myers and Hard [28] previously cited three data sources which estimated fatality rates in agriculture in America ranging from 17 to 42 deaths per 100,000 workers which puts agriculture in the four most hazardous industries. In New Zealand a rate of 21 per 100,000 farm workers per year was reported for the period 1985 – 1994 [29]. In several European countries the fatality rate is significantly lower. Solomen [30] reported fatal injuries per 100, 000 farm workers in 1996. Great Britain (10.8), Germany (15.4), France (12.1), Italy (14.4) and Spain (4.2) all record fatality rates below those of Ireland. In Northern Ireland, Downey [31] reported a rate of 13 per 100,000 workers including family workers. In Denmark, Glasscock et al., [32] quoted the annual review of the Danish Working Environment Authority for 2003 as reporting a fatal farm injury rate of rate of 14.3 per 100,000 workers per year [33]. In Finland, Rissanen and Taattola [34] reported a rate between 9.2 and 14.3 per 100,000 per year during the period from 1988 to 2000 based on data from police sources while Rautiainen [35] reported a fatality rate of 6.5 per 100,000 workers based on farm worker insurance data. In Sweden, Thelin reported that a rate of 11.6 fatal accidents occur per 100,000 persons whose main occupation is farming [36].

These data highlight the range of fatality rates recorded for the agriculture sector. It is notable that all of the European countries quoted have fatality rates below the Irish level. Ireland compares with a number of other countries, most notably Canada, the USA and Australia. It is unknown why the fatality rates of the countries referred to above vary to the extent that they do. Comparing national fatality rates must be approached with considerable caution as different statutory reporting protocols

prevail. Differences in how fatalities are defined for recording purposes will influence the fatality rate. An international baseline study using a common definition of what constitutes a farm fatality would be of significant value. This would facilitate an assessment of factors that may influence the level of fatalities including the type and scale of agricultural activities, the type of labour employed on farms (family or hired in), and the age structure of the workforce.

The changing demographic profile of farm fatalities in Ireland is related to a number of factors including greater awareness of farm safety. This follows sustained promotion of the legislative requirement and higher health and safety standards and practices amongst farmers and farm households. In order to support these initiatives the HSA, in partnership with a range of agriculture industry stakeholders, published the Code of Practice for Preventing Injury and Ill in Agriculture (COP). The objective of this statutory initiative is to provide practical guidance to farmers, farm family members, employees, service providers, farm advisers, trainers and persons with a role related to safety and health in agriculture on the requirements of the Safety, Health and Welfare at Work Act 2005 to help improve the level of safety and health in the agriculture sector. Teagasc, the Irish Agriculture and Food Development Authority, supported, and continue to do so, the legislative approach by providing training to farmers in how to undertake a risk assessment for their enterprises. Data is currently being collected to assess whether the completion of the COP results in a significantly reduced injuries and fatalities amongst younger farmers.

Other factors that may result in fewer deaths amongst those less than 55 years of age are the changing demographic structures of the agricultural workforce and farm

households. Fatalities were found to positively correlate with age as greater numbers of deaths recorded amongst older farmers. The analysis also established that the demographic profile of fatalities has changed in Ireland to reflect international norms [4, 11, 34, 37-41]. During the 1993 – 2000 period a persons under 55 years of age was twice as likely to be killed than a farmer over 55 years of age. Between 2001 and 2009 this profile was reversed and more farmers over 55 dying relative to the Period 1. It is uncertain to what extent the changing demography of fatalities is reflected in other countries as there appears to be relatively little published regarding this topic.

From the research presented in this paper it is hypothesised that structural changes in farming and amongst farm households have changed the demographic profile of those exposed to the risk of a fatality. Throughout the period covered by the paper the numbers working on farms in Ireland declined as the industry consolidated in response to continued market pressure for greater productivity and efficiency [42]. These developments created a push factor encouraging farmers to leave the industry and discouraging new, younger entrants into the business. Growth in the non-farm economy, a pull factor, also provided opportunities for farmer workers to avail of employment in other sectors. This resulted in agricultural workers transferring from farming to other economic activities [43]. The net result of these developments was fewer younger farmers and the relative ageing of the farm workforce. Day [44] found a similar trend amongst Australian farms resulted in greater exposure of elderly farm workers to fatalities.

The demographic restructuring of farm households may also account for the trends, particularly in youth fatalities, noted above. Ireland has witnessed a prolonged period

of limited recruitment of new and, particularly, younger farmers into the agriculture workforce [42]. This may be resulting in smaller numbers of children living on farms and, hence contributing to the decline in youth fatalities.

The findings of this study are of significance to policy makers in Ireland and internationally. They demonstrate that farm fatalities are demographically heterogeneous. Increasingly, older workers are particularly at risk of fatal accidents. Awareness raising campaigns should emphasis the risks to these groups.

Further research needs to be undertaken with this data to establish the cause of farm fatalities and whether these are demographically differentiated. Additional research will also be required to assess hazard perceptions amongst farmers in Ireland.

Internationally, there is a need for comparative research in order to assess the factors that contribute to higher fatality rates and, more importantly, those that mitigate the risk of fatality. The authors would like to acknowledge Teagasc and the Health and Safety Authority for the funding of this research.

## References

1. Cone, J.E., et al., *Fatal Injuries at Work in California*. Journal of Occupational and Environmental Medicine, 1991. **33**(7): p. 813-817.
2. Hwang, S.A., et al., *Severe farm injuries among New York farmers*. Am J Ind Med, 2001. **40**(1): p. 32-41.
3. Hayden, G.J., S.G. Gerberich, and G. Maldonado, *Fatal Farm Injuries: A Five-Year Study Utilizing a Unique Surveillance Approach to Investigate the Concordance of Reporting Between Two Data Sources*. Journal of Occupational and Environmental Medicine, 1995. **37**(5): p. 571-577.
4. Erlich, S.M., et al., *Work-related agricultural fatalities in Australia, 1982-1984*. Scand J Work Environ Health, 1993. **19**(3): p. 162-7.
5. Franklin, R.C., et al., *Agricultural work-related fatalities in Australia, 1989-1992*. J Agric Saf Health, 2001. **7**(4): p. 213-27.
6. Goodman, R.A., et al., *Fatalities associated with farm tractor injuries: an epidemiologic study*. Public Health Rep, 1985. **100**(3): p. 329-33.
7. Hayden, G.J., S.G. Gerberich, and G. Maldonado, *Fatal farm injuries: a five-year study utilizing a unique surveillance approach to investigate the concordance of reporting between two data sources*. J Occup Environ Med, 1995. **37**(5): p. 571-7.
8. Kingman, D.M., G.R. Deboy, and W.E. Field, *Contributing factors to engulfments in on-farm grain storage bins: 1980 through 2001*. J Agromedicine, 2003. **9**(1): p. 39-63.
9. Mirabelli, M.C. and D.B. Richardson, *Heat-related fatalities in North Carolina*. Am J Public Health, 2005. **95**(4): p. 635-7.

10. Myers, J.R. and K.J. Hendricks, *Agricultural tractor overturn deaths: Assessment of trends and risk factors*. Am J Ind Med, 2009.
11. Myers, J.R., L.A. Layne, and S.M. Marsh, *Injuries and fatalities to U.S. farmers and farm workers 55 years and older*. Am J Ind Med, 2009. **52**(3): p. 185-94.
12. McCurdy, S.A. and D.J. Carroll, *Agricultural injury*. Am J Ind Med, 2000. **38**(4): p. 463-80.
13. Finnegan, A. and J. Phelan, *A Survey of Health and Safety on Irish Farms- Implications for Extension and Education*. Proceedings of the 19th Annual Conference of AIAEE; Raleigh, North Carolina, USA., 2003: p. 271-281.
14. Adekoya, N., *Trends in childhood drowning on U.S. farms, 1986-1997*. J Rural Health, 2003. **19**(1): p. 11-4.
15. DOYLE, Y. and R. CONROY, *Childhood Farm Accidents: a continuing Cause for Concern*. Occup Med (Lond), 1989. **39**(1): p. 35-37.
16. Gilliam, J.M., et al., *Farm-related injuries among Old Order Anabaptist children: developing a baseline from which to formulate and assess future prevention strategies*. J Agromedicine, 2007. **12**(3): p. 11-23.
17. Goldcamp, M., K.J. Hendricks, and J.R. Myers, *Farm fatalities to youth 1995-2000: A comparison by age groups*. J Safety Res, 2004. **35**(2): p. 151-7.
18. Hard, D.L. and J.R. Myers, *Fatal work-related injuries in the agriculture production sector among youth in the United States, 1992-2002*. J Agromedicine, 2006. **11**(2): p. 57-65.
19. Pickett, W., R.J. Brison, and J.R. Hoey, *Fatal and hospitalized agricultural machinery injuries to children in Ontario, Canada*. Inj Prev, 1995. **1**(2): p. 97-102.

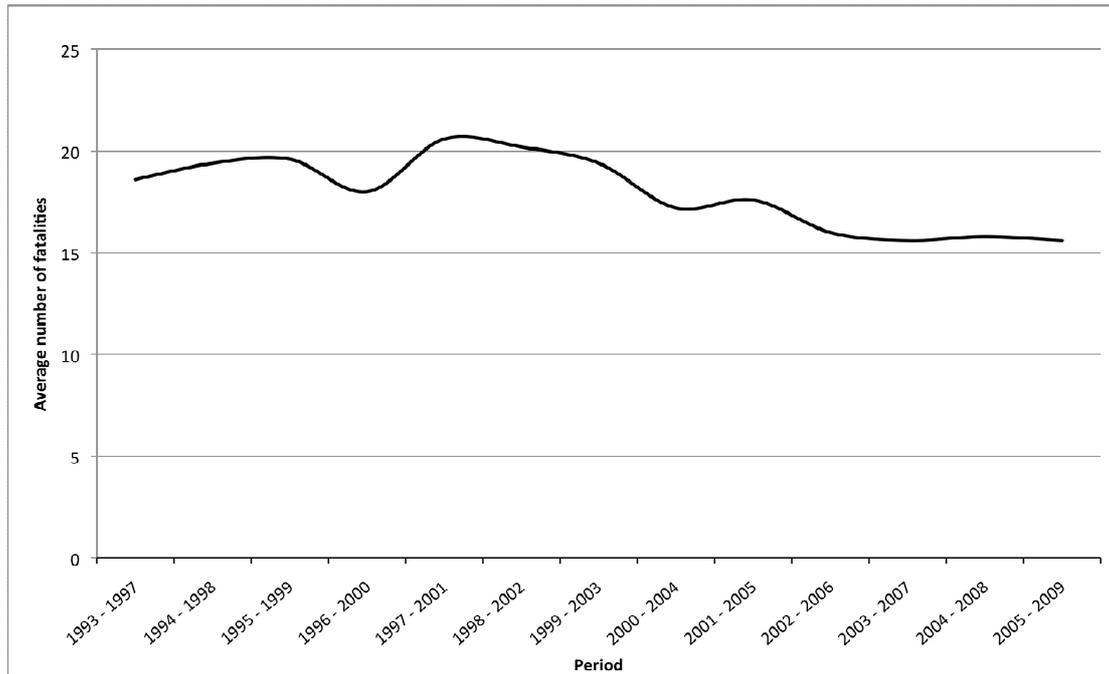
20. Rivara, F.P., *Fatal and Nonfatal Farm Injuries to Children and Adolescents in the United States*, in *Pediatrics*. 1985, American Academy of Pediatrics. p. 567.
21. Salmi, L.R., et al., *Fatal farm injuries among young children*. *Pediatrics*, 1989. **83**(2): p. 267-71.
22. Franklin, R., et al., *Farm Related Fatalities in Australia, 1989-1992*, ACAHS, Editor. 1999, University of Sydney: Sydney.
23. OECD, *Work-force ageing in OECD countries*, in *Live longer - work longer*. 2006, OECD: Paris.
24. Meredith, D., *Impact of the economic downturn on part-time farmers*. *T-Research*, 2009. **5**(1): p. 2.
25. HSA. *Agriculture and Forestry*. 2009 [cited 2010 10/03/2010]; Available from: [http://www.hsa.ie/eng/Sectors/Agriculture\\_and\\_Forestry/](http://www.hsa.ie/eng/Sectors/Agriculture_and_Forestry/).
26. Maltais, V. (2007) *Risk Factors Associated with Farm Injuries in Canada 1991-2001*. Agriculture and Rural Working Paper Series.
27. Pickett, W., W.D. King, and T. Faelker, *Suicides among Canadian farm operators*. *Chronic Dis Can*, 1999. **20**(3): p. 105-10.
28. Myers , J. and D. Hard, *Work-related fatalities in the agricultural production and services sector*. *Am. J. Ind. Med*, 1995. **27**(1): p. 13.
29. Morgaine, K., et al., *Obtaining Health Information from Farmers: Interviews Versus Postal Questionnaires in a New Zealand Case Study*. *Annals of Agriculture and Environmental Medicine* 2005. **12**(2): p. 5.
30. Solomon, C., *Accidental injuries in agriculture in the UK*. *Occup Med (Lond)*, 2002. **52**(8): p. 461-466.

31. Downey, M., *Older, wiser, safer?*, in *All Island Farm Safety Conference*. 2008, Teagasc: Monaghan.
32. Glasscock, D., et al., *Psychosocial factors and safety behaviour as predictors of accidental work injuries in farming*. *Work & Stress*, 2006. **20**(2): p. 12.
33. Arbejdstilsynet, W., *Registration of Occupational Injuries: Annual Review, 2003*. 2004, Danish Working Environment Authority: Copenhagen.
34. Rissanen, P. and K. Taattola, *Fatal Injuries in Finnish Agriculture, 1988-2000*. *Journal of Agricultural Safety and Health*, 2003. **9**(4): p. 7.
35. Rautiainen, R.H., *Agricultural injuries and occupational diseases in agriculture in Finland : Cost, length of disability and preventative effect of a no-claims bonus*, in *College of Public Health*. 2002, University of Iowa: Iowa City. p. 202.
36. Thelin, A., *Fatal accidents in Swedish farming and forestry, 1988-1997*. *Safety Science* 2002. **40**(6): p. 17.
37. Agnew, J. and A.J. Suruda, *Age and Fatal Work-Related Falls Human Factors: The Journal of the Human Factors and Ergonomics Society*, 1993. **35**(4): p. 6.
38. Beer, S.R. and W.E. Field, *Analysis of factors contributing to 674 agricultural driveline-related injuries and fatalities documented between 1970 to 2003*. *J Agromedicine*, 2005. **10**(3): p. 3-19.
39. Hard, D.L., J.R. Myers, and S.G. Gerberich, *Traumatic injuries in agriculture*. *J Agric Saf Health*, 2002. **8**(1): p. 51-65.
40. Kisner, S.M. and S.G. Pratt, *Occupational Fatalities Among Older Workers in the United States: 1980-1991*. *Journal of Occupational and Environmental Medicine*, 1997. **39**(8): p. 715-721.

41. Voaklander, D.C., et al., *Work-related mortality among older farmers in Canada*. Can Fam Physician, 1999. **45**: p. 2903-10.
42. Crowley, C., D. Meredith, and J.A. Walsh, *Agriculture in Ireland at the Millennium: a census atlas*. 2007, Dublin: Teagasc and NIRSA.
43. Dillon, E., et al., *An Analysis of Rural Labour Markets in Ireland*. 2008, Teagasc: Dublin.
44. Day, L.M., *Farm work related fatalities among adults in Victoria, Australia: the human cost of agriculture*. Accid Anal Prev, 1999. **31**(1-2): p. 153-9.

## Figures

Figure 1: Five-Year Moving Average of Fatal Farm Incidents 1993 - 2009



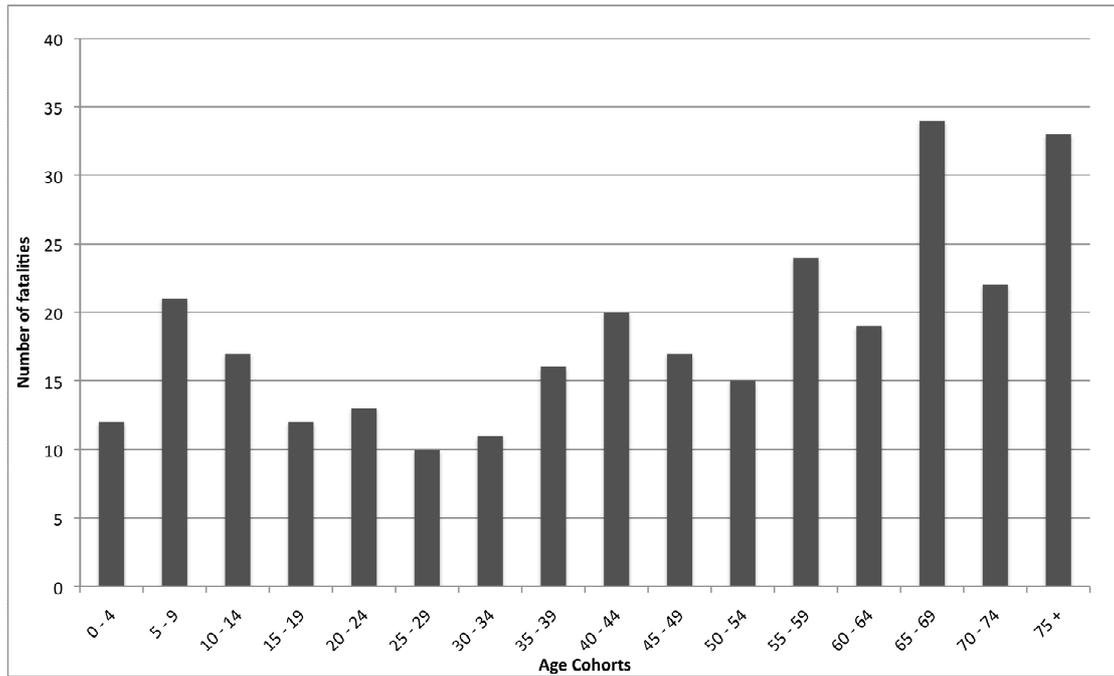


Figure 2: Demographic Distribution of Farm Fatalities in Ireland, 1993 - 2009

