

Research at KI related to Environment and Sustainability, report 2016.

Reported by:

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Department of Public Health Sciences

Social Epidemiology (Allebeck) comprises studies on how diseases and health related conditions vary across different groups in society and how interventions affect health in different groups. Examples of projects are “Mental health in a global perspective”: Through research collaboration with mainly Uganda and Vietnam, the group has a series of projects aiming at analyzing the occurrence of mental disorders and alcohol use in low and middle income countries. In countries with a high HIV prevalence they also study the association between HIV and mental health, an association that can go in different causal directions.

Equity and Health Policy (Burstrom) The group does interdisciplinary studies of social differentials and trends over time in health, health-related quality of life, morbidity, mortality, health care use, social and economic consequences of disease and the impact of policy on health in specific groups in different contexts, using quantitative and qualitative methods.



Public Health Epidemiology (Dalman) The group engages in epidemiological research in areas of relevance for public health. The group value and foster links between science and society, as well as research and practice. The ultimate mission is to identify modifiable risk and prognostic factors for major contributors to the global burden of disease. Example: “Impact of outdoor environment upon physical activity, sedentariness, UV radiation, stress, and general health at compulsory school” (Boldemann).

Global Health Interventions and Evaluation (De Costa/Larsson)

This research group has multidisciplinary competence in medicine, epidemiology, health economics, social science, and caring science, and come from a variety of backgrounds and countries.

They focus on developing interventions as well as implementing and evaluating interventions that have already been applied by governments or programmes. The research areas include maternal health, HIV/AIDS, TB, mHealth (medicine and public health supported by mobile devices), health financing, and public-private mix in health care. They have collaborative projects in Vietnam, India, Uganda, US, China, Finland, and South Africa.



Global Health, HIV and SRHR (Ekström/Thorson) The Global Health, HIV and Sexual and Reproductive Health and Human Rights (SRHR) research group is dedicated to increasing health equity throughout the world. It is home to Hans Rosling’s Gapminder Project and two interdisciplinary research teams on Global Health and Development, HIV/AIDS, and SRHR. Over the last 14 years Ekström has led a number of large research projects mainly in sub-Saharan Africa (Kenya, Tanzania, Uganda,



Burkina Faso, South Africa), aiming at more effective program implementation of HIV prevention and treatment in resource-poor health systems and high-risk contexts and subpopulations (young people, HIV discordant couples, slum residents, migrants, men who have sex with men and injecting drug users).

Health systems and policy (Stålsby Lundborg) The new head for the merged Health Systems and Policy group is Cecilia Stålsby Lundborg, Professor of International Health at Karolinska Institutet. Since 2005, she was the head of the Medicines in the Health System Focusing on Antibiotics, which has merged with the Health Systems and Policy group on January 1, 2015. Her research interests include various aspects of antibiotic use and prescribing, antibiotic resistance, and health-care associated infections, as well as antibiotics and antibiotic resistance in the environment and "One health". At present, most projects are conducted in Asia (India, China, Vietnam) and Europe (mainly Sweden and Malta). Antibiotic resistance is a severe threat to global public health and will affect future generations.



Disaster Medicine (von Schreeb) The deputy head of the group is Associate Professor Johan von Schreeb, who is responsible for the area of Disaster Medicine and the leader of the Center for Research on Healthcare in Disasters. He has e.g. been active in treatment of Ebola patients in Africa, and was appointed "The Swede of The Year" by the Journal Fokus. His team engages in studies on how to improve health assistance to disaster affected populations worldwide.



Clinical Science, Intervention and Technology (CLINTEC)

Removal of antibiotics from urinary waste in the ICU, Intensive care unit

Project group: Olof Beck (Pharmacology, Huddinge), Olav Rooyackers (AnOpIva, Huddinge), Patrik Rossi (AnOpIva Huddinge), Anna-Lotta Öjerskog (AnOpIva, Huddinge)

Resistant bacteria and especially multi resistant bacteria are an increasing problem in society and especially the hospital environment. This is mainly the result of overexposure to antibiotics due to overuse in patients and livestock but also accumulation in the environment. In most countries waste water is filtered for drugs including antibiotics at the main waste stations but there is no control over the waste water from the hospitals to the central waste stations. Waste water from hospitals has been shown to contain measurable amounts of antibiotics, also in Sweden. Many patients treated in the ICU receive significant amounts and combinations of antibiotics, sometimes at high doses. Filtering these antibiotics from the waste water from the ICU will most likely reduce the amounts in the sewage towards the central waste station and by this hopefully the development of more resistance in bacteria.

The aim of the present project is to study whether a newly designed filter will reduce the amount of antibiotics in the urinary waste at the central ICU at Karolinska University Hospital in Huddinge in comparison with the present standard waste procedure.

Department of Women's and Children's Health (KBH)

Unsafe abortion methods take the lives of approximately 47,000 women around the world each year, according to the World Health Organization (WHO). This makes unsafe abortions one of the major causes of death among women, globally speaking.

The fact that a prestigious university such as Karolinska Institutet is conducting research on abortion is very important from a global perspective according to **Kristina Gemzell Danielsson**, Professor of Obstetrics and Gynaecology at Karolinska Institutet, Senior Consultant at the Women's Clinic at Karolinska University Hospital as well as Head of the WHO Collaborating Centre for Research in Human Reproduction.

“It shows that this is an important medical issue, and that there is an academic interest in it. What we do matters to women in Sweden, but it also matters to women in low-resource countries, where the consequences of the lack of safe methods are worsening,” she says.



Department of Medicine Solna (MedS)

Science in immunology and pulmonary diseases: The groups of Magnus Sköld, Susanne Gabrielsson, Johan Grunewald, Marianne van Hage, Åsa Wheelock and Gunnar Nilsson, are working with research on lung diseases such as chronic obstructive pulmonary disease (COPD), sarcoidosis and asthma. These diseases are influenced by environmental pollution, smoking and lifestyle, and they try to understand the mechanisms of these diseases. Why do not all smokers get COPD or all who are exposed to nano- or microparticles sarcoidosis? Do some people have protective mechanisms that we can use in the treatment of these diseases? Can we change our lifestyle or environment to reduce allergy development?

Air pollution also causes diseases like asthma and COPD to become more difficult to control, and by understanding and treating these diseases we hope to reduce the environmental impact on these vulnerable patient populations.

Research in Dermatology and Venereology: Dermatological research benefits from multidisciplinary networks and cooperation; we are studying fundamental processes such as inflammation and cancer and all ages from infants to the aged. The skin represents our ultimate barrier and the need to manage and respond to all on the basis of future attacks, both microbial and toxic.

Unit for Infectious diseases: This unit is working to understand the development of antibiotic resistant bacteria, which is a global health problem of increasing proportions.

Research Division of Molecular Structural Biology: The division works on developing structural information to develop new drugs against pathogens such as tuberculosis.

Department of medical epidemiology and biostatistics (MEB)

The department works generally on environmental factors and health.

The group of Katarina Bälter works on sustainable lifestyle, and studies on the link between diet, nutrition, greenhouse gas emissions and health markers.



Department of microbiology, tumor and cell biology (MTC)

The department is working on vaccine development, antimicrobial resistance, and malaria elimination.

Malaria treatment and control: Scientists such as Hannah Akuffo, Mats Wahlgren, Anders Björkman, and Akira Kaneko work on different aspects of malaria such as novel malaria control strategies and the evolution of resistance to new antimalarial drugs.

Lars Engstrand Group: The work of our group aims at creating a scientific environment with a broad interdisciplinary approach to the interface between epidemiology and the microbiological, immunological and genetic aspects of chronic infectious diseases to clarify the pathogenic mechanisms and to improve the prospects for primary prevention. The main focus is *Helicobacter pylori* and gastro-duodenal disease.

Institute of Environmental medicine (IMM)

IMM perform research which is linked to the environment and sustainable development, for example because it has a clear multi - generation and fairness perspective, a focus on the future health threats and irreversible effects, clearly linked to exposures and changes in the environment, or health risks to vulnerable groups (local and global).

IMM's research mission is to study how the chemical and physical environmental factors affect human health. IMM's overall objective is to, by increasing the understanding of how environmental factors affect human health, prevent disease and ill health, contribute to improving people's health and quality of life and contribute to sustainable development. As with other departments at KI, IMM conducts research, research education and teaching in our disciplines (toxicology, physiology, epidemiology, occupational and environmental medicine and health risk assessment).

In addition, IMM is a specialized department with the task as a national expert body within the physical and chemical environmental medicine. The concept of environmental medicine is used in a broad sense and includes occupational health and lifestyle factors. As an expert body IMM advises authorities and provide a basis for action to help to ensure the health of present and future generations.

In a changing environment, with climate change, new challenges arise regarding chemical and physical health risks. New technologies, chemicals and materials are constantly being developed, not least to achieve energy efficiency (reduce carbon emissions and global warming), and to cure diseases. For a sustainable health the risks of these innovations must be assessed. IMM has a long experience of dealing with past environmental threats (dioxins, radon gas, metals, etc.) and therefore occupies a central role in the construction of the secure and sustainable chemical society.

IMM performs research that focuses on increasingly severe future threats such as health effects of climate change and of new chemicals and materials including nanomaterials. They also perform research on risks for future generations, such as effects of endocrine disrupting chemicals, as well as on environmental health risks in a global perspective.

Unit of Occupational Medicine: The goal of the research is to identify and prevent chemical, physical, ergonomic and psychosocial health risks in the work environment. The unit participates in the training of doctors, specialists in occupational and environmental medicine and other staff. The unit is closely linked to the Center for Occupational and Environmental Medicine (CAMM) at Stockholm County Council.

Unit of Work Environment Toxicology: The work aims to highlight areas that are central to the toxicological risk assessment, focusing on health and safety, indoor air quality and chemical accidents. One theme is acute effects and toxicokinetics.

Unit of Occupational and Environmental Dermatology: The research aims to increase the knowledge of work and environment related skin diseases, risk factors and prevention. The activities are interdisciplinary and based on epidemiological, experimental and clinical methodology.

Unit of Biochemical Toxicology: Activities include exposure and risk assessment, mechanisms and prevention with a focus on particularly cancer but also other health effects. An overall objective is to contribute to increased knowledge that could lead to more reliable risk assessments of chemicals and environmental pollutants, as well as preventive measures. Other current issues that we work with are chemicals synergies and gender differences in carcinogenesis. The unit is responsible for the risk assessments used as a basis for the Swedish occupational exposure limits in the workplace - Criteria for hygienic exposure limits.

Unit of Epidemiology: The unit's research focuses on developing the knowledge of how the risk of developing various diseases are influenced by factors in our environment and lifestyles, as well as interaction with genetic factors. The research focuses largely on the major diseases, such as cancer, cardiovascular disease and diabetes.

Unit of Intervention and Implementation Research (IIR) The unit conducts research on risk prevention and methods to promote health, work and achievement with a focus on the workplace. The research is interdisciplinary and supports the effective implementation of evidence-based practice in areas such as occupational health services. The research includes the identification of risk factors, the development and implementation of preventive and therapeutic interventions, and evaluation of the cost-effectiveness approach.

Unit of Cardiovascular Epidemiology: The research focuses on the importance of the environment and living habits for the emergence and progression of inflammatory diseases such as cardiovascular disease (CVD), rheumatoid arthritis (RA) and multiple sclerosis (MS), and how these factors interact with genetic factors and biomarkers.

Unit of Pulmonary and Airway Research: The unit's research focuses on the mechanisms underlying various forms of environmental impact on host defense against chronic lung diseases. Special attention is paid to chronic bronchitis and chronic obstructive pulmonary disease (COPD).

Unit of Environmental Epidemiology: The research spans a wide spectrum and includes studies on the health risks of air pollution and noise in the surrounding environment as well as risk factors for asthma and allergy in children. Molecular markers are increasingly used to study the synergies between environmental factors and genetic components, and to better characterize exposure and health effects. Several research projects are carried out in international cooperation and aims to strengthen the basis for environmental health risk assessment.

Several epidemiological studies are conducted on the health risks linked to air pollution, including the effects in the cardiovascular system and the respiratory tract. Cardiovascular effects of traffic noise are also examined, especially the interaction with other environmental

factors. Extensive research highlights the risk factors for asthma and allergy in children, among other things, based on a large birth cohort (BAMSE).

Unit of Metals and Health: Exposure to toxic metals, such as arsenic, cadmium, mercury and lead, represent real public health problems, both globally and in Sweden. Exposure usually occurs through drinking water and food. The unit's research is translational in order to improve health risk assessments and preventive public health work. Epidemiological studies, mainly in the mother/child cohorts and at-risk adults, combined with studies of mechanisms of action and sensitivity factors such as gender, genetics and nutrition. The focus is on long-term effects of exposure early in life. The subjects to be studied, particularly arsenic, cadmium, mercury, manganese, lithium and boron, is often found in drinking water and food, including children's food.

Unit of Molecular Toxicology: The field of nano- toxicology studies toxicity and its underlying mechanisms, including carbon nanotubes and graphene, but also other nanomaterials with potential medical applications. The main direction refers to the immune toxicity and genotoxicity of various synthetic nanomaterials, including possible endocrine disrupting effects of nanomaterials. The unit's research aims to identify and characterize the molecular and biochemical processes induced by exposure to toxic substances, not least nanomaterials.

Nutritional Epidemiology Unit: The goal of our research is to understand the relationship between diet and other lifestyle habits and disease risks. By examining the environmental and behavioral, genetic and epigenetic factors influencing the onset of chronic disease, we contribute to the overall objective of IMM and may find new approaches for prevention. In recent years, the goal has expanded to include dietary content of pollutants and their potential effects on health.

Department of Neurobiology, Care Sciences and Society (NVS)

Society: The research is interdisciplinary and includes methods, knowledge and researchers from different disciplines. The research includes the environmental and social changes affecting the development of health at individual, group or community level, and strategies of the various actors in a welfare society to promote health and to help people experience physical, mental and social well-being. This includes studies how people with illness, injury or disability manage their everyday life, work and leisure, and the importance of physical exercise on health. Studies in epidemiology and public health are included to understand how genetic heritage and environment interact to affect disease development.

Department of Neuroscience

At the Dept of Neuroscience, scientists in the Ceccatelli's group are engaged in several projects related to various aspects of sustainability and environmental awareness, e.g. effects of stress hormones on neural cell fate and long-lasting consequences of adverse prenatal factors, and the studies of a novel approach to choose the best individual antidepressant treatment. They also develop new techniques to study neurotoxicity, involving Zebrafish as an alternative model for developmental studies, and human pluripotent stem cells (IPSC) to assess neurotoxicity.

At the Swedish Medical Nanoscience Center at the Dept of Neuroscience, scientists are engaged in a broad range of projects related to various aspects of sustainability and environmental awareness:

- In a collaboration with KTH, devices for antibiotic susceptibility testing for rapid establishment of the bacterial resistance phenotype are developed. This will aid the physician in selecting the correct antibiotic from start, and therefore lower the use of broad-spectrum antibiotics. This in turn will lower the environmental pressure on development of antibiotic resistant strains.
- Microbiology goes nano. Transforming traditional microbiological techniques to the nanoscale will reduce the consumption of antibiotics 100-1000 fold depending on experiment.
- Smart materials to modulate bacterial biofilm formation. This project has a very wide applicability, ranging from coatings of catheters, stents, implants, etc. in the health care sector, to industrial applications. The latter includes microbial fuel cells for energy production, waste water treatment, anti-fouling materials in industrial settings, such as pipes etc.
- Renewable biomasses. We develop methods for specific characterisation of carbohydrate compositions in renewable biomaterials (collaboration with scientists at KTH).
- Pulp-and-paper industry: methods are being developed for real-time quality control of pulp production. As this involves cellulose, this project is also highly relevant for the textile industry (re-use cotton from old clothes to produce viscose, which can be used as new textile).

SWETOX

Swetox research started in 2014 including the EDC-2020 project. This Formas-funded project is developed to meet future regulatory and societal demands on endocrine disrupting chemicals, through research on real and potential endocrine disrupting chemicals and their effects.

Besides endocrine disruptors are nano-safety and drug toxicology and environmental effects of priority research within Swetox. Swetox also monitors environmental and health issues raised by science and society and act upon them when needed.

A central theme within Swetox is to develop methods and develop new models to better assess and anticipate how certain chemicals affect humans and the environment.

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