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Reducing child deaths in high income countries: A call to action

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Although high income countries have made substantial progress towards reducing child mortality over recent decades,¹ rates vary markedly between and within countries,^{2,3} and modifiable factors continue to be identified in many deaths. A series of three articles in *The Lancet*^{1,4,5} has described the epidemiology of child mortality and a standardised approach to child death reviews in high income countries. Patterns of child mortality at different ages are delineated into five broad categories: perinatal, congenital, acquired natural, external, and unexplained;⁴ while contributory factors are described across four broad domains: factors intrinsic to the child, the physical environment, the social environment, and service delivery.⁵ This commentary attempts to draw on the conclusions of these three articles and make practical recommendations on strategies in three key areas with perhaps the greatest potential to further reduce child mortality in high income countries: perinatal conditions, particularly preterm birth; acquired natural conditions, such as sepsis or acute respiratory problems; and external causes, including road traffic fatalities.

Perinatal conditions

Since high mortality rates continue to occur as a consequence of perinatal conditions, co-ordinated strategies that reduce antenatal and perinatal risk factors are essential. Interventions targeted at key modifiable risk factors, such as those aimed at promoting smoking cessation during pregnancy,⁶ and dietary and physical activity interventions for weight management before and during pregnancy, may be effective.⁷ However, much of this evidence is drawn from observational studies prone to selection biases, and randomised controlled trials have generally been under-powered to detect effects on mortality outcomes. Crucially, moreover, a deeper understanding of the barriers and facilitators to behaviour change among pregnant women and indeed health care professionals is also required. Individual risk factors such as maternal smoking or obesity need to be understood in the context of the wider structural and cultural determinants, including wide socioeconomic disparities and the impact of obesogenic environments, which may make it difficult for individuals to effect the changes required to reduce risks.

A significant body of evidence has accumulated on the effectiveness of perinatal interventions aimed at reducing infant mortality due to preterm birth. Fewer multiple embryo transfers during assisted reproductive technologies, cervical cerclage, progesterone supplementation, and reduction of non-medically indicated labour induction or caesarean delivery have beneficial effects on preventing preterm births and their adverse sequelae.⁸ In addition, some therapeutic interventions either targeted at the mother, such as antenatal

corticosteroids aimed at accelerating fetal lung maturation in women at risk of preterm birth,⁹ or targeted at the preterm infant, such as prophylactic administration of protein-free synthetic surfactant to ameliorate the severity of respiratory distress syndrome,¹⁰ reduce the risk of neonatal deaths. While increased coverage of perinatal interventions of proven efficacy will have some effect on reducing infant mortality, most infant deaths due to perinatal causes remain intractable to current interventions, highlighting the need for a strategic prioritisation of further research into preventive therapies. This will require the engagement of policymakers, research funders, and the academic and health professional communities, coupled, where necessary, with legislative changes that incentivise increased involvement by the pharmaceutical industry. It will also require a gathering of a broader portfolio of evidence than has hitherto largely been the case. It is important that future research encompasses long-term outcomes associated with preventive interventions. For example, the potential harmful effects to the child of antibiotic therapy in pregnant women in spontaneous preterm labour and intact membranes, was not established until the trial participants were followed-up into mid-childhood.¹¹ This emphasises the need for assessing long-term health effects within the context of adequately-sized longitudinal follow-up of trials and observational studies. In turn, health effects need to be balanced against the additional economic costs associated with perinatal interventions. Adoption decisions should ultimately be made within a framework that aims to maximise value for the health care spend, whether this is framed in terms of the health of children, or in broader terms of social welfare that encompass children and their families.

Acquired natural conditions

Efforts to prevent child deaths due to acquired natural causes should similarly be rooted in a framework of evidence-based decision making. While the risk of mortality from any individual acquired natural condition is low, there are overarching themes that transcend acute and chronic medical conditions.

In primary and secondary care, improved recognition of severity of illness in children should pay dividend.¹² Approaches will necessarily differ by epidemiological, organisational and cultural context, but some generic lessons can be learnt. These include the need for increased use of validated clinical decision rules, careful listening to parents, being alert to the significance of repeat presentations or of missed appointments, and clinical intuition by experienced clinicians.¹³ Unfortunately, much of the evidence base is compromised by a paucity of research in low prevalence settings.¹⁴ Interactive training tools designed to assist

health professionals in spotting children with serious illnesses might be introduced at little extra cost,¹⁵ and early reports for some initiatives, such as Paediatric Early Warning scores, should encourage further trials.^{16,17} While clinical judgement remains of paramount importance, pertinent written information provided to parents and carers, including 'red flag' signs to trigger further consultation, and relevant sign posting, is essential to empower families to re-consult in an informed and timely manner.²

However, true success on a large scale may only follow a systematic reappraisal of our medical education and health care systems. Enhanced and extended training of General Practitioners, within speciality-based training assessments, will provide increased exposure to acutely ill children, as well as improve skills in caring for children with long-term and end-of-life conditions.^{18,19} Similarly, health care models that better integrate services across healthcare boundaries, with remunerative mechanisms that support the patient pathway rather than discrete episodes of care, require systematic evaluation.

External causes

Prevention of deaths due to external causes requires effective prevention strategies involving collaborative working between health authorities and other agencies, including social, education, environmental, police and legal services, industry, and consumer groups. Much more needs to be done to create healthy environments for children and young people inside and outside of their homes. New legislation requiring the use of protective equipment, product modifications, promotion of safety devices, environmental modifications aimed at preventing road traffic injuries, supportive home visiting programmes, and improved access to health and statutory services, could all play their part.²⁰ While, in some cases, the costs will have to be shared across agencies towards a shared goal of preventing child deaths, in many cases, there will be a strong economic and ethical argument for targeting prevention strategies at the most vulnerable given the persistent socioeconomic gradient in childhood mortality attributable to external causes.⁵

Concluding remarks

This week's series in *The Lancet*^{1,4,5} is a timely reminder of what has been achieved and what remains to be achieved in order to reduce child deaths in high income countries. Concerted strategies at government and inter-government levels are now required to make further inroads. Efforts to further reduce child mortality will ultimately need to be driven by an evidence-based framework that encompasses the burden associated with individual causes,

understanding of modifiable risk factors, and evidence on the efficacy, cost-effectiveness and acceptability of preventive interventions, along with their potential for integration and ability to deliver collateral benefit. Given the consistent socioeconomic gradient in childhood mortality across a wide range of contexts, time periods and study designs,⁵ these strategies should be combined with research initiatives aimed at increasing our understanding of the mechanisms through which relative poverty affects the risk of child death in high income countries. Ultimately, evidence-based prevention strategies should not only further reduce child deaths, but also generate wider benefits to the health and well-being of children and their families, as well as strengthen the economic and social fabrics of our societies.

References

1. Fraser J, Sidebotham, P, Frederick, J, Covington, T, Mitchell, EA. Learning from child death review in the USA, UK, Australia, and New Zealand. *Lancet*, in press.
2. Wolfe I, Cass H, Thompson MJ, et al. Improving child health services in the UK: insights from Europe and their implications for the NHS reforms. *BMJ* 2011; **342**: d1277.
3. Wolfe I, Thompson M, Gill P, et al. Health services for children in western Europe. *Lancet* 2013; **381**(9873): 1224-34.
4. Sidebotham P, Fraser, J, Fleming P, Ward-Platt, M, Hain, R. Patterns of child death in England and Wales. *Lancet*, in press.
5. Sidebotham P, Fraser, J, Covington, T, Freemantle, J, Petrou, S, Pulikottil-Jacob, R, Cutler, T, Ellis, C. Child Death Review Series III: Understanding why children die in high-income countries. *Lancet*, in press.
6. Lumley J, Chamberlain C, Dowswell T, Oliver S, Oakley L, Watson L. Interventions for promoting smoking cessation during pregnancy. *Cochrane Database Syst Rev* 2009; (3): Cd001055.
7. Thangaratnam S, Rogozinska E, Jolly K, et al. Interventions to reduce or prevent obesity in pregnant women: a systematic review. *Health Technol Assess* 2012; **16**(31): iii-iv, 1-191.
8. Chang HH, Larson J, Blencowe H, et al. Preventing preterm births: analysis of trends and potential reductions with interventions in 39 countries with very high human development index. *Lancet* 2013; **381**(9862): 223-34.
9. Roberts D, Dalziel S. Antenatal corticosteroids for accelerating fetal lung maturation for women at risk of preterm birth. *Cochrane Database Syst Rev* 2006; (3): CD004454.
10. Soll R, Ozek E. Prophylactic protein free synthetic surfactant for preventing morbidity and mortality in preterm infants. *Cochrane Database Syst Rev* 2010; (1): CD001079.
11. Kenyon S, Pike K, Jones DR, et al. Childhood outcomes after prescription of antibiotics to pregnant women with spontaneous preterm labour: 7-year follow-up of the ORACLE II trial. *Lancet* 2008; **372**(9646): 1319-27.
12. Harnden A, Mayon-White R, Mant D, Kelly D, Pearson G. Child deaths: confidential enquiry into the role and quality of UK primary care. *Br J Gen Pract* 2009; **59**(568): 819-24.
13. Van den Bruel A, Haj-Hassan T, Thompson M, Buntinx F, Mant D, European Research Network on Recognising Serious Infection i. Diagnostic value of clinical features at presentation to identify serious infection in children in developed countries: a systematic review. *Lancet* 2010; **375**(9717): 834-45.
14. Thompson M, Van den Bruel A, Verbakel J, et al. Systematic review and validation of prediction rules for identifying children with serious infections in emergency departments and urgent-access primary care. *Health Technol Assess* 2012; **16**(15): 1-100.
15. Department of Health (DoH), England. *Spotting the Sick Child*. London: DoH, 2011. <https://www.spottingthesickchild.com/> (accessed 28th March 2014).
16. Parshuram CS, Duncan HP, Joffe AR, et al. Multicentre validation of the bedside paediatric early warning system score: a severity of illness score to detect evolving critical illness in hospitalised children. *Critical Care* 2011; **15**(4): R184.

17. Tibballs J, Kinney S, Duke T, Oakley E, Hennessy M. Reduction of paediatric in-patient cardiac arrest and death with a medical emergency team: preliminary results. *Arch Dis Child* 2005; **90**(11): 1148-52.
18. Davies S. *Our children deserve better: Prevention Pays*. London: Department of Health; 2013.
19. Royal College of Paediatrics and Child Health (RCPCH). *Facing the Future*. London: RCPCH; 2011 (accessed 28th March 2014).
20. Harvey A, Towner E, Peden M, Soori H, Bartolomeos K. Injury prevention and the attainment of child and adolescent health. *Bull World Health Organ* 2009; **87**(5): 390-4.