MAPPING DANISH GLOBAL HEALTH RESEARCH

CORE ISSUES, GEOGRAPHICAL SCOPE AND FUNDING OF RESEARCH IN LOW- AND MIDDLE INCOME COUNTRIES

AN INTERNSHIP COLLABORATION PROJECT BETWEEN LÆGER UDEN GRÆNSER/ MÉDECINS SANS FRONTIÈRES DENMARK AND THE SCHOOL OF GLOAL HEALTH, UNIVERSITY OF COPENHAGEN

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EXECUTIVE SUMMARY

MAPPING DANISH GLOBAL HEALTH RESEARCH - QUO VADIS GLOBAL SUNDHED?

The world of today faces new globalized health challenges that are unique to our time reinforced by trends like the epidemiological transition, urbanisation, climate change, trade and travel. To attain the Sustainable Development Goals (SDGs) and continue improving health worldwide, global health research (GHR) is much needed to ensure evidence-based and innovative interventions.

Global Health is a relatively young discipline emerging from international health and tropical medicine. As former head of the research division at the Danish Development Agency Danida Mr. Klaus Winkel describes the 1990ies were the "golden age of Danish development research" with the support from Danida increasing from 62 million DKK in 1988 to 287 million DKK in 1999.

Due to a larger political shift deprioritizing health and other specific sectors, while emphasizing more cross-sectoral issues e.g. good governance, support was gradually withdrawn. In the light of the major shifts in funding and support, Alexandra Kruse, Læger uden Grænser/ Médecins Sans Frontières (MSF) Denmark, Lena Schneider, Master of Global Health student, University of Copenhagen and Ib Bygbjerg, in his role as internship supervisor at the School of Global Health, University of Copenhagen, joined forces to map and reflect upon changes in Danish GHR over the last 10 years.

It is to emphasize that the attempt of this mapping was not to assess research productivity, but rather "take the pulse" of Danish GHR in low- and middle-income countries (LMIC).

Methodology: A three-fold approach

1. Publications search

A publication search to provide an overview of the fields and project countries of research of Danish GHR in LMICs.

2. Open-ended interviews

Interviews with 19 informants from the GHR scene,

to shed light on their working situation, strengths of Danish GHR, as well as prospects and challenges.

3. External public national funding overview

GHR external public national funding supplementing core funding ("internal" or in kind contribution) from the institution of main affiliation, most often universities or university hospitals or public research institutions.

The findings of this mapping showed the following:

Broad health challenges profile

The coverage of Danish GHR largely aligns with the traditional health challenges relating to poverty-related diseases such as malaria, HIV and tuberculosis (TB), neglected tropical diseases (NTDs) and maternal and child health. More recently, Danish GHR has already successfully established projects on non-communicable diseases (NCDs) and co-morbidities, hereby responding to changing research needs in times of epidemiological transition.

Limited geographical scope

Danish GHR involved a number of LMICs, but concentrates in three countries, namely Tanzania, Ghana and Guinea-Bissau. Danish GHR has contributed to capacity and knowledge building that may strengthen resilience to cope with future health emergencies in the region and changing patterns of diseases.

Achievements of capacity building under threat

Built up research infrastructure was often seen under threat by short funding periods, but most importantly the problem of lack of funding between grants. The "projectification" of all GHR leaves built up capacities like laboratories vulnerable to collapse between funding periods.

Danida remains most influential funder

Irrespective of its decline in support, Danida continues to dominate in external national public funding for Danish GHR. New initiatives like Danida's window 2 funding for emerging economies might have the potential to increase research activity in MICs. However, project grants do only include non-conflict areas like Vietnam, Mexico and Brazil.

In conclusion, Danish GHR has had a long-standing base in LMICs. GHR has become a central part of various research institutions. In the last ten years, various GH departments, sections and clusters have been established.

With a high concentration of research in a few project countries and difficulties to maintain research infrastructure between project funding, the Danish GHR is currently not encompassing those most in need and at risk of leaving particularly vulnerable people behind. Broadening the range of settings in which Danish GHR operates in the years to come will require a major effort, not least in an environment of risk averse funding dominated by strategic foreign policy.

From the perspective of a humanitarian actor like MSF, the settings in which Danish GHR most often takes place raise doubt about the potential to translate research findings into impact-bringing projects in fragile and conflict settings. It is uncertain whether funding for projects operating in these settings will be available in the future.

Contents

List of abbreviations

AMR	Antimicrobial resistance
Danida	Danish International Development Agency
DBL-IHRD	Danish Bilharziasis Laboratory for International Health research
DFC	Danida Fellowship Center
DFF	Dansk Frie Forskningsråd/ Danish Independent Research Council
EDCTP	European and Developing Countries Trails Partnership
DNDi	Drugs for neglected diseases initiative
ENRECA	Enhancement of research capacity network
GH	Global health
GHR	Global health research
HIV	Human immunodeficiency virus
LIC	Low-income country
LMICs	Low- and middle-income countries
MESH	Medical subject headings
MIC	Middle-income country
MSF	Médecins Sans Frontières
NCDs	Non-communicable diseases
NTDs	Neglected tropical diseases
SSI	Statens Serum Institute
SDGs	Sustainable Development Goals
SRH	Sexual and reproductive health
TB	Tuberculosis
UCPH	University of Copenhagen
WASH	Water, sanitation and hygiene

1. Introduction

In the past decades, Global health research (GHR) has shown that it can play a crucial role in leading policy change and improving health for all.[1] As a relatively young discipline that has just gained its own standing, research in low- and middle-income countries (LMICs) still only represents a fraction of health research worldwide.

Koplan's definition of global health (GH) defines it as "an area for study, research, and practice that places a priority on improving health and achieving health equity for all people worldwide."[2] To focus, we defined GHR as scientific studies on prevention, diagnostics, treatment, and care conducted in LMICs. This definition limited the scope of this report, but also allowed us to cover research that has proven to be translational to contexts where people are most in need.

With a strong impetus for what is named GHR, Denmark (DK) has been a strong supporter for research groups and centres since the late eighties. A support that came to a considerable slow-down with the closing of the enhancement of research capacity network (ENRECA) in 2009, after health was no longer considered a priority for Danish development aid through the Ministry of Foreign Affairs. In the last years, new initiatives like the School of Global Health at the University of Copenhagen (UCPH) and global health clusters at other Danish universities emerged. These promise a continued contribution of DK to solving the health challenges of the 21st century. Almost ten years after the closing of ENRECA, it is time to take a look at the current state of GHR in DK, and how GHR may contribute to enhance evidence-based action and practice.

This GHR mapping is a collaboration project of the School of Global Health, UCPH and Doctors without Borders/ Médecins Sans Frontières (MSF) DK. We aimed to reflect upon the changes Danish GHR has experienced over the last ten years providing an overview of its core issues, geographical scope and funding.

This report is not a scientific study, but an attempt to "take the pulse" of the GHR in DK in the light of development and health transitions taking place in LMICs. Its results should be read with caution due to various limitations.

To achieve this, we followed a three-fold approach:

We conducted a publication search to provide an overview of the fields and project countries of research. In addition, we interviewed 19 informants from the GHR scene; helping us to shed light on their situation, strengths of research as well as prospects and challenges. With a focus on national external

[1] Birbeck, G. L., Wiysonge, C. S., Mills, E. J., Frenk, J. J., Zhou, X. N., & Jha, P. (2013). Global health: the importance of evidence-based medicine. BMC medicine, 11(1), 223; Jones G, Steketee RW, Black RE et al. (2003): How many child deaths can we prevent this year? *Lancet 362*: 65 – 71.;

[2] Koplan, J.P., Bond, T.C., Merson, M.H., Reddy, K.S., Rodriguez, M.H., Sewankambo, N.K., & Wasserheit, J.N. (2009). Consortium of Universities for GH Executive Board. Towards a common definition of GH. *Lancet*, 373(9679),1993-1995.

public funding we generated a rough overview of the sources of funding. External public funding hereby refers to funding from national public institutions that supplements core funding from the institution of main affiliation, often universities, university hospitals or public research institutions.

We are confident that a reflection on the state of GHR – its core topics, regional focus and funding – is of importance to align research priorities and needs. We hope to encourage discussion among aspiring and established researchers, students or anyone interested on what GHR ought to look like, and how we can come closer to a common vision of GHR for all.

1.1. A changing international environment

GHR does not find itself in a political vacuum. International trends concerning health, development and the humanitarian system influence research agendas, priorities and funding.

The world of today faces many health challenges that are unique in their complexity and interplay. GH is confronted with an unfinished agenda of infectious diseases that leads many countries to experience a double burden of diseases as non-communicable diseases (NCDs) and their risk factors become more common in LMICs. In addition, health worldwide is shaped by trade, travel, urbanization and climate change.[3]

With the eight Millennium Development Goals succeeded by the Sustainable Development Goals (SDGs), the focus shifted from "killer diseases" towards broader issues like good governance, for example. Even though every individual goal can be linked to health, the SDGs incorporate a wider range of topics with 17 goals and 169 targets measured by 232 indicators.[4] Goals such as the reduction of under-five mortality, for example, persist, but their relative importance may shrink.[5] Another trend concerns the target of aid, as the SDGs put a less stringent focus on the world's most poor and aim to improve lives worldwide.[6]

With many countries "graduating" into the bracket of middle-income countries (MICs), several countries are about to lose important support from international institutions. Furthermore, inequality within emerging countries will result in a large part of the world´s poorest individuals living in settings characterized by epidemiological transition.[7]

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[3] Frenk, J., & Moon, S. (2013). Governance challenges in global health. *New England Journal of Medicine*, *368*(10), 936-942.
[4] United Nations (2017): Sustainable Development Goals. Available online under: https://sustainabledevelopment.un.org/sdgs
[5] MSF 2016: OCB Strategic Vision 2016-2019. MSF, internal document.
[6] Buse, K., & Hawkes, S. (2015). Health in the sustainable development goals: ready for a paradigm shift?. *Globalization and health*, *11*(1), 13.
[7] Sumner, A. (2010). Global Poverty and the New Bottom Billion: What if Three- Quarters of the World's Poor Live in Middle- income Countries?. *IDS Working Papers*, *2010*(349), 01-43.

The world has not experienced armed conflict between major powers for decades. Today, we are living in a multipolar world characterized by regional and chronic internal conflicts due to state failure. The humanitarian system - often responding to health crises due to armed conflict and violence - is built on development assistance and capacity development making it hard to change priorities and free resources to respond to acute humanitarian emergencies. The report "Where is everyone? Responding to emergencies in the most difficult places" showed that emergency response capacity remains insufficient.[8]

During the Ebola crisis, securitisation, the process in which the issue has been rationalized from a point of national security, has left its mark on the world and GHR.[9] Talking about epidemics with the concern of, if and how they could reach the global North was observed again during the Zika outbreak in Brazil increasing the risk that actors will only become involved once wealthy states are under threat.[10]

Research funding might follow these major international trends; increasing importance of MICs and securitisation of Global Health, shaping the GHR agenda of tomorrow. One could argue that in the wake of the European migrant crisis, political efforts to combat causes of migration and externalizing European borders increase the risk for development and GHR to become a tool to achieve goals that lie beyond health.[11]

1.2. Scope of the mapping

This GHR mapping was created to gain an overview of specific health challenges, research areas and geographical scope of GHR in DK. To inform this overview, the assessment also focused on the development of GHR in DK to better understand its past and inform its future.

A three-fold approach aimed to attain an overview of GHR in DK through (1.) a publication search to assess the disease and health challenges addressed, research fields covered and geographical scope. Our complementary (2.) interviews contributed to a deeper understanding of the perceptions of GH actors within DK. Acknowledging research's dependence on funding, we investigated how the (3.) funding landscape developed over time and assessed the current state of funding. A focus was set on external public funding since one of its major actors, the Danish international Development agency (Danida), has historically played a crucial role in defining Danish GHR. From a humanitarian perspective, we also touch upon the alignment between GHR in DK and global medical humanitarian needs (see 5.).

[8] MSF (2014): Where is everyone. Responding to emergencies in the most difficult places. Available under: http://www.msf.org/en/article/msf-report-where-everyone.
[9] Kickbusch, I., Orbinski, J., Winkler, T., & Schnabel, A. (2015). We need a sustainable development goal 18 on global health security. *The Lancet*, *385*(9973), 1069.
[10] Smith, J. (2015). Global health security: a flawed SDG framework. *The Lancet*, *385*(9984), 2249.
[11] Global health advocates (2016). Misplaced Trust. Diverting EU Aid to stop migration. Available under: http://www.ghadvocates.eu/wp-content/uploads/2017/09/Misplaced-Trust_FINAL-VERSION.pdf.

The purpose of this mapping exercise was to focus on GHR by scientists affiliated to Danish institutions. Throughout this report, Danish research is understood as scientific work by researchers affiliated with Danish research entities.

2. Methodology

In consultation, and as indicated above, we decided to draw information from three different approaches: a publication search to assess the output of research, qualitative interviews to complement and inform our findings and a broad overview of funders and funding mechanisms.

2.1. Publications search

To cover a broad range of GHR, we searched for terms such as "global health", "determinants of health", "international health", "low-income" etc. as well as key diseases, filtering for Danish institutions (see Annex I). The PubMed search was limited to any publications within the last four years, between 2013 and 2016. The year 2017 was coded, but later excluded as studies were at risk for not being properly categorized into medical subject headings (MESH) yet.

A first screening identified 2058 publications and after screening for Danish affiliation, 1188 publications were retrieved. GHR from DK were defined by having either at first or last position an author affiliated with selected Danish institution (see Annex I).

To focus on data driven studies in LMICs, other exclusion criteria referred to studies that were focused on the Danish context[12], comments or non-scientific articles, case reports, publications focusing on non-humans, publications on bio-medical basic research[13] or meta-discussions on research methodology. A total of 870 publications were left. Filtering for studies conducted in LMICs, all analyses were based on a subset corresponding to 258 publications. All publications were coded by targeted disease or health challenge, field of research and targeted vulnerable groups (such as children or pregnant women). The research location, world region, project country and its income status were also noted.

2.2. Interviews

Key informants were identified using pre-knowledge of the GHR scene. Following the snowball principle, first interviewees were asked to provide names of key informants with broad knowledge of the GHR scene. To cover a wide range of researchers and institutions, two additional informants were included to account for the research fields of emergency obstetrics as well as intensive care. A list of all interviewees can be found in Annex II.

[12] Studies showed a high dependency on Danish conditions. Various studies examined survival and rehabilitation in a specific region and sub-population of Denmark, for example.
[13] To limit studies included, publications on molecular and genetics research were excluded.

All 19 interviews were conducted in an open-ended style following the outline of an interview guide (see Annex III). All interviews were recorded except for two due to technical issues. Notes of each interview were complemented by listening to the recordings. Notes were then coded according to broader themes using QDA MinerLite.[14] Codes were analysed one by one to identify common themes and synthesize general perceptions among interviewees.

2.3. Funding

Funding data was obtained through official sources such as websites from funders or corresponding ministries. Detailed data collection was limited to the funds administered by The Danida Fellowship Centre (DFC), Innovationsfonden (previously Det Danske Strategiske Forskningsråd) and Den Danske Frie Forskningsråd (DFF). Public external funders were identified by key informants as the major Danish public contributors to GHR. The overview included all funding bigger than one million DKK and projects awarded in a five year period between 2012 and 2016 targeting health research projects in LMICs.

Other funding sources such as private foundation and European programs were identified through interviews. While the original project aimed to include these in a comprehensive overview, time constraints did not allow for detailed data collection.

2.4. Limitations

One inherent dilemma we faced at the start of this report was that research relevant for GH is not necessarily understood or does not understand itself as GHR. Any mapping GHR is thus at risk of leaving out studies that focus on issues that are not commonly understood as GHR, but could nevertheless benefit patients in LMICs. However, a common obstacle to ensure research impact of findings is the translation to low-resource setting. In limiting the scope of this mapping, we aimed to select a subset of medical research that either investigated or applied existing knowledge to those contexts. While cross-country or -regional application might be challenging, studies included are likely to be more adaptable since they were conducted in LMICs.

The search terms for our publications overview favoured traditional GHR such as studies on poverty-related diseases like malaria, Tuberculosis (TB), Human immunodeficiency virus infection (HIV), and neglected tropical diseases (NTDs).[15] While studies on mental health and NCDs, for example, were often integrated through other more general search terms such as “low-income” or “global health” etc., various conditions were not included in the search terms. Our search terms did also not strictly follow

[14] Provalis Research (2018): QDA Miner Lite. Free qualitative data analysis software. Available online under: https://provalisresearch.com/products/qualitative-data-analysis-software/freeware/.

[15] We understand NTDs as including Buruli Ulcer, Chagas disease, Dengue & Chikungunya, Dracunculiasis, Echinococcosis, Yaws, Fascioliasis, African trypanosomiasis, Leishmaniasis, Leprosy, Lymphatic filariasis, Onchocerciasis, Rabies, Schistosomiasis, Soil-transmitted helminthiasis, Cysticercosis, Trachoma.

MESH terms. Furthermore, not all publications of one field might be covered as we did a full text search for the term "Malaria", for example. Therefore, any publication not mentioning the term "Malaria", but referring exclusively to "Plasmodium falciparum" would not have appeared in our search (see Annex I). Our narrow understanding of "Danish" as referring to publications where the Danish researcher was noted at either first or last position also excluded various publications which were co-authored by Danish authors. The publications search should therefore be interpreted with caution and does not adhere to the standards of a systematic review.

Time constraints did not allow us to cover a wider range of interviewees. In an ideal setting, we would have aimed to talk to private funders, policy-makers and a more diverse field of researchers. The selection was guided by the aim to cover a broad range of experts and institutions, but was relying on already made connections and pre-understanding. Interviews were driven by questions, but also anecdotes and narratives of informants. While some interviews focused on the withdrawal of funding of Danida, others went into depth regarding the evolution of GHR in DK. Using interviews as a complementary data source means that empirical findings are mixed with perceptions of reality. Perceptions of researchers do however play a significant role as they influence the way they act and plan. A perception of insufficient funding, might lead a researcher to change their research focus or abandon GHR altogether, for example.

Private funding and European public funding was not analysed in detail. This restricted our analysis of the funding landscape. With European funding stepping up its game, it was hard to assess whether the overall support of GHR changed over time. Trying to see funding in interplay with our publications overview and interviewees´ perceptions, first interferences, but no causal effects could be determined.

3. Brief history and current state of global health research in Denmark

GHR is a relative young discipline emerging from areas around International health and tropical medicine.[16] Main support for the first GHR projects in DK has largely been coming from Danida.[17] According to the long-standing official at the Danish Ministry of Foreign Affairs Mr. Klaus Winkel the 1990´s were the "golden age of Danish development research" with the budget increasing from 62 million DKK in 1988 to 287 million DKK in 1999.[18] The ENRECA project founded in 1989 was initiated by Danida as a bilateral research program within the field of health and other sciences.[19] ENRECA was then followed by the establishment of the ENRECA health research network in in the mid-1990s which continued in

[16] Koplan, J. P., Bond, T. C., Merson, M. H., Reddy, K. S., Rodriguez, M. H., Sewankambo, N. K., & Wasserheit, J. N. (2009). Towards a common definition of global health. *The Lancet*, 373(9679), 1993-1995.
[17] Kruse, A.Y., Bygbjerg, I. C. (2007). The framework of international health research. *Dan Med Bull*, 54, 142-4.
[18] Winkel K. (2017): Danida and Danish international health research. DSTMIH 50th anniversary symposium.
[19] Ministry of Foreign Affairs Danida (2001): Partnerships at the leading edge: a Danish vision for knowledge, research and development.

2004 as the Danish Network for International Health. [20] Even though the Danish Minister of Development was quoted in the first extensive review, the HERNES report, stating that "in the future, Danish research will have a much stronger position in Danish aid", funds started declining in the early 2000s.[21]

GHR in DK, often characterized as health research supported by Danida, has been evaluated six times in the past. Each evaluation led to a comprehensive report. This mapping will mainly focus on and compare with the findings of the HERA report, the last review of Danida-supported health research in developing countries in 2007 and the Christian Michelsen Institute report "Bridging research and development assistance: a review of Danish research networks". These evaluations had a strong focus on Danida and aimed to evaluate the effectiveness and impact of Danida-supported research. [22]

3.1. Main stakeholders

As one of the first GH institutions, the Danish Bilharziasis Laboratory for International Health Research and Development (DBL-IHRD) founded in 1964 concentrated on capacity building and a range of NTDs including schistosomiasis, malaria, lymphatic filariasis, intestinal helminthiasis, cysticercosis and infections caused by the guinea-worm and fish-borne flukes. DBL-IHRD received core funding from Danida and funding was gradually phased out from 2002 onwards. In 2007, parts of the DBL-IHRD were integrated into the Veterinary School and the Faculty of Health of UCPH, and the institution ceased activities in 2012 due to a total halt of funding.[23]

As one of the first Danish universities, UCPH created a department of international health to provide an institutional home for GHR which was followed by the School of Global Health. While the HERA report saw main institutions located in the greater Copenhagen region,[24] universities outside Copenhagen have been stepping up defining their key areas of interest and diversifying the GHR scene. At the Southern University of Denmark, a centre of Global Health was founded and the University of Aarhus has a research cluster of Global Health and Demographics affiliated to its public health department.

Other actors include the Global Health unit at Rigshospitalet, an attempt to coordinate GHR activities within the hospital. Statens Serum Institute (SSI), one of the biggest health research enterprises in DK, has a strong history of GHR including the Bandim Health project (BHP), one of the longest standing

[20] Hera (2007): Review of DANIDA-supported health research in developing countries. Volume I.
[21] Ministry of Foreign Affairs Danida (2001): Partnerships at the leading edge: a Danish vision for knowledge, research and development.
[22]Hera (2007): Review of DANIDA-supported health research in developing countries. Volume I & Volume II.; Torstensen, A. (2006): Bridging research and development assistance: a review of Danish research networks. Available at: https://brage.bibsys.no/xmlui/handle/11250/2435750.
[23] Annette Olsen, Niels Ørnbjerg, Klaus Winkel (Eds): A Success Story in Danish Development Aid – DBL (1964-2012). Available at: http://ivh.ku.dk/english/research/about_parasitology_and_aquatic_diseases/docs/a_succes_story__lowres.pdf
[24] Hera (2007): Review of DANIDA-supported health research in developing countries. Volume I.

and most extensive projects of Danish GHR. The list below displays the main stakeholders of Danish GHR identified by interviewees. Other departments and universities might have projects as well, but were not emphasized in interviews or during an analysis of funded projects.

Main institutions involved in GHR

Rigshospitalet

- Global Health Unit

Roskilde University

- Department of Social Sciences and Business
- Department of People and Technology

Staten Serum Institute

- Bacteria, Parasites & Fungi
- Department of Infectious Disease Immunology
- International Reference Laboratory of Mycobacteriology
- Vaccine Development
- Bandim Health Project

Technical University of Denmark

- Food Institute

University of Aarhus

- Section for Global Health and Demographics, Department of Public Health
- Department of Anthropology

University of Copenhagen

- School of Global Health and Division of Global health under the Department of Public Health
- Centre of Disaster Management
- Centre for Medical Parasitology
- Department of Anthropology
- Paediatric and International Nutrition Unit, Department of Nutrition, Exercise and Sports
- Section for Section for Food Safety and Zoonosis, Department of Veterinary and Animal Science
- Parasitology and Aquatic Pathobiology, Department of Veterinary and Animal Science

University of Southern Denmark, Odense

- Centre for Global Health, Department of Public health

Societies include the Danish Society for Parasitology, Danish Society for Tropical Medicine and International Health, Danish Society of Obstetrics and Gynaecology, Danish Paediatric Society of Infectious Diseases, Danish Paediatric Society, Danish Infectious Diseases Society. Specialized institutions such as the

Institute for Torture Dignity or the Danish Research Centre for Migration, Ethnicity and Health at University of Copenhagen can be considered key players in their respective field.

In 2017, GHR has its own unit in five major research institutions in DK. An increase in departments and sections involved in GHR could contribute to a fragmentation of GHR, but might also merely reflect that GH in itself is highly cross- and interdisciplinary. This development can thus also be interpreted either as a natural phenomenon or a consequence of the absence of formal networks of collaboration after ENRECA.

3.2. Core health challenges and disease foci

The core topics of health-related research displayed in the publications search show an emphasis on nutrition, HIV, NCDs, NTDs, and malaria. These are closely followed by TB and sexual and reproductive health (SRH).

Table 1: GHR in LMICs categorized by disease and health challenge 2013 to 2016

Disease and health issues	*Number of publications*	*Percentage of total publications*
Non-specific health challenge	36	14,0%
Nutrition	28	10,9%
HIV	27	10,5%
Neglected Tropical Diseases	27	10,5%
Non-Communicable Diseases	21	8,1%
malaria	20	7,8%
Sexual and Reproductive Health	17	6,6%
TB	15	5,8%
Other infections	12	4,7%
Foodborne diseases	8	3,1%
Other co-infections	8	3,1%
HIV-TB co-infection	7	2,7%
Measles	7	2,7%
Mental health	6	2,3%
NCD-TB comorbidity	5	1,9%
Antimicrobial resistance	4	1,6%
Cholera	3	1,2%
Respiratory diseases	3	1,2%
Other diarrheal diseases	2	0,8%
NCD-HIV comorbidity	2	0,8%
Grand Total	258	100,0%

These core issues are mirrored in the perception of interviewees who noted malaria, NCDs (specifically hypertension, diabetes), nutrition, TB, HIV, SRH as well as specific NTDs such as schistosomiasis and leishmaniasis (in no particular order).

Non-specific health challenges account for publications within health systems or child health, for example. Targeting no particular or a set of diseases, they might contribute to an explanation of why respiratory diseases and other diarrheal diseases seem to be represented with only a few publications. The publications search further reported separately on various co-infections (see for example HIV-TB, HIV-NCD, TB-NCD).

Regarding the focus population of research, a total of 60 publications had a specific focus on children and youth representing 23%. A third of those publications were related to the topic of nutrition.

3.3. Core research areas

A clear picture emerges when looking at fields of research. GHR is dominated by epidemiological research shortly followed by publications on treatment and disease management. With relative similar importance follow publications on social sciences such as anthropological or ethnographic studies, on diagnostics as well as vaccine research. The epidemiological studies often included first baseline descriptive studies. However, the high number might also be explained by DK's traditional strength in epidemiology fostered through institution like Statens Serum Institute, for example.

Table 2: GHR in LMICs categorized by research area between 2013 and 2016.

Research areas	*Number of publications*	*Percentage of total publications*
Epidemiology	76	29,5%
Treatment and disease management	46	17,8%
Vaccines	31	12,0%
Social science research	25	9,7%
Diagnostics	21	8,1%
Disease mechanism and transmission	11	4,3%
Disease surveillance	10	3,9%
Health education	8	3,1%
Other issue areas	5	1,9%
Health system research	5	1,9%
Health economics	4	1,6%
Health policy	4	1,6%
Prevention	3	1,2%
Determinants of health	3	1,2%
Water, sanitation and hygiene	2	0,8%
Mobile health	2	0,8%
Surgery	1	0,4%
Obstetrics	1	0,4%
Grand Total	258	100,00%

The high output areas reflected in the table are also confirmed by interviewees who point to Danish strengths within mapping drug resistance, new diagnostics, medical anthropology, global

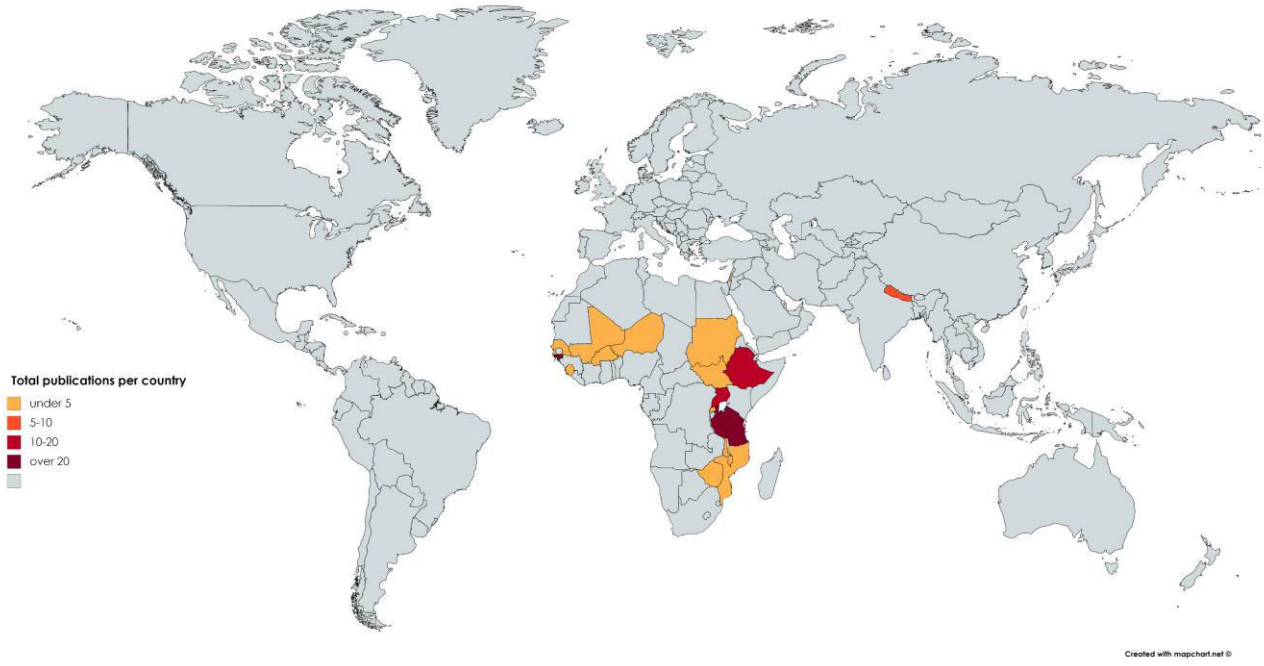
surveillance of infectious diseases, epidemiology, virology, public health, research on vaccination and vaccine development (in no particular order). Others highlighted areas such as mobile health, health systems and health economics research which could not be confirmed here, but could be underrepresented due to the scope of the search.

Informants went broader in defining GHR strengths among topics such as toxicology, environmental health, logistics, hygiene and waste management and disaster management. These areas were not a focus of this mapping, but can complement and strengthen more traditional medical research foci.

3.4. Geographical foci

The number of low-income country (LIC) projects is smaller than MIC project countries. Nevertheless, over 2/3 of all publications over the last four years are based on projects in LICs and a total of 164 publications were connected to research that took place in LICs. Here the legacy of Danida prevails. The five countries with the most publications Nepal, Ethiopia, Uganda, Guinea-Bissau and Tanzania have all, with exception of Guinea-Bissau, been priority countries of Danida. Before priority countries were established, the BHP in Guinea-Bissau was initially funded by Danida. Except for Nepal, all countries are situated within Sub-Saharan Africa.

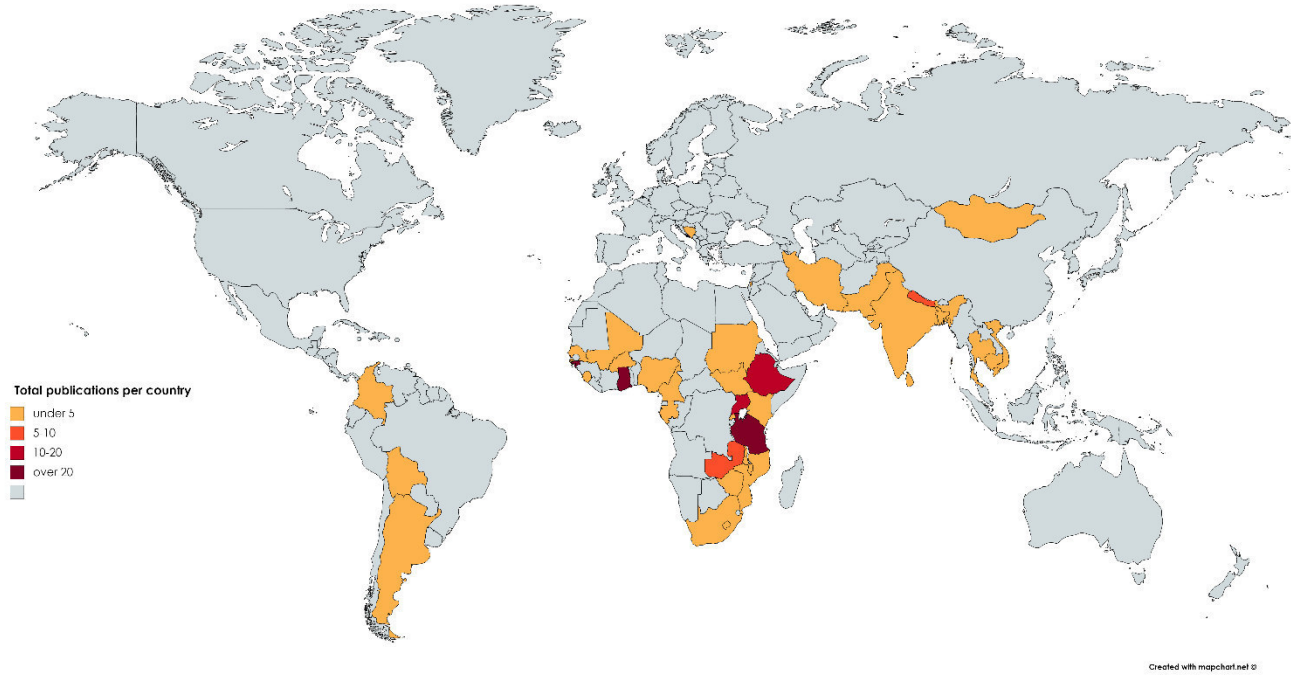
Graphic 1: World map of LICs where GHR published 2013-2016 took place



The range of countries expands considerably, when including MICs. Only in two of the 22 research project MICs more than 5 publications have been noted. We identified 21 publications for the long-

standing priority country Ghana. Zambia that was phased out as Danida priority country in 2013 accounted for 6 publications. Next to Guinea-Bissau, Ghana and Tanzania are the top two countries and the only ones open for so-called South driven projects by Danida in 2017, where the key lead can be a researcher from the respective country.

Graphic 2: World map of LMICs in which Danish GHR published 2013-2016 took place



Working in fragile or conflict contexts with poor security infrastructure is challenging, conducting research in these settings even more so. Almost none of the research locations with major publication output over the last years can be described as conflict or fragile settings.

After a Danida project was closed in South-Sudan due to security concerns, few have followed. Drawing on experiences during the civil war in Guinea-Bissau in 1998, the BHP has used its unique position to conduct research on the effects of displacement in conflict. A project in Uganda tried to establish a system to generate longitudinal data after violence broke out in 2003. However, continued funding for this project could not be secured and it is thus to be discontinued in 2018.

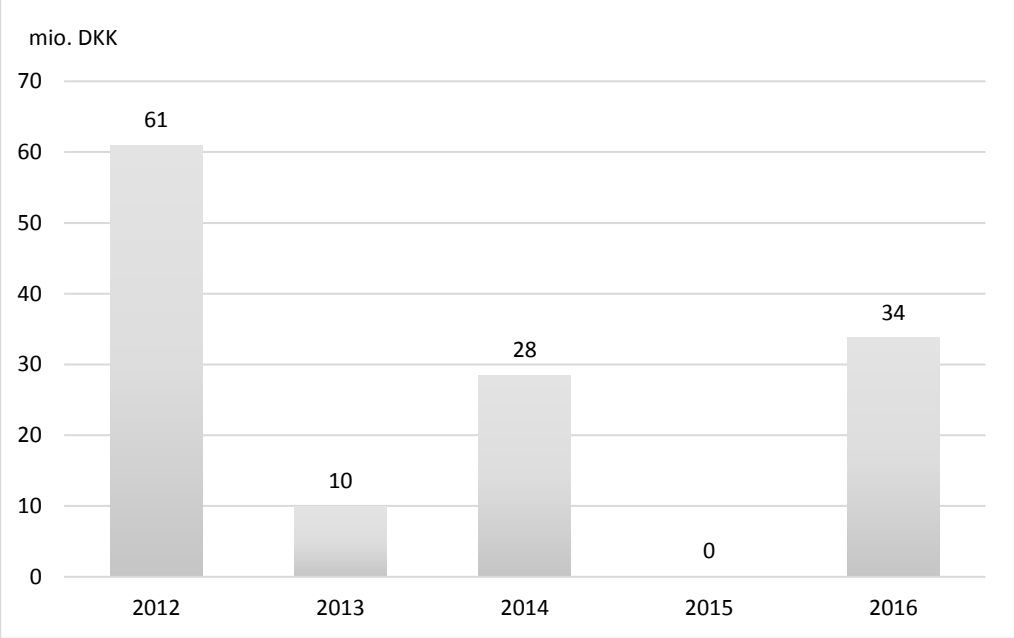
3.5. The funding landscape for global health research

To understand the state of GHR in DK, it is indispensable to look at the funding streams within the country. Most of our interviews, but also analysis and discussion, shifted back to this topic. The withdrawal of Danida from health research was most felt through the termination of ENRECA, the biggest funding mechanism of various projects.

External national public funding

The Danida Fellowship Centre (DFC) was founded in 1990 to manage research activities of Danida. The DFC remains the main administrator for the Danish Ministry of Foreign Affairs funds for development cooperation research. To account for the delay of funding allocation to research output, Table 3 summarizes the projects funded by the DFC between 2012 and 2016. The 2012 call almost exclusively focused on health projects and a total of 60 million DK was allocated to 10 projects. Only one project on the edge of GH was funded in 2013 focusing on insects as food. In 2014 three projects received funding, whereas in 2015 no funds were allocated due to budget cuts. A total of four projects were funded in 2016.

Table 3: Funding allocated by DFC for GHR in LMICs 2012- 2016[25]



DFC funding has also concentrated on projects in priority countries, particularly Tanzania, which stood out receiving 41% of all DFC funding for GHR between 2012 and 2016. Tanzania was followed by Ghana attracting about one fourth of DFC funding. Except for Bangladesh and Vietnam, all DFC countries have been located in Sub-Saharan Africa thereby again aligning with Danida priority country policy.

Danida had a broad range of priority countries that have been scaled down over the last couple of years. Priority status was phased out with Zambia and Benin in 2013, with Bhutan in 2014 and with Vietnam in 2015.[26]

[25] Funding allocated by the Danida Fellowship Center for GHR in low- and middle income countries between 2012-2016.
[26] Ministry of Foreign Affairs DK 2017: Introduction to DANIDA. Priority countries. Available online at: http://introductiontodanida.um.dk/en/danida-at-work/danidas-work-at-a-glance/priority-countries/; Danida Fellowship Centre(2017): Research collaboration projects in growth and transition countries ("Window 2"), 2018. Call for Phase 1

Looking at the application call in 2017 can shed light onto future priorities. The call is divided into window 1, a long-term funding for up to five years for research in Danida priority countries and window 2, up to three years of funding for projects in selected MICs. Window 1 includes five different general topics for proposals within GHR. Funding is available for South-driven and North-driven proposals from Ghana and Tanzania and additional North-driven proposals in Kenya. Projects are awarded with a maximum of 12 million DKK over a five-year period.[27] Window 2 offers a maximum of five million DKK available for a period of one and a half to three years. Health projects include occupational health and safety in Bangladesh, efficient healthcare management in Brazil and Mexico, health care in Vietnam and other projects that might be open to health-related proposals.[28]

This funding call shows that health research by Danida will be limited to one LIC, Tanzania, and announces a larger shift towards MICs where research for development is intertwined with Danish strategic sector cooperation.

Other Danish public external funders like DFF and Innovationsfonden have not favoured to fund GHR abroad, but have covered substantial funding for basic research on GH topics in Denmark. DFF awarded funding to one project in 2013 and two projects in 2014 that supported GHR in LMICs. All grants were around 2 million DKK.[29]

Innovationsfonden (or Dansk Strategiske Forskningsråd before 2014) supports the biggest grants in the Danish external public funding scene. In 2013, 20 million DKK were awarded to a nutrition project focusing on products for African markets. This funding follows the trend of supporting Danish research that ultimately benefits Danish producers and business. In addition, a project on "Foetal exposure and epidemiological transition" was awarded almost 18 million DKK in 2014.[30]

Comparing Innovationsfonden with both DFF and DFC, Innovationsfonden funding is usually concentrated on one bigger project receiving up to 20 million DKK. To our best knowledge "Foetal exposure and epidemiological transition" with a large cohort in Tanzania was the only major GHR project between 2012 and 2016.

Innovationsfonden also funded projects on poverty-related diseases based in DK. Promising projects focussed on issues that represent new global challenges such as colorectal cancer, antimicrobial

applications. Available online at: http://dfcentre.com/wp-content/uploads/2017/11/Call-2018-window-2-final-second-edition-21-Nov-2017.pdf.

[27] Danida Fellowship Center (2017): Research collaboration projects in Danida priority countries ("Window 1"), 2018 Call for Phase 1 applications. Available at: http://dfcentre.com/wp-content/uploads/2017/11/Call-2018-window-1-final.pdf

[28] Danida Fellowship Centre: Research collaboration projects in growth and transition countries ("Window 2"), 2018. Call for Phase 1 applications. Available online at: http://dfcentre.com/wp-content/uploads/2017/11/Call-2018-window-2-final-second-edition-21-Nov-2017.pdf.

[29] Danish Ministry of Education and Research (2017a): Who has received funding? Available at: https://ufm.dk/en/research-and-innovation/funding-programmes-for-research-and-innovation/who-has-received-funding

[30] Danish Ministry of Education and Research (2017b): Bevillinger. Available at: https://ufm.dk/forskning-og-innovation/rad-og-udvalg/tidligere-rad-og-udvalg/det-strategiske-forskningsrad/bevillinger

resistance (AMR), intensive care units, gestational diabetes and epigenetics. Looking at funding supported by DFF for GHR-related projects conducted in DK a diverse picture emerges. Topics of DFF cover infectious diseases with a high burden in LMICs such as hepatitis C, malaria, HIV/AIDS, TB, diarrheal infections like E. coli as well as NTDs like whipworms, for example. It thus seems that the stakes for receiving funding through DFF and Innovationsfonden for GHR projects in LMICs are still higher than for those of GHR-related projects conducted in DK.

Private national funding

Various foundations crowd the scene of private national funding in DK. Private funding is scattered, and many interviewees noted that private funding is often unpredictable and cannot be relied upon.

The views on private national funding were diverse; with some seeing certain funds moving towards GH and becoming interested in funding GHR in LMICs, whereas others saw them as not being available for substantial support. Some also warranted caution as private foundations allegedly were more interested in MICs rather than LICs. The common response to our question of private national funding was, however, that national private foundations are often reluctant to fund research abroad. Funding is also restricted to smaller grants that cannot sustain research projects. Further, some were critical towards leaving the responsibility to set and prioritize the GHR agenda to private funding.

The major Danish private funds mentioned to us were Novo Nordisk Fonden, Lundbeck, Augustinus A.P. Møller, Velux, Bjarne Jensen Fonden, Merkur Fonden, Poul Due Jensen Fonden, Tryg foundation, Leo Pharma. Specific areas of GHR seemed to benefit from securing funds by involving industry products. Researchers were aware of the delicate balance they have to maintain when engaging funding from private companies.

Specific insight into private GHR funding requires time and effort which this mapping could not afford. However, it seems questionable that any private Danish private fund will step up and show committed support for GHR in LMICs at this point in time.

European public funding

Funding via the European Union has become more attractive as it offers the clear opportunity to secure substantial and long-term funding in an environment that is often characterized by short-term and restricted funding.

The European Union has stepped up its funding for GHR considerably since 2012. Three programs drive GHR, namely the European and Developing Countries Trails Partnership (EDCTP), the innovative medicine initiative and to a lesser degree Horizon 2020. The Joint Programming Initiative on Antimicrobial Resistance further serves as a research hub for projects targeting AMR.

During interviews, we were often led to ask the question whether EU programs could fill the vacuum Danida's funding withdrawal has left behind. Many declined, since European funding is highly competitive, often demands cross-European collaborations and requires capacities that are beyond faculty teams. Some saw Danida funding as a potential stepping stone towards European funding. Seeking European funds, but also the reporting after funds are received, was described as time-consuming, complicated and requiring a professional secretariat.

International private funding

International private funding mainly through actors like the Wellcome Trust, Bill and Melinda Gates Foundation, Rockefeller Foundation and Hewlett Packard Foundation has also started to benefit Danish research. While it may be difficult to have overview of private funding possibilities in DK, international private research was perceived by most as being more transparent, flexible and accessible, but also very competitive requiring a strong network and contacts.
Researchers were aware of the power of major foundations in directing the research agenda. Working in LMICs, many were concerned by disease specific funding often leading to huge disparities between general health services and specialized and well-funded vertical projects such as HIV-clinics, for example.

3.6. Strong partnerships, capacity-building and long-term cooperation

It was emphasized repeatedly that developments after the Paris agreement[31]; the ENRECA health program and Danida´s policies in the early 2000s have had a stark affect, not only on what kind of research was conducted, but for whom research was done and with which aim. The ENRECA program required a shift towards research infrastructure and capacity building in the global South. Genuine partnerships and research collaboration that produced joint publications enabled research partners to build a career within their own countries. This improvement of local institutions might have also avoided brain drain.

Many saw capacity building in developing countries as the main driver of their work and emphasized that you could now see the fruits of the work looking at the research scene in countries like Guinea-Bissau, Tanzania and Ghana. It was disagreed upon whether this focus on research capacity is being replaced by a more top-down approach or whether it persists as a general principle that has changed Danish GHR culture in the long run.

Without ENRECA, however, it was clear that even though some tried to uphold formal networks, societies or initiatives such as GH Minders, informal and potentially more exclusive contacts are gaining

[31] OECD (2005), "The Paris Declaration on Aid Effectiveness", signed March 2, 2005. Available under: http://www.oecd.org/dac/effectiveness/34428351.pdf

importance. In interviews, it was voiced that that most researchers primarily know about other key projects directly relevant to themselves.

3.7. The future of global health research: Trends and challenges

Our conversations ended with a direct question regarding the future of GHR. The overall perception was rather pessimistic. Some of the recurring frustrations related to the two following issues: The struggle to maintain research infrastructure built up in LMICs and the uncertain future for researchers within GHR, in both DK and partner countries.

The high fragmentation of GHR was associated with research following specific funding calls. People either had to redirect their interest to fit research trends and funding priorities, but some had also abandoned GHR. Researchers emphasized a shift from medical and classical GHR topics to more social science and cross-sectional topics. Future GHR might therefore shift towards legal, religious, political, economic and social aspects of health.

Many reported that programs, mostly funded by DFC in 2012, are now running out and were either bound to be closed or sustained at a minimum by small means. A higher dependence on more short-term project funding made it difficult to maintain local capacity in between funding periods and research infrastructure such as laboratories were under threat of closure. Obtaining funding to cover running costs has been increasingly difficult due to "projectification" of funding. Future funding opportunities are less predictable and have made the long-term planning, crucial to research, difficult leading to uncertainties causing frustrations among many.

In addition, many researchers are concerned about the future of research development in LMICs. Several explained to us that the number of Ph.D. supervisors is far lower than the number of funded Ph.D. scholarships. Programs that had educated students were now leaving them behind without a perspective and adequate supervision.

In DK, there is also concern about the next generation of researchers. To secure funding, post-docs have to team up with senior researchers following their lead, while being confronted with short-term employments. In various projects researchers had preferred to continue their career elsewhere rather than being employed by the university. It remained unclear how the next generation should be kept in a field that had become so unpredictable and left little room to follow individual research interests.

4. Conclusion

GHR has become deeply rooted in public institutions as the emergence of new departments, sections and clusters at public research and health institutions demonstrates. GHR is spread out around various entities, sometimes within the same institution. This might lie within the diverse nature of GH, but might make fragmentation and incoherence of the research field likely.

Central disease foci include malaria, nutrition, HIV, NCDs, NTDs as well as SRH. Core research areas show a high focus on epidemiology. This traditional strength may be explained by the presence of strong institutions like the SSI and long-standing experience with national registry research.

It is notable that high output project countries like Tanzania and Ghana are among the countries receiving long and substantial Danida funding. Whether research in those countries still relies on Danida funding, or previous support has enabled researchers to seek additional funding, is not clear. The BHP in Guinea-Bissau stands out with a high research output without receiving recent DFC funding.

Recognizing the key role of Danida; Tanzania, Ghana and to a lesser extent Kenya may remain the focus of Danish GHR as they can expect larger research projects within the next funding period. New funding opportunities via DFC will expand the geographical scope of research to include more MICs following an international trend. Research for development is expected to be linked to strategic sector cooperation placing research for development on an agenda that is driven by other goals than improving health alone. This shift indicates a continuation of withdrawal from research support in LICs and might further contribute to a low presence of GHR in conflict and fragile settings.

A general appreciation for capacity building through partnerships and research collaborations was a key achievement that many associated with the ENRECA program. Due to "projectification" of funding on all levels, it is questionable to what extent established research infrastructure in LMICs can be sustained between project funding periods. When projects are funded for very limited periods without options for renewal or transitional phasing out of funding, built up research infrastructure is at risk of being lost.

In Denmark, the next generation of researchers is also affected by this development and often left with short-term employment and uncertain prospects. With this unpredictable future, one might ask if GHR can keep its high profile and secured positions in key research institutions in the long run. Closer international collaboration could lead the way to sustain or even expand GHR expertise and competence.

Overall, GHR has had a long-standing base in LMICs working on poverty-related diseases. With a limited number of countries supported and no support for sustaining research infrastructure long-term, reprioritizing and maintaining the high value placed on capacity building could contribute to aligning research and global needs. Closing this gap will be a task requiring major efforts, not least in an environment of risk averse funding dominated by strategic foreign policy.

5. A humanitarian perspective and reflection

Humanitarian assistance is provided in response to man-made or natural disasters. Disease outbreaks and natural disasters leave millions in need of assistance. With additional protracted crises

forcing increasing numbers of people to leave their homes, it is estimated that a total of 136 million people will require assistance in 2018.[32]

GH and humanitarian medical work have long been interlinked. With a need to fully establish evidence-based action in humanitarian medical operations, guidelines and policies rely on GHR.[33] This brief reflection explores how close Danish GHR is to the settings and challenges experienced in the field of medical humanitarian aid.

Like GHR in DK, humanitarian aid and its varying goals indicate a high level of fragmentation covering different medical and non-medical areas.

The coverage of Danish GHR aligns with the global needs relating to poverty-related diseases such as malaria, HIV and TB. However, the settings in which Danish GHR takes place raise doubt about the potential to translate research findings to the humanitarian setting. Danish GHR is predominantly present in Sub-Saharan Africa, but research tends to concentrate in three countries, namely Tanzania, Ghana and Guinea-Bissau. Nevertheless, they border countries experiencing protracted crises. Here, Danish GHR has contributed to capacity building and gained knowledge that may strengthen resilience to cope with future health emergencies in the region.

Global attention to humanitarian aid in MICs is rising due an increasing number of the world´s poor living in MICs and conflict in these settings such as the war in Ukraine. Conflicts in MICs are often hard to access and difficult to respond to due to new challenges like previously advanced level of health services and a high prevalence of NCDs, for example. GHR could play an essential role providing the evidence-base for a response to these pressing challenges. But in support of GHR in MICs, Danida focusses on key emerging markets and strategic sector cooperation. This link leaves little hope for the incorporation of fragile or conflict settings in MICs into the scope of Danish GHR in the near future.

Without more explicit support in those settings, where health challenges are most pressing, GHR runs at risk of becoming a tool of foreign policy without unleashing its potential to lead the way for evidence-based medical humanitarian work.

[32] UN OCHA (2018): Global humanitarian overview 2018. Available under: https://www.unocha.org/sites/unocha/files/GHO2018.PDF.
[33] Shanks, L. (2014). Why humanitarian aid became professional: the experience of MSF. Journal of Humanitarian Assistance. Sept, 23.

6. Annex

Annex I: Search strategy

Search terms on pubmed

("Global Health" OR "determinants of health" OR "international health" OR "low-income" OR "middle-income" OR maternal health OR child health OR maternal mortality OR child mortality OR neo-natal mortality OR malnutrition HIV OR Aids OR malaria OR "TB" OR tuberculosis OR rotavirus OR cholera OR Shigella OR "E.coli" OR Cryptosporidium OR Giardia OR Leishmaniasis OR "sleeping sickness" OR Chagas OR dengue OR pneumonia OR meningitis OR Schistosomiasis OR bilharziasis OR "Lymphatic filariasis" OR elephantiasis OR Onchocerciasis OR ancylostomiasis OR necatoriasis OR cysticercosis OR taeniasis OR Strongyloidiasis OR trichuriasis OR ascariasis OR Typhoid OR Salmonella OR hepatitis C OR leprosy OR trachoma OR "rheumatic fever" OR "Buruli Ulcer" OR Leptospirosis OR Ebola OR Marburg OR "water health" OR "antibiotic resistance" OR AMR OR MDR-TB OR polio OR diphtheria OR "dtp" OR measles) AND (diagnostic* OR treatment OR management OR prevent* OR vaccine OR vaccination* OR "vector control" OR trial OR drug OR medicine OR nutrition OR surgery OR pediatrics OR paediatrics OR sanitation OR obstetric* OR "second-line treatment" OR surveillance OR "intensive care" OR "primary health care") AND (University of Copenhagen OR Københavns Universitet OR Copenhagen Business School OR IT University of Copenhagen OR Roskilde University OR Roskilde Universitet OR Technical University of DK OR Danmarks Tekniske Universitet OR University of Southern DK OR Syddansk Universitet OR Aalborg University OR Aalborg Universitet OR Aarhus University OR Aarhus Universitet OR Statens Serum Institut* OR Steno Diabetes Cent* OR Rigshospitalet OR "Danish Institute for International Studies" OR "Danish Institute for Human Rights")

Annex II: List of interviewees

List of interviewees, interviewed between 22.9.2017 and 5.12.2017

1. Ali Salanti
2. Anders Perner
3. Astrid Permin
4. Bjarke Lund Sørensen
5. Christian Wejse
6. Christine Benn
7. Flemming Konradsen
8. Frank Aarestrup
9. Freddy Karup Pedersen

10. Henrik Friis
11. Ib Bygbjerg
12. Klaus Winkel
13. Lasse Vestergaard
14. Lise Østergaard
15. Morten Sodemann
16. Nanna Hvidt
17. Susan Whyte
18. Thor Theander
19. Vibeke Rasch

Annex III: Interview guide

Mapping GHR mapping in Denmark

Introduction and objectives

The GHR mapping is a collaboration project of Divison of Global Health, University of Copenhagen (UCPH) and Doctors without Borders/ Médecins Sans Frontières (MSF) Denmark. This project aims to a scope the research capacities and expertise within more broadly global health and more specifically medical operational research within Denmark.

1.1. Identifying key areas of expertise and/or competence of GHR within Denmark
    - to evaluate opportunities and „closeness to the field“ of Danish research
    - to encourage research cooperation across projects and institutions
1.2. Providing a broad overview of GHR in Denmark
    - Deeper insight into funding and research priorities over the last five years
    - „Know where we are, know where we are heading“ - Outlook onto future priorities and focus areas

The GHR map aims to answer the following questions

- What are the central areas of expertise within the Danish GHR scene
- How has the Danish GHR scene developed and where is it heading?

- How present is medical operational research[34] within Danish GHR? What are the capacities regarding operational medical research? *How close is Danish GHR to field?*

Detailed interview guide

Introduction

- Who are you? Please describe your position, affiliations as well as shortly highlight your research interests and current projects.

GHR mapping:

- How could you imagine that a global health map to be useful for funders or the research community? And if so, how?

Clinical GHR in Denmark

- What are the strengths of GHR within Denmark?
- Which are the key research areas in which Danish researchers show extraordinary expertise?
- Which are projects by you and others have stood out to you in the past and present? Why have they stood out?
- What are Danish GHR capacities in emergency and fragile areas?

Funding

- Who are the main funders of GHR that is conducted by researchers in Denmark? How would you describe their relative importance?

Priorities

- How has the Danish GHR scene evolved in the last five years?
- Which were the top priorities of research five years ago and what are they now?
- Where do you think GHR is moving in Denmark?
- Any other comments?

[34] Operational medical research is understood as clinical research that has a potential impact for patients in settings in which humanitarian organizations' work.