Accident and Emergency/Intensive Care

G1 IS GLASGOW MENINGOCOCCAL SEPTICAEMIA PROGNOSTIC SCORE (GMSPS) USEFUL IN PREDICTING MORTALITY IN SEVERE MENINGOCOCCAL SEPTIC SHOCK?

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GMSPS is often used in randomised controlled trials (including recently completed rBP1, trial) to identify children with high mortality in meningococcal septic shock. A score of more than 12 out of 15 has been reported to be associated with 80–100% mortality.

Aims: (1) To evaluate the usefulness of Glasgow Meningococcal Septicaemia Prognostic Score (GMSPS) in predicting mortality in meningococcal septic shock (2) To identify the clinical or laboratory parameters associated with death in these children.

Method: We conducted a prospective study on the ventilated children with meningococcal septic shock admitted to the Paediatric Intensive Care Unit in a referral centre between 1997–1999 were studied.

Results: 42 children were ventilated for meningococcal septic shock. 4 children (9.7%) died, 36 (87.8%) required ionotropic support, 3 required haemofiltration (CVVH) and 1 underwent ECMO. Non-survivors were significantly younger, had lower mean WBC counts, platelets, fibrinogen and pH than the survivors. GMSPS [mean (95% CI) 12.7 (10.5,14.9) vs 10.0(9.2,10.8) (p=0.07)] was not significantly different between survivors and non-survivors. However, on multiple regression analysis only thrombocytopenia, prolonged INR and low fibrinogen were associated with mortality. A combination of these 3 was associated with 100% mortality. GMSPS of 15/15 had a positive predictive value 20%, sensitivity of 25%, specificity of 87% for predicting death and was associated with only 20% mortality

Conclusion: We found that GMSPS is no longer useful in predicting mortality in severe meningococcal septic shock. A combination of thrombocytopenia, prolonged INR and low fibrinogen is the best predictor of mortality.

G2 INCREASE IN SEVERE S. PNEUMONIA INFECTIONS REQUIRING PAEDIATRIC INTENSIVE CARE AND A DECREASE IN ANTIBIOTIC PRESCRIBING

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Introduction: We have become concerned about an increase in the number of children admitted to our paediatric intensive care unit (PICU) with severe S. Pneumonia infections.

Method: A retrospective review of case notes of patients with positive S. Pneumonia, admitted between Dec 1992—Dec 2000, was conducted. Clinical presentation, progression and laboratory findings were recorded to identify any diagnostic features. The Prescription Prescribing Authority (PPA) was contacted for prescribing patterns.

Results: During the eight year period 31 patients with invasive pneumococcus admitted to our unit were identified. There has been a steady increase in serious invasive pneumococcal disease, 14 children between 1992–98 compared to 18 children in the last two years. These cases include pneumococcal induced haemolytic uraemic syndrome (4), pneumococcal meningitis (11) and septicaemia (3). The sequelae of these infections included severe neurological deficit with almost complete loss of higher cerebral function (6 in 6ys 9 in 2 years), hearing loss (4 vs 3) and profound deafness requiring cochlear implants (3 vs 3). There was 1 death over the last 6 years and 2 in the last two years. All patients in the last two years had presented to their GP on more than two occasions prior to admission to ICU. The PPA report a 25% reduction in antibiotic prescriptions in children since 1997 from a level of 9817 (>1000) prescription/y.

Conclusions: We are concerned that the rise in pneumococcal diseases we have observed may be due to a change in antibiotic prescribing practices. Because of external pressures, primary health care physicians may now be hesitant to treat children with viral symptoms who re-present a second or third time with antibiotics. S. Pneumonia is carried in the oropharynx by 33% of the paediatric population. Viral infections may pave the way for pneumococcal super-infections.

G3 FACTORS AFFECTING NITROGEN BALANCE IN CRITICALLY ILL CHILDREN

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Critically ill patients catabolise endogenous protein and have a negative nitrogen balance. The aim of nutritional support is to minimise or prevent the loss of lean muscle mass and promote a positive balance.

Aims: To prospectively determine nitrogen balance in critically ill children and identify factors associated with a positive balance.

Method: Eighty-two children, 59 male, median age 8.09 [range 0.7–18.6] years were studied. Admission diagnoses were hepatological (35), neurological (31), respiratory (8) and other (8). 24-hour urine collections were made from admission until day 14 or discharge. Nitrogen (N) balance was calculated as nitrogen intake—urinary nitrogen excretion. Other clinical variables known to affect nitrogen balance were also collected. Data is presented as mean ± s.d. for a total of 413 study days.

Results: See table.

Abstract G3

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 7</th>
<th>Day 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>N excretion (mg/kg)</td>
<td>237.9 [137.1]</td>
<td>325.0 [149.9]</td>
</tr>
<tr>
<td>N balance (mg/kg)</td>
<td>-156.3 [196.5]</td>
<td>-23.9 [312.8]</td>
</tr>
</tbody>
</table>

A significant difference in N balance was found between the sexes, females achieving +ve balance by day 2, males by day 8. Children admitted with a chronic illness had +ve balance by day 4 but acute admissions were -ve balance even by day 14. When no nutrition or enteral nutrition (EN) was given N balance became -ve whereas a +ve balance was achieved with parenteral nutrition (PN), the greatest +ve balance being attained when EN and PN were administered together. N balance correlated positively with age and energy intake, and negatively with measures of nutritional status and serum IGF-1 concentration. N balance was no different in those who developed sepsis or died and was not associated with a longer duration of ventilation or stay on PICU.

Conclusion: Like adults, children become catabolic when critically ill though to a lesser degree and for a shorter period of time. In contrast to adults the presence of a negative nitrogen balance does not affect outcome.

G4 USE OF TISSUE PLASMINOGEN ACTIVATOR (T-PA) IN CHILDREN WITH FULMINANT MENINGOCOCCALIA (FM)—A RETROSPECTIVE MULTICENTER STUDY

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Aims: To summarise the clinical observations, outcome and adverse effects associated with the systemic use of t-PA in children with FM.

Patients and methods: 60 consecutive children (1994–2000) with FM from 21 different hospitals in 8 countries in whom t-PA was used were retrospectively analysed according to a defined protocol. t-PA was administered with a mean dose of 0.26 mg/kg (range 0.008–0.6mg/kg) and a mean duration of 8.5 hrs (range 1.2–72 hrs).

Mortality and complications: The mortality was 45% (27 deaths). 18 of 33 survivors had amputations (11 below knee/elbow or greater; 7 less severe).

Observations and safety: 1. Bleeding Risk: 5 patients suffered intracerebral haemorrhages of which 3 were lethal. 6 children had ‘considerable’ bleeding episodes, and in 13 ‘minor’ bleeding was
documented. 2. Amputations and Shock: Investigators at certain centres ascribed reduction in eventual extent of amputation or improvements in cardiovascular parameters to the use of tPA.

Conclusions: 1. Safety: There are serious concerns about the safety of t-PA given the extremely high mortality and incidence of confirmed intracerebral bleeds. 2. Potential benefit: Some clinicians ascribed less severe than expected amputations and improvements of shock to tPA therapy. 3. Dose strategy: Due to the variation in doses used, high PAI-1 levels in FM (previously published) and safety concerns, a safe dosing strategy at different disease timepoints is not yet known.

Further controlled studies including dose-finding, safety and efficacy endpoints must be carried out before the use of tPA becomes routine.

G5 HLA-DR PREDICTS SYSTEMIC INFLAMMATORY RESPONSE SYNDROME FOLLOWING CARDIOPULMONARY BYPASS

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Introduction: Sepsis and systemic inflammatory response syndrome (SIRS) are the major causes of ICU morbidity and mortality. Recent data suggests that the balance between pro- and anti-inflammatory mediators is the critical factor determining clinical severity. Monocyte HLA-DR expression reflects this balance with low levels indicating a predominantly anti-inflammatory response to injury. Such cases may be at increased risk of secondary sepsis/SIRS. We undertook a prospective observational study of the relationship between HLA-DR and subsequent sepsis/SIRS following the inflammatory insult of cardiopulmonary bypass.

Method: Peri-operative and daily flow cytometric analysis of monocyte HLA-DR expression in whole blood taken from cases undergoing elective cardiac surgery. SIRS was defined by WCC (>12 x 10^9/l) and temperature changes (>38 or <36°C) and sepsis as these features plus with positive blood cultures.

Results: 82 cases were studied. The percentage of monocytes expressing HLA-DR fell in all cases with the lowest values seen in the first 24–72 hrs. 14 cases subsequently developed sepsis/SIRS and had lower minimum levels of HLA-DR than controls (32% vs 85% p<0.0001, Mann-Whitney). The median interval between minimum HLA-DR and a diagnosis of sepsis/SIRS was 5 days (IQR 4–12). HLA-DR was independently associated with subsequent sepsis/SIRS on multiple logistic regression analysis after correction for bypass time, age, sex, complexity of surgery, and Paediatric Index of Mortality on admission to ICU. The odds ratio for developing sepsis/SIRS with HLA-DR <60% was 12.9 (95%CI 3.4–48).

Conclusions: Low HLA-DR expression identifies a subpopulation at greatly increased risk of sepsis/SIRS following an inflammatory insult. Such cases may benefit from immunomodulatory strategies.

G6 INVESTIGATING SEPSIS-ASSOCIATED MYOCARDIAL DYSFUNCTION: PURIFICATION AND ANALYSIS OF MYOCARDIAL DEPRESSANT FACTORS RELEASED BY PERIPHERAL BLOOD MONONUCLEAR CELLS UPON EXPOSURE TO N. MENINGITIDIS

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The pathways leading to myocardial depression in septic shock are poorly defined. It has previously been shown that serum from children with meningococcal septicaemia causes depression of rat myocardial contractility both acutely and after a period of incubation[1]. We have developed an in vitro model to investigate the nature of circulating myocardial depressant factors released in sepsis. Aims: To identify factors released in sepsis causing cardiac myocyte contractile dysfunction.

Methods: Human peripheral blood mononuclear cells (PBMC’s), obtained by FICOLL separation from healthy volunteers, were cultured with heat killed N.meningitidis. Adult rat ventricular myocytes were obtained by collagenase perfusion. Contraction was induced by field stimulation in a heated cell bath. Purification of myocardial depressant factors was carried out using size and charge based gel filtration to isolate active fractions for further analysis.

Results: The stimulated PBMC supernatant induced depression of myocardial contractility - mean of 15% reduction (SD 5.85, p<0.01) in contraction amplitude - after PBMC exposure to 10^8 bacteria/ml. No effect is seen with supernatant of control unstimulated PBMC’s. Preliminary results suggest an active fraction in the 20–40KD range (mean reduction of 14.6%, p=0.01), in the same region as TNFα elution by ELISA of PPLC fractions. The factor(s) appears to be protein, relatively heat stable, and possibly bound to albumin.

Conclusions: N.meningitidis induces synthesis of myocardial depressant factors in PBMC’s. Further characterisation is being undertaken to define the role of TNFα, IL-1β and endotoxin by their inhibition. Definitive identification will also be obtained using 2D-gel electrophoresis and mass spectrometry of the active fractions. [1]Ped Crit Care Med 1(1):2000.

G7 OUTCOME FROM BACTERIAL MENINGITIS IN CHILDREN ADMITTED TO A REGIONAL PAEDIATRIC INTENSIVE CARE UNIT

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Introduction: Very few recent data exist concerning neurological outcome from bacterial meningitis in children requiring intensive care.

Aim: To define the outcome of all cases of bacterial meningitis aged ≤ 16 years admitted to a Regional PICU over 1997–98.

Method: Retrospective case review.

Results: 56 children were studied (29 boys; 27 girls). The median age was 1.75 years (range 0.05–15). 44 (79%) were transferred from other hospitals and 12 (21%) admitted via A&E. The causative organism was meningococcus in 44, pneumococcus in 8, H. influenzae in 1, Group B streptococcus in 1 and unidentified in 2. The median length of PICU stay was 3 days. 43 patients (77%) required IPPV. 40 children (71%) had a significant GCS ≤ 13) reduction in conscious level. The median lowest GCS was 9 (range 4–15). 11 children (20%) had a poor outcome, defined as death (3) or major handicap (8); 9 children (16%) survived with mild or moderate disability; 36 (64%) were considered to have a good outcome. Analysis of variance showed low GCS and young age to be independent determinants of poor outcome (p < 0.05). Brain herniation secondary to raised intracranial pressure (ICP) was the cause of death in 2/3. In total, 38 symptoms suggesting raised ICP occurred in 30 children (54%). 54 neurological investigations were performed in 28 patients (50%). No child underwent ICP monitoring. 4/9 (44%) cranial ultrasound and 9/16 (56%) CT brain scans performed in the acute illness phase suggested raised ICP. 16 (10%) brain scans performed in the late illness phase showed major ischaemic damage. CSF pressure was measured at LP in 3 cases was elevated in all 3 (18, 36, 40 cmH2O).

Conclusion: These results suggest that raised ICP is common in children with bacterial meningitis requiring PICU and may cause ischaemic brain damage and poor outcome. Such data have important implications for the monitoring and treatment of these patients.

G8 MECHANICAL VENTILATION IN PATIENTS WITH UNILATERAL LUNG COLLAPSE OR CONSOLIDATION: EFFECT OF LATERAL POSITIONING ON VIRTUAL SHUNT

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Background: In children and adults with various respiratory problems the effect of posture on the distribution of pulmonary perfusion is similar. The dependent lung in the lateral decubitus position receives more of the total perfusion than it does in the supine position. However, ventilation changes differ: in adults the dependent lung is preferentially ventilated whereas in children the opposite occurs.

Aims: To evaluate the effect of lateral positioning on virtual shunt (VS) in mechanically ventilated (MV) infants and children with unilateral lung collapse or consolidation.

Methods: 14 ventilated patients (7mths to 14yrs) with unilateral lung changes were selected. After informed consent, VS was calculated non-invasively using a validated model (Barnes AJ. Crit Care Med 1995;12:375). Assessment of gas exchange is performed by varying...
fractional inspired oxygen (FiO2) and noting the response in saturation. An equilibration period of 3 mins is needed after each step in FIO2. VS values for supine (S), disease dependent (DD) and disease uppermost (DU) positions were calculated.

**Results:** In all, when in the S position, VS (measured) was 14.4±5.3%. DD and DU positioning resulted in a fractional change from S of 0.13±0.29 and −0.11±0.28 respectively (P<0.05) i.e., worsening of VS in 10/14 patients in DD and lessening of VS in 10/14 in DU.

**Conclusions:** Taken together these findings suggest that in ventilated children with intrapulmonary shunting due to unilateral lung collapse or consolidation ventilation-to-perfusion relationships are optimised with the DU, even though perfusion is preferentially directed to the dependent lung.

**TOWARDS BETTER WEIGHT ESTIMATION IN THE SERIOUSLY ILL CHILD—A COMPARISON OF METHODS**

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**Aims:** Rapid weight estimation in the seriously ill child is essential for the calculation of drug and fluid administration. This is crudely predicted by the formula (Age+2)²/4. However in practice, this estimation is rarely accurate. We examined a sample of children from our region in order to assess the accuracy of this commonly used formula. We also collected anthropomorphic data that would be easy to collect from an immobilised patient and that was likely to predict weight.

**Methods:** Measurements of age, weight, mid-arm circumference (MAC) and shoe size were recorded from 169 consecutive children seen in the outpatient clinic. Children too young to wear shoes were excluded from the analysis. Shoe size was ascertained by asking parents and checking the shoes of the individual child. Scatter diagrams of age versus weight, MAC versus weight and shoe size versus weight were plotted using Microsoft Excel.

**Results:** See table. There is a strong linear correlation between age and weight (r=0.84) and a stronger linear correlation between mid-arm circumference and weight (r=0.91). A plot of shoe size versus weight is best described by an exponential curve with a correlation coefficient (r) of 0.93. Using ‘best fit’ curves it is possible to derive modified formulae for weight estimation that improve the accuracy of weight prediction.

**Abstract G9**

**Method of prediction** | **Mean difference from observed result (kg)** | **Overall % difference in observed v predicted**
--- | --- | ---
Standard (( Age+4)x(x2) | 7.5 | 24%
(Age+1.7)x3 | 5.4 | 17%
(MAC in cm)x(3.6-40) | 4.8 | 15%
6cm x ((Shoe size x1.02)) | 4.5 | 14%
Combined formula | 2.6 | 8%

**Conclusions:** The formula (Age+4)x(x2), although providing a rough guide to a child’s weight, does not best predict weight in our population. (Age+1.7)x3 provides a slightly better guide, but weight estimation can be significantly improved using measurements of mid-arm circumference and shoe size.

**RISKS OF AND OUTCOME FOR ACUTE SECONDARY DETERIORATION FOLLOWING MINOR HEAD INJURY IN CHILDDHOOD: IMPLICATIONS FOR MANAGEMENT**

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One in 20 children (600,000) present annually to A & E with minor head injury. Practice guidelines recommend all children with transient loss of consciousness, persistent headache or vomiting, skull fracture or showing any other reason for concern should be admitted for 48 hours to detect those with intracranial haemorrhage and/or the later onset of cerebral oedema. These guidelines result in 1 in 200 (60,000) children being admitted annually. To estimate the risk of secondary deterioration following minor head injury we identified all children in Tyne and Wear, Northumberland and Cumbria who died or required a neurosurgical procedure and/or intensive care following a minor head injury over a 12 year period 1988-1999. Minor head injury was defined as GCS 13 at initial examination, no abnormal neurological signs and no physical evidence of skull fracture. The comparative sample was 3249 children presenting to a local A & E over 2 years with minor head injury. 15 children with secondary deterioration were identified (extradural haemorrhage 14, subdural haemorrhage 1, intracranial haemorrhage 1, cerebral oedema 1). 1 died at home without presenting to hospital. 14 presented to A & E of whom 11 were admitted. Risk was 1 in 6,100 minor head injury A & E presentations and 1 in 1,800 minor head injury admissions. Only 1/15 had transient loss of consciousness 15/15 had headache and vomiting and only 4/15 had skull fractures. These factors increased the risks to 1 in 5468, 3193 and 1519 A&E presentations respectively. The outcome was poor; 5/15 died, 3/15 survived with impairment and only 7/15 were normal. All had major preventable factors in their management. Secondary deterioration after minor head injury is a rare event. Admission of large numbers of low risk children is not effective for these rare children. Consideration should be given to CT scanning those with persistent and/or progressive headache and vomiting after minor head injury.

**AWARENESS OF TOXIC SHOCK SYNDROME ASSOCIATED WITH MINOR BURNS**

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BURNS are a recognised cause of toxic shock syndrome (TSS). What is less appreciated is that even relatively minor burns (<5% body surface area) can precipitate TSS with multi-system failure. We wished if there was adequate awareness of the syndrome amongst GP’s, A&E staff, paediatricians, and parents of children with minor burns, discharged from A&E.

**Aims:** To determine 1) the delay between presenting feature and diagnosis of TSS in children with <5% burns, 2) the nature of advice given to parents of a child with <5% burns.


**Results:** Six cases of TSS were associated with <5% burns (age 12–36 months, median 20.5). All had a presenting symptom of either fever or diarrhoea (two of which were discharged on representation). Time from first feature of TSS to diagnosis was 15–24 hours (median 24 hours). Five of the six were diagnosed only upon tertiary referral. Four were ventilated, four required inotropic support. Fifty-one hospitals responded to the telephone survey. Written burns advice was distributed by 35 (69%) of these. Fever was only mentioned in 25 (49%), diarrhoea in 6 (12%), rash in 4 (8%), none mentioned mucocutaneous features.

**Discussion:** There is an apparent delay in recognition and diagnosis of TSS at all levels of care. Such delays preclude early therapeutic intervention with fluid resuscitation, antibiotics and intravenous immunoglobulin, which may attenuate the course and severity of the disease. Parental advice should highlight the possibility of TSS. There needs to be increased recognition amongst A&E doctors and paediatricians.

**MANAGEMENT OF CONVULSIVE STATUS EPILEPTICUS (CSE) IN CHILDREN: ASSESSMENT OF PRACTICE AGAINST PUBLISHED GUIDELINES**

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**Introduction:** CSE is a common neurological emergency necessitating admission to a paediatric intensive care unit (PICU). Advanced Paediatric Life Support (APLS) guidelines using lorazepam as a first-line anticonvulsant were published to aid uniformity in management and reduce complications such as apnoea needing intubation.

**Aims:** To compare the referring hospital management of patients with CSE admitted to PICU, against APLS guidelines. To establish the number of referring hospitals using APLS guidelines.

**Methods:** Retrospective case notes analysis of admissions to PICU with a diagnosis of CSE over a 15-month period (September 1999 – November 2000) was performed. Children with epilepsy and developmental delay were excluded. All anticonvulsant medications given at the referral hospital (including by ambulance staff) were
Corticosteroid use in children referred with croup: significant impact from an educational programme targeted on primary care and A&E

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Background: In children hospitalised with croup, corticosteroid therapy (SRx) reduces illness severity, duration of hospital stay and re-attendance rate. In early 1998, only 5% of our referrals with croup received SRx before arrival. We held a series of educational events for GPs and new A&E SHOs. We developed a clinical guideline for croup in 1999, which proposed that all children seen with croup should receive oral prednisolone, and defined criteria for hospital referral.

Aim: To assess the impact of our guideline/ educational programme on pre-referral SRx and outcome of children with croup.

Methods: We reviewed all records of children referred to our Short Stay Ward (SSW) with croup over 32 months (Jan 1998-Oct 2000). Children <6 months or with upper airway disorders were excluded.

Results: 517 children (340 boys; 177 girls) were referred with croup; pre-SSW SRx rose from 5% to 50% (peak 77% after guideline launch). Overall, 181 (35.5%) had SRx before arrival; 19 (10.5%) of whom were hospitalised after observation, compared with 55 (16.4%) of 336 without SRx. Croup referrals fell by 32% over the study period, resulting in a re-attendance rate. In early 1998, only 5% of our referrals with croup received SRx before arrival. We held a series of educational events for GPs and new A&E SHOs. We developed a clinical guideline for croup in 1999, which proposed that all children seen with croup should receive oral prednisolone, and defined criteria for hospital referral.

Conclusion: An educational programme and guideline developed jointly with GPs and targeted at GPs and A&E staff resulted in reduced referrals and significant increase in SRx in children with croup. Children given SRx before hospital referral have less respiratory distress on arrival and are less likely to progress to full admission.

Missed educational opportunities—an important aspect of the burden of injury

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Aims: All injuries have multiple consequences to the individual and society. Consequences such as missed educational opportunities are rarely if ever evaluated. Approximately 1 in 3 Welsh children attend A&E departments each year, predominately with minor injuries. This study set out to determine how much educational time was lost as a result of minor injuries.

Methods: A case controlled study of children attending three A&E departments, with minor injuries, on successive Sundays for 3 months in 1999 was carried out. School attendance for each half day in the following school week was recorded for cases and controls obtained from the school register, and for a random sample for each half day in the week preceding injury. The difference in attendance between the matched pairs was compared using the Wilcoxon signed rank test.

Results: 422 cases were matched with controls in 130 schools. Bruises (27.3%), sprains (26.1%), lacerations (17.3%) and minor fractures (13.5%) accounted for the majority of injuries. Differences between cases and controls were unaffected by adjustment for age, sex and deprivation score. There was no significant difference between case and control attendance for the week preceding injury. Cases, excluding fractures, missed an average of 2.62 half days from school compared to 0.60 half days for controls (p<0.001).

Conclusion: The combination of excess school loss after minor injury and the high incidence of these injuries indicates that missed educational opportunities are an important aspect of the burden of injury, with potentially significant consequences.