

Surgical services for children in developing countries

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Abstract There is growing evidence that childhood surgical conditions, especially injuries, are common in developing countries and that poor care results in significant numbers of deaths and cases of disability. Unfortunately, however, surgical care is not considered an essential component of most child health programmes. Strategies for improving paediatric surgical care should be evidence-based and cost-effective and should aim to benefit the largest possible number of children. The most likely way of achieving policy change is to demonstrate that childhood surgical conditions are a significant public health problem. For paediatric purposes, special attention should also be given to defining a cost-effective package of surgical services, improving surgical care at the community level, and strengthening surgical education. Surgical care should be an essential component of child health programmes in developing countries.

Keywords Child health services; Surgery; Pediatrics; Wounds and injuries/epidemiology/surgery; Abnormalities/epidemiology/surgery; Osteomyelitis/epidemiology/surgery; Cost of illness; Disabled children; Health policy; Africa South of the Sahara (*source: MeSH, NLM*).

Mots clés Service santé infantile; Chirurgie; Pédiatrie; Plaies et traumatismes/épidémiologie/chirurgie; Malformations/épidémiologie/chirurgie; Ostéomyélite/épidémiologie/chirurgie; Coût maladie; Enfant handicapé; Politique sanitaire; Afrique subsaharienne (*source: MeSH, INSERM*).

Palabras clave Servicios de salud infantil; Cirugía; Pediatría; Heridas y lesiones/epidemiología/cirugía; Anomalías/epidemiología/cirugía; Osteomielitis/epidemiología/cirugía; Costo de la enfermedad; Niños incapacitados; Política de salud; África del Sur del Sahara (*fuentes: DeCS, BIREME*).

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Voir page 834 le résumé en français. En la página 834 figura un resumen en español.

Introduction

Perhaps the most significant advance associated with the surgical care of children during the past century has been the realization that “children are not small adults”. Rather, children develop distinct surgical conditions, present unique anaesthetic challenges, and have special perioperative needs. Moreover, the consequences of paediatric surgical conditions may be lifelong since they affect children at critical times during development.

The recognition that the surgical needs of children differ from those of adults has led to remarkable improvements in care. Many children with congenital anomalies that were once thought incompatible with life are now living normally. Severely injured children are restored to normal function, failed organs are replaced, neonatal surgery has become routine, and the efficacy of fetal surgery is being investigated in clinical trials.

Nevertheless, there are still major gaps in the surgical care of children living in developing countries. Paediatric surgery has often been viewed as too expensive and as a non-

essential service, and it has been excluded from most child health programmes in such countries.

The inadequate surgical care of children in developing countries has not been without consequences. In many of these countries, congenital anomalies go unrepaired, treatable injuries result in lifelong disabilities, and children die of easily correctable surgical problems, e.g. airway foreign bodies and incarcerated inguinal hernias.

Burden of childhood surgical diseases

The most important issue surrounding the surgical care of children in developing countries is the burden of surgical diseases^a on paediatric populations. Epidemiological data on this subject are scarce.

The pattern of paediatric surgical diseases in sub-Saharan Africa^b provides an insight into this. We focus on sub-Saharan Africa both because it has the greatest disparities in health care^c and is the one with which we are most familiar (2). Patterns of

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^a The best definition of childhood surgical diseases is that they are conditions most commonly treated by surgeons. For surgeons working in developing countries this includes a wide spectrum of surgical conditions. The conditions include, but are not limited to, injuries (e.g. burns, head injuries, fractures), correctable congenital anomalies (e.g. cleft lip and palate, inguinal hernia), surgical infections (e.g. abscesses, osteomyelitis) and urgent abdominal problems (e.g. peritonitis and bowel obstructions).

^b The terms “Africa” and “sub-Saharan Africa” are used synonymously in this article. The health and economic data presented exclude data from Eritrea and Namibia (paucity of data) and Réunion and South Africa (because of differences from other parts of sub-Saharan Africa).

^c Sub-Saharan Africa is the least healthy region of the world (1). The infant mortality rate is almost 50% higher than the average for low-income developing countries, and at least ten times higher than the rate in industrialized countries. The average per capita income is US\$ 340 (range US\$ 80–5110). In 1985, a total of 36% of the urban population and 75% of the rural population were below the absolute poverty line. The average per capita expenditure on health in sub-Saharan Africa is less than US\$ 14 per annum.

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disease and the availability of resources vary between regions of the world, but sub-Saharan Africa epitomizes many of the challenges inherent in attempting to provide surgical care for children in developing countries.

The available information suggests that surgery patients are responsible for approximately 6–12% of all paediatric admissions in sub-Saharan Africa, although the proportion may be higher in some urban areas. At the main government referral hospital in Banjul, the Gambia, surgical patients accounted for 11.3% of paediatric admissions (3). The commonest admission diagnoses were injuries, congenital anomalies, and surgical infections, accounting for almost 90% of paediatric surgical admissions (Fig. 1). At the rural Ahmadu Bello University Teaching Hospital, Malumfashi, northern Nigeria, paediatric surgery represented 6.6% of the paediatric workload and 9.6% of all operative procedures (4). The most frequent operations performed in this hospital were for congenital problems (40%), infections (22%), and traumas (21%).

Injuries

Injuries are the commonest surgical problem affecting African children. For children in Africa who survive the first four years of life, injury becomes the most likely cause of disability and death, a situation that remains true until the fourth decade of life (5). In a recent review of injuries and noncommunicable diseases in developing countries, childhood disability-adjusted life years (DALYs) related to injuries were the highest in sub-Saharan Africa (6). DALYs related to injuries were higher among males than females and among children aged 0–4 years than among those aged 5–14 years.

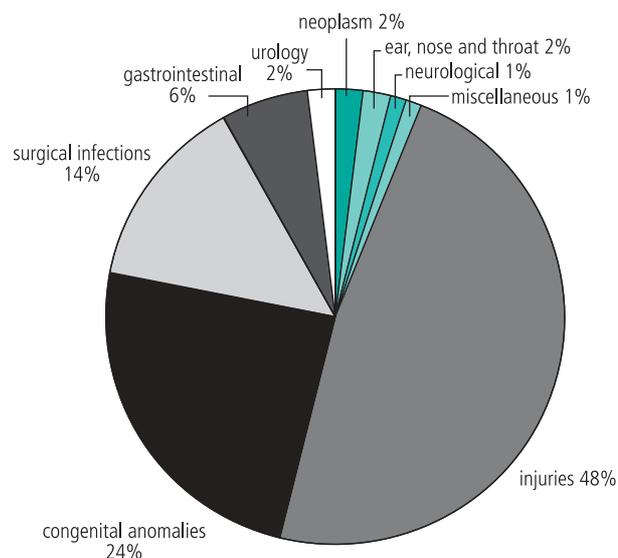
That injuries are a significant cause of death and disability among African children should not be surprising, since, in most established market economies, they are the leading cause of death and disability for the age group 1–19 years. In low-income countries also, especially those that have recently become industrialized and motorized, injuries are an important health problem. Even in those countries with the lowest incomes, injuries comprise one of the leading causes of death among adults and are a major cause of disability in most age groups (7–12).

In rural East Africa, injuries (40 000 episodes and 100 deaths per 100 000 of the general population annually) rank third in importance behind diarrhoea and malaria (13). Mortality rates associated with injury are even higher in urban areas of Africa. For example, one community survey in an urban area of Uganda indicated that the annual mortality rate attributable to injury was 217 per 100 000 (12). The lifetime risk of dying from an injury in urban Uganda was 10% for both males and females and was twice as high as the risk of maternal death (14). In Ghana the all-age, annual, non-fatal injury rate has been estimated at 7.6 per 100 (10).

Road traffic accidents, falls, burns and accidental poisoning are the commonest categories of childhood injuries. Child safety is seen as a relatively low priority, and it can be expected to remain so in the foreseeable future in the face of poorly maintained roads, large numbers of old vehicles, inadequate law enforcement, and overloaded public transport systems. Hundreds of thousands of children are permanently disabled in Africa every year as a consequence of injuries and poor trauma care.

Armed conflicts also take their toll (15). During 2000, a total of 11 major wars were being fought in Africa, involving

Fig. 1. Paediatric surgical admissions to a government referral hospital in Gambia, January 1996 to May 1998 ($n = 1726$) (3)



WHO 02.170

half the countries in the continent and 20% of the population. It is estimated that 120 000–200 000 child soldiers aged 5–16 years are currently participating in such conflicts. Children involved in armed conflicts sustain bullet and shrapnel wounds, as well as burns and land mine injuries, all of which require surgical care. In Africa, landmines are responsible for killing or injuring 12 000 people a year, many of them children.

Childhood injuries also place a significant burden on health services. At the main government referral hospital in Banjul, injuries accounted for almost half the paediatric surgical admissions (3) (Fig. 1). In Lilongwe, Malawi, 9.7% of all paediatric admissions were related to accidents; 27% of cases were burns and scalds, and 32% were fractures, usually caused by falls (16). A household survey suggested that 21% of urban children and 15% of rural children would suffer an accidental injury each year and that half of them would visit health centres. At Baragwanath Hospital, Johannesburg, 25% of paediatric surgical admissions are related to injuries.

Congenital abnormalities

Congenital abnormalities are another common and under-reported problem. A recent study from an urban centre in South Africa showed the incidence of congenital anomalies at birth to be 11.8 per 1000 live births (17), with central nervous system, musculoskeletal, and cardiovascular anomalies being the commonest. Extrapolation from other studies conducted in developing countries indicates that the cumulative incidence of severe congenital abnormalities may affect up to 85 per 1000 children by the age of 5 years (18). The impact of congenital anomalies on childhood morbidity and mortality in Africa is unknown. Neonates with surgical problems are especially problematic, most notably in emergency settings. In Zaria, Nigeria, 38% of neonates developed postoperative complications and the overall mortality rate was 30.5% (19). Inguinal hernias, genitourinary and anorectal malformations, meningomyeloceles, and cleft lip and palate are the commonest congenital anomalies requiring surgical repair in Africa.

Surgical infections

Surgical infections pose another threat to African children. Abscesses, pyomyositis, and osteomyelitis are common in tropical regions of Africa, and their increased incidence is most probably related to malnutrition or immunosuppression associated with parasitic infections. Surgical infections, particularly chronic osteomyelitis, are a significant burden on health services. At the main government referral hospital in Banjul, for example, osteomyelitis accounted for 7.8% of paediatric surgical admissions and 15.4% of total inpatient days (3). The number of hospital days taken up by osteomyelitis was second only to that for burns.

Extent of the problem

What percentage of the paediatric population in sub-Saharan Africa can be expected to require surgical care during childhood? To attempt to answer this question we investigated the number of children in Banjul who sought care for surgical problems at the main government hospital during 1997 (20) (Fig. 2). Surgical problems were defined as all injuries (e.g. fractures, lacerations, head injuries and soft tissue injuries), correctable congenital anomalies (e.g. inguinal hernia, club-foot), surgical infections (e.g. abscesses and osteomyelitis), and other conditions requiring surgical care. The annual presentation rate for all surgical conditions was 543 per 10 000 children aged 0–14 years. A total of 46% of children presenting with surgical problems required surgical procedures, 68.2% of which were classified as minor. The estimated cumulative risk for all surgical conditions was 85.4% by the age of 15 years. Although based on a small paediatric population and a relatively short period of time, our data suggest that a significant proportion of children living in urban areas of sub-Saharan Africa require surgical care at some time during childhood.

Consequences of poor surgical care

Inadequate surgical care for children in many developing countries has had tragic consequences. The impact on child health remains poorly defined, but it is likely that poor surgical care contributes significantly to the high disability rates in these countries. In Uganda, for example, 12% of households reported a disability related to injury (14). In our experience many of the disabilities that result from injury could either be prevented or corrected if surgical care were improved.

Fig. 3 illustrates some of the consequences of poor surgical care. The most common disabilities associated with injuries relate to mismanaged burns, fractures, and dislocations. Many of these complications result from late presentation because of poor access to surgical care.

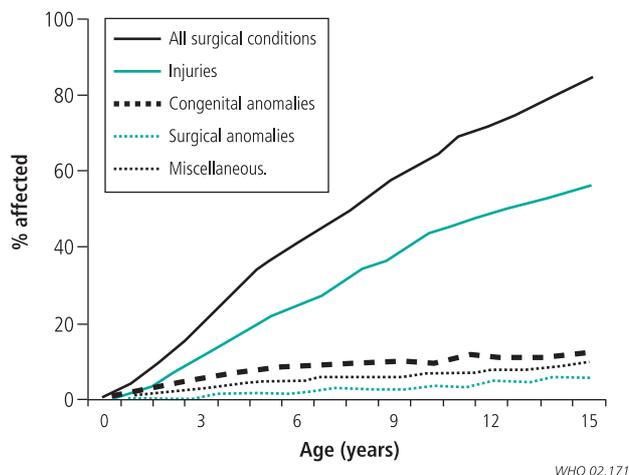
Challenges for paediatric surgery

In contrast to the situation in industrialized countries, where many surgical problems are technical in character, the challenges for paediatric surgery in developing countries are those of definition, policy and delivery.

Paediatric surgery in developing countries

The role of paediatric surgery in developing countries remains poorly defined. Clearly, the socioeconomic conditions in most of these countries oblige paediatric surgical care to differ from

Fig. 2. Estimated risk of requiring surgical care in a paediatric population living in Banjul, Gambia. Cumulative risk was estimated using age-specific incidences (20)



that practised in developed countries. Attempts to copy paediatric surgical care as practised in developed countries have often reinforced the notion that surgical care for children is too expensive.

Health care policy in developing countries

Health care policy in developing countries does not reflect the surgical needs of children. There has been a general failure to recognize the importance of surgical care in the developing world (27), where it tends to be viewed as a luxury. It is often forgotten that surgery is an essential component of basic health care, for example, in relation to the management of injuries, urinary retention, and inhaled foreign bodies. At other times surgery is preventive, as in the case of elective hernia repair.

Health care policy reflects the political will to make improvements. A lack of political commitment by governments and international agencies may be the single most important reason why surgical care has not progressed in developing countries. Irrespective of the availability of resources, political commitment is the principal prerequisite for ensuring essential health services for the disadvantaged in these countries. True commitment to the improvement of a particular health situation requires the formulation of a comprehensive action plan containing specific goals and arrangements for monitoring and evaluation. We are unaware of any government or international agency that has a health action plan addressing the most common surgical needs of children.

Delivery of surgical services

The issue is not whether selected children can receive surgical care but whether children in general have access to appropriate surgical services. Only a small fraction of children in developing regions have access to basic surgical care.

Long distances from hospitals and prohibitive transportation costs prevent the timely treatment of paediatric surgical conditions. Travelling to a hospital may take several days, during which time the patient's condition may deteriorate, leading to increased operative risk and mortality. Disease processes are often far advanced when a patient reaches hospital, such that

Fig. 3. Consequences of poor surgical care. The examples selected represent sequelae that could have been prevented with basic surgical care



Upper extremity burn contracture. Scarring of burn wounds around joints may permanently destroy range of motion (ankylosis). Contractures can be prevented using relatively simple burn care (splinting and split thickness skin grafting).



Neglected osteomyelitis of the tibia. Childhood osteomyelitis is a common surgical problem in the tropics. Note the multiple draining sinuses and extruding tibia. Early recognition of osteomyelitis can prevent the need for sequestrectomy (surgical debredement of the dead bone).



Two children with bonesetter's gangrene—extremity necrosis related to splints placed by traditional bone setters to treat fractures (26). If the child survives the initial sepsis episode the soft tissue of the extremity sloughs. Basic trauma care should be an essential component of primary care programs.



there may be pathological consequences threatening survival. It is also worth noting that children are often referred after folk medicine or traditional remedies have failed.

In virtually every developing country there are limited facilities, equipment, human resources, and drugs. Medical facilities at the primary and secondary levels are often inadequate for the large populations they are intended to serve. There are insufficient medical and nursing personnel to treat the thousands of sick children. Training is not optimal and there are enormous workloads.

Many facilities have poor diagnostic capabilities or none at all. As a rule, laboratory, histological, and radiological facilities are only available on a limited basis. Equipment for carrying out anaesthesia and surgery is often deficient, and facilities for sophisticated postoperative care are frequently minimal and dependent on the individual initiative of the surgeons concerned. Insufficient beds, shortages of surgical supplies, and inefficiency in operating theatres often dictate that only urgent or emergency surgery can be performed. Patients requiring urgent attention for traumas, burns, and osteomyelitis typically fill all the available beds, and operating lists may be taken up entirely with such cases.

There is a chronic shortage of qualified paediatric surgeons in many developing countries. In Africa, 10 surgeons with paediatric surgical training work in the West African subregion and a further 29 practise in East and southern Africa, predominantly in Kenya and South Africa. Almost without exception the trained paediatric surgeon works in a large central hospital that is overcrowded, underfunded, and poorly maintained. In many parts of Africa, general surgeons attend to the surgical needs of children. This was confirmed in a recent study of general surgery practice in Namibia and South Africa (22). The majority of the surgeons had received some paediatric surgical training; however, this was considered inadequate by nearly half of all surgeons and by 60% of those who had qualified in the previous 10 years.

Improving paediatric surgery in developing countries

It appears that there are four areas where efforts should be focused. We do not advocate wholesale changes to existing structures, as many are very successful, but consider that existing services should be built on and that community participation should be encouraged.

Demonstrating the need for paediatric surgery care

Health policy in developing countries cannot reflect the surgical needs of children until there are data demonstrating that paediatric surgical diseases are a significant public health problem. There is a major need for data on the epidemiology of paediatric surgical diseases, the morbidity and mortality associated with poor surgical care, and the cost of paediatric surgical services. Support for research on these matters could perhaps be given by WHO, UNICEF, and other international agencies.

Information on surgical diseases in developing countries can be expected to become increasingly important as evidence-based methods are used to a greater extent in the allocation of resources. In the absence of data demonstrating that surgical diseases are a problem, it would be unreasonable to expect resources to be allocated for surgical care. In the Global Burden of Disease (GBD) study (11), childhood surgical conditions were underrepresented. Of 58 major paediatric surgical diagnoses recorded at the main government referral hospital in the Gambia only 21 were included in the analysis.^d Of course, the GBD methodology cannot include all diagnoses but a GBD study focusing solely on the paediatric age group might offer the best prospect of resolving this matter.

Defining a cost-effective package of paediatric surgical care

Just as the World Bank has defined a package of basic health care, an essential package of paediatric surgical services for developing countries should be defined. It should be based on the epidemiology of childhood surgical diseases in developing countries and on the estimated need and expense of surgical care. Included should be both preventive and curative services. With regard to surgical services, the programme should define which operations are appropriate, the level of the health system at which they can be performed, and the level of training required in order to carry them out. The package might include injury prevention, routine screening of neonates for congenital anomalies, simple protocols for the management of uncomplicated paediatric surgical problems, and criteria for referring children to secondary or tertiary facilities.

Improving paediatric surgical care at the community level

There is a need for paediatric services attached to rural clinics and hospitals. It is vital to bear in mind that primary care can only succeed if supported by an efficient and reliable referral system with an infrastructure extending from the primary to the tertiary level, such that paediatric surgical conditions can be treated effectively. Although most paediatric surgery is now performed at a higher level, these services should be made available to communities. We believe the vast majority of paediatric surgical problems, i.e. traumas, uncomplicated congenital anomalies and surgical infections, could be managed at primary or secondary care levels. If general practitioners or general surgeons received a degree of additional training they could probably do most of this work. In a rural hospital in Nigeria, 95% of operations were considered simple enough to be performed by general duty

doctors if they had experience in general surgery (4). The question arises as to whether the present system of surgical specialization is a principal cause of the decline of surgery in the developing world. Rather than training paediatric surgeons, the solution for developing countries may be to re-establish general surgery to deal with the operative management of common surgical conditions (23, 24).

The provision of basic paediatric surgical care at the primary and secondary levels requires training material to be published on the subject. The inclusion of a chapter on surgical care in the planned WHO child health pocket book is a major step forward in this respect. A paediatric surgery manual for the district hospital level would be ideal.

Strengthening paediatric surgical education

A major problem with paediatric surgical care in developing countries is that there is a general lack of knowledge on the care of children with surgical conditions. Special attention should therefore be paid to paediatric surgical education. Knowledge in this area should be increased at all levels. In this respect, village health workers should also be included, even though they might only occasionally care for children with surgical problems. Paediatric surgical education should be broadly based. It should cover traumas, infections, malignancies and the common surgical conditions encountered in developing countries. There is also a clear need to train additional paediatric surgeons for these countries. Specialists in paediatric surgery are needed to manage the more difficult cases, to set practice standards, and to educate other health care providers.

Paediatric surgical education could be strengthened through the work of donor organizations (25). Developing countries have, through various agencies, organizations, and surgical colleges, established surgical development programmes, which could teach technical skills and patient management to primary practitioners, medical students, general doctors, and professional nurses. Transferring surgical knowledge to these groups is important because fully trained paediatric surgeons will not be available to most children in the foreseeable future in developing countries. International cooperation involves needs assessment, the establishment of appropriate local and regional training, and teaching programmes, the donation of equipment, the use of surgical journals and textbooks, assistance in research, and the provision of fellowships for young surgeons. There is also an important role for visiting surgical specialists, but in this connection it is desirable to place emphasis on transferring surgical knowledge and encouraging the development of local doctors rather than on treating patients.

While the intentions behind sending children to developed countries for specialized surgical care are laudable, it should be noted that the funds spent on caring for a single patient in this way could easily cover the cost of several weeks of surgical teaching in a developing country. Teaching visits can be of immense value to local staff and can ultimately improve the care of large numbers of patients. Moreover, visiting specialists often learn much about the realities of practising surgery in environments with limited resources.

^d Examples of some of the common paediatric surgical diseases excluded from the GBD study include inguinal hernias (the most common congenital anomaly in our series), osteomyelitis (second only to burns in total hospital days), and club foot (a common condition which, if not treated, results in lifelong deformity).

Conclusions

The surgical care of children can be improved in developing countries, notwithstanding the serious socioeconomic problems that they experience. Progress can only occur, however, if poor surgical care is recognized as a significant public health problem and if communities become aware that good surgical care can improve their children's health.

The available information suggests that the best way to facilitate an improvement in the surgical care of children in developing countries is to consider surgical problems within the realm of child health. If a child with pneumonia can be treated properly at a health centre in rural Africa, it should also be possible to give proper care to a child with a fracture. Both pneumonia and fractures are child health problems, and both deserve proper care. To continue to exclude basic surgical care from child health programmes destined children to death and disability. This situation is ethically unacceptable.

The definition of surgical conditions as child health problems does not mean that there should be separate surgical services for children, nor does it imply that paediatric

surgeons should care for all children with surgical problems. It does mean, however, that an agency should be given the task of improving surgical care and that the persons with the greatest interest in child health and development should be involved in the necessary research, education, and planning. Unless children with surgical problems have an advocate, surgical care is likely to remain forgotten among other health priorities.

The details of how surgical care should be integrated into child health programmes, and its exact role, remain to be determined. Whatever its role, however, it should be evidence-based, cost-effective and work towards benefiting the largest possible number of children. Research into these matters is crucial. It is needed in order to arrive at a better definition of the burden of childhood surgical conditions, to determine the best clinical practices, and to design and test prevention strategies. The available information suggests that the prevention and improved management of childhood injuries should be the first priority for paediatric surgery in developing countries. ■

Conflicts of interest: none declared.

Résumé

Services de chirurgie pédiatrique dans les pays en développement

On dispose de données de plus en plus nombreuses qui montrent que les problèmes de santé de l'enfant relevant de la chirurgie, notamment les traumatismes, sont courants dans les pays en développement et que des soins inadéquats sont à l'origine de nombreux décès et cas d'incapacité. Il est regrettable, malgré cela, que la chirurgie ne soit pas considérée comme une composante essentielle de la plupart des programmes de santé de l'enfant. Les stratégies visant à améliorer les services de chirurgie pédiatrique devraient reposer sur des faits, être d'un bon rapport coût/efficacité

et bénéficier au plus grand nombre d'enfants possible. Mais il faudrait pour y parvenir démontrer que les affections pédiatriques relevant de la chirurgie sont un enjeu de santé publique important. A cette fin, il conviendrait de s'attacher aussi à définir un ensemble d'interventions chirurgicales d'un bon rapport coût/efficacité, d'améliorer les prestations chirurgicales au niveau communautaire et de renforcer la formation dans ce domaine. La chirurgie devrait faire partie intégrante des programmes de santé de l'enfant dans les pays en développement.

Resumen

Servicios de cirugía pediátrica en los países en desarrollo

Hay cada vez más pruebas de que las afecciones quirúrgicas de la infancia, especialmente los traumatismos, son comunes en los países en desarrollo, y de que una asistencia deficiente en ese sentido se traduce en un número considerable de defunciones y casos de discapacidad. Lamentablemente, sin embargo, la atención quirúrgica no se considera un componente esencial de la mayoría de los programas de salud infantil. Las estrategias de mejora de la atención quirúrgica pediátrica deberían estar basadas en la evidencia y ser costoeficaces, y aspirar a beneficiar al mayor

número posible de niños. Para propiciar ese cambio de política, nada mejor que demostrar la relevancia del problema de salud pública que representan las afecciones quirúrgicas de la infancia. En materia de pediatría, hay que hacer también un esfuerzo especial para definir un paquete costoeficaz de servicios quirúrgicos, mejorar la atención quirúrgica a nivel de la comunidad y fortalecer la formación en cirugía. La atención quirúrgica debe ser un componente esencial de los programas de salud infantil en los países en desarrollo.

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