



Health in children: A conceptual framework for use in healthy ageing research



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ARTICLE INFO

Article history:

Received 16 September 2013

Accepted 19 September 2013

Keywords:

Child

Health

Ageing

ABSTRACT

Objective: With increasing life expectancy, there is a focus on “healthy ageing”. Most activities in this area focus on the elderly. However, the ageing process starts much earlier. Childhood offers an important window to lay a base for future healthy ageing. Thus, to address the full ageing process, we should include younger populations in ageing research.

If we aim for healthy ageing across the life course, we need to clarify the meaning of health at different ages. The aim of this paper was to develop a conceptual framework for child health, which can be used as a starting point for healthy ageing research from a life course perspective.

Results: We conceptualize child health as: “a dynamic state, not merely the absence of disease or disability, but also adequate resilience that permits optimal physical, mental, and social functioning, and optimal quality of life in order to achieve full potential and to become an independent, functional, and social individual.” We propose five core dimensions of child health: Absence of physical disease; absence of psychiatric disorders; optimal physical, mental, and social functioning, including adequate development; good quality of life or well-being; and adequate resilience.

Conclusion: This conceptualization of child health and its dimensions can be seen as a first step towards building a framework for future studies into healthy ageing across the life course.

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Better three hours too soon than a minute too late.

Source: William Shakespeare.

1. Introduction

1.1. 21st century's challenge

Around the world, life expectancy is increasing, but whether the number of life years spent in good health is also increasing, is debated [1–3]. For example, in the UK, life expectancy at birth for men increased by 4.8 years between 1981 and 2001, whereas healthy life expectancy increased by only 2.6 years in the same period [4].

Even though great success has been achieved in increasing life expectancy, the upcoming challenge lies in improving life beyond extending it. Under the header “healthy ageing” multiple scientific

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and community programmes have been developed to improve the ageing process. Ageing has been described as a condition characterized by deterioration, exclusive to the elderly population and as a progressive loss of function accompanied by increasing morbidity and decreasing fertility with advancing age [5]. Hence, most of the activities in ageing research are focused on the later stages of the ageing process and, as such, on the elderly population. Although it is never too late to start changing an individual's lifestyle and environment to improve the ageing process, it could also be postulated that it is never too early.

1.2. *It is never too late. . . but also, it is never too early!*

Multiple interventions to enhance healthy ageing have been suggested. Caloric restriction, for example, has been reported to increase life span in animal models and has received great attention in recent literature, but a recent study in monkeys did not show improved survival and whether this is an intervention that can be translated to humans is still being debated [6–8]. Physical activity constitutes another example of an intervention to maintain health. For example, among people over the age of 50, engaging in high levels of physical activity can increase life expectancy by three years – time mostly spent free from cardiovascular disease [9].

Scientific efforts like these support the idea that it is never too late to implement changes to improve the health and life expectancy of individuals and populations. However, if the circumstances that affect the ageing process do not start in the last decades of life but rather early in life, strategies aimed at maintaining or recovering health should begin earlier in life. Adverse events early in life have been shown to be associated with morbidity in later life, including diabetes and cardiovascular disease (Developmental Origins of Health and Disease, DOHaD) [10]. In addition, lifestyle factors are known to influence markers of DNA damage [11]. It is known that these health-related behaviours, such as physical activity and diet, tend to track from childhood into adulthood [12]. Many of those behaviours may be founded early in life and this time provides a window of opportunity for the implementation of interventions aimed at maintaining or returning to health and thus at positively delineating future health and ageing trajectories.

Thus, to address the full ageing process adequately, we should take a life course perspective and include younger populations rather than mainly focusing on the elderly. In addition, to achieve healthy ageing in the population, we first need to further clarify the meaning of health and healthy ageing at different life stages. This paper aims to provide a conceptual framework for child health, which can be used as a starting point for healthy ageing research from a life course perspective.

1.3. *Why focus on health rather than on disease?*

Although health could be considered the ultimate goal of health-care, it is often unclear how health is explicitly defined. Many authors have attempted to define health from different viewpoints, including medical, philosophical, and spiritual perspectives. In contrast, “health research” has mostly focused on specific diseases, rather than on an overall concept of health. The associations between risk factors and health (outcomes) are often multifaceted.

On the one hand, a single risk factor may be associated with more than one health outcome, whereas on the other hand, different risk factors may have the same effect on overall health or a specific health outcome. This also applies to interventions aiming at improving the ageing process and health. Physical activity for example has been associated with improvements in multiple outcomes, including mortality, cardiovascular disease, and quality of life [13,14]. Although studies and medical efforts dealing with

specific diseases deserve great attention to prevent, treat or cure those diseases, the focus on associations between specific risk factors and specific diseases may limit the insight into the overall impact of risk factors on health. Instead, a more general focus on health as a multidimensional outcome might provide a more practical approach to prevention and intervention strategies.

1.4. *What is health?*

The most widely used definition of health is that by the World Health Organization, which defines health as “A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” [15]. Although this definition is often cited, it has been suggested that an optimal definition could have a stronger focus on the dynamic aspects of health and could be easier to use in practice [16,17].

Several authors proposed other definitions of health. In 1941 Sigerist proposed: “A healthy individual is a man who is well balanced bodily and mentally, and well-adjusted to his physical and social environment. He is in full control of his physical and mental faculties, can adapt to environmental changes, so long as they do not exceed normal limits; and contributes to the welfare of society according to his ability. Health is, therefore, not simply the absence of disease: it is something positive, a joyful attitude toward life, and a cheerful acceptance of the responsibilities that life puts upon the individual” [18]. In 2005 Bircher stated that health is “A dynamic state of well-being characterized by a physical, mental and social potential, which satisfies the demands of life commensurate with age, culture, and personal responsibility. If the potential is insufficient to satisfy these demands the state is disease” [19].

An important aspect of these two definitions is the dynamic balance between an individual's potential and the demands that the individual faces. This balance may vary across the life course and between individuals. Thus, if two people with different potentials experience the same demands, one may be considered healthy whereas the other may be considered diseased.

From these definitions, it could be inferred that health is a dynamic state that would differ for different individuals under diverse circumstances. The question arises, however, if the definition of health can be applied across life stages.

Childhood is a unique period in life. Children are in a constant process of change and development. The speed of this process may vary at different stages of childhood and the effects of external influences, including specific interventions, on child health may vary according to the developmental stage. In addition, childhood is a critical period providing a window of opportunity to set the stage for later health. In childhood, a strong base can be laid for future health, for example by proper nutrition or a supporting environment for optimal development. As such, child health, and deviations from it, may have a major influence on health trajectories throughout life [20,21]. Thus, we feel that, given the specific nature of health in children, a separate conceptual framework of child health is required.

1.5. *Child health in the literature*

Although its relevance seems substantial, there is no single definition of child health, which comprehensively covers all its aspects and potential dimensions, as well as being practically applicable [22].

Although the majority of children could be considered healthy at a specific point of time, most scientific efforts focus on understanding diseases among children rather than on obtaining and maintaining health. A search in Pubmed (July 2012) for the term “child health” in titles and abstracts produced only 12 008 hits, of which only 13% dealt – although not always directly – with child

health as an overall concept (as opposed to, for example, child dental or gastrointestinal health).

In 2004, the Committee on Evaluation of Children's Health of the United States National Research Council and Institute of Medicine published the report, "Children's health, the nation's wealth". This report is a comprehensive analysis of many aspects of child health in the United States and contains descriptions and discussions of influences on child health, and measurement of child health in the United States. In addition, the committee presents a new conceptual framework of child health. In this report, children's health is defined as "The extent to which individual children or groups of children are able or enabled to (a) develop and realize their potential, (b) satisfy their needs, and (c) develop the capacities that allow them to interact successfully with their biological, physical, and social environments" [23]. The report specifies three domains of health: health conditions, functioning, and health potential [23].

In this report, a longitudinal model of child health and the influences on child health over time is presented which takes into account the child's former health and the effects on the child's subsequent (adult) health [23]. The model emphasises the fact that not just the cross-sectional measure of child health is of importance, but also the relative position of that measure on the health trajectory that the child is on from birth until early adulthood [23,24].

Building further upon this report, in this paper we revisit the definition of child health with the goal of providing an overall conceptual framework and a limited number of specific dimensions that can be used in healthy ageing research from a life course perspective.

2. Proposed conceptual framework of child health

The way in which child health is conceptualized is strongly influenced by the perspective and the question that needs to be answered. Medical professionals treating individual children, parents, researchers, and policy makers may all have different views on child health and may therefore all need a different conceptual framework or at least a different way to operationalize it for their specific purpose [20]. One solution to this might be to strive for a single overall conceptual framework by identifying the core issues and dimensions that should be considered in all circumstances and to allow for flexible operationalization of these core issues depending on the circumstances [20].

To further continue the efforts to achieve this, we propose a new conceptual framework of child health that can be utilized, tested and improved in future efforts and that is based on the authors' expertise and discussion amongst them during a workshop held in the spring of 2012 with the specific purpose of developing this conceptual framework. We propose that child health can be seen as: "A dynamic state, not merely the absence of disease or disability, but also adequate resilience that permits optimal physical, mental, and social functioning, and optimal quality of life, in order to achieve full potential and to become an independent, functional, and social individual".

This framework incorporates the dynamic nature of child health and development, it strives for the "optimum" for each individual irrespective of general gold standards, which may differ between children and over time, and it takes into account the window of opportunity for future health that childhood presents. In addition, it incorporates resilience to deal with health challenges, which may be larger in children than in adults.

2.1. Dimensions of child health

For practical application, we propose five core dimensions, which can be adjusted according to the situation:

- (1) Absence of physical disease.
- (2) Absence of psychiatric disorders.
- (3) Optimal physical, mental, and social functioning, including adequate development.
- (4) Good quality of life or well-being.
- (5) Adequate resilience.

2.2. Measurement of the dimensions of child health

Many measures of (aspects of) child health have been proposed and used in the literature and in clinical practice, including the Child Health Questionnaire and the Achenbach System of Empirically Based Assessment (ASEBA) [20,25,26]. In general, these measures show great variability in the aspects of child health covered [20].

The proposed dimensions of child health can be measured in different ways. A detailed discussion of these different measurement methods is beyond the scope of this paper. Therefore, we here only touch upon these methods briefly.

For the first and second dimensions, absence of specific physical diseases and psychiatric disorders, the most important question is which diseases (or traits) and disorders render a child "unhealthy". At different ages and for different purposes, specific diseases and disorders can be included. These may be acute, but for most purposes, the focus will be on chronic conditions that generate a continuous challenge to a child's health and that involve regular medical attention. Thus, a child with a chronic illness, such as asthma, requiring periodic medical attention or medication might be classified as unhealthy, whereas a child born with polydactyly who functions normally without medical attention after recovery from surgery might be classified as healthy. Conditions that could be considered chronic illnesses include: asthma, congenital heart disease, autism, diabetes, and epilepsy, among many others.

For the third and fourth dimensions, optimal functioning and development and good quality of life, a large number of different measurement options exist, including neurodevelopmental testing batteries and extensive questionnaires, such as the Child Health Questionnaire (with child and proxy versions), the Griffiths and the Bayley developmental scales and many others [20,25,27]. A full overview of measurement options is beyond the scope of this paper, but the choice of measurement type may depend on the question to be answered, as may the cut-off point for defining "health". Furthermore, a useful instrument for classification of functional status is the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY), which provides a framework for the characterization of components of health [28].

The fifth dimension we propose, resilience, refers to the ability of the individual to deal with life's stressors. These stressors may be physical, such as infections or metabolic challenges, as well as psychological. How to measure resilience against all types of stressors is not fully clear and can be debated. Specific aspects of physical resilience may be measured by stress testing, such as response to physical exercise or to a glucose challenge, but to the best of our knowledge, there is no overall measure for physical resilience. Mental resilience may be measured using various coping scales [29]. As with the other dimensions, the best measure will vary depending on the situation in which the definition is used. More so than the other dimensions, resilience deals with a child's capacity to respond to its environment in a proper way, thus minimizing the risk of future disease or long-term negative consequences. As childhood is a key period for future health, this dimension is especially important in children.

2.3. Combining the dimensions of child health

A further question is how to combine the different dimensions. If we assume we can reliably measure all dimensions, they could then

either be combined into one single measure or be kept as separate dimensions to form a profile.

Researchers, clinicians, and policy makers may have to allow this to vary under different circumstances. Given the complexity of the concept of child health, it may be preferable to have a measure, which includes different dimensions that together create a profile, which can be compared between populations. In specific situations, however, a single overall rating may be preferable [21,30].

If the dimensions are combined, it should be considered whether it is necessary and feasible to assign weights to the dimensions to value their contribution to overall health. Having a congenital anomaly, for example, may be weighted differently than not having optimal social development. Even within a single dimension, aspects (such as specific diseases) may be weighted differently depending on their severity and on the specific circumstances in which the definition is used.

The five dimensions are unlikely to be completely independent from each other. As examples, optimal functioning and development may be strongly influenced by the presence of physical or psychiatric disorders; and a restricted social development in childhood may influence mental health in later life [20].

How the interactions between the dimensions are measured and weighted will depend upon the specific circumstances and questions to be answered.

Another aspect of the measurement of child health is the unit in which it or its dimensions should be measured. It might be considered as a dichotomous measure (healthy or unhealthy) or a scale. Given the complexity of the concept of child health, a scale seems to be a more appropriate unit. This would also allow for an easier use of weights and different weightings, for different cut-off points and an easier comparison over time. However, further evaluation of this aspect is required.

3. A journey of a thousand miles starts with a single step (Lao-tzu)

To improve ageing beyond increasing life expectancy, we need to consider the trajectories of health throughout the full life course. The realization that it is never too early to implement interventions to improve health brings with it the need for a conceptual framework of child health that is broadly applicable. The overall concept of child health we propose in this paper gives a framework for future studies in this area. The five core dimensions describe essential aspects, yet allow for enough flexibility to apply the concept in different circumstances. This conceptual framework and its dimensions are yet to be tested in practice, but could be used and improved in future efforts and could serve as a platform for further studies, adding a broader focus to the field of healthy ageing research.

Contributors

Janine F. Felix and Oscar H. Franco declare that they have participated in the conceptualisation and design of the project, the construction of the conceptual framework, drafting and revision of the initial manuscript and that they have seen and approved the final version.

Trudy Voortman declares that she has participated in the construction of the conceptual framework, has conducted the literature search, reviewed and revised the manuscript and that she has seen and approved the final version.

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Competing interests

No further statements other than the funding source.

Funding

JFF, TV, EHvdH, AS, ETML, AT, JCK-dJ, and OHF currently work or were working at the time of preparing the manuscript in ErasmusAGE, a centre for ageing research across the life course funded by Nestlé Nutrition (Nestec Ltd.), Metagenics Inc. and AXA. Nestlé Nutrition (Nestec Ltd.), Metagenics Inc. and AXA had no role in design and conduct of the study and preparation, review or approval of the manuscript. The other authors report no specific funding support. All authors are independent from the funding sources.

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