



An innovation in child health: Globally reaching out to child health professionals

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Abstract

Worldwide deaths of children younger than 5 years reduced from 12.7 million in 1990 to 6.3 million in 2013. Much of this decline is attributed to an increase in the knowledge, skills, and abilities of child health professionals. In turn this increase in knowledge, skills, and abilities has been brought about by increased child-health-focused education available to child health professionals. Therefore child-health-focused education must be part of the strategy to eliminate the remaining 6.3 million deaths and to achieve the United Nations Millennium Development Goals. This article describes a child-health-focused program that was established in 1992 and operates in 20 countries: Australia, Bangladesh, Botswana, Cambodia, China, Ethiopia, Hong Kong, India, Kenya, Malawi, Mongolia, Myanmar, Sierra Leone, the Seychelles, the Solomon Islands, Tanzania, Tonga, Vanuatu, Vietnam, and Zimbabwe. The Diploma in Child Health/International Postgraduate Paediatric Certificate (DCH/IPPC) course provides a comprehensive overview of evidence-based current best practice in pediatrics. This includes all subspecialty areas from infectious diseases and emergency medicine through to endocrinology, respiratory medicine, neurology, nutrition, and dietetics. Content is developed and presented by international medical experts in response to global child health needs. Content is provided to students via a combination of learning outcomes, webcasts, lecture notes, personalized study, tutorials, case studies, and clinical practice. One hundred eleven webcasts are provided, and these are updated annually. This article includes a brief discussion of the value and focus of medical education programs; a description of the DCH/IPPC course content, approaches to teaching and learning, course structure and the funding model; the most recent evaluation of the DCH/IPPC course; and recommendations for overcoming the challenges for implementing a multinational child-health-focused program.

Keywords: Child health; pediatrics; global health; health education

The value of educational initiatives

Significant, yet insufficient, progress has been made in the reduction of child deaths since 1990. Worldwide deaths of children younger than 5 years reduced from 12.7 million in 1990 to 6.3 million in 2013 [1]. At least some of this decline is attributed to an increase in the knowledge, skills, and abilities of health professionals.

In turn this increase in knowledge, skills, and abilities has been brought about by increased child-health-focused education available to health professionals. Therefore child-health-focused education must be part of the strategy to eliminate the remaining 6.3 million deaths and to achieve, albeit late, the United Nations Millennium Development Goals.

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Existing interventions

Of the millions of children younger than 5 years who die each year it is estimated that more than 60% of the deaths and 41–72% of newborn deaths could be prevented by existing interventions [2, 3]. The key to the application of many of these successful interventions using clinical equipment and techniques is the adequate education of the health care professionals who champion and implement them. Similarly, the recognition of symptoms, identification of health issues, development of clinical management plans, and production of health care plans all rely on the education of health care professionals. Thus a major challenge is to develop and maintain the human resources in pediatric care within each country, to enable them to effectively deliver existing interventions and, as they are developed, new interventions [4]. A 3-year study by the World Health Organization [5] found many of these interventions were not complex or difficult to implement – for example, immediate thermal care for newborn babies and extra support for feeding small and preterm babies. Similarly the Lancet Neonatal Survival Steering Team reports simple inexpensive interventions result in a significant reduction in neonatal mortality [6]. These interventions can usually be quickly and effectively implemented once health professionals become aware of their importance. This is best achieved through education.

Health care professionals

Desirable health outcomes including infant survival, survival of children younger than 5 years, and immunization coverage are closely correlated with the concentration of qualified health professionals [7]. Ahmed et al. [7] argue the number and type of human resources available within health systems vary considerably yet most include physicians, nurses, and community health professionals. Thus the quality of child health is directly influenced by the density of health professionals, and a lack of educated health professionals is an avoidable limiting factor in the success of interventions to improve child health [8]. Indeed Lawn et al. [9] found key impediments to improving child health outcomes included lack of personnel with adequate knowledge and skills, suboptimal treatment compliance, and the costs associated with health care. The adverse effects of each of these can be markedly reduced through education.

Education

Research into developmental psychology and neurology highlighted the link between healthy childhood and healthy adulthood in the later part of the last century [10]. Evidence is continuing to grow about the link between adult diseases affected by child health. These include obesity, diabetes, cardiovascular disease, and hypertension. This is likely to increase the burden on child health professionals as they are asked to manage the precursors of adult illness within populations of children [11]. As this awareness has been translated into action on a broad scale to meet the noble objectives espoused in the United Nations Millennium Development Goals, these insights have been augmented by economic reasoning arguing for larger investment in human capital [10]. The 2003 report by the United Nations has been reinforced by reports from other respected international agencies also calling for greater investment in children. These include reports from the United Nations Children's Fund [12] in 2008 and the Organization for Economic Cooperation and Development [13] in 2006 which incorporate children in both developed and developing countries.

There have been calls for child health care professionals to be able to collaborate effectively with the education sector and, in particular, to have access to meaningful educational initiatives within pediatrics [14]. Other authors simply argue for improved education and training for all health professionals [15], whereas Fleischman et al. [16] report the quality of available training as the most significant barrier in a pediatric educational needs assessment in urban and rural communities. High-quality education across large geographical areas has been found to be effective within pediatrics. Hall et al. [17] reported the success of an educational program in neonatology administered across 14 primarily European countries. Similarly, Warren et al. [18] reported the success of a pediatric continuing education program, particularly within rural USA, and Bundy et al. [19] reported the success of a quality improvement program for pediatric practice. Carefully developed and thoughtfully administered education can be accessed by all health care professionals who focus on child health, including physicians, nurses, community health professionals, and those involved in prehospital care. Busy child health professionals find education that is provided at a location and time agreeable



to them particularly convenient. Moreover, education that is provided where child health professionals work makes it possible to apply it immediately and therefore consolidates learning in practice. This is where a great deal of powerful learning happens.

The Task Force for Scaling Up Education and Training was established as part of a global health workforce alliance. This task force sought to identify what strategies had been successful within 10 countries across three continents: India, Pakistan, Bangladesh, Ethiopia, Malawi, Tanzania, Kenya, Ghana, Venezuela, and Brazil [8]. These countries were chosen because they were implementing or had successfully implemented a significant increase in the size and capability of their health workforce. The task force produced a series of “critical success factors for scaling up education and training of health professionals within countries.” The Diploma in Child Health/International Postgraduate Paediatric Certificate (DCH/IPPC) program fulfills three of these critical factors: (1) commitment to produce appropriately trained health professionals to meet health needs, (2) substantial expansion of preservice education and training programs, and (3) provision of good information systems for health workforce education, with monitoring and assessment [8].

The DCH/IPPC program

If we accept that too many children die, that large numbers of children die unnecessarily, that existing interventions can prevent most of these deaths, and that education of the health workforce in all countries is key to implementing existing interventions, then the question becomes: How can we implement an effective widespread educational strategy that will rapidly and continuously increase the knowledge, skills, and abilities of health care professionals who focus on child health? A proven solution is the use of a centrally developed, coordinated, and quality-assured educational program that is locally driven and tutored, that is adaptive to local needs and conditions, and that uses educational tools developed by a team of international child health experts. The DCH/IPPC program is such a solution.

The DCH/IPPC program was established in 1992 and operates in 20 countries: Australia, Bangladesh, Botswana, Cambodia, China, Ethiopia, Hong Kong, India, Kenya,

Malawi, Mongolia, Myanmar, Sierra Leone, the Seychelles, the Solomon Islands, Tanzania, Tonga, Vanuatu, Vietnam, and Zimbabwe. The DCH/IPPC course provides a comprehensive overview of evidence-based current best practice in pediatrics. This includes all subspecialty areas from infectious diseases and emergency medicine through to endocrinology, respiratory medicine, neurology, nutrition, and dietetics. Content is developed and presented by international experts in response to global child health needs. Content is provided to students via a combination of learning outcomes, webcasts, lecture notes, personalized study, tutorials, case studies, and clinical practice. One hundred eleven webcasts are provided, and these are updated annually. The webcasts are provided online or via DVD. Participants work through three webcasts each week, undertake a minimum of 4 hours of personal study and, outside Australia, have an additional 1-hour tutorial per week from a local pediatrician. Six months of relevant pediatric experience is required for certification.

Formative assessment is provided throughout the DCH/IPPC course, with ongoing feedback to each student provided by a tutor and self-assessment questions supplied with each webcast. Summative assessment is provided through student presentation of case reports, with oral and written examinations conducted at training sites within each country. Quality is maintained via attentive selection and supervision of on-site tutors to maintain local integrity and an international education advisory group to monitor educational content, implementation, and assessment. Participants complete feedback forms during the course plus evaluations after completing the course. Results of this feedback and the evaluations are iteratively fed into course development. This continuous approach to quality improvement over the past 24 years has ensured the development of a robust program to meet international and local needs. Importantly DCH/IPPC alumni have lifelong free access to annually updated course content. Furthermore, monthly newsletters are provided to alumni, tutors, and students.

The DCH/IPPC model successfully addresses a number of challenging problems experienced by many countries. These include working with the weak and fragmented health systems present within many countries that hinder the scaling up of essential interventions [20]. Providing child and maternal health education from a source independent of any individual



health system allows health care professionals to access valuable educational resources regardless of the health system in which the child health professional operates. Moreover, this child health education is provided without an undue burden being placed on any health system that would prevent the successful scaling up of essential interventions. This accelerates intervention implementation and overcomes major barriers referred to by researchers [6, 21] who cite an inability to rapidly scale up interventions as being a significant barrier to the reduction in child mortality.

It is important to recognize that each country has a unique health system and many countries have multiple health systems. Therefore it is essential that a multinational educational program is sufficiently flexible to allow adaptation to any existing health system anywhere in the world. The DCH/IPPC program achieves this through the use of locally based tutors. These tutors know the local health system. Moreover, the locally based tutors are fully familiar with local conditions. These include conditions directly relevant to health (including disease states, prevalence of parasites or disease vectors, and available health resources), as well as others that are extremely influential on the success of health interventions (such as language, cultural norms, cleanliness of water, available information technology, and literacy levels within local populations). These local tutors are also best placed to educate health professionals about their roles as gatekeepers to health systems and as navigators of health systems for effective application of resources [7]. This ensures all patients in need are able to access their health system and to navigate through the system in a way that optimizes the use of often scarce resources, including personnel, vaccines, and medicines. Other continuing education programs focused on child health professionals also highlight the importance of including local child health professionals as teaching faculty [22]. Tutorials provide local adaptation, addressing key differences in cultural and traditional medicine practices, genetics, legal responsibilities, local treatment and immunization protocols, how best to use local resources, and how to interpret common presentations. Tutorials also provide an opportunity for case discussion, bedside teaching, and questions. Both participants and tutors send questions to webcast presenters, the answers to which are published in the DCH/IPPC monthly newsletter for all to benefit.

The DCH/IPPC program uses a blended learning approach, integrated within an international–local matrix. Blended learning allows education materials to be produced and quality-assured centrally, whereas face-to-face tutorials are delivered locally by on-the-ground mentors who ensure education materials are interpreted in a local context. The requirement that learners apply what they learn within a practical setting ensures they become capable of interpreting the education materials and adapting this interpretation to real-world practice at their location.

Breadth of the DCH/IPPC program

Whereas the value of decreasing infant mortality, birth mortality, and mortality of children younger than 5 years is unquestionable, it is also imperative to care for older children. Sanci et al. [23] found health professionals have a lack of education in adolescent health and lack competency in key areas. This is despite increasing incidences of psychosocial problems, including accidental and intentional injury, depression, suicide, substance abuse, unplanned pregnancy, eating disorders, and sexually transmitted infection [24]. Therefore any child health program needs to include adolescent health. The DCH/IPPC model includes adolescence by focusing on child health from birth through to young adulthood. Similarly, a significant amount of DCH/IPPC program content focuses on noncommunicable disease. Diseases such as diabetes, cardiovascular disease, and chronic respiratory disease are emerging issues in developing countries and are a significant component of the disease burden.

Equally important is the need to react to emerging health threats and to changing health trends. In some cases the DCH/IPPC program has been able to rapidly produce educational tools to address specific illnesses (e.g., *Enterovirus 71*) and to use these tools to upskill health care professionals. These tools are then quickly available to the health professionals who need them, using proven existing education techniques. Similarly, Liu et al. [25] argue that those involved with the development and implementation of child survival strategies should be familiar with the major causes of child death and be able to direct resources toward combating these causes. This is essential, and the content of the DCH/IPPC course is monitored to ensure it addresses these causes. For example, Liu et al. [25] reported the



major causes of neonatal death were preterm birth complications, intrapartum-related complications, and sepsis or meningitis, whereas the major causes of death in older children were pneumonia, diarrhea, and malaria. Each of these is addressed in depth within the DCH/IPPC course content. The ongoing review of DCH/IPPC course content is important and ensures the content addresses contemporary health education needs.

Funding model

The DCH/IPPC is a not-for-profit child health educational enterprise. A sliding fee structure is designed to cover costs and ensure sustainability while lowering the affordability burden for child health professionals in those countries whose economies are least able to meet this burden. That is, the fees incurred by students in, say, sub-Saharan Africa, are less than those incurred by students in, say, Australia. In this example, the fees charged to students in Australia cross-subsidize fees charged to students in sub-Saharan Africa and costs for education in all countries are met. Within each country fees are established to reflect available scholarship support and realistic income.

Iterative evaluation

Ongoing course evaluation is inbuilt within the DCH/IPPC program. The iterative nature of this evaluation allows the content and delivery of each successive course to be evaluated and the results fed into successive courses to continually improve content and delivery. Results of the latest evaluation are summarized below. These are from the 865 DCH/IPPC

course participants who completed their final examination at the Children's Hospital Westmead, Sydney, Australia, in December 2014. Of the 865 potential respondents, 564 (65.9%) chose to provide a course evaluation. Evaluations were completed anonymously to enhance candid reporting. The results are provided in Tables 1–3.

Respondents were asked to specify what they liked most and liked least about the course. Responses are reported in Table 4.

Respondents recommended the following areas for improvement (numbers in parentheses represent the number of respondents):

- Improve lecture audience questions to be clearer on recording (7)
- Interactive forum/discussion board (15)
- More short courses would be beneficial (13)
- Mid-year or quarterly assessments and feedback and revision session (21)
- Label more of the images on slides (13)
- More specific content in various areas (15)
- Lecture transcripts (8)
- More clinical scenarios discussed (24)
- More practical skills and interactive sessions (13)
- Nothing, it was really good (3)

Respondents reported the following when asked what were the most important things they had learned (numbers in parentheses represent the number of respondents):

Table 1. The extent to which respondents agreed with key statements about the Diploma in Child Health/International Postgraduate Paediatric Certificate (DCH/IPPC) course

Statement about the course	Respondents who strongly agreed with or agreed with the statement (%)
Overall the course content as outlined in the learning objectives was relevant to my practice	98.6
The examination process fairly assessed the course material	92.4
Newsletters contributed to my educational experience	95.2
This course changed my current practice with regard to my <i>knowledge</i> of pediatrics	97.3
This course changed my current practice with regard to my <i>skills</i> in pediatrics	87.6
This course changed my current practice with regard to my <i>confidence</i> in dealing with children, young people, and their families	96.3
I believe this course changed my current practice from the perspective of my patients	91.5
The DCH/IPPC Team provided excellent service during the time I was enrolled as a participant	91.5



Table 2. The extent to which respondents expectations about the Diploma in Child Health/International Postgraduate Paediatric Certificate course were met

Expectation	Respondents whose expectations were entirely met or partially met (%)
To be able to undertake an appropriate detailed and pediatric-focused history	89.4
To be able to conduct a thorough and pediatric-focused physical examination including assessment of growth and development	88.5
To be able to formulate an appropriate provisional diagnosis taking into consideration a wide range of differential diagnoses	88.8
To be able to develop an appropriate investigation and management plan with a pediatric focus specific to the context of the patient's location	88.8
To be able to understand how to implement the management plan in the context of the community and local services, including allied health and local health systems of the patient and the patient's family	88.7

Table 3. The extent to which respondents reported the Diploma in Child Health/International Postgraduate Paediatric Certificate course as being relevant to their practice and learning needs

	Entirely relevant (%)	Partially relevant (%)
Rate to what degree this course is relevant to your practice	73.8	8.5
Rate to what degree your learning needs were met by this course	71.8	14.0

- Managing or identifying a common pediatric condition (32)
- Indicators of a sick child, including red flags/emergencies (27)
- When to refer a child (19)
- Diagnostic/investigations for presentations (13)
- Communication skills—for example, family (15)
- That children are not small adults (18)
- Systematic approach to a child (11)
- Importance of history and parental concerns (14)
- Clear approach to a variety of pediatric emergencies (11)

Case reports

In addition to ongoing evaluations there are many powerful case studies that demonstrate the value of the DCH/IPPC program to children. These include:

- Case 1: Hanoi, Vietnam, 2013.
A 9-day old infant with recent onset of vomiting presented to an emergency department physician graduate of the

DCH/IPPC program. The baby was critically ill, exhibited profound bradycardia (65 beats per minute), had increased pigmentation, and had high potassium levels. The graduate recognized congenital adrenal hyperplasia and immediately gave hydrocortisone intravenously. Within 2 min the baby's pulse rate returned to a healthy 135 beats per minute. A life-threatening problem was detected by the graduate, who implemented the appropriate treatment, thereby saving the life of the infant thanks to the DCH/IPPC webcast on "Paediatric Endocrine Emergencies."

- Case 2: Honiara, Solomon Islands, 2012.
A 4-month-old baby with escalating stridor after 1 week presented to a pediatrician graduate of the DCH/IPPC program. The graduate noted the baby had a hemangioma on the lower cheek and recognized the likely association of the hemangioma with laryngeal hemangiomas because of a DCH/IPPC webcast. The baby received propranolol orally, consistent with current best practice, and promptly recovered. The DCH/IPPC graduate then



Table 4. Aspects of the Diploma in Child Health/International Postgraduate Paediatric Certificate course that were liked most and least by respondents

Liked most about the course	Liked least about the course
Accessible, relevant content. Online access to quality lecture recordings, newsletters, slides, example questions; a broad range of course materials (40+)	Technical issues relating to audio quality (7)
Professionalism and expert lectures (20)	Overlap of content between lectures (14)
Comprehensive, detailed, systematic (19)	Lack of examination practice papers (20)
Presented information on current problems seen commonly in children (24)	Not all lectures had case examples (15)
Fantastic audio and video quality (9)	Cost of course too high (9)
Availability of notes and self-assessment questions (35)	Limited seats for GP workshop (5)
Friendly office staff (12)	Limited number of past papers (13)
	Internet login/viewing issues (18)
	Some lectures too specific (11)
	Nothing (20+)
	Inconvenient examination location (5)

taught this diagnosis and treatment to a visiting overseas pediatrics registrar from a tertiary teaching hospital.

Anecdotal evidence for the value of the DCH/IPPC program for the education of healthcare professionals and the health of children is available at www.magga.org.au/about-us/testimonials/.

Alumni reports

Alumni of the program are provided with perpetual free access to DCH/IPPC educational materials. In return for this access, alumni are required to provide a report relating to their child-focused activities and challenges. This offers a valuable additional source of information to ensure the DCH/IPPC program remains focused on the activities and challenges of child health professionals. In addition to the iterative evaluations and case reports, this strategy provides essential contemporary information to allow the course to evolve in ways that will continue to constructively support advances in child health.

Lessons learned from the DCH/IPPC program

1. *Match the educational processes of learners.* Be considerate of the different learning styles and educational systems used throughout the world. Whereas some countries may choose to adopt the latest educational trends, understand that other countries choose to use traditional approaches to education. Both decisions are equally

valid. Most importantly, the aim of the DCH/IPPC program is to improve the child health knowledge, skills, and abilities of health practitioners in multiple countries. This can be achieved only if education is delivered in a way that it can be incorporated into the learning styles and educational systems that are used in these countries. The intent of the DCH/IPPC program has always been to provide excellent education pertaining to child health, rather than to impose a particular learning style or educational doctrine on a country where such a doctrine would simply be contrary to the educational practices used in that country.

2. *Flexibility in the use of information technology.* Be considerate of the variability of information technology available within different locations. Many health practitioners work in countries or geographical locations where cutting-edge information technology is unavailable. Moreover, many of these areas have considerable need for education within child health, and indeed education within multiple aspects of health care. Computers are usually available in most areas, yet high-speed Internet access at readily affordable prices is not yet universally obtainable. For example, DCH/IPPC course materials are now available via smartphone access; however, this is not a financially viable option for students in some countries. Therefore, although webinars and webcasts may be used to teach in areas with



cutting-edge information technology, it is important to be able to deliver valuable educational content via CD or DVD to areas where this level of information technology is not yet available. This flexibility in the application of information technology is essential for an international program catering to populations with variable access to information technology.

3. *Evaluate constantly.* One of the strengths of the DCH/IPPC program has been to adapt to the diverse needs of the population that it serves. This has been achieved through a continual cycle of evaluation whereby concepts are carefully considered, then cautiously implemented, then evaluated, and the results of the evaluation used to improve the concept, whereupon the improved concept is implemented, then evaluated, and the cycle continues. This cycle of evaluation and improvement is used within all aspects of the program, from program content and assessment through to teaching and learning strategies. This enables the program to develop new content in response to emergent health issues and trends, to ensure the teaching and learning strategies used by the program are consistent with the teaching and learning strategies used within the individual countries where the program is used, the information technology that is used matches that available to learners, and the assessments optimize reliability and validity.
4. *Evolve carefully rather than revolutionize suddenly.* Many excellent programs have been damaged by their implementing change of too great a magnitude or too suddenly. The adage 'do not fix what is not broken' applies to educational programs. Many programs have been irreparably broken by well-meaning wholesale changes. When one is considering change to a successful educational program, it may be more constructive to evolve it carefully than revolutionize it suddenly. This avoids the flaws inherent within many changes whereby sudden broad-based changes inadvertently damage or destroy key elements of a successful program. Any change should be carefully considered with the goal of enhancing one or more aspects of the program while concurrently avoiding a decrease in the effectiveness of any aspect of the program. Before one considers making any changes, consult with those involved in the provision

of the program (including teachers, student supervisors, administrators, and information technology support personnel) and those who receive the program (including the learners and their associated health organizations).

Challenges

Large-scale multinational educational programs are not without challenges. Three challenges in particular are (1) the variety of information technology available to health professionals worldwide, (2) the number and geographical location of suitable tutors, and (3) optimizing the contribution of key stakeholders within each region. The information technology available to health professionals worldwide varies considerably. In general, reliable high-speed Internet access occurs across a spectrum from fewer information technology resources within rural and remote sites in developing countries through to a surfeit of the latest information technology within urban areas in developed countries. The blended approach to teaching and learning adopted by the DCH/IPPC program requires flexibility in the use of information technology delivery methods to meet the information technology resources available throughout this spectrum of communities. The DCH/IPPC program successfully addresses this by delivering content via the Internet, where use is broad and reliable. In areas where speed or reliability is an issue, then distance education materials are delivered via DVDs sent to the student. However, the cost and availability of Internet access remains a significant challenge for health professionals in some developing countries.

A second challenge is finding suitable on-the-ground tutors. A particular strength of the DCH/IPPC program is that it takes contemporary knowledge, skills, and abilities relevant to child health and translates them to local needs by using local tutors. Whereas it is possible to move qualified tutors from one country or locale to another, therefore bringing an educated capable tutor to the student, if the tutor does not have knowledge of the local health system, cultural norms, patient illness profiles, language, or dialect, then this limits the ability to translate contemporary education to meet local needs. The high level of quality assurance for the DCH/IPPC is maintained by ensuring appropriately qualified and experienced local personnel act as tutors and mentors for students.



A third challenge is optimizing the political will within regions to implement the program, although this is common to most health or educational initiatives and is usually overcome through diplomatic, polite persistence. This requires the establishment of professional relationships with key stakeholders within each country and with key political, clinical, and administrative personnel and offices within relevant geographical regions. Working with diplomatic and ambassadorial representations is particularly valuable. The DCH/IPPC program achieves this through e-mail, videoconferencing, and phone communication, as well as an essential program of strategic visits by the DCH/IPPC Executive Principal to the countries where the DCH/IPPC program operates.

Additional challenges include supporting the needs of remote participants in geographically isolated areas. Ensuring local regulatory requirements are met leads to the need for formal recognition of the DCH/IPPC program before its commencement within any country. This is vital though resource and time-consuming. Responding to constant changes in local and national systems and structures requires ongoing flexibility. Similarly, ensuring constructive and beneficial relationships with changing key personnel in ministries and local, national, and international authorities is essential.

Conclusion

The World Health Organization dataset *Estimates of Health Personnel* [26] contains data from 198 countries. This dataset was extensively analyzed by Anand and Barnghausen [27], who consider the dataset to be the most reliable, consistent, and comprehensive dataset of its kind. After controlling for variables that included measures of poverty, literacy, and income, they found the density of available human resources within health care accounted for significant variations in (1) infant mortality, (2) mortality of children younger than 5 years, and (3) maternal mortality across countries. They concluded that investment in human resources for health is essential to reducing child mortality, as well as to improving maternal health. There is no better way to invest in human resources for health care than through the education of health care professionals. The DCH/IPPC program offers an inexpensive, cost-effective, proven strategy for effectively improving the child and maternal health knowledge, skills, and abilities of a broad range

of child health professionals in developing and first-world countries.

Conflict of interest

The authors declare no conflict of interest.

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References

1. United Nations Inter-agency Group for Child Mortality Estimation (UN IGME). Levels and trends in Child Mortality Report 2014. New York: United Nations Children's Fund, 2014. [accessed 2015 Jun 30]. Available from: <http://data.unicef.org/resources/childmortality2014>.
2. Jones G, Steketee R, Black R, Bhutta Z, Morris S, Bellagio Child Survival Study Group. How many child deaths can we prevent this year? *Lancet* 2003;362(9377):65–71.
3. Haines A, Sanders D, Lehmann U, Rowe AK, Lawn JE, Jan S, et al. Achieving child survival goals: potential contributions of community health workers. *Lancet* 2007;369(9579):2121–31.
4. Chen L, Evans T, Anand S, Boufford JU, Brown H, Chowdhury M, et al. Human resources for health: overcoming the crisis. *Lancet* 2004;364(9449):1984–90.
5. World Health Organization. Essential interventions, commodities and guidelines for reproductive, maternal, newborn and child health. Geneva: WHO, 2011. [accessed 2015 Jun 30]. Available from: www.who.int/pmnch/knowledge/publications/201112_essential_interventions/en/.
6. Darmstadt G, Bhutta Z, Cousens S, Adam T, Walker N, de Bernis L. Evidence based, cost effective interventions: how many newborn babies can we save? *Lancet* 2005;365(9463):977–88.
7. Ahmed S, Hossain M, RajaChowdhury A, Bhuiya A. The health workforce crisis in Bangladesh: shortage, inappropriate skills-mix and inequitable distribution. *Hum Resour Health* 2011;9(3):1–7.
8. Crisp N, Gawanas B, Sharp I. Training the health workforce: scaling up, saving lives. *Lancet* 2008;371(9613):689–91.
9. Lawn J, Vousens S, Zupan J. Neonatal survival steering team. 4 million neonatal deaths: When? Where? Why? *Lancet* 2005;365(9462):891–900.
10. Katz I, Redmond G. Investment in early childhood in Australia: international comparisons and recent trends. *Health Sociol Rev* 2009;18(1):94–107.



11. Wise P. The Transformation of child health in the United States. *Health Aff* 2004;23(5):9–25.
12. United Nations Children’s Fund. The childcare transition: a league table of early childhood education and care in economically advanced countries. Florence: UNICEF, 2008.
13. Organization for Economic Cooperation and Development. Starting strong II: Early childhood education and care. Paris: OECD, 2006.
14. Burkle F, Argent A, Kissoon N. The reality of pediatric emergency mass critical care in the developing world. *Pediatr Crit Care Med* 2011;12(6 Suppl):S169–79.
15. Leblanc J. Creating a global climate for pediatric cardiac care. *World J Pediatr* 2009;5(2):89–92
16. Fleischman R, Yarris L, Curry M, Yuen S, Brein A, Meckler G. Pediatric educational needs assessment for urban and rural emergency medical technicians. *Pediatr Emerg Care* 2011;27(12):1130–5.
17. Hall M, Cuttini M, Flemmer A, Greisen G, Marlow N, Schulze A, et al. European online postgraduate educational programme in neonatology – the way forward? *Eur J Pediatr* 2009;168(4):449–56.
18. Warren L, Sapien R, Fullerton-Gleason L. Is online pediatric continuing education effective in a rural state? *Prehosp Emerg Care* 2008;12(4):498–502.
19. Bundy D, Morawski L, Lazoric S, Bradburu S, Kamachi K, Suresh G. Education in quality improvement for pediatric practice: an online program to teach clinical QI. *Acad Pediatr* 2014;14(5):517–25.
20. Travis P, Bennett S, Haines A, Pang T, Bhutta Z, Hydner A, et al. Overcoming health-systems constraints to achieve the millennium development goals. *Lancet* 2004;364(9437):900–6.
21. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al. What works? Interventions for maternal and child undernutrition and survival. *Lancet* 2008;371(9610):417–40.
22. Wilkins K. Providing outreach continuing education in countries with limited resources. *Clin Orthop Relat Res* 2008;466(10):2413–7.
23. Sanci L, Glover S, Coffey C. Adolescent health education programs: theoretical principles in design and delivery. *Ann Acad Med* 2003;32(1):78–85.
24. Raphael D. Determinants of health of North-American adolescents: evolving definitions, recent findings, and proposed research agenda. *J Adolesc Health* 1996;19(1):6–16.
25. Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, et al. Global, regional and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet* 2012;379(9832):2151–61.
26. Dataset: World Health Organization. Estimates of Health Personnel: physicians, nurses, midwives, dentists, pharmacists. Geneva: WHO, 2004.
27. Anand S, Barnighausen T. Human resources and health outcomes: cross-country econometric study. *Lancet* 2005;364(9445):1603–9.

Related Information

Children are the future of the world. More attention should be paid to children’s health including their physical and mental health. *Family Medicine and Community Health* has published several articles focusing on the health of children.

- Bystander resuscitation of a near-drowning child in a rural south China township
<http://www.ingentaconnect.com/content/cscript/fmch/2013/00000001/00000004/art00008>
- A 2-year-old child with cough and respiratory distress
<http://www.ingentaconnect.com/content/cscript/fmch/2014/00000002/00000002/art00007>
- A case-control study on family environment characteristics of accident-prone children
<http://www.ingentaconnect.com/content/cscript/fmch/2014/00000002/00000004/art00004>
- A new paradigm for assessment of infant feeding deviation
<http://www.ingentaconnect.com/content/cscript/fmch/2015/00000003/00000004/art00008>
- Health-related behaviors in children of ethnic minorities and Han nationality in China
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- Massage treatment of chronic persistent pediatric asthma
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