ARCHIMEDES

Towards evidence based medicine for paediatricians

Edited by Bob Phillips

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In order to give the best care to patients and families, paediatricians need to integrate the highest quality scientific evidence with clinical expertise and the opinions of the family.[1] *Archimedes* seeks to assist practising clinicians by providing "evidence based" answers to common questions which are not at the forefront of research but are at the core of practice. In doing this, we are adapting a format which has been successfully developed by Kevin Macaway-Jones and the group at the *Emergency Medicine Journal*—"BestBets".

A word of warning. The topic summaries are not systematic reviews, through they are as exhaustive as a practising clinician can produce. They make no attempt to statistically aggregate the data, nor search the grey, unpublished literature. What *Archimedes* offers are practical, best evidence based answers to practical, clinical questions.

The format of *Archimedes* may be familiar. A description of the clinical setting is followed by a structured clinical question. (These aid in focusing the mind, assisting searching,[2] and gaining answers[3].) A brief report of the search used follows—this has been performed in a hierarchical way, to search for the best quality evidence to answer the question.[4] A table provides a summary of the evidence and key points of the critical appraisal. For further information on critical appraisal, and the measures of effect (such as number needed to treat, NNT) books by Sackett[5] and Moyer[6] may help. To pull the information together, a commentary is provided. But to make it all much more accessible, a box provides the clinical bottom lines.

The electronic edition of this journal contains extra information to each of the published *Archimedes* topics. The papers summarised in tables are linked, by an interactive table, to more detailed appraisals of the studies. Updates to previously published topics will be available soon from the same site, with links to the original article.

Readers wishing to submit their own questions—with best evidence answers—are encouraged to review those already proposed at www.bestbets.org. If your question still hasn't been answered, feel free to submit your summary according to the Instructions for Authors at www.archdischild.com. Three topics are covered in this issue of the journal.

- Can traffic calming measures achieve the Children's Fund objective of reducing inequalities in child health?
- Should verrucas be covered while swimming?
- What is the normal range of blood glucose concentrations in healthy term newborns?

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Public health trials

Can we really be expected to look for randomised controlled trials to test the effectiveness of large scale community interventions? Is it really ethical to educate only some children specifically about the dangers of traffic, or to randomly allocate some children at high risk of abuse/neglect to health visiting and ignore others, or to treat some meningococcal contacts with ceftriaxone instead of rifampicin, in order to "prove" that an intervention works?

There is a school of thought that places the randomised controlled trial as the only way to show that an intervention is effective. Many books about evidence based medicine take this as a central truth. There is evidence to support this claim—Schultz has shown the powerful effect of randomisation in trials of obstetric care.[1]

However, when you move from the tidy world of pill giving (or inhaler spraying, or cream rubbing) into the land of free roaming children, a number of things change. The intervention is often not a neat package with a quality control; who teaches the educational programme may affect its outcome. The intervention has a tendency to dissipate; if one new mother acquires some effective coping strategies for infant crying, she might well share them with her "control group" friend. The analysis of the data isn't always straightforward (for example, if it is villages that have been randomised to get insecticide coated mosquito nets, then you should analyse by number of villages, not number of people infected or number infected with malaria). And who gives consent to do this experiment on a whole community (such as fruit and veg education for weight reduction)?

Despite these problems, many randomised trials have been conducted on large scale interventions—all of those mentioned in this piece, in fact. They are not always large enough to show a convincing effect (or lack of one[2]), and this fundamentally questions their utility.[3] The question of whether we should be expecting these trials is still unanswered, but while they are being performed we should try to assess them in attempting to practice in the most evidence based way we can.

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Additional information on each of the topics is available on the *ADC* website (www.archdischild.com)

Can traffic calming measures achieve the Children's Fund objective of reducing inequalities in child health?

Report by
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You are the child health lead in a primary care trust. The manager of the local Children's Fund comes to ask your advice about how best to meet the Children's Fund sub-objective of reducing inequalities in child health for children aged 5–13. A local child safety organisation has applied to the Children's Fund for a grant to arrange traffic safety education sessions in the local community, teaching children how to cross roads more safely. The manager wonders whether this is the best way to reduce inequalities in child traffic injuries.

Meanwhile, the Children's Fund has done some preliminary work on one of its other objectives of involving the local community. In their consultations with workers, children and families, they have found that:

- Children say it is unfair that they don't have enough safe places to play. They don't like cars speeding through their neighbourhood.
- Parents feel under stress when the kids are in all the time but worry about sending them to the playground on the far side of a busy road.

The Children's Fund is charged with delivering preventive services, listening to what children and families say they need, and reducing inequalities in child health. Traffic education might well help to address this. But will it actually reduce child traffic injuries and increase the local community's sense of safety on the streets? Is there something else—perhaps targeting the traffic rather than the children—that might be more effective, and more responsive to the local community?

Structured clinical question

How effective are educational programmes [intervention] compared with traffic calming [intervention] in reducing child [patient] traffic injuries [outcome]?

Search strategy and outcome

Using Cochrane library—traffic calming OR traffic education: 1 relevant.

Using Medline: 3 relevant.

See table 1.

Commentary

Traffic safety education is widely available to children in the UK in primary schools. All children will therefore have some exposure to traffic safety advice and any programme would be additional. Some programmes involve face to face education

Table 1 Influence of traffic calming measures on injuries

Citation	Study group	Study type (level of evidence)	Outcome	Key results	Comments
Elvik (2001)	33 studies of traffic calming measures were included, all of which employed some version of a before-and-after study design. All studies were non-experimental	Systematic review, meta-analysis (level 2a)	Effects of traffic calming on reported injury accidents	On average, traffic calming measures reduced injuries by to 15% (95% CI −17% to −12%). Studies were weighted according to study design and the overall effect for studies with matched comparison groups was a 12% reduction, while studies with a simple before-and-after design found a 36% reduction in injury accidents	Some of the studies did not include a control group. Separate effects on morbidity/mortality not available. Single authorship means that it is not clear whether more than one independent reviewer extracted the data
Duperrex *et al* (2002)	15 randomised controlled trials of pedestrian safety education programmes. Study participants were children in 14 studies and institutionalised adults in one	Cochrane systematic review (level 1a)	Preventing pedestrian-motor vehicle collisions and in changing behaviour, attitude and knowledge of pedestrians	The relative probability of trained pedestrians behaving correct in traffic compared to non-trained ones ranged between 0.49 and 9.29. Safety education improved the attitude/intentions of pedestrians by a standardised mean difference of 0.17 to 1.48 The impact of educational programmes on participants' knowledge was inconsistent across studies	None of the trials assessed the effect of pedestrian safety education on pedestrian injury Allocation concealment was adequate in three trials, outcome assessment was blinded in eight. Most of the studies lost large numbers of participants to follow up
Dowswell *et al* (1996)	Health promoting interventions to reduce unintentional injuries in children aged 0–14 years	Systematic review, narrative form, update of previous review Differences in interventions and outcome measures in the trials meant that a meta-analysis was not carried out	Health promotion interventions to reduce childhood unintentional injuries	Traffic calming was among the interventions found effective in reducing injury. Few studies were found to have achieved behaviour changes in child pedestrians and fewer still were able to link child education campaigns with changes in casualty rates	No information on the number of included studies and the methodological rigour of these Lack of effect sizes makes it difficult to compare the described interventions
Roberts *et al* (1994)	Child pedestrian injury rates, costs of child pedestrian education, costs of implementing traffic calming	Cost and efficacy analysis of traffic education and traffic calming measures	Estimates of lives saved in New Zealand if money spent on traffic safety education was instead used on traffic calming measures	Using the study's efficacy estimate the researchers calculated that 18 (CI 6–22) pedestrian injury hospitalisations might be prevented in a year, were resources spent on traffic education instead used on traffic calming	The extent of traffic calming was not detailed in relation to costs The study did not account for the longer life time of traffic calming interventions compared with the one year cost

of study participants (direct education), while others use parents or teachers as educators (indirect education). The reviews do not address whether some programmes are more effective than others.

The Cochrane review of educational programmes found that the intervention improved the children's attitude to traffic safety. This was measured as change in the proportion of routes the participants classified as safe or "concept of speed". The programmes' impact on the children's *knowledge* varied across studies. No trials assessed the effect of educational programmes on pedestrian injury, or adverse effects such as raising levels of anxiety or stopping children going out. The studies that assessed behavioural changes varied considerably in their design and outcome measures.

Traffic calming refers to interventions designed to control traffic, usually in urban residential areas. They aim to reduce the number of commuters using residential streets and the speed of the remaining traffic. Initiatives include improving main roads to carry additional traffic and restricting or removing traffic from residential streets by closing roads to motor vehicles or introducing one-way systems. Speed reducing initiatives include speed cushions, humped pelican crossings, raised junctions, narrowing the road(s), gateways at the entrances to the area, build-outs to protect on-street parking spaces, and mini-roundabouts.

The traffic calming meta-analysis found that area-wide urban traffic calming schemes reduced the number of injury accidents by an overall 15% (25% on residential streets and 10% on main roads). The review included non-controlled studies, and the overall effect of the controlled studies was 12% with the matched comparison group (95% CI: 1–21%) and 15% with the general comparison group (95% CI: 4–24%). With regard to educational programmes, the effect of the intervention varied considerably between studies, in particular between study designs. The review did not describe which types of traffic calming measures were most effective in reducing accidents.

A New Zealand study divided the annual costs associated with child pedestrian education nationally with that of implementing traffic calming in an average residential street, thus estimating the number of streets in which traffic calming could be introduced using the resources from the educational programmes. From the effect sizes found in a previously conducted controlled study the researchers estimated that 18 injury hospitalisations a year might be prevented with such a change. This calculation assumed no effect from traffic safety education on accident injuries.

Comparing initial implementation costs of traffic calming with annual costs of educational programmes does not take into account the ongoing benefits from traffic calming after the implementation year. The introduction of traffic calming schemes is likely to be more expensive than educational programmes in the first year. While the cost of educational programmes will be repeated annually for the length of the programme, costs of traffic calming will be limited to maintenance.

Compared with traffic safety education programmes, traffic calming seems to be the more effective option. However, it might be useful to compare traffic calming with and without additional educational programmes. Our search did not yield studies of this nature. The cost and effectiveness of traffic calming has not been addressed in comparison with other safety options such as school crossing attendants. However, their work tends to be limited to term-time before and after school.

Traffic calming, particularly traffic calming in areas of high disadvantage, has greater potential to reduce inequalities than educational programmes which tend to be taken up more enthusiastically by the better off.

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CLINICAL BOTTOM LINE

- Traffic calming measures appear more effective than educational programmes in reducing child traffic injuries.
- Traffic calming has been shown to produce a 15% reduction in injury accidents (95% CI: 12–17%).
- There is no evidence of the effect of educational programmes on child traffic injuries, although there is some evidence of behaviour change.
- Traffic calming has greater potential to reduce inequalities in child health.

Should verrucas be covered while swimming?

Report by

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The son of one of the authors came home from school with a letter explaining that prior to swimming each term, children would have their feet checked for verrucas. School policy stated that if a verruca was discovered a protective sock must be worn.

Many public swimming pools have no restrictions on children swimming with verrucas, and in view of conflicting policies we wondered whether verrucas were transmitted during swimming and if wearing verruca socks was a necessary intervention.

Structured clinical question

In a child [patient] with a verruca (plantar wart), does wearing an occlusive dressing or sock while swimming [intervention] reduce transmission [outcome]?

Search strategy and outcome

Secondary sources: Cochrane—none.

Primary sources: Medline 1966 to present (verruca OR plantar wart) AND swim LIMIT to "English language".

Embase: same search strategy—no additional papers.

Search results—7 articles, 2 relevant plus 3 from manual search. See table 2.

Commentary

The Department of Health *Guidance on infection control in schools and nurseries*[1] suggests that affected children may go swimming but that verrucas should be covered.

Table 2 Verrucas and swimming

Citation	Study group	Study type (level of evidence)	Outcome	Key results	Comments
Bunney (1972)	68 matched pairs of swimmers. One of the pair wore "Plastsocks" and the other bare feet (control group)	Paired (level 2b)	Incidence of new plantar warts in the "Plastsocks" group versus the control group	During the study period the sock group was entirely free from plantar warts, while the control group developed 9 new plantar warts ($p<0.01$)	The study did not look at the effectiveness of "Plastsocks" in preventing the transmission of infection
Johnson (1995)	146 adolescents aged 10–18 who used locker rooms	Comparison of 80 pupils who only used locker rooms, with 66 members of a swim club who used locker rooms plus communal showers (level 4)	Incidence of plantar warts	Significant difference in prevalence between those who used public shower rooms and locker rooms (27%) compared to those who used only locker rooms (1.25%) ($\chi^2=15.46$, df=1, $p=0.001$)	Shower rooms proposed as a risk factor, with the warm, moist environment important for viral transmission. Author states that he is conducting a follow up study to determine whether the incidence of plantar warts among shower room users (swimmers) can be reduced by limiting foot-to-floor contact, but subsequent paper not found in search
Allen (1968)	14075 pupils from 40 primary and secondary schools	Random sample of 40 schools in Hertfordshire (level 4)	Prevalence of plantar warts	Prevalence of 2.9% for secondary schools and 1.8% for primary schools	Prevalence appeared greater in those using heated covered pools (4.02%), compared to those using pools, which were not covered and heated either at school (2.91%) or public pools (2.10%). Authors concluded that difference may be due to differing periods of exposure. No statistically significant difference was found between the groups that did gymnastics in barefoot compared to plimsolls
Tranter (1969)	Pupils from 6 junior schools	Junior schools chosen at random (level 4)	Incidence of plantar warts and the amount of swimming undertaken	Correlation coefficient was calculated giving a significant positive value at the 5% level suggesting a positive relationship between the amount of swimming and the incidence of warts Correlation coefficient showed no relation between the amount of barefoot physical exercise and the incidence of plantar warts	Evidence suggested that if a school has its own pool, used only by its pupils and if they were examined twice/term and children with plantar warts excluded the incidence of warts will decline. If the school uses a communal pool the incidence will not decline
Gentles (1973)	773 bathers at a public swimming bath	Random sample: 9.3% of bathers (level 2c)	Incidence of verrucas	Overall incidence of verrucas was 4.8%, with 0.76% in adults, 6.9% in juveniles. Incidence of 10.2% during school swimming sessions and 5.1% during public swimming sessions ($p<0.05$)	The incidence of veruccas was noted to be higher than previously recorded. Authors conclude swimming baths are involved in the "vicious circle" of infection and floor contamination

Our search revealed little up to date information on the prevalence of verrucas in schoolchildren, or the effectiveness of preventive measures. One paper studied protective footwear, but this study looked at the role of protective footwear in preventing the acquisition of plantar warts in unaffected individuals. It did not examine the prevention of spread by affected individuals wearing footwear.[2] There were no studies looking at the effectiveness of simply covering a plantar lesion with an adhesive dressing in the prevention of spread.

Only one study looked at the prevalence of plantar warts in swimmers compared to non-swimmers.[3] This study found that adolescents who used locker rooms plus communal showers at a swim club had a significantly higher prevalence of warts than young people using only locker rooms.

Three studies looked at the prevalence of verrucas in swimmers. One[4] found a greater prevalence of warts in those swimming in heated covered pools compared to uncovered pools, concluding that this difference may be accounted for by a differing period of exposure. Another[5] found a positive correlation between the amount of swimming and the incidence of warts. The third[6] found a higher incidence of verrucas in those swimming during a school session than during a free-swimming session.

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CLINICAL BOTTOM LINE

- Swimming is part of the national curriculum up until the end of key stage 2, by which time children are expected to be able to swim 25 metres.
- Although studies have shown an association between verrucas and swimming, none have looked at the increased risk of verruca acquisition with swimming.
- No studies have considered the effectiveness of protective socks/dressings in preventing transmission.
- Expecting children to wear protective socks, without evidence of their effectiveness, may stigmatise children and put them off swimming altogether.

What is the normal range of blood glucose concentrations in healthy term newborns?

Report by

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You are the attending neonatal consultant. It is 6 pm on a Friday after a busy week on the unit. A rather flustered midwife appears from the postnatal ward with a baby and two anxious parents. The baby is full term and appropriately grown, following a normal vaginal delivery and just 8 hours old. Mum has been attempting to breast feed but the baby is reported to have been "not feeding well" and "jittery". There are no prenatal risk factors for sepsis. Your examination of the baby is normal—he is now not "jittery".

A capillary heel prick blood test (Medisense) done on the postnatal ward has given a blood glucose reading of 2.6 mmol.

Because this result is perceived to be abnormal (low), one of the neonatal trainees has suggested to the parents that he may need admission to the neonatal unit. As she has had three previous babies, the mother was hoping for an early (six hour) discharge from hospital.

The midwife asks you to "sort out the situation".

Some hours later, the laboratory plasma glucose result (taken at the same time as the Medisense capillary sample) is available. This result is 3.4 mmol/l.

The mother agreed to stay overnight with the baby on the postnatal ward, received breast feeding support, and was discharged home next morning. No further blood samples were taken. A phone call to the mother on day 3 confirmed that the baby remained well and fully breast fed.

Structured clinical question

In otherwise healthy newborn babies, what is the normal range of blood glucose, in the first days of life?

Search strategy and outcome

[newborn] AND [blood glucose OR hypoglycaemia] AND [Exp cohort studies]

Search results

Cochrane Library: no relevant studies found.

Primary sources (Medline): 3 observational studies.

See table 3.

CLINICAL BOTTOM LINE

- The normal range of blood glucose is around 1.5–6 mmol/l in the first days of life, depending on the age of the baby, type of feed, assay method used, and possibly the mode of delivery.
- Up to 14% of healthy term babies may have blood glucose less than 2.6 mmol/l in the first three days of life. Lowest concentrations are more likely on day 1.
- There is no reason to routinely measure blood glucose in appropriately grown term babies who are otherwise well. "Jitteriness" is a mostly benign finding.
- Feeding difficulty should be overcome with education, promotion, and support for breast feeding.

Commentary

There was remarkable agreement between the results of these three studies in spite of different populations (UK, Denmark, and India) and different methods of assay (whole blood glucose: microenzymatic and glucose dehydrogenase photometric methods; plasma glucose: glucose oxidase method).

Breast fed babies have statistically significantly lower blood glucose concentrations (mean 3.6 mmol/l; range 1.5–5.3) in the first week of life, compared to formula fed babies (mean 4.0 mmol/l; range 2.5–6.2).

Breast fed full term babies with low blood glucose concentrations produce ketones and other fuels as an adaptive mechanism.

Jitteriness is an extremely common and usually benign finding in otherwise well term newborns.[1] In a study of 102 full term babies with "jitteriness",[2] sucking on the examiner's hand stopped the tremor in over 80%. Of the 18 babies whose tremor continued, only five had hypoglycaemia and 13 had hypocalcaemia

In our case, the difference between the Medisense heel prick (2.6 mmol/l) and the laboratory plasma glucose of 3.4 mmol/l, highlights the poor predictive value of reagent strips to detect true hypoglycaemia (PPV 0.18 for blood glucose of <2.0 mmol/l). Use of reagent strips will on average wrongly diagnose hypoglycaemia in one out of four babies who are in fact normoglycaemic.[3]

If a baby appears well but "jittery", he or she should be examined carefully and have a suckling stimulation test. If he or she fails this test, blood assay of calcium and glucose should be done. Blood glucose of less than 1.5 mmol/l should prompt further investigation in any baby (well or otherwise).

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Table 3 Blood glucose in newborns

Citation	Study group	Study type (level of evidence)	Outcome	Key result	Comments
Hawdon *et al* (1992)	156 term infants, breast or bottle fed	Observational, cross sectional (1b)	Assay of whole blood glucose, gluconeogenic precursors, and ketone bodies from day 1 to day 6	12% had blood glucose <2.6 mmol/l, days 1–3	Range of blood glucose was <1.5 to 6.2 mmol/l Lowest levels were on day 1 Widest range on day 2
Hoseth *et al* (2000)	223 term infants, exclusively breast fed	Observational, cross sectional (1b)	Assay of whole blood glucose between 1 and 96 hours of age	14% had blood glucose <2.6 mmol/l	Range of blood glucose was 1.4 to 5.3 mmol/l. Lowest levels were on day 1
Diwakar and Sasidhar (2002)	220 healthy term infants, AGA, exclusively breast fed	Observational, longitudinal (1b)	Assay of plasma glucose at 3, 6, 24, and 72 hours of age	14% had blood glucose <2.6 mmol/l	Range of blood glucose was 1.3 to 8.3 mmol/l Levels similar at each timepoint

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POSTCARD FROM DOWN UNDER

Desperately seeking asylum

Opening the newspaper you read about a nation holding 2700 people in detention without trial. Of these, 600 are children, and of these, 50 are children not accompanied by a member of their family. Amnesty International alleges that staff refer to inmates by number instead of name, that solitary confinement is used as punishment even for children, and that tear gas is used without discrimination to quell disturbances.

The year is 2002, the month January and the country, not some pariah state where these sorts of statistics provoke a sigh and the thought "Oh no, not again", but Australia. The people are the illegal immigrants.

The camps are private facilities, run by a company called Australian Correctional Management, itself a division of the American company Wackenhut Correctional Corp. Enclosed by razor wire, the camps are in some of Australia's most inhospitable spots. The other side of the wire is desert with daytime temperature far in excess of body temperature, prompting children to ask a visiting child psychiatrist "Doesn't Australia have flowers?".

The Australian Government is proud of its record on accepting immigrants—and certainly for a relatively small population it accepts a fairly large number of refugees. But it is with the illegal immigrants—and the government view that this is an issue of internal politics—where the controversy lies. The electorate, for the most part, are behind the government on this issue. In the November 2001 Australian general election, Prime Minister John Howard, who until an immigration crisis involving the MV Tampa had been very low in the opinion polls, was returned to power with a reasonable majority. Most commentators agree that this election was won and lost on the issue of immigration. Interestingly, this was not because the opposition disagreed with government policy, since it did not. Time and again the opposition was nearly indecently eager to endorse the government view, and in doing so seeming to take its political lead from them.

There is one Australian view which holds that Australia is a country isolated in the middle of Asia, and that any weakness in immigration policy will open the floodgates. There is another view, most frequently expressed by the founder of the One Nation political party, Pauline Hanson, which holds that this has already begun. One Nation polled well in the 1998 General Election—the Australian electoral system giving small but significant clout to the lesser parties. It did much less well in 2001, and there is yet another view which suggests that this is because the views of One Nation were, by this time, being adequately expressed by the mainstream political parties.

Words are powerful things—a fact too easily undermined by the over frequent use of that old cliché about the pen and the sword. Politicians are extremely familiar with this power. They use phrases like "illegal immigrant" or "queue jumper"—referring to the government insistence that for each "illegal" given refugee status, they will accept one less via legal channels. The media—some of it, at least—takes up these phrases, and they are heard repeated in tea rooms and taxis. These, instead of the differently evocative "desperate refugees", "fleeing families", or even "children". As a letter writer in a newspaper cleverly asked with respect to the queue jumpers: "Where is the queue to escape a burning building?". This writer, along with newspaper columnist Phillip Adams were, for me, an bedrock of sanity in the confusion I felt trying to reconcile this cold hearted attitude with the genuine warmth of character and generosity I found to be an essential feature of nearly every Australian I met. The Australian view that they live in the Lucky Country, and that everyone deserves a Fair Go are parts of the national mantra, but something was amiss here.

The Australian Government says that 80% of the detainees get a primary decision on their status within 15 weeks of incarceration. Amnesty International reckons the average detention time to be eight months. In any case, some 80% of those detained are eventually found to be genuine refugees. In the meantime, it is hard to decide which is more distressing: children on hunger strikes, self mutilating, and threatening suicide; or the radio shock-jock saying that he didn't mind the hunger strikes because this was saving him, a tax payer, the cost of paying for their food.

The physical isolation of Australia from much of the developed world means that they don't have a very clear appreciation of how the rest of the world perceives them—either positively or negatively. This helps to reinforce their opinion that the rest of the world doesn't understand their special circumstances. The question that the rest of the world needs to ask, and to keep on asking, is: "What special circumstances make it reasonable to imprison a child?".

I D Wacogne
Dr Wacogne was on secondment at the Royal Children's Hospital, Brisbane for two years and is now a locum consultant in general paediatrics at Birmingham Children's Hospital, UK