

## Strengthening care of injured children globally

Charles Mock,<sup>a</sup> Francis Abantanga,<sup>b</sup> Jacques Goosen,<sup>c</sup> Manjul Joshipura<sup>d</sup> & Catherine Juillard<sup>e</sup>

**Abstract** Part of the solution to the growing problem of child injury is to strengthen the care that injured children receive. This paper will point out the potential health gains to be made by doing this and will then review recent advances in the care of injured children in individual institutions and countries. It will discuss how these individual efforts have been aided by increased international attention to trauma care. Although there are no major, well-funded global programmes to improve trauma care, recent guidance documents developed by WHO and a broad network of collaborators have stimulated increased global attention to improving planning and resources for trauma care. This has in turn led to increased attention to strengthening trauma care capabilities in countries, including needs assessments and implementation of WHO recommendations in national policy.

Most of these global efforts, however, have not yet specifically addressed children. Given the special needs of the injured child and the high burden of injury-related death and disability among children, clearly greater emphasis on childhood trauma care is needed. Trauma care needs assessments being conducted in a growing number of countries need to focus more on capabilities for care of injured children. Trauma care policy development needs to better encompass childhood trauma care. More broadly, the growing network of individuals and groups collaborating to strengthen trauma care globally needs to engage a broader range of stakeholders who will focus on and champion the improvement of care for injured children.

Une traduction en français de ce résumé figure à la fin de l'article. Al final del artículo se facilita una traducción al español. الترجمة العربية لهذه الخلاصة في نهاية النص الكامل لهذه المقالة.

### Introduction

Injury has become a leading cause of death and disability globally. The two age groups most affected are older children (aged 5–14 years) and adolescents and younger adults (aged 15–44). For every person injured, many more are left with temporary or lifelong disabilities. The burden of injury is especially pronounced in low- and middle-income countries (LMICs), where 95% of all childhood injury deaths occur.<sup>1</sup>

To decrease this burden, a spectrum of activities are needed, including injury surveillance, injury prevention and improvements in care of the injured (e.g. trauma care). Obviously, a major emphasis should be on prevention. However, much can also be accomplished by improvements in trauma care. To gauge the potential extent of such gains, we can examine existing discrepancies in outcome of injured patients in different countries. One study comparing outcomes of severely injured patients in three countries at different economic levels showed that case-fatality rates among seriously injured persons (i.e. with an Injury Severity Score  $\geq 9$ ) increased from 35% in high-income United States of America to 55% in middle-income Mexico to 63% in low-income Ghana. These results show that people injured to a similar extent are nearly twice as likely to die in a low-income setting as in a high-income setting.<sup>2</sup> If these inequities could be eliminated, an estimated 2 million of the 5 million injury deaths each year could be averted.

In addition to mortality, there is also a large burden of avoidable disability globally. The majority of injury-related disability in LMICs is due to extremity injuries, as opposed to

high-income countries where there is a relatively higher burden from more difficult to treat head and spinal cord injuries. The disability from extremity injuries should be eminently amenable to low-cost improvements in orthopaedic care and rehabilitation.<sup>3,4</sup>

There is often a misperception that improvements in trauma care would be expensive and impractical in LMICs. However, the Disease Control Priorities Project has shown that several interventions that need to be promoted to improve trauma care are among the most cost-effective in the health-care armamentarium. Among these, the following interventions were identified as having cost-effectiveness ratios of below 100 (US\$ 100 per disability-adjusted life year averted): strengthening of prehospital care through training of community-based paramedics and village lay-first responders; community ambulances; and basic surgical care (including care of injuries) at district hospitals. Thus, these interventions are considered extremely cost-effective when assessed on a scale ranging from 1 (most cost-effective) to 100 000 (least cost-effective).<sup>5</sup>

In this paper, we address how to better implement the array of cost-effective and sustainable trauma care improvements globally, especially regarding care of the injured child. First, we review some of the recent individual country efforts that specifically address care of the injured child in the LMIC setting. We show that there are many capable individuals successfully confronting barriers and difficulties in their own institutions, some with innovative solutions from which others around the world can learn. We will then discuss how to build on such individual examples to make more progress

<sup>a</sup> Department of Violence and Injury Prevention and Disability, World Health Organization, 20 avenue Appia, 1211 Geneva 27, Switzerland.

<sup>b</sup> Department of Surgery, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

<sup>c</sup> Department of Surgery, Johannesburg Hospital, Johannesburg, South Africa.

<sup>d</sup> Academy of Traumatology (India), Ahmedabad, India.

<sup>e</sup> Department of Surgery, University of California at Los Angeles, Los Angeles, CA, United States of America.

Correspondence to Charles Mock (e-mail: mockc@who.int).

(Submitted: 1 October 2008 – Revised version received: 23 February 2009 – Accepted: 27 February 2009)

globally. We conclude with practical steps that can be taken to reduce the currently unacceptable burden of death and disability from childhood injury.

## Progress in individual institutions and countries

It has long been recognized that injured children are not just small injured adults. Although some of the same general principles of trauma care do apply, there are many specific considerations for children that need to be addressed, such as paediatric-size equipment, modifications in technique for airway maintenance, differences in calculation of fluid requirements for shock resuscitation, among many others. Likewise, care of the injured child necessitates an appreciation of the special psychological, emotional and developmental needs of the child and his/her family. Thus, special attention is indeed needed in development of trauma care services for injured children.

A variety of authors have addressed such issues in the LMIC setting, several have reviewed the overall scenario with paediatric trauma care at their institutions. Shen et al. looked at the patterns of injury and major interventions required among injured children in Gambia.<sup>6</sup> Gurses et al. looked at similar issues, including cost of care in Turkey.<sup>7</sup> Some authors have expanded on such reviews, looking at structural issues that influence care in their systems. Van As and Rode reviewed the history of the development of the paediatric trauma unit at their hospital in South Africa.<sup>8</sup> Inon & Haller looked at systems issues for paediatric trauma care in several countries, focusing on Argentina. After the initiation of the national Argentine Paediatric Trauma Registry, they identified deficits in paediatric trauma care that were then addressed through training and standardization of initial paediatric trauma management. These measures were associated with a decrease in mortality among seriously injured children from 14.1% to 5.9%.<sup>9</sup>

Some studies have demonstrated the role that specific interventions could play in reducing mortality and morbidity. Gaudeuille et al. looked at the barriers faced in managing a particularly difficult type of fracture (supracondylar humerus fractures) in the Central African Republic. They commented that the currently poor functional results could

### Box 1. Essential trauma care services<sup>20</sup>

- Obstructed airways are opened and maintained before hypoxia leads to death or permanent disability.
- Impaired breathing is supported until the injured person is able to breathe adequately without assistance.
- Pneumothorax and haemothorax are promptly recognized and relieved.
- Bleeding (external or internal) is promptly stopped.
- Shock is recognized and treated with intravenous fluid replacement before irreversible consequences occur.
- The consequences of traumatic brain injury are lessened by timely decompression of space occupying lesions and by prevention of secondary brain injury.
- Intestinal and other abdominal injuries are promptly recognized and repaired.
- Potentially disabling extremity injuries are corrected.
- Potentially unstable spinal cord injuries are recognized and managed appropriately, including early immobilization.
- The consequences to the individual of injuries that result in physical impairment are minimized by appropriate rehabilitative services.
- Medications for the above services and for the minimization of pain are readily available when needed.

be improved upon by a specific type of X-ray equipment (image intensifier).<sup>10</sup>

A few studies have reported on the results of innovative strategies. Obaidullah et al. confronted the issue of maintaining joint mobility after release of axillary burn contractures in Pakistan. Commonly used splints were too hot and uncomfortable for their environment and had low compliance. They used a low-cost innovative solution of a cloth figure-of-eight sling. This resulted in a good range of shoulder motion, comparable to other methods, as well as high skin graft take.<sup>11</sup> Similarly, Hudson et al. demonstrated the effectiveness and safety of the use of tissue expanders in reconstructive surgery after burns in children in South Africa.<sup>12</sup>

Karkiner et al. in Turkey and Landau et al. in South Africa evaluated changes in protocols for management of children with blunt hepatic trauma. They found that selective non-operative management (versus routine surgery) was safe in their environment. Selective non-operative management has been widely used in high-income countries, resulting in fewer unnecessary surgeries. However, its applicability and safety in LMICs had thus far not been well addressed. These studies from Turkey and South Africa did demonstrate that this technique could be used effectively and safely in their environment, but such use was dependant on somewhat expensive imaging technology.<sup>13,14</sup>

As already mentioned, many special considerations apply to the care of

injured children. Nonetheless, broader efforts to improve training, resources, or organization and planning for all trauma patients may also improve care of injured children. Several studies from LMICs have shown improvements in outcome for both children and adults with such measures. For example, in the prehospital setting, most people in the world currently do not have access to formal emergency medical services (EMS) or ambulance services, especially in rural areas. One programme specifically addressed this scenario. In mine-infested areas of Cambodia and northern Iraq, this programme created a two-tiered response system. The first tier included lay-first responders who had first aid training. The second tier consisted of a smaller number of paramedics with more advanced training. Equipment and supplies were provided, but not ambulances. They continued to rely on the existing transport system of private and commercial vehicles, as well as non-motorized transport. This program greatly improved timely care for victims of mine blasts and other forms of trauma. Mortality among severely injured persons decreased substantially from 40% to 9%.<sup>15</sup>

In Mexico, Arreola-Risa et al. reported on training programmes designed to strengthen the performance of an existing, basic EMS. In this locale, few prehospital providers had formal certification as emergency medical technicians. An effort by local government provided better training for existing

Table 1. Human and physical resources needed for treatment of obstructed airways<sup>20</sup>

Resources	Resources needed by facility level <sup>a,b</sup>			
	Basic	GP	Specialist	Tertiary
<b>Airway: knowledge and skills</b>				
Assessment of airway compromise	E	E	E	E
Manual manoeuvres (chin lift, jaw thrust, recovery position, etc.)	E	E	E	E
Insertion of oral or nasal airway	D	E	E	E
Use of suction	D	E	E	E
Assisted ventilation using bag–valve–mask	D	E	E	E
Endotracheal intubation	D	D	E	E
Cricothyroidotomy (with or without tracheostomy)	D	D	E	E
<b>Airway: equipment and supplies</b>				
Oral or nasal airway	D	E	E	E
Suction device: at least manual (bulb) or foot pump	D	E	E	E
Suction device: powered: electric/pneumatic	D	D	D	D
Suction tubing	D	E	E	E
Yankauer or other stiff suction tip	D	E	E	E
Laryngoscope	D	D	E	E
Endotracheal tube	D	D	E	E
Oesophageal detector device	D	D	E	E
Bag–valve–mask	D	D	E	E
Basic trauma pack	D	E	E	E
Magill forceps	D	D	E	E
Capnography	I	D	D	D
Other advanced airway equipment	I	D	D	D

<sup>a</sup> Basic: outpatient clinics, often staffed by non-doctors; GP: hospitals staffed by general practitioners; Specialist: hospitals staffed by specialists, usually including a general surgeon; Tertiary: tertiary care hospitals, often university hospitals, with a wide range of specialists.

<sup>b</sup> Items in the resource matrices are designated as follows: E, essential; D, desirable; I, irrelevant (not usually to be considered at the level in question, even with full resource availability).

staff and tightened requirements for newly hired staff so that all full-time staff were eventually certified. As a result, mortality for all trauma patients treated by the EMS decreased from 6.3% to 2.5%.<sup>16</sup>

In the hospital setting, the main trauma hospital in Khon Kaen, Thailand instituted a trauma audit committee to better oversee trauma care. This committee identified a high rate of medically-preventable deaths, i.e. those that could be prevented by improvements in care. In trauma, these are often from airway obstruction or single organ intra-abdominal injuries, which should be treated well in most environments. Correctable problems identified by the committee included inadequate resuscitation for shock, delayed surgery for head injuries and communication problems. Low-cost, corrective action was instituted to target these problems, including improved communication within the hospital by use of radios, better supervision of junior doctors through increased senior staffing in the emergency department at peak times,

and improved reporting and monitoring of trauma cases at hospital meetings (i.e. better use of techniques of quality improvement). These improvements resulted in a decrease in mortality among all admitted trauma patients from 6.1% to 4.4%.<sup>17</sup>

Thus, much is indeed being done well to strengthen the care of injured children in many institutions and locations worldwide. This includes efforts that specifically address the care that children receive and broader efforts to strengthen trauma care systems that benefit children and adults alike. The question now becomes how to build on such local and national efforts to make more comprehensive progress globally.

### Global efforts to improve care

To expand the individual efforts mentioned, we have two additional foundations on which to build. Both of these foundations emphasize improving health care through improved organization and planning. The first is the essential services approach of interna-

tional public health. Essential services are those that are high-yield, but low-cost, and which realistically could be assured to almost everyone in a given population. Programmes have included defining the core services to promote, identifying barriers to such services, and providing technical input and assistance to countries and high-need areas to improve capacity to deliver these services. Examples of programmes that have successfully done this include the Expanded Programme on Immunizations, the Essential Medicines Programme, the Global TB Programme, and the Safe Motherhood Initiative and related programmes to make pregnancy safer. Until recently, this approach had not been applied to trauma care.

The second foundation to build on is the trauma system development from high-income countries. This has entailed improving the spectrum of care for the injured in both prehospital and hospital-based settings, as well as streamlining referrals between hospitals. Such improvements in organization and planning for system-wide trauma care

Table 2. Implementation of WHO trauma care recommendations in several countries

Country	Use of WHO recommendations
Colombia	<ul style="list-style-type: none"> <li>Recommendations contained in <i>Prehospital trauma care systems</i> incorporated into national legislation: Decree 3616 of 2005 and Resolution 1043 of 2006, both of which address basic qualifications for providers of prehospital care and standards for equipment in ambulances, as well as establishing methods for audit of the quality of care provided.<sup>22,23</sup></li> <li><i>Guidelines for essential trauma care (EsTC)</i> used as basis for needs assessment of trauma care capabilities in selected provinces.</li> </ul>
Ecuador	<ul style="list-style-type: none"> <li><i>Guidelines for EsTC</i> used as basis for needs assessment of trauma care capabilities in seven provinces in south-east Ecuador.</li> <li><i>Guidelines for EsTC</i> endorsed by the Ecuadorian Trauma Society.</li> </ul>
Ghana	<ul style="list-style-type: none"> <li><i>Guidelines for EsTC</i> endorsed by Ghana Medical Association.</li> <li>Nationwide needs assessment conducted using <i>Guidelines for EsTC</i> as basis.<sup>24</sup></li> <li>Stakeholders conference held in 2005, bringing together trauma care experts, Ministry of Health planners, WHO personnel and several members of parliament. This adapted the <i>Guidelines for EsTC</i> to Ghanaian circumstances and discussed implementation methods. It produced: "Recommendations for a national policy on strengthening the care of injured persons in Ghana".</li> </ul>
India	<ul style="list-style-type: none"> <li><i>Guidelines for EsTC</i> endorsed by Academy of Traumatology (India).</li> <li>Stakeholders conferences were conducted in 2003 and 2005 to adapt recommendations to Indian circumstances and to discuss implementation strategies. These were co-sponsored by government and WHO. Stakeholders involved include trauma care clinicians from government and private sector, non-government organizations, public health planners.</li> <li><i>Guidelines for EsTC</i> used as basis for needs assessments of trauma care capabilities in Gujarat state.<sup>25</sup></li> </ul>
Mexico	<ul style="list-style-type: none"> <li><i>Guidelines for EsTC</i> endorsed by Mexican Association for the Medicine and Surgery of Trauma (AMMCT).</li> <li>Nationally representative needs assessment conducted using <i>Guidelines for EsTC</i> as basis in collaboration with AMMCT and WHO Country Office.<sup>25,26</sup></li> <li>Stakeholders conference conducted (2004) to adapt <i>Guidelines for EsTC</i> to Mexican circumstances. This was sponsored by national Ministry of Health and WHO. Stakeholders included representatives of most national professional societies that deal with trauma, as well as national Ministry of Health and several state health department planners.</li> <li>The <i>Guidelines for EsTC</i> has been translated into Spanish and re-published by the Pan American Health Organization for use in Latin America.</li> <li>Recommendations contained in <i>Prehospital trauma care systems</i> and <i>Guidelines for EsTC</i> incorporated into national legislation establishing standards for prehospital care providers.<sup>27</sup></li> </ul>
Mozambique	<ul style="list-style-type: none"> <li><i>Prehospital trauma care systems</i> used as basis for prehospital trauma care needs assessment and used in development of emergency medical services in Maputo.</li> </ul>
Viet Nam	<ul style="list-style-type: none"> <li><i>Guidelines for EsTC</i> used as basis for needs assessments of trauma care capabilities in several provinces.</li> <li>Findings of these needs assessments prompted affordable and sustainable improvements in trauma care in Hanoi, an excellent example of how the <i>Guidelines for EsTC</i> can be used to stimulate on-the-ground improvements.<sup>28</sup></li> <li><i>Guidelines for EsTC</i> and <i>Prehospital trauma care systems</i> have been translated into Vietnamese and re-published locally as collaborative effort of WHO Country Office and Vietnamese Ministry of Health.</li> </ul>

EsTC, essential trauma care.

have resulted in 15–20% reductions in mortality of treated trauma patients and 50% reductions in medically preventable deaths.<sup>18,19</sup> Thus far, similar system-wide approaches have been only minimally applied in LMICs.

The Essential Trauma Care Project has sought to combine these two different perspectives. It has sought to promote improved trauma system planning in LMICs by applying a public health approach. This project has been a collaborative effort of WHO and the International Society of Surgery. Representatives of these two organizations, working with other groups and with trauma care clinicians and administrators from many countries globally, have

created the *Guidelines for essential trauma care*.<sup>20</sup> This defines 11 core essential trauma care services, that every injured person in the world should realistically be able to receive (Box 1). These are the most cost-effective and high-yield trauma care services.

To assure the availability of these services, the guidelines delineate 260 individual items of human resources (skills, training, staffing) and physical resources (equipment, supplies) that should be in place in the range of health-care facilities globally. These recommendations cover the breadth of trauma care, including initial resuscitation, definitive care of injuries to all body regions and long-term reha-

bilitation. An example of one of the sets of resources guidelines, for airway management, is shown in Table 1. Recommendations are given for a range of facilities, from small rural clinics to tertiary care facilities. Likewise, individual resources are designated as either essential or desirable. Essential items are felt to be the most cost-effective and widely applicable, being relevant to countries at all economic levels. When they are not present at a given facility, they could be assured primarily through improved organization and planning, at no or minimal additional cost. Desirable items help to strengthen the provision of trauma care but are not as cost-effective. They are more amenable to middle-

income countries or to specific facilities that have particularly high volumes of trauma patients.

One of the sections of the guidelines addresses special considerations for care of the injured child. It shows how the human and physical resources recommendations need to be adjusted to assure optimal care of the injured child. For example, these special skills include the ability to recognize and manage specific paediatric orthopaedic injuries that are highly prone to disability, also the ability to interpret spinal X-ray films taking into account the anatomy of the childhood spine as it varies with age. Among the special equipment and supplies needed are the range of paediatric sizes for airway equipment, intravenous cannulas, nasogastric tubes, etc., as well as laboratory facilities that are able to perform tests on small samples of blood.

In similar fashion to the above-noted recommendations for trauma care at fixed facilities (clinics and hospitals), WHO has developed *Prehospital trauma care systems*<sup>21</sup> to give guidance on ways to strengthen care of the injured in the field, before arrival at fixed facilities. This addresses several scenarios, such as how to improve existing basic formal EMS (including ambulances); how to start new basic EMS systems in locations where none currently exist; and, in locations where instituting a formal EMS would not be feasible, how care of the injured can be improved by building on existing, although informal, systems of prehospital care and transport. These recommendations cover a wide variety of prehospital issues, including medical care, logistics, transport, communication, quality improvement, information systems and records and legal/ethical considerations.

These two publications are intended as planning tools for ministry of health planners and for administrators and clinicians at individual facilities or in individual institutions. They provide flexible templates, to be adjusted as needed based on local circumstances. Likewise, both are meant to serve as advocacy statements, to be used by who ever wishes to push for affordable and sustainable improvements in trauma care in their own environment. Their legitimacy for advocacy is further increased by the fact that they were developed with the input of a wide range of experts, in-

#### Box 2. Summary table of recommendations on ways in which to strengthen care of the injured child globally

##### Policy and planning

- Each country should define core, minimum essential trauma care services that every injured child should realistically be able to receive. Key WHO guidance documents<sup>20,21</sup> provide input on what these services should entail and how they can be modified to fit a country's particular situation.
- Countries (or provinces and districts) should undertake needs assessments to identify high priority ways in which the above-noted minimum essential trauma care services can be better assured to every injured child.

##### Administrative functions

- Capacity for organization and planning for trauma care should be strengthened in both individual facilities and in ministries of health.
- Trauma-related quality improvement programmes should be established to identify and address correctable factors in preventable deaths, appropriate for local conditions.

##### Human resources

- Key human resources (skills, training and staffing) should be defined as part of the resources needed to assure minimum essential trauma care services. These skills should include those specifically needed for care of the injured child, such as different techniques for trauma resuscitation and an appreciation of the special psychological, emotional and developmental needs of the child and his/her family.
- Adequate human resources for trauma care should be promoted through assuring appropriate core competencies in schools of medicine, nursing and other relevant professions. They should also be promoted by increased capacity for conducting continuing education on trauma.

##### Physical resources

- Each country should define trauma-related equipment and supplies that are essential at different levels of the health care system. These resources should include those specifically needed for care of the injured child, such as the range of paediatric sizes for equipment.
- Availability of such essential items should then be promoted by measures such as tightening up procurement and repair processes and should be assured through appropriate monitoring processes, such as quality improvement programmes and hospital inspection.

##### Prevention

- Links to child injury prevention should be promoted such as by using hospital data to better inform community injury prevention strategies and by counselling of injured children and their families on actions that they can undertake to prevent future injuries, when appropriate.

cluding representation from at least two countries on each continent. Likewise, representatives of a wide range of professional societies were involved in creating the recommendations, including, among others, international specialty organizations such as the International Society of Surgery, the World Federation of Neurosurgical Societies and the International Committee of the Red Cross, as well as country organizations such as the Ghana Medical Association and the Academy of Traumatology (India).

The true usefulness of these publications lies in whether they are able to actually promote and stimulate improvements in care of the injured on the ground. Since their release, there has been progress in this regard (Table 2). Several ministry of health stakeholder meetings have been called to examine how the recommendations contained in these publications can be adjusted to national circumstances and imple-

mented within national policy. In some cases, actual national policy changes have directly resulted from these publications. Likewise, the publications have been used as the basis for needs that have uncovered deficiencies in human and physical resources that could be remedied by affordable and sustainable measures, especially by greater attention to detail in planning and administration.

A particularly interesting example of the use of the publications to improve care comes from Viet Nam. A needs assessment of trauma care capabilities in the Hanoi area was conducted in 2002 using the *Guidelines for essential trauma care* as a template. This demonstrated several important deficiencies in resources, especially at commune health stations and smaller hospitals. Some of these deficiencies were in low-cost, but critical, supplies and equipment. This assessment led to increased attention

to trauma care by the Hanoi Health Department. A repeat assessment the following year demonstrated a notable improvement in capabilities. This had come about primarily through improved organization and planning, with no increased budget having been allotted to trauma care.<sup>28</sup> Similar accomplishments are eminently achievable worldwide.

Finally, increased global attention has been focused on trauma care through World Health Assembly Resolution 60.22: “Health systems: emergency-care system”. The WHA is the governing board of the WHO. It consists of every minister of health, or their designee, from 193 Member States. Its resolutions direct WHO’s activities and carry considerable influence on actions of individual countries, as well as non-government organizations and funders. In 2007, for the first time the World Health Assembly passed a resolution encouraging governments worldwide to increase their efforts at providing care for trauma and other emergency conditions. The resolution

listed 10 actions that Member States could take to achieve this, including measures like: “Identifying a core set of trauma services and developing methods to assure and document that such services are provided to all who need them”. The resolution adds further endorsement to the above-noted guidance documents and global efforts to promote and implement them.<sup>29,30</sup>

## Conclusion

There are many dedicated people working hard to strengthen care of the injured in general and care of injured children particularly, in the circumstances of LMICs. They have reported several practical, innovative solutions to overcome resource restrictions for a range of clinical issues. Their efforts have recently been aided by increased international attention to this problem. Although there are no major, well-funded global programmes to improve trauma care yet, recent WHO guidance publications and the broad network of collaborators who have worked on

them have stimulated increased global attention to improving planning and resources for trauma care. This has in turn led to increased national attention, including conduct of needs assessments and implementation of WHO recommendations in national policy.

Most of these global efforts, however, have not yet specifically addressed children. Given the special needs of the injured child and given the high burden of injury-related death and disability among children, clearly greater emphasis on childhood trauma care is needed. There are several practical steps that can be taken to achieve this goal. These are summarized in Box 2 and primarily include low cost and affordable steps to improve the organization and planning for trauma care services for children. By taking these practical steps, countries worldwide can lower the unacceptably high and tragic rates of childhood death and disability from injury. ■

**Competing interests:** None declared.

## Résumé

### Renforcement des soins aux enfants victimes de traumatismes dans le monde

L’une des solutions au problème grandissant posé par la traumatologie infantile réside dans le renforcement des soins délivrés aux enfants victimes de traumatismes. Le présent article attire l’attention sur les gains en matière de santé réalisables par un tel renforcement et passe ensuite en revue les progrès récemment obtenus par différents établissements et pays dans les soins aux enfants victimes de traumatismes. Il examine comment ces efforts individuels ont été aidés par l’attention internationale grandissante accordée aux soins aux enfants traumatisés. Malgré l’absence de programme mondial de grande envergure et bien financé pour améliorer ces soins, les récents documents-guides élaborés par l’OMS et un large réseau de collaborateurs ont stimulé l’intérêt mondial pour une meilleure planification et un meilleur financement de ces soins. À son tour, cet intérêt a attiré davantage l’attention sur le renforcement des capacités de traitement des traumatismes dans les pays, y compris l’évaluation des besoins et la mise en œuvre des recommandations de l’OMS dans le cadre des politiques nationales.

Néanmoins, la plupart de ces efforts mondiaux ne visaient pas encore spécifiquement les enfants. Les besoins particuliers des enfants victimes de traumatismes, comme la mortalité et la charge d’incapacité importantes liées aux traumatismes dans cette classe d’âges, appellent à donner une plus grande priorité aux soins prodigués à ces enfants. Les évaluations de ces soins menées dans un nombre grandissant de pays doivent se concentrer davantage sur les capacités de traitement des enfants. Les politiques de soins aux victimes de traumatismes doivent être développées de manière à mieux intégrer les soins aux enfants. Plus largement, le réseau en expansion des individus et des groupes collaborant au renforcement des soins aux victimes de traumatismes doit impliquer une gamme plus étendue de parties prenantes, qui concentreront leurs efforts sur l’amélioration des soins aux enfants aux enfants traumatisés et militeront pour cette amélioration.

## Resumen

### Fortalecimiento mundial de la asistencia a las lesiones infantiles

Parte de la solución al problema creciente de las lesiones infantiles consiste en fortalecer la asistencia que reciben los pacientes. En este artículo se señalan los potenciales beneficios sanitarios que se obtendrían, se examinan los avances recientes que se han realizado en materia de asistencia a los niños con lesiones en diferentes instituciones y países, y se analiza cómo ha contribuido a ello la mayor atención prestada a nivel internacional a la asistencia a los traumatismos. Aunque no hay grandes programas mundiales bien financiados para mejorar la asistencia a los traumatismos, los documentos de orientación elaborados recientemente por la OMS y una amplia red de colaboradores han estimulado un aumento de la atención mundial a la mejora de la planificación y de los recursos para la asistencia a los traumatismos, lo cual ha generado, a su vez, un aumento de la atención al fortalecimiento de la capacidad de asistencia a los traumatismos en los países, y en

particular a la evaluación de las necesidades y a la aplicación de las recomendaciones de la OMS en las políticas nacionales.

Sin embargo, la mayor parte de estos esfuerzos mundiales todavía no se han ocupado específicamente de los niños. Dadas las necesidades especiales de los niños con lesiones y la elevada mortalidad y discapacidad relacionadas con las lesiones en esta población, hay una necesidad evidente de prestar mayor atención a la asistencia a los traumatismos en la infancia. La elaboración de políticas de asistencia a los traumatismos debe prestar más atención a los traumatismos infantiles. A un nivel más general, la creciente red de individuos y grupos que están colaborando en el fortalecimiento de la asistencia a los traumatismos necesita comprometer a una gama más amplia de partes interesadas que se centren en la defensa de la mejora de la asistencia a los niños víctimas de lesiones.

## ملخص

### تعزيز رعاية الأطفال المصابين على الصعيد العالمي

إلا أن معظم هذه الجهود العالمية لم تتصد للاحتياجات النوعية الخاصة بالأطفال. فنظراً للاحتياجات الخاصة للأطفال المصابين، وللععبء الثقيل للوفيات المرتبطة بالإصابات وللإعاقة التي تسببها الإصابات لدى الأطفال، فإن الحاجة ماسة لتأكيد أكثر وضوحاً على رعاية الأطفال المصابين. وتحتاج تقييمات الاحتياجات الخاصة برعاية الرضوح، والتي تجرى حالياً في عدد متزايد من البلدان، إلى التركيز أكثر من ذي قبل على القدرات الخاصة برعاية المصابين. لذلك، فإن السياسات التي تعد حول رعاية الرضوح ينبغي أن تدرج فيها رعاية رضوح الأطفال بشكل أفضل. وبشكل عام، فإن الشبكة المتزايدة الاتساع للأفراد والجماعات التي تتعاون من أجل تعزيز رعاية الرضوح على الصعيد العالمي لا بد لها من إشراك طيف واسع من الأطراف المعنية التي ستركز على تحسين رعاية الأطفال المصابين وأداء دور ريادي في هذا المجال.

إن تعزيز الرعاية التي يتلقاها الأطفال المصابون هو جزء من الحل للمشكلة المتفاقمة لإصابات الأطفال. وتوضّح هذه الورقة المكاسب الصحية المحتملة التي ستنجم عن تقديم الرعاية للأطفال المصابين، ثم تستعرض الورقة أوجه التقدّم المُحرَز في الوقت الراهن في رعاية الأطفال المصابين في بلدان ومؤسسات بعينها. وستناقش الورقة أيضاً العون الذي يمكن أن تتلقاه هذه الجهود الفردية بفعل ازدياد الاهتمام على الصعيد الدولي برعاية الرضوح. ورغم عدم وجود برامج عالمية كبرى تتمتع بتمويل جيد لتحسين رعاية الرضوح، فإن الوثائق التوجيهية التي أعدتها مؤخراً منظمة الصحة العالمية و شبكة واسعة من المتعاونين معها، قد أدّى إلى إثارة متزايدة للاهتمام العالمي لتحسين التخطيط وزيادة الموارد لرعاية الرضوح. وقد أدّى هذا الأمر بدوره إلى ازدياد الاهتمام بتعزيز القدرات في رعاية الرضوح في البلدان، ويشمل ذلك تقييم الاحتياجات وتنفيذ توصيات منظمة الصحة العالمية في السياسات الوطنية.

## References

1. Krug E. *Injury: a leading cause of the global burden of disease*. Geneva: World Health Organization; 1999 (WHO/HSC/PVI/99.11).
2. Mock CN, Jurkovich GJ, nii-Amon-Kotei D, Arreola-Risa C, Maier RV Trauma mortality patterns in three nations at different economic levels: implications for global trauma system development. *J Trauma* 1998;44:804-14. PMID:9603081 doi:10.1097/00005373-199805000-00011
3. Mock CN, Boland E, Acheampong F, Adjei S. Long-term injury related disability in Ghana. *Disabil Rehabil* 2003;25:732-41. PMID:12791558 doi:10.1080/0963828031000090524
4. MacKenzie EJ, et al. Functional recovery and medical costs of trauma: an analysis by type and severity of injury. *J Trauma* 1988;28:281-97. PMID:3351987 doi:10.1097/00005373-198803000-00003
5. Laxminarayan R, et al. Advancement of global health: key messages from the Disease Control Priorities Project. *Lancet* 2006;367:1193-208. PMID:16616562 doi:10.1016/S0140-6736(06)68440-7
6. Shen C, et al. Pediatric trauma at a government referral hospital in The Gambia. *West Afr J Med* 2003;22:287-90. PMID:15008289
7. Gurses D, et al. Cost factors in pediatric trauma. *Can J Surg* 2003;46:441-5. PMID:14680351
8. van As AB, Rode H. The history of paediatric trauma care in Cape Town. *S Afr Med J* 2006;96:874-8. PMID:17077913
9. Inon AE, Haller JA Jr. Caring for the injured children of our world: a global perspective. *Surg Clin North Am* 2002;82:435-45. PMID:12113377 doi:10.1016/S0039-6109(02)00014-2
10. Gaudeville A, Douzima PM, Sanze BM, Ndemanga JK, Mandaba JL. Difficulties in the management of supracondylar fractures of the humerus in children living in Central African Republic. *Med Trop (Mars)* 1998;58:273-6. PMID:10088107
11. Obaidullah, Ullah H, Aslam M. Figure-of-8 sling for prevention of recurrent axillary contracture after release and skin grafting. *Burns* 2005;31:283-9. PMID:15906481 doi:10.1016/j.burns.2004.08.012
12. Hudson DA, Lazarus D, Silfen R. The use of serial tissue expansion in pediatric plastic surgery. [discussion 593-4]. *Ann Plast Surg* 2000;45:589-93. PMID:11128755 doi:10.1097/0000637-200045060-00003

13. Landau A, van As AB, Numanoglu A, Millar AJ, Rode H. Liver injuries in children: the role of selective non-operative management. *Injury* 2006; 37:66-71. PMID:16246338 doi:10.1016/j.injury.2005.07.013
14. Karkiner A, Temir G, Utku M, Uçan B, Hoigör M, Karaca I. The efficacy of non-operative management in childhood blunt hepatic trauma. *Ulus Travma Acil Cerrahi Derg* 2005;11:128-33. PMID:15877243
15. Husum H, Gilbert M, Wisborg T, Van Heng Y, Murad M. Rural prehospital trauma systems improve trauma outcome in low-income countries: a prospective study from North Iraq and Cambodia. *J Trauma* 2003; 54:1188-96. PMID:12813342 doi:10.1097/01.TA.0000073609.12530.19
16. Arreola-Risa C, et al. Effect of Emergency Medical Technician certification for all prehospital personnel in a Latin American city. *J Trauma* 2007;63:914-9. PMID:18090026 doi:10.1097/TA.0b013e31806bf141
17. Chardbunchachai W, Suppachutikul A, Santikarn C. *Development of service system for injury patients by utilizing data from the trauma registry*. Khon Kaen: Khon Kaen Hospital; 2002 (ISBN: 974-294-569-1).
18. Mann NC, Mullins RJ, MacKenzie EJ, Jurkovich GJ, Mock CN. A systematic review of published evidence regarding trauma system effectiveness. *J Trauma* 1999;47:S25-33. PMID:10496607 doi:10.1097/00005373-199909001-00007
19. Jurkovich GJ, Mock CN. A systematic review of trauma system effectiveness based on registry comparisons. *J Trauma* 1999;47:S46-55. PMID:10496611 doi:10.1097/00005373-199909001-00011
20. *Guidelines for essential trauma care*. Geneva: World Health Organization; 2004.
21. *Prehospital trauma care systems*. Geneva: World Health Organization; 2005.
22. Resolucion Numero 1043 de 2006. Bogota: Ministerio de la Proteccion Social Republica de Colombia; 2006. Available from: <http://www.minproteccionsocial.gov.co/VBeContent/NewsDetail.asp?ID=14997&IDCompany=3> [accessed on 20 March 2009].
23. Decreto Numero 3616 de 2005. Bogota: Ministerio de la Proteccion Social Republica de Colombia;2005. Available from: <http://www.minproteccionsocial.gov.co/VBeContent/NewsDetail.asp?ID=14639&IDCompany=3> [accessed on 20 March 2009].
24. Quansah R, Mock C, Abantanga F. Status of trauma care in Ghana. *Ghana Med J* 2004;38:149-52.
25. Mock C, Nguyen S, Quansah R, Arreola-Risa C, Viradia R, Joshipura M. Evaluation of trauma care capabilities in four countries using the WHO-IATRIC Guidelines for Essential Trauma Care. *World J Surg* 2006;30:946-56. PMID:16736320 doi:10.1007/s00268-005-0768-4
26. Arreola-Risa C, Mock C, Vega Rivera F, Romero Hicks E, Guzmán Solana F, Porras Ramírez G, et al. Evaluating trauma care capabilities in Mexico with the World Health Organization's Guidelines for Essential Trauma Care. *Rev Panam Salud Publica* 2006;19:94-103. PMID:16551383 doi:10.1590/S1020-49892006000200004
27. Norma Oficial Mexicana 237-SSA1-2004, Atención prehospitalaria de las urgencias médicas [Prehospital attention for medical emergencies]. Mexico City: Orden Juridico Nacional; 2006. Available from: [http://www.ordenjuridico.gob.mx/Federal/PE/APF/APC/SSA/Modificaciones/2006/15062006\(1\).pdf](http://www.ordenjuridico.gob.mx/Federal/PE/APF/APC/SSA/Modificaciones/2006/15062006(1).pdf) [accessed on 20 March 2009].
28. Nguyen TS, Mock C. Improvements in trauma care capabilities in Vietnam through use of the WHO-IATRIC Guidelines for Essential Trauma Care. *Inj Control Saf Promot* 2006;13:125-7. doi:10.1080/17457300500310152
29. Mock C, Arafat R, Chadbunchachai W, Joshipura M, Goosen J. What World Health Assembly Resolution 60.22 means to those who care for the injured. *World J Surg* 2008;32:1636-42. PMID:18427892 doi:10.1007/s00268-008-9568-y
30. Resolution WHA60.22. Health systems: emergency-care systems. In: *Sixtieth World Health Assembly, Geneva, 14-23 May 2007*. Geneva: World Health Organization; 2007.