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TOP TEN

Top 10 TARN research publications

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ABSTRACT

The last 25 years have seen Trauma Audit and Research Network's (TARN) research agenda develop into a significant portfolio of over 100 publications, including a number of international collaborations. Holding the largest trauma registry in Europe, TARN continues to provide researchers with the ability to pursue their interests in both epidemiological and clinical topics relating to traumatic injury. This edition of the *Emergency Medicine Journal* provides an opportunity to celebrate some of these papers with a 'Top 10', which have been voted by members of the TARN Research Committee on the basis of their impact.

Established 25 years ago by a small group of collaborators, the Trauma Audit and Research Network (TARN) is now recognised as the UK's national clinical audit for traumatic injury and holds the largest trauma registry in Europe. Based at Salford Royal NHS Foundation Trust, TARN's role is to support hospitals by providing evidence of the standards of care through the analysis of key process measures and case-mix adjusted outcomes.

All trauma-receiving hospitals across England, Wales and the Republic of Ireland, including some hospitals across other parts of Europe, submit data to TARN via a secure web-based data collection system.

Equally, the last 25 years have seen TARN's research agenda develop into a significant portfolio of over 100 publications, including a number of international collaborations. With both a growing national and international interest in trauma research, it has meant that the management of the research at TARN has also evolved. An operational committee led by TARN's Research Director, Professor Fiona Lecky, meet each month to discuss new research requests, monitor progress on existing projects and review manuscripts prepared by the researchers. Through the work of the TARN analysts and the statistical, clinical and administrative support, TARN can continue to provide researchers with the ability to pursue their interests and academic development in both epidemiological and clinical topics relating to traumatic injury.

This edition of the *Emergency Medicine Journal* provides an opportunity to celebrate some of these papers with a 'Top 10', which have been voted by members of the TARN Research Committee on the basis of their impact.

Hospital, this is possibly one of the most significant publications from TARN.¹ Analysis from 1989 to 2003 based on 22 216 patients with head injury showed a 10-fold higher mortality and less improvement in the adjusted OR of death when compared with those patients without head injury. Patients with severe head injuries presenting between 1996 and 2003 treated (entirely) in non-neurosurgical centres demonstrated a 26% increase in mortality and 2.15-fold increase in the risk-adjusted OR of death when compared with patients treated at a neurosurgical centre. This work lent a strong support—including National Institute for Health and Care Excellence (NICE) guidance—towards the treatment of patients with severe head injuries at specialist neurosurgical centres.

2. Increased mortality associated with cerebral contusions following trauma in the elderly: bad patients or bad management?

The ageing population is a topic causing much global debate.² There is a significant increase in elderly trauma cases presenting to emergency departments; similarly, there has also been a demonstrable increase in traumatic brain injury within this age group. However, the elderly population has been shown to have worse outcomes than younger patients presenting with the same condition. With this evidence, there has been a trend towards the reduction of neurosurgical intervention for elderly patients.

This work, led by Mark Wilson, set out to demonstrate whether there were variations in the care and to answer the key question 'Do elderly patients with head injuries do worse because of a self-fulfilling prophecy of poorer management?' Results demonstrated that the elderly group showed significant delays to CT, transfer times and less senior clinicians treating this patient group when compared with younger patients with cerebral contusions; however, it is uncertain whether or not this is due to therapeutic nihilism in older patients or a more complex presentation (low energy vs high energy trauma). Further work is suggested to look at both these age groups to review different forms of brain injury and further address discrepancies in care. With the changes in patient demographics, publications such as these are an important step to help drive equality in care across all age ranges.

1. Trends in head injury outcome from 1989 to 2003 and the effect of neurosurgical care: an observational study

In collaboration with colleagues based at the Neurosurgical Department at Salford Royal

3. The effect of preinjury warfarin use on mortality rates in patients with trauma: a European multicentre study

There have been a number of studies investigating the association between preinjury warfarin and



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patient outcome, but these provide conflicting results.³ This large multicentred study conducted by a team at Morriston Hospital South Wales reviewed patients admitted to emergency departments between 2009 and 2013 from data held on the TARN database. When matched for age, injury severity, GCS and pre-existing conditions, the results demonstrated that preinjury warfarin use was associated with a significantly higher OR of death when compared with non-preinjury warfarin patients. Unlike other studies, this work adjusted for confounders such as demographics, injuries and site of hospital care. The results are an important consideration for those treating with warfarin.

4. A new approach to outcome prediction in trauma: a comparison with the TRISS model

Following on from the 1995 paper, this work proposed a revised outcome prediction model.⁴ To address some of the concerns in regard to missing data, inclusion criteria and the use of the Trauma and Injury Severity Score (TRISS) (a model derived from adult trauma victims excluding, children, patients who arrive intubated, interhospital transfers and burns), the model was adapted to include age–gender interaction, use GCS instead of the Revised Trauma Score to reduce issues with missing data and the inclusion of subsets such as children, penetrating injuries, intubated and transferred patients. Predictive performance (model discrimination between deaths and survivors) was significantly better than that of the TRISS with the area under the receiver operating characteristic curve (AROC) value of 0.947 (95% CI 0.943 to 0.951) on the prediction set and 0.952 (95% CI 0.946 to 0.957) on the validation set. This paper formed the basis of the departure from TRISS to the current—probability of survival—‘Ps’ risk adjustment model TARN has used since 2004 to audit trauma care. This was seen as a further improvement in outcome prediction modelling and more applicable to a European population.

5. Standardised comparison of performance indicators in trauma: a new approach to case-mix variation

With the aim of producing more accurate comparisons between different hospitals, one of TARN’s earlier papers proposes an outcome prediction model.⁵ Using TRISS methodology but standardised with respect to case-mix—a new statistic is introduced—‘Ws’, the ‘standardised observed—expected survival rate’ or ‘standardised excess survival rate’. TARN still uses this direct standardisation of risk adjusted survival to compare hospital performance across its member hospitals. This methodology compares each hospital’s performance on six different survival probability strata, which is weighted for the proportion of that strata in the national case-mix. Hence, each hospital’s performance is directly compared with all other TARN member hospitals on the national case-mix of survival probabilities. This is a more valid comparison than standardised mortality ratios, which are indirect (each hospital’s comparison is to the national mortality rate, rather than directly to other hospitals).

6. Testing the validity of the ATLS classification of hypovolemic shock

To test the validity of the advanced trauma life support (ATLS) classification of hypovolemic shock, data on adult patients presenting to emergency departments across England and Wales between 1989 and 2007 were analysed.⁶ Patients with admission physiology, injury and outcome were used and divided into the four groups representing ATLS classes of shock based on HR, GCS, systolic BP and RR. The findings demonstrate an inter-

relationship between derangements of HR, systolic BP, RR and GCS, but not to the extent suggested by ATLS classification.

7. The effect of specialist neurosciences care in adult severe head injury: a cohort study

With national guidelines (NICE) recommending that all severe head injury (SHI) should be treated at neuroscience units, this study aimed to investigate the effect of specialist neuroscience care on mortality for this patient group.⁷ A total of 5411 patients sustaining blunt trauma with SHI between 2003 and 2009 were identified with 27.4% receiving treatment in neuroscience units (NSUs) only. For patients with SHI who were managed entirely in non-NSUs, there was an associated 11% increase in crude mortality ($p < 0.001$) and a 1.72-fold increase in the OR of death (CI 1.52 to 1.96). Case-mix adjusted OR of death for patients with SHI treated at non-NSUs was 1.85 (95% CI 1.57 to 2.19). The results support national guidelines; an increase in transfer rates to NSUs could improve SHI outcomes. Since the *Lancet* publication in 2005,¹ this research further exemplified the need for a health-care system that can provide timely and accessible specialist care for patients with severe head injuries.

8. The GCS at 40 years: standing the test of time

The GCS is used to assess impairment in level of consciousness and since its inception 40 years ago; it is now globally used in both clinical practice and research. In collaboration with Sir Graham Teasdale, one of the creators of the GCS, this publication looks at its role, reliability and impact.⁸ It also looks at the validity of the tool and seeks to address some of the past myths and criticisms around it. After 40 years, it is concluded that the GCS has evolved into a widely used clinical tool that includes risk assessment, classification and prognosis with a significant role in the improvement of head injury outcome.

9. Trends in trauma care in England and Wales 1989–1997

The first Royal College of Surgeons report in 1988 highlighted significant deficiencies in the care of the injured patient.⁹ This early, yet key, piece of work published in the *Lancet* aimed to look at whether there had been any improvements in outcome and standards of care from 1989 to 1997. Data were analysed from 97 hospitals and after taking into account any potential selection bias from missing data and new hospitals, the severity adjusted OR of death after trauma showed a gradual decline from 1989. Furthermore, when adjusting for injury and age, there was significant variability in the proportion of survivors between the highest and lowest 10% of hospitals analysed. This publication encouraged further work at TARN to investigate specific areas impacting on patient outcomes. In addition, it supported the continued attempt to place trauma on the healthcare agenda.

10. A comparison of European trauma registries. The first report from the EuroTARN group

EuroTARN was established in 2002 and is one of the first initiatives between TARN and other existing and newly developed trauma registries across Europe to establish a core dataset and make an initial comparison of trauma care outcomes across Europe.¹⁰ This paper describes the process of establishing a core dataset and the trial data collection phase that demonstrated observed differences in trauma outcomes across countries for similar patient groups. This collaboration typified a common desire between European countries to establish uniformity in data collection to allow effective comparisons of care.

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