

# FROM COMMUNICABLE TO NONCOMMUNICABLE DISEASES AND INJURIES

## Teaching about noncommunicable diseases in low- and middle-income countries: A student-led and easy-to-implement educational module

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**Background:** Health conditions in low- and middle- income countries (LMICs) are becoming more like those in developed countries, with noncommunicable diseases (NCDs) rising rapidly and infectious diseases declining. Driven by changes in lifestyle related to shared risk factors such as high dietary sodium consumption, physical inactivity, and alcohol and tobacco use, the surging burden of NCDs in LMICs demands attention that is wanting in public health and medical curricula. Therefore, this module was designed to help health profession students acquire the knowledge and skill sets necessary to plan and execute a policy or program to address NCDs in LMICs, a valuable foundation that will be applicable in their future careers.

**Structure/Method/Design:** The NCDs module consisted of a two-part, 5-week experience nested into a pre-existing global health course for Yale medical, public health (PH), nursing, and physician assistant (PA) students. Part 1 consisted of four lectures from multidisciplinary speakers: a physician working to build NCD research capacity and infrastructure in LMICs; a health communications specialist tailoring campaigns to promote behavioral change; an advocacy manager focused on putting NCDs on the global policy agenda; and a physician developing kidney disease programs in developing countries worldwide. The second part of the module consisted of a parallel student project. Students utilized knowledge and skills learned from the speakers to research and present sustainable, targeted NCD interventions. These interventions were required to be both cost-effective and feasible in the local context. We assessed the impact of the module using matched pre-and post-module surveys designed to assess the knowledge, skills, and attitude objectives regarding NCDs.

**Results (Scientific Abstract)/Collaborative Partners (Programmatic Abstract):** Not applicable

**Summary/Conclusion:** Forty-three students completed the pre- and post-module surveys (9 medical students, 3 PA, 2 nursing, and 29 PH students). Prior to the module, students rated their exposure to NCDs in resource-limited settings as moderately low to moderate. Divided into 12 groups, students completed projects on topics of their interest, such as “Type II Diabetes in Nicaragua: Management and Prevention” and “Indoor Air Pollution: Challenges in Rural China.” Post-module surveys indicated significant improvement across all 24 knowledge and skills objectives regarding NCDs. Notably, students gained knowledge in using epidemiological data in the cultural context to tailor interventions to affect sustainable change ( $P < 0.001$ ) as well as skills in analysis ( $P < 0.001$ ) and feedback of NCD programs ( $P < 0.001$ ). Finally, students’ overall satisfaction with the module was rated as moderately high.

This well-received, easily implemented, student-led module addresses a growing burden in global health and serves as a model to incorporate this topic into health care training at other institutions.

## Evaluation of Surinamese medicinal plants for their potential influence on angiogenesis in embryos of the zebra fish *Danio rerio*

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**Background:** Preparations from the aerial parts of the true aloe Aloe vera (L.) Burm.f. (Xanthorrhoeaceae), the wild sage Lantana camara L. (Verbenaceae), and the bitter melon Momordica charantia L. (Cucurbitaceae); the leaves of the Chinese cinnamon Cinnamomum cassia (Nees & T. Nees) Farw (Lauraceae); the bark and young leaves of the guava Psidium guajava L. (Myrtaceae); and the roots of the eggplant Solanum melongena L. (Solanaceae) are popularly used in Suriname for treating wounds. In this study, aqueous extracts from these plants have been evaluated for their potential to influence angiogenesis. To this end, the extracts were assessed for their effects on the regeneration of the amputated caudal tail fin, as well as total sub-intestinal vessel and body length of zebra fish embryos.

**Structure/Method/Design:** Embryos from wildtype (AB) and Tg(fli1a:EGFPy1)/+ zebra fish of which the caudal tail fin had been amputated, were exposed to serial dilutions of the plant extracts between 10<sup>-7</sup> and 10<sup>-4</sup> g/mL. The effects of the extracts on the regeneration rate of the caudal fin were determined at 48 hours post-fertilization (hpf) by comparing the longitudinal distance of the fin growth with that of sham-operated embryos. In parallel, the plant extracts were assessed at the indicated concentrations at 96 hpf for their effects on the total sub-intestinal vessel and body length of the embryos by examination under a stereomicroscope and a fluorescence microscope, respectively, followed by processing of the data with the Axiovision 4.8.1 software, and comparison with untreated controls.

**Results (Scientific Abstract)/Collaborative Partners (Programmatic Abstract):** Up to 10<sup>-4</sup> g/mL, none of the plant extracts improved the regeneration rate of the amputated caudal fin or increased total sub-intestinal vessel or body length of the zebra fish embryos. On the contrary, exposure of the animals to the L. camara extract at 10<sup>-5</sup> and 10<sup>-4</sup> g/mL led to a decrease of the total sub-intestinal vessel length of more than 50% and almost 100%, respectively.

**Summary/Conclusion:** None of the plant extracts evaluated in this study displayed wound healing or pro-angiogenic properties under the experimental conditions applied. However, the L. camara preparation may possess interesting anti-angiogenic characteristics. Cell culture studies to verify this suggestion using human umbilical vein endothelial cells are in preparation.

## Helminthiasis in Bocas del Toro, Panama—NGO patient records as an indicator of broader health-burden trends

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**Background:** Floating Doctors (FD) is a 501(c)(3) non-profit organization that provides free medical care to difficult-to-reach indigenous (Ngobe) populations in Bocas del Toro, Panama. FD partners with students and physicians throughout the United States and the world to bring their patients quality medical care. The Ngobe communities served by FD lack accurate population and health data, which makes determining burden of disease in these regions challenging. Analysis of FD’s patient database may reveal broader health trends in these unserved communities.

**Structure/Method/Design:** All 2968 entries in the FD electronic database containing complete demographic and health data for

patients seen since 2010 were included in this study. The burden of disease, measured as the ratio of unique diagnoses per total patient encounters, was determined. Prevalence of intestinal helminthiasis, representing the greatest burden to the total patient population, was compared between 25 communities using bivariate and multivariate analysis.

**Results (Scientific Abstract)/Collaborative Partners (Programmatic Abstract):** FD patient records over the past 2 years indicate that intestinal helminthiasis represents the greatest perceived health burden in all 21 Ngobe communities visited, with 32% (95% CI,  $\pm 5.99$ ) of patients seeking treatment for worms, while non-indigenous patients present with worms in only 10% (95% CI,  $\pm 4.53$ ) of 421 consultations. Integrating the data from each community into geographic information systems (GIS) has allowed for meaningful graphic data presentation.

**Summary/Conclusion:** The overwhelming burden of helminthiasis is well known to FD clinicians and quantifying this burden in each community has provided both FD and the local Ministry of Health with an improved understanding of 1) geographic distribution of helminth burden, 2) the effectiveness of individual anthelmintic programs, and 3) regions that may require novel anthelmintic approaches.

As a consequence of this research and the partnership between Floating Doctors, US medical schools, and local Ministry of Health, a group of first-year medical students from Stony Brook University will be conducting a fecal sample study in the indigenous town of Norteno this summer. In addition to identifying the types of helminths burdening the community they will coordinate with the school's principal, teachers, and Peace Corps volunteer to implement a helminth education curriculum. This winter MD and MPH students will also be applying for a grant to install a Pan-American Health Organization (PAHO) chlorine filtration system for Norteno's largest aqueduct.

### Risk and prevalence of vertebral fractures among breast cancer survivors in China

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**Background:** Osteoporotic fractures lead to significant morbidity and mortality worldwide. Women with breast cancer (BC) are at high risk for fracture due to the deleterious impact of BC therapies on bone density. In China, BC survival is improving as screening, diagnosis and treatment programs expand, however, the long-term impact of BC therapy on fracture risk among Chinese women remains unknown and no guidelines exist to prevent BC treatment-induced bone loss. We designed a pilot study to evaluate the scope of this problem among BC survivors at a large cancer referral hospital in Beijing.

**Structure/Method/Design:** BC survivors receiving care at the Cancer Institute and Hospital of the Chinese Academy of Medical

Sciences between April and December 2013 were invited to participate. Women between 50 and 70 years of age were eligible if they had initiated treatment for BC at least 5 years prior to enrollment, and had no evidence of metastatic bone disease. Study procedures included a self-administered questionnaire regarding risk factors for and personal history of fracture and a thoracolumbar x-ray to assess for presence of vertebral fractures (VF).

**Results (Scientific Abstract)/Collaborative Partners (Programmatic Abstract):** 100 women were enrolled with a mean age of  $57 \pm 5$  years, and BMI of  $26.6 \pm 4.8$  kg/m<sup>2</sup>. Mean years since BC diagnosis was  $6.0 \pm 0.8$ . The majority of cases were stage I or II at diagnosis (79.2%) and estrogen and/or progesterone receptor positive (87%). In total, 12 VFs were identified via thoracolumbar x-ray. In terms of fracture risk, average reported lifetime height loss was  $1.7 \pm 1.1$  cm, 11% reported a parental history of fracture, 9% reported a personal history of fracture, and 22% of women reported falling within the past year. Forty-five percent of all participants reported taking calcium supplements, but only 4% reported taking vitamin D supplements. Only 25% of women reported having a bone density scan since being diagnosed with BC and 14.4% had been diagnosed by a physician with low bone density or osteoporosis.

**Summary/Conclusion:** Prevalence of VF among our cohort of Chinese BC survivors was 12%, much higher than recently reported rates among age-matched healthy Chinese women in Beijing of less than 5%. Chinese women undergoing BC therapy should be routinely evaluated for osteoporotic fracture risk. Larger studies are necessary to identify sub-groups at particularly high risk in order to inform screening and prevention guidelines.

### Design of the Dhulikhel Heart Study (DHS): The epidemiology of emerging cardiovascular disease in Nepal

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**Background:** The burden of disease in developing countries is shifting from infectious to noncommunicable diseases with devastating consequences to public health. As in most of the developing countries Nepal is currently experiencing a rapid growth in cardiovascular disease (CVD) but there is little community-based data available to measure its impact and track trends. The Dhulikhel Heart Study (DHS), based out of Dhulikhel Hospital, Kathmandu University, was designed to address this need by providing comprehensive data using standardized protocols to evaluate CVD prevalence, incidence, and risk factors.

**Structure/Method/Design:** The DHS is a prospective, longitudinal cohort study targeting all adults age  $\geq 18$  years and residing in the town of Dhulikhel, in central Nepal, for a baseline examination and planned 20-year follow-up. The home visit includes collection of informed consent, demographic and socio-economic characteristics, medical history, health behaviours, physical and cognitive function,