11   Poteat T, Hanna DB, Rebeiro PF, et al. Characterizing the human immunodeficiency virus care continuum among transgender women and cisgender women and men in clinical care: a retrospective time-series analysis. *Clin Infect Dis* 2020; **70:** 1131–38.

12   Reisner SL, Moore CS, Asquith A, et al. High risk and low uptake of pre-exposure prophylaxis to prevent HIV acquisition in a national online sample of transgender men who have sex with men in the United States. *J Int AIDS Soc* 2019; **22:** e25391.

13   US Centers for Disease Control and Prevention. Estimated HIV incidence and prevalence in the United States, 2010–2016. *HIV Surveillance Supplemental Report* 2019; **24:** 1–89.

14   McCree DH, Walker T, DiNenno E, et al. A programmatic approach to address increasing HIV diagnoses among Hispanic/Latino MSM, 2010–2014. *Prevent Med* 2018; **114:** 64–71.

15   Martinez O, Lopez N, Woodard T, Rodriguez-Madera S, Icard L. Transhealth Information Project: a peer-led hiv prevention intervention to promote HIV protection for individuals of transgender experience. *Health Soc Work* 2019; **44:** 104–12.

16   Wood S, Gross R, Shea JA, et al. Barriers and facilitators of PrEP adherence for young men and transgender women of color. *AIDS Behav* 2019; **23:** 2719–29.

17   Martinez-Velez JJ, Melin K, Rodriguez-Diaz CE. A preliminary assessment of selected social determinants of health in a sample of transgender and gender nonconforming individuals in Puerto Rico. *Transgend Health* 2019; **4:** 9–17.

18   Cashman SB, Adeky S, Allen AJ, et al. The power and the promise: working with communities to analyze data, interpret findings, and get to outcomes. *Am J Public Health* 2008; **98:** 1407–17.

19   Ginther DK, Schaffer WT, Schnell J, et al. Race, ethnicity, and NIH research awards. *Science* 2011; **333:** 1015–19.

20   Hoppe TA, Litovitz A, Willis KA, et al. Topic choice contributes to the lower rate of NIH awards to African-American/black scientists. *Sci Adv* 2019; **5:** eaaw7238.

21   Bauer MS, Damschroder L, Hagedorn H, Smith J, Kilbourne AM. An introduction to implementation science for the non-specialist. *BMC Psychol* 2015; **3:** 32.

22   Sutton MY, Martinez O, Brawner BM, et al. Vital voices: HIV prevention and care interventions developed for disproportionately affected communities by historically underrepresented, early-career scientists. *J Racial Ethn Health Disparities* 2020; published online Oct 30. https://doi.org/10.1007/s40615-020-00908-2.

23   Martinez O, Fernandez MI, Wu E, et al. A couple-based HIV prevention intervention for Latino men who have sex with men: study protocol for a randomized controlled trial. *Trials* 2018; **19:** 218.

24   Rodriguez-Diaz CE, Ortiz-Sanchez EJ, Vargas-Molina RL, Jovet-Toledo GG, Santiago-Rodriguez EI. Feasibility, acceptability, and preliminary efficacy of a stigma management intervention for Spanish-speaking HIV-positive gay, bisexual, and other men who have sex with men. International AIDS Conference, Durban, South Africa, July 18–22, 2016 (abstr TUPED443).

25   Rhodes SD, Mann-Jackson L, Alonzo J, et al. ENGAGED for CHANGE: a community-engaged process for developing interventions to reduce health disparities. *AIDS Educ Prev* 2017; **29:** 491–502.

26   Moctezuma G, Guan S. Socioeconomic disparities associated with awareness, access, and usage of pre-exposure prophylaxis among Latino MSM ages 21–30 in San Antonio, TX. *J HIV AIDS Soc Serv* 2019; **18:** 206–11.

Roll-out of the Global Burden of Animal Diseases programme

With continuing population growth and rising demand for food, livestock and aquaculture are integral to improving food and nutrition security, health, and livelihoods.[1] These positive contributions are being undermined, however, by the negative effects of livestock production and consumption on society and the environment—eg, production of greenhouse gases, environmental degradation,[2] emergence of zoonotic diseases,[3] and antimicrobial resistance.[4] Furthermore, excessive consumption of some livestock products is linked to risk of non-communicable diseases.[5]

There is little evidence available for addressing these concerns through improving livestock production and animal health systems, and no systematic approach to understanding global livestock populations and the resources invested in animals by societies globally. Knowledge of the major constraints on livestock productivity and the means to address them are insufficient, and there is a need for robust assessments of the impact of livestock on food security, disease risks, and climate change. In 2018, the Global Burden of Animal Diseases (GBADs) programme was launched to address these vital issues.[6]

Since that time, we have made progress in developing a comprehensive framework for characterising livestock populations and assessing the value invested in livestock, as well as a system to capture net losses in production and societal expenditure on animal health issues (figure). The GBADs programme recognises that many animal health problems are related to production and nutrition issues that need to be resolved in a socioeconomic context.

An important organisational development has been the integration of the World Organisation for Animal Health (OIE) within the leadership of the GBADs programme. This role acts upon OIE's 2016 resolution[7] to improve understanding of the economic impacts of animal diseases and gives an important institutional platform to the GBADs programme. Through existing OIE partnerships, GBADs will strengthen links with the Food and Agriculture Organization of the UN, WHO, and the International Livestock Research Institute.
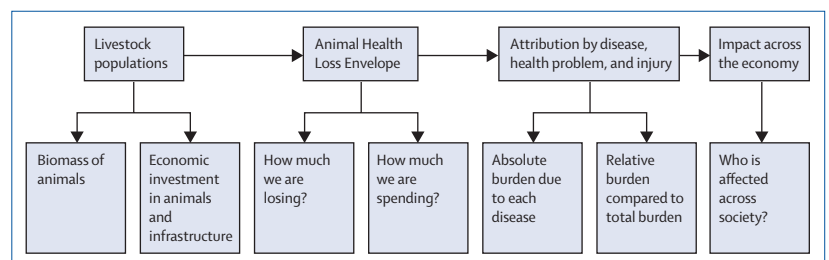
Figure: Core structure of the framework for the Global Burden of Animal Diseases programme

GBADs will focus initially on making global estimates of animal disease burdens; over time, this will be strengthened with in-depth country, disease, and sector-level studies. The GBADs programme now has strong engagement with research groups in Australia, Ethiopia, Indonesia, Mexico, the Netherlands, Norway, Ireland, and the UK and is developing national case studies in those locations. The team has engaged with multinational companies involved in pharmaceuticals, livestock production, and data management in livestock systems.

The GBADs programme has themes that will describe where, how, by whom, and why animals are kept in populations and production systems. This theme will generate and integrate information on the biomass contained in livestock populations[8,9] and estimate the level of investment in animals and the infrastructure used to manage them. Levels of production will be compared with a state with no disease and perfect health and nutrition to estimate an Animal Health Loss Envelope (AHLE). Adapting methodology from the Global Burden of Disease Study,[10] the AHLE will then be attributed to specific causes through animal health ontology and attribution. The AHLE will account for loss and expenditure at farm level, and will calculate the impacts of lost animal health in the wider economy and trade and on human health. To support the latter, we will collaborate closely with the Institute for Health Metrics and Evaluation and WHO. The GBADs programme's themes will be supported by engagement with governments, the private sector, and non-governmental organisations. Additionally, education programmes will be established that provide a global knowledge framework to assess the effects of animal disease and health problems in livestock. In this way, GBADs will provide information to public and private sector decision makers, adding value to their management of animal health and welfare.

Climate change and pandemic disease are two of the major threats facing humanity, threats with which livestock are closely entwined. The GBADs programme team is committed to a better understanding of our livestock systems and of their positive and negative impacts on society and the environment locally, globally, and nationally. There is an urgent need to develop intelligence systems able to improve decision making for people managing livestock to limit the environmental consequences and public health risks related to livestock production and consumption, while also helping people across the world access high-quality protein and micronutrients, produced in a humane way.

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1   Mehrabi Z, Gill M, Wijk M, et al. Livestock policy for sustainable development. *Nature Food* 2020; **1:** 160–65.
2   Livestock, Environment and Development Initiative, Food and Agriculture Organization of the United Nations. Livestock's long shadow: environmental issues and options. Rome: Food and Agriculture Organization of the United Nations, 2006.
3   Jones BA, Grace D, Kock R, et al. Zoonosis emergence linked to agricultural intensification and environmental change. *Proc Natl Acad Sci USA* 2013; **110:** 8399–404.
4   Woolhouse M, Ward M, van Bunnik B, Farrar J. Antimicrobial resistance in humans, livestock and the wider environment. *Philos Trans R Soc Lond B Biol Sci* 2015; **370:** 20140083.
5   GBD 2017 Diet Collaborators. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2019; **393:** 1958–72.
6   Rushton J, Bruce M, Bellet C, et al. Initiation of Global Burden of Animal Diseases Programme. *Lancet* 2018; **392:** 538–40.
7   OIE. Resolutions adopted by the World Assembly of delegates of the OIE during its 84th General Session: 22–27 May, 2016. Paris: OIE World Organisation for Animal Health, 2016.
8   Rothman-Ostrow P, Gilbert W, Rushton J. Tropical livestock units: re-evaluating a methodology. *Front Vet Sci* 2020; **7:** 973.
9   OIE. OIE Annual report on antimicrobial agents intended for use in animals (fourth report). Paris: OIE World Organisation for Animal Health, 2020.
10   GBD 2019 Risk Factors Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; **396:** 1223–49.