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DEVELOPMENT DISSERTATION BRIEF

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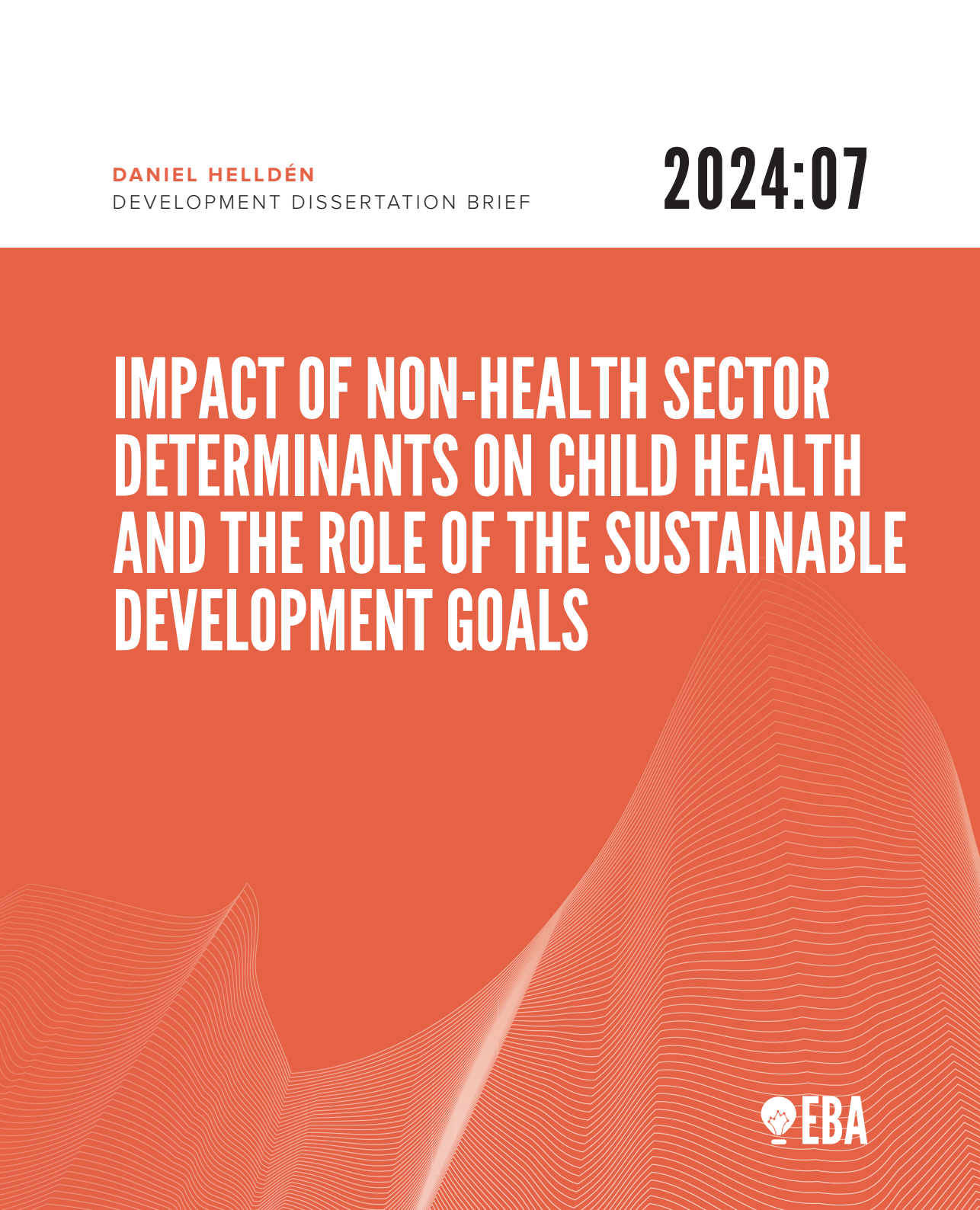
IMPACT OF NON-HEALTH SECTOR DETERMINANTS ON CHILD HEALTH AND THE ROLE OF THE SUSTAINABLE DEVELOPMENT GOALS



Impact of Non-Health Sector Determinants on Child Health and the Role of the Sustainable Development Goals

Daniel Helldén

Development Dissertation Brief, 2024:07

to

The Expert Group for Aid Studies (EBA)

Daniel Helldén defended his thesis “Impact of non-health sector determinants on child health and the role of the Sustainable Development Goals” in 2024 at the Department of Global Public Health, Karolinska Institutet, Stockholm Sweden. Combining research with clinical work as a resident in pediatrics at Astrid Lindgren´s Children´s Hospital, his main research interests include non-health determinants of child health and the impact of climate change on child health.

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Sammanfattning

Betydande framsteg har gjorts inom barnhälsa globalt och i Kambodja under de senaste decennierna, och 2015 antogs de globala målen för hållbar utveckling (SDG:s) med ett holistiskt synsätt på hållbar utveckling. Förståelsen av hur icke-hälsorelaterade faktorer påverkar barns hälsa är dock fortfarande begränsad, särskilt när det gäller hur dessa bidrar till barnadödlighet och förekomst av infektionssjukdomar. För ett bättre multisektoriellt samarbete behövs en ökad förståelse för hur faktorer utanför hälsosektorn påverkar barns hälsa. I den här rapporten sammanfattar jag min avhandling om hur faktorer utanför hälsosektorn påverkar barns hälsa och bidrar till ojämlikhet och hälsoklyftor i Kambodja. Jag har utforskat det komplexa sambandet mellan barnhälsa och SDG:s i Kambodja och andra låg- och medelinkomstländer med kvalitativa och kvantitativa metoder. Resultaten indikerar att det finns starka synergier och interaktioner mellan barns hälsa och hållbarhetsmålen i Kambodja. Vi kunde se en särskilt tydlig koppling till SDG 16: Fredliga och inkluderande samhällen – som visar att det finns en betydande potential för att förbättra barns hälsa genom framsteg när det gäller mål 16. Ett undantag var SDG 15: Ekosystem och biologisk mångfald där interaktionerna var svagare.

Trots de tydliga interaktionerna kvarstår utmaningar när det gäller att effektivt tillämpa multisektoriella samarbetsteorier. Analyser av data från de senaste demografiska hälsoundersökningarna avslöjar nyckelfaktorer för dödlighet under fem år och sjuklighet i infektionssjukdomar. Dessa nyckelfaktorer inkluderar kvinnors användning av preventivmedel, tillgång till rent vatten och hygien samt hushållets välstånd. Dessa faktorer är fortfarande kritiska i både Kambodja och andra låg- och medelinkomstländer.

Avhandlingen betonar vikten av att utnyttja synergier och hantera konflikter mellan utvecklingsmålen för att förbättra barns hälsa, samtidigt som ett holistiskt synsätt på insatser för utsatta barn globalt bör prioriteras.

Abstract

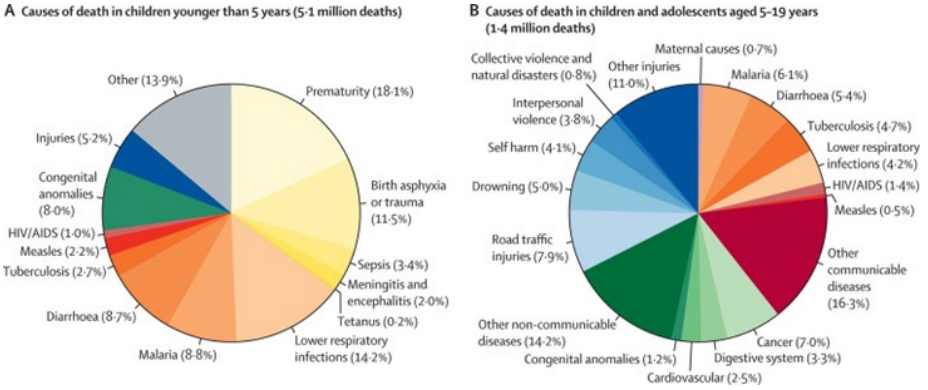
Significant progress has been made in child health in Cambodia and globally during the past decades, and in 2015 the Sustainable Development Goals (SDGs) were adopted as a holistic approach to sustainable development. However, the understanding of the non-health determinants affecting child health remains limited in many low- and middle-income countries (LMICs), especially concerning the underlying causes of child mortality and the incidence of infectious diseases, and the need for multisectoral collaboration. This development dissertation brief (DDB) is a summary of my doctoral thesis that addresses these knowledge gaps by exploring the relationship between child health and the SDGs in Cambodia and in other (LMICs) through qualitative and quantitative methods. The findings of the thesis indicate that, except for SDG 15 (Life on land), there are synergies between child health and the level of progress towards the SDGs in Cambodia, particularly with SDG 16: Peace, justice, and strong institutions – showing significant relevance for improving child health.

However, challenges persist in applying multisectoral collaboration theories effectively to address social factors. Analyses of recent Demographic Health Survey (DHS) data reveals key determinants of under-five mortality and morbidity from infectious diseases, including maternal contraceptive use, household water sources, and wealth. These factors remain critical in both Cambodia and other LMICs. The thesis emphasizes leveraging synergies among the SDGs while addressing inherent trade-offs to enhance child health outcomes, while advocating for a holistic approach to interventions for vulnerable children globally.

Introduction

Child health can be defined as a state of physical, mental, intellectual, social and emotional well-being, and not merely the absence of disease or infirmity of people aged under 18 years in line with the United Nations (UN) Convention on the Rights of the Child and the constitution of the World Health Organization (WHO). Traditionally, the focus of child health has been to reduce child mortality, particularly for children under the age of five. The number of children dying before their fifth birthday has more than halved, from approximately 12.6 million in 1990 to 4.9 million in 2022, while the number of neonatal deaths has fallen from 5.2 million to 2.3 million during the same period (United Nations Inter-agency Group for Child Mortality Estimation, 2023). Despite the advancements made, there are significant disparities in child mortality between and within countries. The causes of death are still predominantly related to communicable diseases for under-five children, while it is a more diverse picture when it comes to older children and adolescents (Figure 1) (Villavicencio et al., 2024).

Figure 1: Global causes of death in children under-five (A) and in older children and adolescents (B) in 2021



Source: From Villavicencio et al. (2024). Reproduced with permission from the journal.

Various efforts have been made to try and decipher the most important factors contributing to the reduction of under-five mortality in low- and middle-income countries (LMICs). The most prominent has been the success factor studies led by the Partnership for Maternal, Newborn & Child Health at WHO, which aimed to investigate the determinants of under-five mortality among LMICs using quantitative and qualitative research methods. They showed that improvements in health sector determinants of child health (for instance access to healthcare, immunization rates and number of skilled birth attendants) contributed to around half of the reduction in child deaths between 1990 and 2010 (Bishai et al., 2016; Kuruvilla et al., 2014). They conclude that improvements in non-health sector determinants (for example education level, access to clean water, higher income and good governance) can be attributed to the remaining 50 percent of the reduction. Building on this work, multivariable regression analysis on data from LMICs between 1980–2010 estimated that

approximately 44–66 percent of the reduction in under-five mortality could be attributed to improvements in non-health sector child health determinants (Cohen et al., 2017).

Global child morbidity has received less attention than child mortality, which might be due to the more complex causes and differences in the morbidity burden across the developmental stages and adolescence (Alfvén, Dahlstrand, Humphreys, Helldén, Hammarstrand, Hollander, Lager, et al., 2019). The overall global child morbidity burden has decreased between 1990 and 2017, however not at the same pace as mortality rates (Kassebaum et al., 2017). The leading causes of years lost to disability among young children are congenital anomalies, malnutrition and diarrheal diseases while older children and adolescents suffer mainly from anemia due to iron deficiency, asthma and psychiatric disorders with considerable differences between geographic regions (Guthold et al., 2021). The survival, health and well-being of children are essential to end extreme poverty and promote the development of societies (Every Woman Every Child, 2015). Simultaneously, social, economic, political, environmental, and cultural determinants have central impacts on child mortality and morbidity. Developments and improvements outside the health sector are set to promote child health while specific child health interventions are essential to broader development.

Global child health and the SDGs

With the Millennium Development Goals (MDGs) ending in 2015, the UN General Assembly agreed on the Sustainable Development Goals (SDGs) as a framework for sustainable development: the 2030 Agenda (UN General Assembly, 2015). There are 17 SDGs, 169 targets and 231 unique indicators aligned across three dimensions of sustainable development: environment, economic and social. SDG target 3.2 is concerned with child mortality;

"By 2030, end preventable deaths of newborns and children under five years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-five mortality to at least as low as 25 per 1,000 live births". Most middle- and high-income countries have already or are on track to achieve this target by 2030. However, 65 countries, mostly found in Sub-Saharan Africa and Asia will likely not achieve the target by 2030 (Paulson et al., 2021). Several other targets are related to child health, with United Nations Children's Fund (UNICEF) identifying at least 35 indicators in the SDG monitoring framework pertaining to children. There is a lack of data for tracking these indicators, and in general many LMICs will need to accelerate the work towards achieving the other child health related targets as well (UNICEF, 2018b).

The SDGs, their targets and indicators, are directly and indirectly connected. Although these interactions are made explicit in the preamble of the 2030 Agenda, this recognition is not reflected in the formulation of the SDG targets and indicators (ICSU & ISSC, 2015). This lack of clarity has led researchers to develop different approaches to analyzing these interactions, from more quantitative modeling methods (Allen et al., 2016; Fleskens et al., 2014) to document reviews (Le Blanc, 2015; Vladimirova & Le Blanc, 2016).

As a response to this challenge, researchers at Stockholm Environment Institute developed the SDG Synergies approach which assess the interactions between SDG goals or targets, explicitly incorporating the context-specificity of the interactions (International Council for Science, 2016; Weitz et al., 2018). From the assessment, a score on a scale from -3 to +3 is made and the scores of the interactions are the basis for more advanced analysis of interactions through network analysis. In this way, both the individual scoring (first order interaction) and the "ripple" (second order interaction) they make through the network can be calculated and illustrated (Barquet et al., 2019; Newman, 2010; Weitz et al., 2018). A simplified SDG Synergies approach has been used to assess interactions between child health and 34 targets among the non-health

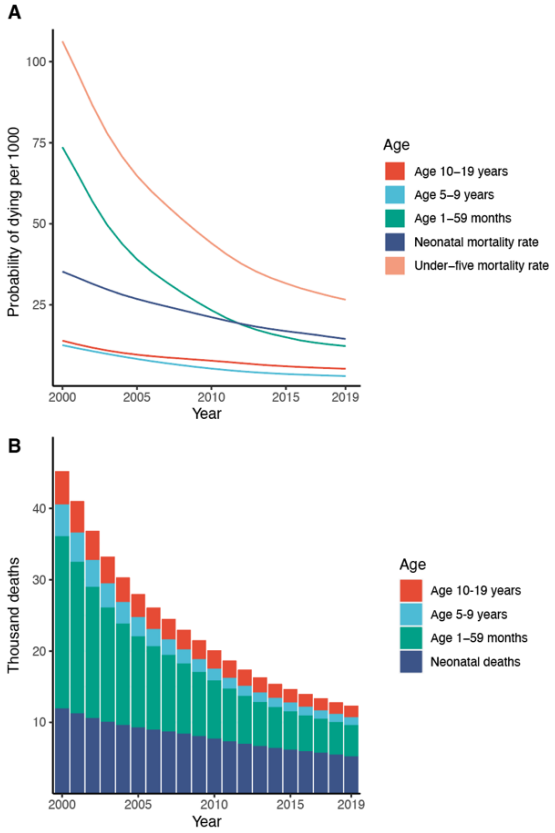
SDGs based on literature and expert consultation (Blomstedt et al., 2018). The generic analysis suggested that a range of SDGs potentially have synergetic interactions with child health and showed how the SDG Synergies approach could be of use to untangle the interactions between child health and the SDGs. Yet, a generic approach to describing interactions will not generate scientific evidence that policy makers can make use of, since the strength, position and nature of the interactions are highly context specific (Blomstedt et al., 2018; International Council for Science, 2017; Nilsson et al., 2016). Capturing the complexity of child health in the 21st century, the SDGs frame the most pressing issues for child health while the global community has increasingly acknowledged that the development and improvements in child health have been at the expense of the environment and the health of future generations of children (Coll-Seck et al., 2018).

Child health in Cambodia

Cambodia achieved MDG 4 (Reduce child mortality) by reducing the under-five mortality rate by two-thirds from 1990 to 2015 (Ahmed et al., 2016). The trends of child mortality in Cambodia are presented in Figure 2. A range of studies have indicated the importance of multisectoral collaborations and various cross-sectoral policies to lower poverty and improve maternal and child health over the last two decades (Kaba et al., 2018; Royal Government of Cambodia, 2018; UNICEF, 2017). The improvement in child mortality has continued beyond 2015, with the under-five mortality rate estimated to be 24 per 1,000 live births in 2022. The pattern of child mortality mirrors the global phenomenon of neonatal deaths accounting for a higher proportion of the number of deaths when the overall under-five mortality rate declines (United Nations Inter-Agency Group for Child Mortality Estimation, 2023). Disparities exist between geographical regions and income groups with under-

five mortality rates being higher in rural and north-eastern geographical areas and among lower income groups (Cambodia NIS et al., 2015).

Figure 2: Child mortality trends over time in Cambodia. (A) Probability of dying per 1,000 individuals at the start of the age. (B) Number of deaths per age group



Source: Data from United Nations Inter-Agency Group for Child Mortality Estimation (UN Inter-agency Group for Child Mortality Estimation, 2020).

As for child morbidity, neonatal disorders and infectious diseases continue to cause the most disability adjusted life years (DALYs) for children under five. For children aged 5–14 years, the causes of morbidity are more varied, primarily caused by non-communicable diseases and injuries (Kyu et al., 2018). The mortality rate among under-five children from lower respiratory infections has declined by more than 80 percent since 1990, mainly due to increased vaccination coverage, lower household air pollution and an improved nutritional status of children (Troeger et al., 2020). However, lower respiratory infections are still a leading cause of death and DALYs with diarrhea is the second (Kyu et al., 2018). Malnutrition as a multisectoral issue and cause of significant child mortality and morbidity is widely recognized (Cambodia NIS et al., 2015; Ikeda et al., 2013; Laillou et al., 2020). Moreover, several dimensions of poverty remain prevalent, such as lack of quality housing and education, with nearly 50 percent of children experiencing three or more of such deprivations in 2018 (UNICEF, 2018a).

The focus on multisectoral collaboration and cross-sectoral policies between the traditional health sector and other relevant sectors such as education and water and sanitation have been a hallmark of the success in reducing child mortality in Cambodia (Kaba et al., 2018; UNICEF, 2017). However, how stakeholders view multisectoral collaborations for child health in Cambodia has not been studied and it is evident that much remains to be done. Moreover, a systematic assessment of the determinants of child mortality and morbidity from infectious diseases is lacking in Cambodia and globally. The 2030 Agenda and the adoption of the SDGs into the localized Cambodian SDGs (CSDGs) offer an opportunity to rejuvenate the focus on a multisectoral approach to child mortality and morbidity and its vital determinants of health in Cambodia.

Research aims

The overall aim of my dissertation was to explore the non-health determinants of child health in Cambodia and to provide an updated investigation of the determinants of child mortality as well as morbidity from infectious diseases in Cambodia and in LMICs. I had four specific aims and studies, from which I will present key findings in this brief:

1. To investigate the interactions between child health and the SDGs in Cambodia (Study I).
2. To understand how stakeholders perceive the SDGs and child health in the era of the SDGs and multisectoral collaborations for child health in Cambodia (Study II).
3. To explore factors that are associated with under-five mortality and child morbidity from infectious diseases in Cambodia (Study III).
4. To investigate determinants of under-five mortality and morbidity from infectious diseases in LMICs in the SDG era (Study IV).

Results & Discussion

My major overall findings were:

- The interactions between child health and the SDGs in Cambodia are mutually promoting with the exception of SDG 15 (Life on land).
- Adoption of the SDGs led to an increased sense of ambition and possibility for multisectoral collaboration while there was a discrepancy between the envisioned best way of conducting such collaborations with how they actually were conducted.

- Maternal and household characteristics such as mothers use of contraceptives, improved household water sources and household wealth quintile were important determinants of under-five mortality and morbidity from infectious disease in Cambodia.
- Fundamental child, maternal and household characteristics are still key determinants for under-five mortality and infectious disease morbidity in LMICs in the SDG era.

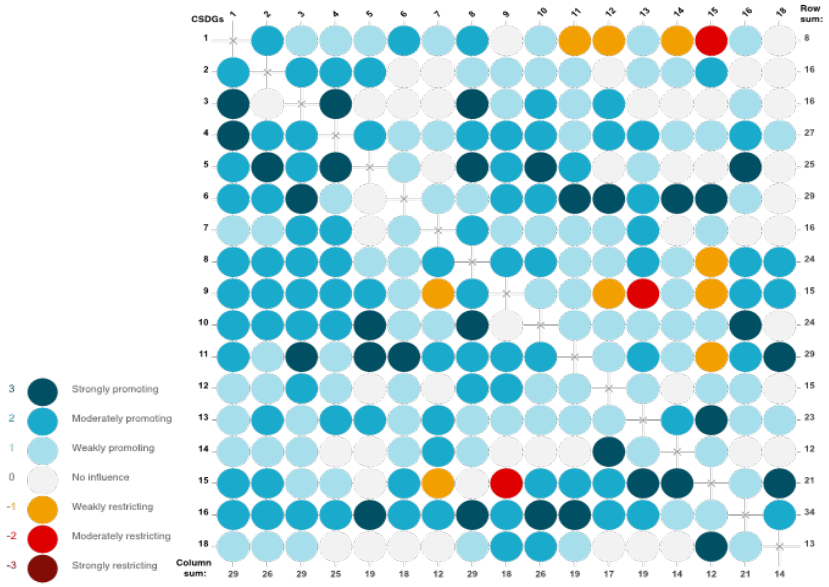
The key results are presented and discussed below while full methodological details and results can be found in the individual studies and in the thesis (see Appendix).

Child health and the SDGs in Cambodia: Focusing on synergies and handling trade-offs

The first study was based on the semi-qualitative SDG Synergies approach. An interdisciplinary Cambodian stakeholder group consisting of 29 participants scored 272 unique pairwise interactions between 17 CSDGs and child health from +3 (strongly promoting) to -3 (strongly restricting). From this, a cross-impact matrix was derived, and network analysis was applied to determine the first- and second-order effects (the "ripple") of the interactions, with a focus on child health.

There were a high number of perceived positive interactions (n=212, 78 percent) versus negative (n=12,4 percent) and a significant number were deemed not to have any direct positive or negative influence (n=48, 18%) (Figure 3, showcasing the whole network). When focusing on how the CSDGs interact with child health specifically (Figure 4), improved child health seemed to promote progress for all CSDGs except for CSDG 15 (Life on land) when considering the second-order interactions, while all CSDGs positively promoted child health.

Figure 3: Cross-impact matrix of the 17 Cambodian Sustainable Development Goals where number 3 represents child health. Color according to scale. The row sum implies the goal's net influence on the network, and the column sum shows how much the goal is influenced by all other goals in the network



Source: From Helldén et al. (2022). Reproduced with permission from the journal.

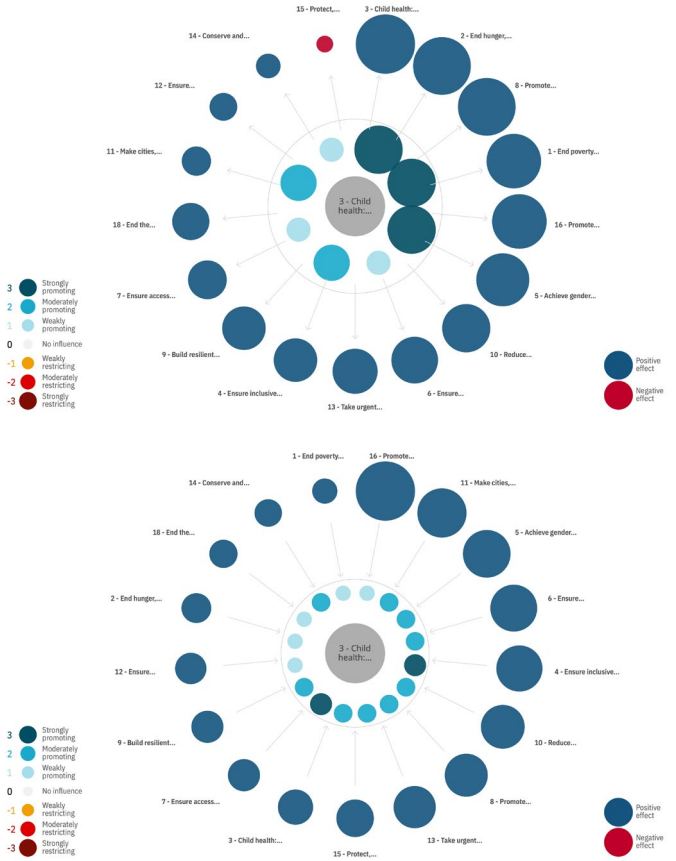
The close relationships between various determinants and child health, as represented by the CSDGs, have been emphasized before. However, we build on this and importantly illustrate a positive feedback-loop whereby making progress on child health leads to progress on other CSDGs that in turn promotes child health. This reinforcing relationship is essential to accelerate positive developments in child health, and it further emphasizes how improvements in child health are dependent on the state of other sectors or determinants.

When deciphering the interactions between the CSDGs and child health, it becomes clear that CSDG 16 (Peace, justice and strong institutions) has the most promoting potential, both when it comes to first and second-order interactions. The impacts of a well-functioning legislative and governance structure on child health are known as it is foundational for making progress on other CSDGs that also positively impact child health in Cambodia. Perhaps the most illustrative example of how targeted institutional programs can influence child health is the poverty identification system ID-Poor, which is a community-based program that identifies vulnerable households and provides social and health services (Kaba et al., 2018). The prominence of the participants in the studies to focus on CSDG 16 (Peace, justice and strong institutions) and government ministrie' institutional power highlights interesting parallel storylines in the narrative around sustainable development in Cambodia.

Continuing, the positive improvements in many different sectors during political stability since the 2000s, including drastically lowering the poverty rate and having reduced under-five mortality substantially over a relatively short time period, is undeniably an impressive achievement. Yet, there are growing concerns regarding the increasing centralization of government power, limited freedom of speech and transparency under the banner of stability and development, which have important implications for healthcare services and other determinants of child health (Frewer, 2013; Norén-Nilsson & Bourdier, 2019; Un, 2019). Over the last years there has been a shrinking space for civil society and there are often conflicting views between civil society and government ministries on a range of issues (Schröder & Young, 2019). The importance of CSDG 16 (Peace, justice and strong institutions) for child health in Cambodia could perhaps both be seen as a testament to the necessity of institutional stability for improving child health and an opportunity lost if not fully achieved as envisioned in the SDGs.

When considering the second-order interactions, CSDG 15 (Life on land) seemed to be negatively influenced by improvements in child health (Figure 4).

Figure 4: The Cambodia Sustainable Development Goals from the perspective of child health. Figure 4a illustrate the second-order influence of child health on the CSDGs and Figure 4b vice versa. Color according to scale



Source: From Helldén et al. (2022). Reproduced with permission from the journal.

If progress is made on the child health, it will have a direct positive impact on eight other SDGs (the inner circle, first order interactions; Figure 4a). If you take into account how the goals in the inner circle together affect all other goals (i.e. take into account second order interactions), you get a picture of how progress in child health can have a positive effect on, for example, SDG 2. You can also see that through these second order interactions you get a small negative impact on SDG 15. Figure 4b shows the reverse relationship, taking into account how all the SDGs that have a positive effect on child health (first order interactions, inner circle) are in turn affected by other SDGs.

Although the negative influence appears to be minor, the finding put the spotlight on trade-offs that are not evident if one would only consider the first-order interactions. Examining the interactions leading to this negative influence, it becomes clear that child health was perceived to promote progress on CSDG 1 (No poverty), CSDG 8 (Decent work and economic growth), CSDG 9 (Industry, innovation and infrastructure) as well as CSDG 11 (Sustainable cities and communities). These, in turn, had a restricting impact on CSDG 15 (Life on land), leading to the indirect negative influence of promoting child health. The impressive growth in many economic sectors throughout Cambodia has been coupled with an expansion of different industries, while rural economic growth is often driven by land being transformed from forest into agricultural fields (Beauchamp et al., 2018; Royal Government of Cambodia, 2007). There are also widespread deforestation practices even in protected areas, severely impacting vulnerable ecosystems and biodiversity (Pauly et al., 2022). While the direct and indirect negative impacts of improving child health on CSDG 15 (Life on land) are likely minor, the tension between increased economic growth, human capital and environmental related goals is evident and with climate change it will become even more prominent.

Multisectoral collaboration and child health in Cambodia

The second study in the thesis took a qualitative approach. Semi-structured interviews were conducted with 29 key child health stakeholders from a range of government and non-governmental organizations in Cambodia. Guided by the research aim through framework analysis, themes, subthemes, and categories were derived. We found that multisectoral collaborations are complex processes, often taking substantial resources and efforts from the included stakeholders. There must be a significant advantage of engaging in the collaboration in order to make it worthwhile and it is likely that the adoption of the CSDGs assisted in framing and explicitly providing a framework for multisectoral collaboration (Huxham, 2003). The participants expressed a desired linear stepwise approach to conducting multisectoral collaborations for child health. As originally theoretically proposed, each step in the process is objectively evaluated until a decision is made and the next step can take place (Dewey, 1938). The desire of funders, be it government or international funders, often put a strong emphasis on clear project management and monitoring of deliverables which might further strengthen the desire of collaborators to have this kind of rational stepwise approach to the collaboration (Bennett et al., 2018). The process or project-oriented view on the multisectoral collaboration was favored by the participants, yet according to their description of the multisectoral collaborations they were not carried out in this way or had to adapt to unforeseen circumstances. A more dynamic model of multisectoral collaboration, whereby the collaboration is equally driven by relationships and power dynamics between the stakeholders as the desire to fulfill implementation plans or reach a set of objectives (Kuruvilla et al., 2018). As evident from the descriptions by the participants, this model seems to be more representative of the realities of conducting multisectoral collaborations for child health in Cambodia.

Importantly, participants detailed a set of success factors and obstacles in relation to the multisectoral collaboration. The primary success factor, or obstacle in its absence, was funding. Providing incentives for multisectoral collaborations and sustaining funding through different organizations can be a cumbersome process, and many funders might be hesitant to provide such funding due to the perceived lack of monitoring and accountability (Rasanathan et al., 2018). Crucially, having control of the funding was one of the major sources of power in the collaboration, together with being part of the government or having a close connection to a government ministry. Distorted power dynamics, territory feelings, and lack of leadership were often cited as obstacles to successful multisectoral collaborations. This has been extensively studied in other forms of collaborations, with mutual relationship building, shared ownership and accountability of the collaboration being key counterweights (Faul, 2015; Purdy, 2012). Cambodia has made multisectoral collaboration a cornerstone of its child health plans, providing sustainable financing schemes, an enabling environment for multisectoral collaboration that is built on networks, shared ownership and accountability holds promise to leveraging synergies and handling trade-offs found to accelerate child health improvements in the country.

Factors associated with child mortality and morbidity in Cambodia and globally

For the third study, the latest Cambodian Demographic Health Survey (CDHS) dataset from 2021 was analyzed by both traditional regression and machine learning models. From this, it was clear that under-five mortality was associated with two key maternal determinants: contraceptive use of the mother and the birth order of the child. There is an established relationship between contraceptive use and lower under-five mortality, and in the study of the 2014 CDHS similar results were found (Um & Sopheab, 2021).

In Cambodia, contraceptive use is closely linked to increased status of the mother in the household (Lai & Tey, 2020). Similarly, higher education of the mother greatly increases the probability of a woman using contraceptives (Nkoka et al., 2021). There are still cultural and practical barriers to accessing modern contraceptive options for women in Cambodia (Rizvi et al., 2021). Empowering women to make their own reproductive choices leads to fewer unwanted pregnancies and has been shown to reduce child mortality in many different settings.

Given the lack of data on health service seeking patterns in our model, contraceptive use might also be indicative of health literacy and health seeking behavior among mothers which could serve as a protective factor against under-five mortality (Nkoka et al., 2021). The importance of birth order, specifically being born fourth or later leading to an increased odds of under-five mortality has not been previously shown in Cambodia. The finding might reflect a growing child health inequality whereby poor households have more children that are at higher risk of under-five mortality, but this warrants further investigation. In other settings, there is an established relationship between having a high birth order and under-five mortality (Bhusal & Khanal, 2022; Budu et al., 2021).

For morbidity burden from infectious diseases, three household-related determinants were found: having an improved water source or being in the middle, richer, or richest wealth quintile seemed to protect children, while households in the Great Lake and Coastal regions had a higher risk of infectious disease. Having access to clean water is a fundamental determinant of infectious diseases in children, particularly food and water-borne diseases, and the relationship has been established in many similar settings (Merid et al., 2023). There was a marked reduced risk of infectious disease if the child lived in a household that was in the middle, rich or richest wealth quintile. There is ample

evidence of the growing inequality in child health in Cambodia, with infectious diseases primarily affecting children living in poor and vulnerable households (Antunes et al., 2018; Greffeuille et al., 2016; Hong et al., 2017; Jacobs et al., 2016).

The results also indicates that children living in the Great Lake (Banteay Meanchey, Battambang, Kampong Chhnang, Kampong Thom, Pursat and Siemreap) or Coastal regions (Kampot, Kep, Koh Kong and Preah Sihanouk) had an increased risk of infectious diseases, not previously detailed. Living in other regions outside of Phnom Penh also tended to be associated with increased risk, albeit not statistically significant. It might be that these regions (Great Lake and Coastal) are home to large water bodies that lead to a higher risk of exposure to infectious diseases and that they are more prone to climate change related flooding and cyclones that can further intensify transmission (World Bank Group, 2023).

Factors associated with child mortality and morbidity in low- and middle-income countries 2015–2021

Using similar methods as in the third study but using data from 44 LMICs between 2015–2021, Study IV provides a global perspective, showcasing a more complex pattern when it comes to the determinants of under-five mortality and morbidity from infectious diseases in LMICs. Overall, a larger number of determinants were found to be associated with child mortality, ranging from child-specific determinants (sex of the child, if it was a twin, birth order and interval), maternal-related (higher age, educational attainment and contraceptive use as well as a health facility delivery) to household characteristics (access to electricity, using electricity or gas as cooking fuel and being in the higher wealth quintiles). Drawing conclusions on determinants for child mortality from multiple countries with varying contexts are difficult, and perhaps not desirable, but it is notable that key risk factors and determinants identified are still very much relevant.

Similarly, determinants for infectious disease morbidity in this global dataset were diverse. In general, known risk factors for infectious disease such as household energy source being charcoal leading to higher household air pollution levels were found and consistent with literature. The relation between the state of the household and risk of infectious disease among children is complex, and often varies depending on the country or sub-country region of measurement (Muindi et al., 2023; Winskill et al., 2021).

Conclusions – the double nature of making progress on child health

While Cambodia made impressive advancements during the MDG era and seems to be continuing the reduction in under-five mortality, the findings from my dissertation illustrate the double nature of child health in the country. There is a need to focus on the unfinished goal of reducing preventable child mortality and protecting children living in poorer households in vulnerable geographies from infectious diseases. To improve child health in Cambodia, there is a need to capitalize on the synergies between the SDGs while carefully handling potential trade-offs. The adoption of the SDGs promoted an aspirational perspective on child health allowing multisectoral collaborations to be effective if implemented in a realistic and sustainable way. Nevertheless, fundamental child, maternal and household characteristics still determine vulnerabilities of children and contribute to worse child health outcomes in Cambodia and globally. A focus on the most vulnerable children and a holistic approach to designing interventions should be considered to accelerate improvements in child health in Cambodia and globally. Indeed, there is an urgent need to revitalize focus on the health and well-being of children and adolescents if continued progress is to be made. Placing children at the center of the SDGs will be paramount if significant achievements are to be made by 2030 (Figure 5).

Figure 5: Child in the center of the SDGs

Source: Alfvén, Dahlstrand, Humphreys, Helldén, Hammarstrand, Hollander and Målqvist (2019). Reproduced with permission from the journal.

Policy implications

Several policy implications can be derived from this thesis.

- Understanding the interactions between different goals or targets is vital to identify synergies to leverage and trade-offs to consider in order to accelerate child health improvements in Cambodia and other LMICs.
- Ensuring the realization of CSDG 16 (Peace, justice and strong institutions) likely has the most synergetic potential for child health in Cambodia, while environmental related CSDGs such as CSDG 15 (Life on land) could be negatively impacted by improvements in child health.

- The Cambodian government and civil society's adoption and continued support of the SDGs are important to ensure higher ambition for and multisectoral actions to improve child health.
- Multisectoral collaborations, if provided with sustainable funding and conducted in a grounded, realistic manner, have the potential to exploit synergies, manage trade-offs, and improve child health determinants.
- Improving the conditions of vulnerable households as well as empowering women will be key to accelerating further reductions in child mortality and the burden of infectious diseases in LMICs.
- At a global level, acting on the fundamental child, maternal and household determinants remains essential to reduce child mortality and infectious disease morbidity in the SDG era.
- Beyond the SDGs, the thesis showcases how the next sustainable development agenda must balance the need to focus on the most vulnerable children to reduce preventable child mortality and morbidity while ensuring that children can thrive and transform societies.

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Appendix

Study I: A stakeholder group assessment of interactions between child health and the Sustainable Development Goals in Cambodia. Daniel Helldén, Thy Chea, Serey Sok, Linn Järnberg, Helena Nordenstedt, Göran Tomson, Måns Nilsson, Tobias Alfvén. Nature Communications Medicine 2022 Jun 16;2:68
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Study II: Sustainable development goals and multisectoral collaborations for child health in Cambodia: a qualitative interview study with key child health stakeholders. Daniel Helldén, Serey Sok, Thy Chea, Helena Nordenstedt, Shyama Kuruvilla, Helle Mölsted Alvesson, Tobias Alfvén. BMJ Open 2023 Nov 21;13(11):e073853
https://bmjopen.bmj.com/content/13/11/e073853

Study III: Exploring the determinants of under-five mortality and morbidity from infectious diseases in Cambodia – a traditional and machine learning approach. Daniel Helldén, Serey Sok, Alma Nordenstam, Nicola Orsini, Helena Nordenstedt, Tobias Alfvén. Scientific Reports 2024 Aug 27;14(1):19847
https://www.nature.com/articles/s41598-024-70839-z

Study IV: Determinants of under-five mortality and morbidity from infectious disease in low- and middle-income countries Daniel Helldén*, Alma Nordenstam*, Serey Sok, Nicola Orsini, Helena Nordenstedt, Tobias Alfvén. In manuscript.

Of the 17 Sustainable Development Goals (SDGs) in the 2030 Agenda, one is specifically about health – Goal 3. But how does a country's development affect children's health in relation to the other 16 goals? And how does children's health affect the other 16 goals? This thesis uses the situation in Cambodia to examine how much child health depends on development and progress in sectors other than health.

Av de 17 hållbarhetsmålen i Agenda 2030 handlar ett mål specifikt om hälsa – mål 3. Där ingår barns hälsa. Men hur påverkas barns hälsa av ett lands utveckling när det gäller de övriga 16 målen? Och hur påverkar barns hälsa de övriga 16 målen? Den här avhandlingen utgår från situationen i Kambodja för att undersöka hur mycket barns hälsa beror på utveckling och framsteg inom andra sektorer än hälsa.

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