From: "William B. Karesh" <karesh@ecohealthalliance.org>
Sent: 02/02/2017 1:37:12 PM (-08:00)
To: "Terra Kelly" <trkelly@ucdavis.edu>; "Jonna Mazet" <jkmazet@ucdavis.edu>
Cc: "Predict@ucdavis.edu" <Predict@ucdavis.edu>; "Chris Johnson" <ckjohnson@ucdavis.edu>; "Tracey Goldstein" <tgoldstein@ucdavis.edu>
Subject: Re: Meeting with Charles - FAO

Thanks so much Terra.

This may end up being like their efforts with IDENTIFY in EPT-1: years of discussions ending with a slow grind to the finish line.

Jonna, not sure if you have a chance to discuss with Alisa, but I'm guessing Andrew will be at the Rome meeting. It's after our next SM call, so maybe we can put it on the agenda (FAO Pivot) and raise the subject again.

BK

William B. Karesh, D.V.M
Executive Vice President for Health and Policy

EcoHealth Alliance
460 West 34th Street - 17th Floor
New York, NY 10001 USA

+1.212.380.4463 (direct)
+1.212.380.4465 (fax)
www.ecohealthalliance.org

President, OIE Working Group on Wildlife

Co-chair, IUCN Species Survival Commission - Wildlife Health Specialist Group

EPT Partners Liaison, USAID Emerging Pandemic Threats - PREDICT-2 Program

> On Feb 1, 2017, at 11:56 PM, Terra Kelly <trkelly@ucdavis.edu> wrote:
>
> Hi Billy,
>
> Bel, our PREDICT Ghana Country Coordinator, met with Charles Bebay and Sophie (FAO-Rome) today in Accra. I gather from his message below that they are still not sure whether they will be conducting EPT-2 activities in Ghana and that we may know more here in a few weeks after

a meeting in Rome. Jonna and I are traveling to Accra the week of Feb. 20th and will have an opportunity to touch base with Charles at that time.

Thanks,
Terra
---------- Forwarded message ----------
From: **Sammuel BELNONO** <REDACTED
Date: Wed, Feb 1, 2017 at 4:22 PM
Subject: Meeting with Charles - FAO
To: Terra Kelly <trkelly@ucdavis.edu>, Joseph Adongo AWUNI <REDACTED>,
"Dr. Richard D. Suu-Ire" <REDACTED>

Dear all, I was at Alisa Hotel this afternoon to meet Charles. FAO was at workshop with some of its staff and partners and I therefore had to wait for a coffee break to talk to Charles and Sophie from FAO office in Rome. According to Sophie, FAO had funding for Influenza and GHSA focused zoonotic diseases which had Ebola as its focus earlier on. This has however been re-oriented to focus on priority zoonotic diseases.

The issue of FAO and EPT is currently being discussed and meetings are being held with country teams. A global meeting is scheduled for 15 February 17 in Rome after which a clear decision would be taken with regards to FAO's role in the surveillance programme of EPT.

She also said FAO plans to talk with Predict at the Global level on collaboration in the EPT project in countries and that she was not in a position to say what the situation would be with respect to Ghana now. So she advised partners at the country levels to continue to talk while the matter is still being discussed.

Charles informed me that Frederica will return next week and that Predict Ghana should continue to talk with her while the matter was being looked at in Rome.

Since they were at a workshop and had only 15minutes to talk with me, not much could be discussed further and they had to return to session.

In effect, the matter should be monitored at the global level since Sophie said the matter would be discussed with Predict Global.

From: predict-request@ucdavis.edu on behalf of "Amanda Fine" [REDACTED]
Sent: 02/12/2017 10:32:55 PM (-08:00)
To: "William B. Karesh" <karesh@ecohealthalliance.org>; "Jonna Mazet" <jkmazet@ucdavis.edu>; "Tracey Goldstein" <tgoldstein@ucdavis.edu>; "Chris Johnson" <ckjohnson@ucdavis.edu>
Cc: "Sarah Olson" [REDACTED]; "Enkhtuvshin Shiilegdamba" [REDACTED]; "predict@ucdavis.edu" <predict@ucdavis.edu>
Subject: [predict] Re: URGENT - Re: PREDICT Management Team call scheduled for 2/13 10am PST/1pm EST

Thanks Billy. To answer the question about the delay in testing, please let Andrew know that this is the central government veterinary laboratory so the same one that responded to the PPR outbreak in livestock in the fall of 2016 and is now responding to the outbreak in saiga antelope and the additional testing of livestock given that transmission post vaccination in livestock is occurring. We do plan to export these PCR products to UCD so that there are no delays in the sequencing work and to confirm this first round of PREDICT testing at SCVL.

Cheers,

Amanda

On 2/13/17 12:23 PM, William B. Karesh wrote:

> Dear All,
>
> I edited Sarah's document slightly for clarity and taking into account Amanda's email and attached it here. I think I will have cell phone coverage later today at the camp we are staying at in South Africa, but just in case I can not get on the call, maybe one of you can report this to Andrew.
>
> I am not comfortable sharing the written report with USAID until we have results confirmed and approved by the Mongolian government for release. So, I suggest just an oral report out of the status on the SM call.
>
> In any case, I changed the last line to 10% "positivity" and mentioned "PCR Products" since we are not really sure what the early results mean. I also extrapolated the 10% to mean you have only tested 500 samples.
>
> I'm not sure if it is possible to speed things up a bit, but Andrew is always interested in AI, and that is the only expectation from USAID's investment in Mongolia. So, he might ask why testing from last spring or this past fall is not further along. On the other hand, he might just be really happy that the work has begun.
>
> Thanks for the quick response!!
>
> Billy

--
Amanda E. Fine, VMD, PhD
Wildlife Health Program Associate Director - Asia
Wildlife Conservation Society (WCS)
REDACTED

From: onehealthnextgen-request@ucdavis.edu on behalf of "Giles Sioen" <giles.sioen@futureearth.org>
Sent: 08/13/2020 9:33:06 PM (-07:00)
To: "Vipat Kuruchittham" <vipat@seaohun.org>
Cc: "Catherine Machalaba" <machalaba@ecohealthalliance.org>; "Fumiko Kasuga" <fumiko.kasuga@futureearth.org>; "Ratsuda Poolsuk" <ratsuda@seaohun.org>; "Peter Daszak" <daszak@ecohealthalliance.org>; "Kevin Olival" <olival@ecohealthalliance.org>; "Tracey Goldstein" <tgoldstein@ucdavis.edu>; "Alison Andre" <andre@ecohealthalliance.org>; "OHW NG" <ohw-ng@seaohun.org>; "onehealthnextgen Sympa List" <onehealthnextgen@ucdavis.edu>; "Josh Tewksbury" <josh.tewksbury@futureearth.org>; "Olesya Kochkina" <olesya@seaohun.org>
Subject: [onehealthnextgen] Re: Belmont Forum "Climate, Environment and Health"- Scoping Process for Asia

Dear Pat and all

Thank you for your inputs here and my sincere apologies for the silence until now while I was trying to get a better grasp of the situation. I have to clarify that the current phase is still preliminary before the formal scoping work will begin; however, it seems the timing around COVID-19 is causing several delays. As things move forward very slowly, I think the information we have gathered until now has been extremely useful and we can continue to keep our eyes and ears open for potential events and partners so that we can engage efficiently when things speed up again.

Looking forward to continued talks in the near future!

Best wishes
Giles

On Mon, Jul 27, 2020 at 2:59 PM Vipat Kuruchittham <vipat@seaohun.org> wrote:

> Dear Giles,
>
> Thank you for the background information. I or SEAOHUN Secretariat is pleased to support and facilitate the engagement with our group of universities from 8 Southeast Asian countries. I will be happy to connect in the week of 10 August or after. I am happy to find time if it is urgent for us to connect.
>
> As for the events, I can share some details on the GHSA Ministerial Meeting as I am involved in one of the working groups. The GHSA Ministerial Meeting will go virtual on 19-20 November 2020 (tentative). The save-the-date should be announced on https://ghsagenda.org/ soon. There will be a call for side meetings for the group to conduct virtually using the platform given by the organizer. Then, each side meeting will present its summary on 18 November (Day 0) to be further summarized and presented to the Ministerial Meeting on Day 1.
>
> A conference you may consider is the Global Health Security Conference on 22-25 June 2021 in Australia (https://www.ghsconf.com/).
>
> A big event that has been posted from 2020 to 2021 is the 20th International Congress for Tropical Medicine and Malaria (https://ictmm2020.org/). It is now scheduled for 17-21 August 2021 in Bangkok.
>
> Best regards,
>
> Pat
> ---

Vipat Kuruchittham, PhD
Executive Director

On Mon, Jul 27, 2020 at 8:28 AM Giles Sioen <giles.sioen@futureearth.org> wrote:

Dear Catherine, thank you for the very valuable introduction to Pat and Tuck from SEAOHUN!

Dear Pat,

It's a pleasure to meet you and thank you very much for the helpful background information. My name is Giles Sioen and I am a Science Officer/Interim Lead for Research and Innovation based at Future Earth's Japan Global Hub. My main activity among others is supporting theHealth Knowledge-Action Network (Health KAN) and I work with Fumiko Kasuga, our Global Hub Director in Japan who has a strong health background. Josh Tewksbury, who is the Global Hub Director in the US is also very much engaged in this process. Our Knowledge-Action Networks bring together academia, policy, business, civil society and more to address the world's most pressing sustainability challenges. Several of the Health KAN Steering Committee members, such as Peter Daszak, have a One Health approach and are also part of the oneHEALTH Global Research Project.

Most recently, the Belmont Forum approached us to support the second scoping activity for the call on Climate, Enviornment and Health (first one can be found here). The first round was fully facilitated by the Development team of the Health KAN and had a global focus. This time around, they are aiming for a more inclusive and improved process, including partnership building in the various regions. Several organizations have been approached and Future Earth was specifically requested to support the Asia region. Most recently, we had the first call with our contacts from across the region and this is where we think your added expertise in the region will be extremely valuable for a more comprehensive scoping of the important topics in the region.

At this stage, we are building the network and still looking for some preliminary information to better plan this task. For this purpose, it would be extremely helpful to tap into your expertise and knowledge about relevant planned online events in the region where we can potentially organize a side-event (see table below). Furthermore, it would be helpful if your network is aware of some country-specific priorities in the region. General research needs/ questions? And key actors you think should be included in this process going forward.

Here are a few of the currently identified events:

Name of Event	Dates	Location	Weblink	POC
Prince Mahidol Conference (PMAC)	January 2021	Thailand	http://pmac2021.com/site	
Global health ministerial conference		Thailand		
3rd Asia Pacific Conference and Meeting on Mental Health	8-9 October 2020	Singapore		
6th Global Public Health 2020	1-2 December 2020	Indonesia	https://health3000.org/	

Thank you very much in advance for your engagement. Your help is much appreciated. If you are happy to further support this process then I will add your contact information to the key actor's list and I suggest we have a call so that we can align and better engage for the upcoming next steps (details are still to be determined).

Best regards and wish you a pleasant week
Giles

On Sun, Jul 26, 2020 at 1:14 AM Vipat Kuruchittham <vipat@seaohun.org> wrote:

> Dear Catherine, thank you very much for connecting us with Fumiko and Giles.
>
> Dear Fumiko and Giles,
>
> Established in late 2011, with support from the United States Agency for International Development (USAID), Southeast Asia One Health University Network (SEAOHUN) is a regional network of universities in Southeast Asia working together to build a sustainable and competent One Health workforce to address One Health issues. Its members comprise subject matter experts of multiple disciplines of One Health in 81 universities in 7 Southeast Asian countries: Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Thailand, and Vietnam. Myanmar will soon join SEAOHUN as the 8th country. SEAOHUN and its members aim to improve One Health workforce capacity with cross-sectoral competencies to effectively prevent, detect and respond to infectious disease threats. Currently, we are supported by the USAID One Health Workforce Next Generation project led by University of California Davis and its consortium including EcoHealth Alliance. You may learn more about us at https://www.seaohun.org/ or https://www.facebook.com/seaohun
>
> We will be pleased to provide inputs on priorities and also explore other possible areas of collaboration with your group.
>
> Best regards,
>
> Pat
> ---
> **Vipat Kuruchittham, PhD**
> Executive Director

On Mon, Jul 20, 2020 at 10:23 AM Catherine Machalaba <machalaba@ecohealthalliance.org> wrote:

> Dear Pat and Tuck,
>
> I wanted to make the connection with Dr. Giles Sioen and Dr. Fumiko Kasuga from the Future Earth hub based in Tokyo. They are supporting the scoping process in Asia for the Belmont Forum's 2nd Collaborative Research Action on Climate, Environment and Health (https://www.belmontforum.org). This is a funding mechanism to support transdisciplinary research partnerships.
>
> The scoping process is intended to gain input on funding priorities. I think the call for proposals will be released in April 2021 or later, but the scoping process has just started. SEAOHUN is a highly

relevant stakeholder group. Country eligibility to apply will ultimately depend on whether a country's science foundation signs on, so the list of countries has not yet been determined. I hope that several SEAOHUN countries will be eligible and SEAOHUN members will apply.

Fumiko and Giles may reach out to you over the coming months to participate in scoping calls or events. This is not intended to be time-intensive, but SEAOHUN's input will be valuable to inform the scope and focus of the call for proposals.

Fumiko and Giles: Dr. Vipat Kuruchittham is Executive Director and Ms. Ratsuda Poolsuk is Operations Manager for the Secretariat of the Southeast Asia One Health University Network, which has a membership of 70+ universities in Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand, The Philippines, and Vietnam. There are many exciting training and research initiatives through this network, contributing to workforce capacity strengthening and reinforcing many of the One Health coordination platforms that governments are establishing. Their office is in Chiang Mai, Thailand.

Thank you all very much!

Kind regards,
Catherine

Catherine Machalaba, MPH, PhD
Policy Advisor and Research Scientist

EcoHealth Alliance
520 Eighth Avenue, Suite 1200
New York, NY 10018

1.212.380.4472 (direct)
1.401.569.7371 (mobile)
1.212.380.4465 (fax)
www.ecohealthalliance.org

Immediate Past Chair, Veterinary Public Health Special Primary Interest Group, American Public Health Association

Program Officer, IUCN SSC Wildlife Health Specialist Group

Science Officer, Future Earth oneHEALTH Project

EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.

--
Giles Bruno SIOEN, Ph.D.
Interim Lead Research & Innovation
Science Officer
Future Earth
Research. Innovation. Sustainability.
Postdoctoral Fellow, Japan Society for the Promotion of Science
Institute for Future Initiatives (IFI)
The University of Tokyo

--
Giles Bruno SIOEN, Ph.D.
Interim Lead Research & Innovation
Science Officer

Future Earth
Research. Innovation. Sustainability.
Postdoctoral Fellow, Japan Society for the Promotion of Science
Institute for Future Initiatives (IFI)
The University of Tokyo

From: "Peter Daszak" <daszak@ecohealthalliance.org>
Sent: 01/16/2017 3:17:21 PM (-08:00)
To: "Jonna Mazet (jkmazet@ucdavis.edu)" <jkmazet@ucdavis.edu>
Subject: confidential
Attachments: NAM.docx
Importance: High

Hi Jonna,

I looked through Section 2 and there's no one in there who I know well or who knows me well. I've met Peter Palese a couple of times. I could reach out to him. There's Chen Zhu, who would probably support me if I could get to him, but he's a foreign member and also v. difficult to get hold of, so it's a long shot. The only other person is Tom Maniatis from Columbia who was involved in the GVP meeting at Columbia few months ago.

I think the right thing to do is for me to email Peter Palese and Tom Maniatis, tell them that you and Jim Hughes would like to support my nomination, cc'ing you on the email and see if they're willing to talk to you about co-nominating. Given the short turn-around, I think that's the only option right now…

Unless… are all of the people that I do know from Section 9 (yours and Jim's)? Could you check and if one of these isn't maybe they could be the co-nominator.

US members
- Enriqueta Bond
- Don Burke
- Arturo Casadevall
- Pat Conrad
- Michael P. Doyle
- Harvey Fineberg
- Baruch Fischhoff
- Roger Glass
- Jesse L. Goodman
- David Heymann
- Gerald Keusch
- Lonnie King
- Terry McElwain
- Michael Osterholm
- David Relman

Foreign members:
- Roy Anderson
- Sarah Cleaveland
- Andrew Haines, London School of Hygiene and Trop Med.
- Oyewale Tomori
- Chen Zhu

I've filled out my info, put down a draft statement etc. Let me know if none of the above would work and I'll email Peter Palese and Tom Maniatis, and hopefully you can get some movement from these folks - maybe with you and Jim, they might have some name recognition and want to help…

Cheers,

Peter

Peter Daszak
President

EcoHealth Alliance
460 West 34th Street – 17th Floor
New York, NY 10001

+1.212.380.4473 (direct)
+1.212.380.4465 (fax)
www.ecohealthalliance.org

EcoHealth Alliance leads cutting-edge research into the critical connections between human and wildlife health and delicate ecosystems. With this science we develop solutions that promote conservation and prevent pandemics.

Hi Peter,
If we're going to get you nominated this year, we better get moving. We need a primary nominator. Recall Jim suggested section 2: "Biochemistry, Cellular & Developmental Biology, Medical Microbiology and Immunology, Genetics" with cross-listing in bridging Section 9: "Public Health, Biostatistics, and Epidemiology". He agreed last year to be your co-nominator for Section 9, so I need you to give me someone in Section 2 who might carry the nomination.

OK what about the following:\

US members

- Enriqueta Bond
- Don Burke
- Arturo Casadevall
- Pat Conrad
- Michael P. Doyle
- Harvey Fineberg
- Baruch Fischhoff
- Roger Glass
- Jesse L. Goodman
- David Heymann
- Gerald Keusch
- Lonnie King
- Terry McElwain
- Michael Osterholm
- David Relman

Foreign members:

- Roy Anderson
- Sarah Cleaveland
- Andrew Haines, London School of Hygiene and Trop Med.
- Oyewale Tomori
- Chen Zhu

The 2017 Subject Emphasis is SOCIAL AND ENVIRONMENTAL DETERMINANTS OF HEALTH. So we will want your application to emphasize the following:
Identify candidates with expertise in the social, environmental, legal, and behavioral determinants of health in individuals and populations and health inequalities between groups and the biological processes that underlie them. Areas of expertise included, but are not limited to
i. Social determinants (e.g. social structures and economic/legal systems contributing to health inequities including: poverty, discrimination, gender, sexual orientation, education and job opportunities, social support, networks, and social interaction, cultural and religious influences)
ii. Environmental determinants (e.g. physical and built environments including: density, safety/crime/violence, transportation, toxic exposures)

iii. Health literacy
iv. Genetic interactions with social and environmental determinants of health
v. Development and testing of interventions and novel strategies to modify social, behavioral and environmental determinants of health

In addition, we will want the materials to take the following into consideration, in that the application must:
1. Convey this clearly: WHY SHOULD THE CANDIDATE BE AN NAM MEMBER?
a. The sections on sponsor statement, contributions (past/future), and citation are critical.
b. Identify candidate's impact in terms that are understandable to those less familiar with the field.
2. Avoid these common errors in the candidate's personal information:
a. Missing or excessive contact information
b. Missing demographic information
c. Incorrect date of birth, citizenship information
3. Avoid these common errors in nomination details:
a. Wrong section or subsection
b. Missing bridging section where applicable
c. Institutional affiliation of both sponsors is the same as the candidate (at least one must be from an entirely separate institution)
d. >10 (maximum allowed) bibliographic citations

In addition to a co-nominator, I will need the following information in a Word document:

CANDIDATE: Name, Credentials, Institution

Type of Nomination: Regular/66+/Intl Section/Subsection: (#)/(x) Bridging Section(s): (#)

Demographics: ⌡ Female o Racial & Ethnic Diversity

Caucasian, half-Ukrainian, quarter English, quarter Welsh

Geographic Location: [state/country] NY/USA Age: [effective October 1] 51

Subject Emphasis ⌡ Social and Environmental Determinants of Health

SPONSORS: Name, Institution
Name, Institution

PAST AND POTENTIAL CONTRIBUTIONS TO NAM:
[~6 lines]
Forum on Microbial Threats, member (2010-), chair-elect (2017-); Member, Forum on Microbial Threats workshop planning committees on vector-borne diseases (2014), global environmental change and infectious disease dynamics (2013), and briefing on H7N9 influenza and MERS-CoV (2013); Member, NAS-IOM Committees on "achieving sustainable global capacity for

surveillance and response to emerging diseases of zoonotic origin" (2008-9) and "National needs for research in veterinary science" (2004-5); Speaker at IOM workshops on rapid medical countermeasure response to infectious disease (2014), fungal diseases (2010), and H1N1 (2009); Reviewer, IOM report, Infectious disease movements in a borderless world (2009).

CITATION OF ACCOMPLISHMENT: (50 words)
Identified the animal origin and drivers of emerging viruses (SARS, Nipah, Hendra, MERS), mapped socioeconomic and ecological causes to identify global emerging disease hotspots. Won 2000 CSIRO medal for collaborative research, member of the Cosmos Club, Editor-in-Chief of EcoHealth, member and Chair-elect of the NASEM Forum on Microbial Threats.

PROPOSERS' STATEMENT:
[~13 lines]
Here's my short bio (very boastful). Please take what you can from that. Also, Jim mentioned I should highlight international reputation, but the form doesn't ask much about that. I've put some examples after brief bio…

Dr. Peter Daszak is President of EcoHealth Alliance, a US-based organization that conducts research and outreach programs on global health, conservation and international development. Dr. Daszak's research has been instrumental in identifying and predicting the impact of emerging diseases across the globe. His achievements include identifying the bat origin of SARS, identifying the underlying drivers of Nipah and Hendra virus emergence, producing the first ever global emerging disease 'hotspots' map, developing a strategy to find out how many unknown viruses exist that could threaten to become pandemic, identifying the first case of a species extinction due to disease, and discovering the disease chytridiomycosis as the cause global amphibian declines. Dr Daszak is a member and Chair-elect of the National Academy of Sciences, Engineering and Medicine's Forum on Microbial Threats, the NRC Advisory Committee to the US Global Change Research Program, the Supervisory Board of the One Health Platform, the One Health Commission Council of Advisors, the CEEZAD External Advisory Board, the Cosmos Club, the Advisory Council of the Bridge Collaborative; has served on the IOM Committee on global surveillance for emerging zoonoses, the NRC committee on the future of veterinary research, the International Standing Advisory Board of the Australian Biosecurity CRC; and has advised the Director for Medical Preparedness Policy on the White House National Security Staff on global health issues. Dr. Daszak is a regular advisor to WHO, OIE and FAO, and is actively involved in the WHO Expert group on Public Health Emergency Disease Prioritization. Dr Daszak won the 2000 CSIRO medal for collaborative research on the discovery of amphibian chytridiomycosis, is the EHA institutional lead for USAID-EPT-PREDICT, is on the Editorial Board of Conservation Biology, One Health, and Transactions of the Royal Society of Tropical Medicine & Hygiene, and is Editor-in-Chief of the journal Ecohealth. He has authored over 300 scientific papers, and his work has been the focus of extensive media coverage, ranging from popular press articles to television appearances.

PRIMARY FIELD & AREA OF SPECIALIZATION OR EXPERTISE:
[3 lines]

Infectious diseases, specializing in analyzing the underlying socio-economic and environmental drivers of infectious disease epidemics. Novel collaborative ('one health') approaches - designing modeling and analytical strategies to predict and prevent emergence and spread.

CURRENT EMPLOYMENT:
[up to 3]
President, CEO, and Chief Scientist, EcoHealth Alliance, a US based international non-profit conducting scientific research and outreach programs on emerging diseases globally, 2008-.

PRINCIPAL PREVIOUS EMPLOYMENT:
[up to 3]
Executive Director, Consortium for Conservation Medicine, 2001-2008
Faculty Postdoctoral Researcher, University of Georgia, 1999-2001
Guest Researcher, Centers for Disease Control and Prevention, 1999

RESIDENCIES OR FELLOWSHIPS:
[up to 5]

EDUCATION:
[up to 3, highest first]
Ph.D University of East London, UK, parasitology (1994)
B.Sc. (hons.) Bangor University, UK, Zoology with Applied Zoology (1987)

PRINCIPAL HONORS, AWARDS:
[~6 lines]
Robert Leader Endowed Lecturer, Michigan State Univ. (2015); Hsu-Li Distinguished Lectureship in Epidemiology, Univ. Iowa (2013); Elected member of the Cosmos Club, Washington DC (2012); honored with naming of a parasite (2012) and centipede (2001) species; Speaker at TEDMED; Presidential Lecturer, Univ. Montana (2008); Finalist, NIH Director's Pioneer Award (2007); Zayed Prize, authors of "Millennium Ecosystem Assessment" (2006); Silver Medal for collaborative research, CSIRO (2000); Meritorious service award, CDC (1999).

CURRENT MAJOR GRANT(s):
[~2 lines]
Institutional lead, USAID EPT2- PREDICT-2 Consortium ($118 million). Chief of Party, USAID RDMA IDEEAL ($2.5 million): how land use change drives infectious disease risk. PI, R01AI110964 ($3.1 million): how wildlife hunting and trade drives risk of SARS in China.

MAJOR NATIONAL LEADERSHIP POSITIONS, SOCIETIES AND BOARDS:
[~5 lines]
NRC Committee to advise the US Global Change Research Program (USGCRP); NRC review committee, National Climate Assessment report, 2015 & NEON report 2004; External Advisory Board, DHS CEEZAD; Supervisory Board, One Health Platform; Council of Advisors, One Health Commission; Editorial Board, One Health, Trans Roy Soc Trop Med Hyg, Conserv Biol;

Editor-in-Chief EcoHealth; Review panels for NIAID, NIH/NSF EEID, NIH IRAP, CDC; Steering committee NIAID workshops on bat viruses & viral zoonoses; briefed White House OSTP, Director for Medical Preparedness & Policy, and Pandemic Prediction and Forecasting STWG.

2016 WHO: Expert group on Public Health Emergency Disease Prioritization
2016 - Co-Chair Future Earth Health KAN Development Committee
2016- International Advisory Group, No More Epidemics
2015 WHO: Expert group on characterization of emerging disease threats for R&D
2011- Scientific Advisory Board, VIZIONS: Vietnam Initiative on Zoonotic Infections (Oxford Univ CRU, Ho Chi Minh City).
2009 FAO-OIE-WHO: Organizing Committee, Joint Technical Consultation on Influenza and Other Emerging Zoonoses at the Human Animal Interface.
2008 Parliamentary Forum on Emerging Diseases, One Health and Biosecurity, Australia
2007-10 DIVERSITAS (UNESCO/ICSU): Executive Committee member, Treasurer
2006-14 DIVERSITAS (UNESCO/ICSU): Chair, ecoHEALTH Cross-Cutting Network
2006-10 OIE (World Organization for Animal Health) ad hoc committee on amphibian diseases
2005 Planning Committee ESSP Joint Project on GEC & Human Health.
2005-10 Intl. Ecohealth Assoc: Charter Board, Treasurer, Chair of Development Committee, Co-Chair of Membership Committee.
2004-7 DIVERSITAS (UNESCO/ICSU): Scientific Committee
2004-10 Australian Biosecurity CRC – International Advisory Standing Committee
2006-8 Amazon Ctr. Envl. Educ. & Research Foundation (ACEER) Scientific Advisory Board
2002-5 Millennium Ecosystem Assessment: Lead Author, human health
2002 WHO/UNEP working grp. V: Ecosystem disruption, biodiversity & infectious diseases
1998-9 IUCN Species Survival Commission: consulted by Veterinary Specialist Group, Passerine TAG and Pacific Island Land Snail Group

SELECTED BIBLIOGRAPHY:
[up to 10 items] *=corresponding author

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2. Pike J, Bogich TL, Elwood, SE, Finnoff DC, Daszak P*. (2014). Economic optimization of a global stategy to address the pandemic threat. **PNAS**.111:18519-18523

3. Ge X-Y, Li J-L, Yang X-L, Chmura AA, Zhu G, Epstein JH, Mazet JK, Hu B, Zhang W, Peng C, Zhang Y-J, Luo C-M, Tan B, Wang N, Zhu Y, Crameri G, Zhang S-Y, Wang L-F, Daszak P*, Shi Z-L* (2013). Isolation and characterization of a bat SARS-like Coronavirus that uses the ACE2 receptor. **Nature** 503: 535-538.

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6. Smith KF*, Behrens M, Schloegel LM, Marano N, Burgiel S & Daszak P* (2009). Reducing the risks of the wildlife trade. **Science**, 324: 594-595.

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10. Daszak P*, Cunningham AA & Hyatt AD (2000). Emerging infectious diseases of wildlife - threats to biodiversity and human health. **Science** 287: 443-449

From: "David J Wolking" <djwolking@ucdavis.edu>
Sent: 02/17/2017 7:34:35 AM (-08:00)
To: "William Karesh" <karesh@ecohealthalliance.org>; "Prof. Jonna Mazet" <jkmazet@ucdavis.edu>; "Christine Kreuder Johnson" <ckjohnson@ucdavis.edu>
Subject: Fwd: [predict] RE: Please Hold the data: Key Partners Meeting for establishment of Myanmar CDC

Just FYI - CDC establishing a country office in Myanmar.

D

---------- Forwarded message ----------
From: **Valitutto, Marc** <ValituttoM@si.edu>
Date: Fri, Feb 17, 2017 at 5:32 AM
Subject: [predict] RE: Please Hold the data: Key Partners Meeting for establishment of Myanmar CDC
To: "Warren, Dora (CDC/CGH/DGHT)" <dyw3@cdc.gov>, Karen Cavanaugh <kcavanaugh@usaid.gov>, "bzinner@usaid.gov" <bzinner@usaid.gov>, "REDACTED", "hpyne@worldbank.org" <hpyne@worldbank.org>, "REDACTED"
Cc: "Ei Ei Khin REDACTED", "Phyu, Khin (CDC state.gov)" <phyuks@state.gov>, "predictmgt@usaid.gov" <predictmgt@usaid.gov>, "predict@ucdavis.edu" <predict@ucdavis.edu>, "Zimmerman, Dawn" <ZimmermanD@si.edu>, "Murray, Suzan" <MurrayS@si.edu>

Dear Dora,

Thank you for the invitation. The PREDICT Myanmar team will be there.

Thank you,
Marc

Marc T. Valitutto, VMD

Global Health Program | Wildlife Veterinary Medical Officer & Myanmar Project Liaison
Smithsonian Conservation Biology Institute
National Zoological Park | 3001 Connecticut Avenue NW | Washington DC 20008
T US: +01 202 633 4892 | T Myanmar: +95 996 284 2176 | F +01 202 673 4733 | valituttom@si.edu

-----Original Message-----
From: Warren, Dora (CDC/CGH/DGHT) [mailto:dyw3@cdc.gov]
Sent: Friday, February 17, 2017 5:16 AM
To: Karen Cavanaugh <kcavanaugh@usaid.gov>; 'bzinner@usaid.gov' <bzinner@usaid.gov>; REDACTED; 'bzinner@usaid.gov' <bzinner@usaid.gov>; REDACTED;

[redacted]; 'hpyne@worldbank.org' <hpyne@worldbank.org>; [redacted]; Valitutto, Marc <ValituttoM@si.edu>; [redacted]
Cc: Ei Ei Khin [redacted]; Phyu, Khin (CDC state.gov) <phyuks@state.gov>
Subject: Please Hold the data: Key Partners Meeting for establishment of Myanmar CDC

Dear Colleagues,

Colleagues from the US CDC, Atlanta and IANPHI Emory University will be in Myanmar to continue the discussion with the Ministry of Health and Sports re: the establishment of the Myanmar CDC. We would like to meet with stakeholders to discuss progress to date and how we can continue to collaborate to support Ministry of Health in this endeavor.

Please save March 13th in your Calendar. We will send out a confirmation note but are tentatively planning on holding the meeting at the US embassy in Yangon, beginning at 11 AM.

Thanks, and best regards,

Dora Warren
Director, US CDC Myanmar

Subject: One Health Work Group Call #3
Location: teleconference

Start: 05/15/2017 12:00:00 PM (-07:00)
End: 05/15/2017 1:00:00 PM (-07:00)
Show Time As: Tentative

Organizer: Ogawa, V. Ayano (VOgawa@nas.edu)
Required Attendees:
'daszak@ecohealthalliance.org';'dmrizzo@ucdavis.edu';'george.poste@asu.edu';'jeff.duchin@kingcounty.gov';'mary_wilson@harvard.edu';REDACTED REDACTED';'Hughes, James M';'William B. Karesh';'Gail Hansen';'Barton Behravesh, Casey (CDC/OID/NCEZID)';'Cardwell, Kitty';Mundaca-Shah, Ceci;Tran, Thu Anh;'Jonna Mazet'
Optional Attendees: 'Stephanie Calderone';'Elizabeth S Chase';'andre@ecohealthalliance.org';'amanda.andre@ecohealthalliance.org'

Conference call info (*NOTE: this number is different from the one you have been using previously):

Toll-free dial-in (U.S. and Canada): REDACTED
International dial-in: REDACTED
Conference code: REDACTED

Please feel free to contact me with any questions.

Warm regards,
Ayano

Antimicrobial Resistance, Food Safety, and One Health: The Need for Convergence

Samantha L. Lammie[1] and James M. Hughes[2,3,*]

[1]School of Medicine, [2]Division of Infectious Diseases, Department of Medicine, School of Medicine, and [3]Emory Antibiotic Resistance Center, Emory University, Atlanta, Georgia 30322; email: samantha.lammie@emory.edu, jmhughe@emory.edu

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*Corresponding author

Keywords

foodborne disease, stewardship, superbugs, epidemiology, infection, antibiotic resistance

Abstract

Antimicrobial resistance is a complex, multifaceted, urgent global health problem. There is increasing concern about the emergence of multidrug-resistant superbugs. These superbugs result in infections responsive to treatment with few if any currently available antimicrobial agents, reviving memories of the preantibiotic era and evoking concerns about a postantibiotic era. Use of antibiotics exerts selective pressure on pathogens as well as on commensal organisms that are part of the normal flora of humans, animals, and the environment; this favors the emergence of resistant strains and sometimes involves the food supply. Addressing this urgent threat requires implementation of a multifaceted strategy that has been articulated in the past few years; implementation will require sustained political will, investment in systems and research, and a One Health approach involving improved communication, cooperation, and collaboration among the many professional disciplines and organizations with important roles to play at the intersection of human, animal, and environmental health. Priorities include strengthened human and animal health surveillance and monitoring for resistant organisms, antimicrobial stewardship programs, infection-control programs, development and approval of new antimicrobial agents, research on innovative therapeutic approaches, development of rapid diagnostic tests and new vaccines, and educational programs that target professional groups and the public.

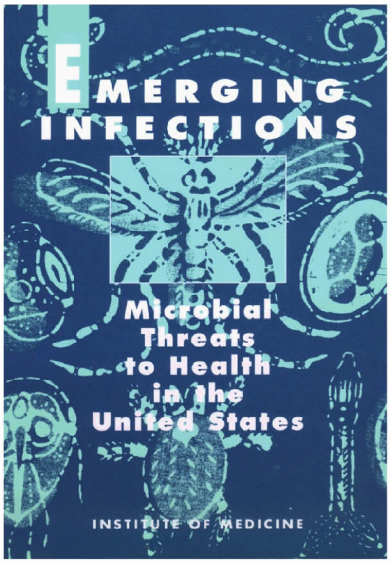
INTRODUCTION

Antimicrobial resistance is a complex, multifaceted, urgent global problem. There is increasing concern about the emergence of multidrug-resistant superbugs. These superbugs result in infections responsive to treatment with few if any currently available antimicrobial agents, which bring to mind the preantibiotic era. Use of antibiotics exerts selective pressure on pathogens as well as on commensal organisms, which favors the emergence of resistant strains.

Antimicrobial agents should be viewed as global public goods. Targeted use of an appropriate antibiotic(s) is critical in minimizing the impact of emergence of resistance in individual patients and their communities. The problem is urgent because the antibiotic development pipeline has been dry in recent years as a result of a market failure and an innovation gap.

Addressing this urgent threat requires the multifaceted strategy that has been articulated in recent years. Elements include strengthened surveillance of antimicrobial usage and resistance in humans, animals, and the environment locally, nationally, and globally; strengthened infection-control programs in human and animal health settings; improved antimicrobial stewardship in humans and animals; innovative approaches to incentivize new drug development; reform of regulations for approval of new drugs for treatment of rare but life-threatening infections; development of rapid point-of-care diagnostic tests to strengthen stewardship programs; use of available vaccines and development of new vaccines targeting drug-resistant pathogens; increased research on mechanisms of resistance, on strategies to interrupt transmission of resistant organisms, and on innovative therapeutic approaches; and improved communication and collaboration among human, animal, and environmental health professionals (Hughes 2011, Infect. Dis. Soc. Am. et al. 2011).

In 1992, the Institute of Medicine (IOM) published a consensus study focused on threats to the United States posed by emerging infections (Lederberg et al. 1992). The committee developed a definition of emerging infections that included antimicrobial resistance (**Figure 1**). In 2003, the IOM published a second consensus study on this topic; they concluded that much work needed



IOM definition of emerging infections:

New, reemerging, or drug-resistant infections whose incidence in humans has increased within the past two decades or whose incidence threatens to increase in the near future.

Lederberg et al. 1992

Figure 1

Institute of Medicine (IOM) expert committee definition of emerging infections (Lederberg et al. 1992).

to be done to strengthen preparedness, detection, and response capacity in the United States and globally (Smolinski et al. 2003) and that cooperation among many disciplines was critically important. The first committee identified six major factors contributing to disease emergence; the second committee validated those and added seven more (**Table 1**). Although microbial adaptation and change in response to selective pressure are central to the problem, **Table 1** highlights the importance of the majority of these 13 factors in contributing to the continued emergence of antimicrobial resistance.

One Health: the collaboration of various disciplines to ensure optimal health for humans, animals, wildlife, plants, and the environment on local, national and global levels

WHO: World Health Organization

For years, infectious disease physicians and public health officials have been urging that more attention be given to antibiotic resistance. A dearth of drugs in the antibiotic pipeline and increasingly difficult-to-treat multidrug-resistant infections are focusing attention on the importance of antimicrobial stewardship in humans and animals. With more than two million Americans experiencing antibiotic-resistant infections, resulting in 23,000 deaths, and total excess direct healthcare costs of at least $20 billion annually, much remains to be done. In addition, *Clostridium difficile* causes at least 250,000 illnesses and 14,000 deaths annually (CDC 2013a).

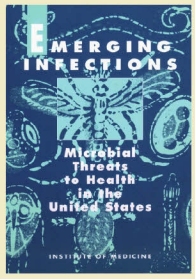
The One Health concept involves a focus on issues at the human, animal (both domestic and wildlife), and environmental interfaces. The concept is not new, having been promoted by Rudolf Virchow and others in the late nineteenth century, and emphasizes the linkages between human, animal, and environmental health in today's rapidly changing world. The concept received relatively little attention during much of the twentieth century, but in recent years, a One Health movement has generated increased interest, primarily as a result of efforts by the veterinary community (Am. Vet. Med. Assoc. 2008; **https://www.onehealthcommission.org/**). Given the complexity of the antimicrobial resistance challenge and concerns about issues at the interface of human health, animal health, and the environment, it seems particularly important to emphasize the role of a One Health approach in addressing the problem.

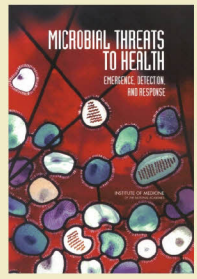
The importance of addressing food safety and surveillance and prevention of foodborne diseases was highlighted by the World Health Organization (WHO) as the theme for World Health Day (**Figure 2**) in 2011 (Fukuda 2015). The nature of the global food supply and consumption patterns

Figure 2

Poster for World Health Day: April 7, 2011.

Table 1 Factors contributing to the emergence of infection diseases[a]





1992	2003
Human demographics and behavior	**Human susceptibility to infection**
Technology and industry	Climate and weather
Economic development and land use	**Changing ecosystems**
International travel and commerce	**Poverty and social inequality**
Microbial adaptation and change	War and famine
	Lack of political will
Breakdown of public health measures	Intent to harm

[a]Factors in bold favor the emergence of antimicrobial resistance.

are changing, and a collaborative approach involving public health, animal health, and industry is essential to address these challenges (Doyle et al. 2015, Tauxe et al. 2010).

Foodborne diseases lie at the intersection of human and animal health. Approximately 1 in 6 Americans becomes ill with a foodborne infection each year; almost 130,000 of these individuals are hospitalized and 3,000 die (Scallan et al. 2011a,b).

The Centers for Disease Control and Prevention (CDC) emphasizes four priority action areas: stewardship, infection control, resistance tracking, and novel antibiotic and diagnostic test development. The report cites organisms of concern that are usually (nontyphoid *Salmonella* and *Campylobacter jejuni*) or may be [*C. difficile*, extended-spectrum β-lactamase-producing *Enterobacteriaceae* (ESBLs), and methicillin-resistant *Staphylococcus aureus* (MRSA)] transmitted via the foodborne route. *C. difficile* was labeled an urgent threat to health, whereas drug-resistant nontyphoid *Salmonella*, drug-resistant *C. jejuni*, ESBLs, and MRSA were classified as serious threats (CDC 2013a).

Approximately 15% of emerging infectious disease (EID) events have been associated with foodborne transmission (Parmley et al. 2012). This is of concern, given that the interconnectedness of global food systems is resulting in increased antibiotic-resistant foodborne disease transmission. We have a global food supply; 75% of processed food in the United States has at least one internationally sourced ingredient (FDA 2011).

CDC: Centers for Disease Control and Prevention

ESBLs: extended-spectrum β-lactamase-producing *Enterobacteriaceae*

Inappropriate antibiotic use is a pervasive issue in human medicine. Inappropriate antibiotic prescriptions, over-the-counter availability, poor patient adherence to prescribed medications, use of substandard medications, and self-medication with previously unused antibiotics all fuel the development of resistance (CDC 2013a).

Concern is increasing over agricultural antibiotic use and the threat it poses to human health. Subtherapeutic levels of antibiotics intended for growth promotion, combined with crowded conditions, are thought to contribute to antimicrobial resistance globally (Tsalik 2014). As early as

the 1960s, studies revealed that drug-resistant *Salmonella* discovered in food animals and humans transferred resistance traits to other enteric bacteria (Wegener 2012). As a result, the United Kingdom's Swann Committee in 1969 recommended that only antibiotics with few therapeutic indications in humans be used as growth promoters (Swann 1969, Watts 2014, Wegener 2012).

Data on usage in humans and animals are limited. However, the CDC and WHO state that antibiotic use in animals is likely higher than it is among humans (CDC 2013a, WHO 2014a), and some estimates suggest that 70–80% of use in the United States occurs in animals. WHO acknowledges potential transfer of resistance from food-producing animals to humans (WHO 2014a), and the CDC describes the development of drug-resistant bacteria from antibiotic use in food-producing animals. These resistant bacteria can be transmitted through the food supply, infect humans, and lead to adverse health effects in humans (CDC 2013a).

Human medicine and agriculture must work together to control resistance. The One Health movement offers a necessary part of the solution. In the Netherlands, great success has been seen with One Health public health interventions. The Netherlands was the first country to ban the growth-promoting antibiotic avoparcin in 1995 after discovering its contribution to the emergence of vancomycin resistance (CDC 2014a, Wegener 2012).

Some progress has been made in addressing antibiotic resistance globally, but much more needs to be done. With constant movement of foods and people between countries, surveillance is difficult, yet critical. The proportion of resistance attributable to antimicrobial use in humans and animals, respectively, is unknown, and without data to drive action, effective interventions are problematic. Analysis of the impact of resistance on healthcare systems, patients, the food supply, and society is needed (WHO 2014a).

Government support for these measures is increasing in the United States, the United Kingdom, France, and other countries. A growing number of consumers are calling for antibiotic-free meat. The global health landscape is primed for One Health interventions, and opportunities for action must be identified and implemented.

DRUG-RESISTANT FOODBORNE PATHOGENS OF GREATEST CONCERN

In the mid-1990s, studies found that fluoroquinolone-resistant *Salmonella* and *Campylobacter* in food animals spread to humans (Wegener 2012). Now, there is concern for foodborne transmission of other resistant organisms, and additional data on this issue are needed.

Salmonella

Salmonella is a gram-negative bacillus that colonizes many different animal species, including pigs, cattle, and poultry (WHO 2013). Many wild animals and pets, including cats, dogs, birds, and reptiles, can transmit *Salmonella* (WHO 2013). Transmission is fecal-oral, and the majority of cases are foodborne, caused by consumption of contaminated food of animal origin (Silva et al. 2014, WHO 2014a). Most strains cause gastroenteritis (WHO 2014a).

A number of studies have characterized the connection between animal and human *Salmonella* infections. One recent study retrospectively calculated annual *Salmonella* Typhimurium and Enteritidis seroincidence from serologic studies in 13 European countries; when the model was applied to 13 other European countries, the researchers found a significant association between seroincidence in humans and prevalence of the same *Salmonella* infections among laying hens, broilers, and slaughter pigs (Molbak et al. 2014).

Antibiotic resistance varies by serotype (CDC 2014a). Resistance to ceftriaxone and ciprofloxacin is most important, with isolates resistant to these agents being more likely to be resistant to multiple drug classes (CDC 2013a). Approximately one in five *Salmonella* Heidelberg infections, a serotype also known to produce outbreaks among poultry, is resistant to ceftriaxone, and ceftriaxone resistance has been shown to complicate treatment of severe *Salmonella* infections in children (CDC 2014b). The National Antimicrobial Resistance Monitoring System (NARMS) found that 3% of nontyphoid *Salmonella* isolates were resistant to nalidixic acid, a quinolone used for laboratory testing to screen for resistance to ciprofloxacin, and 8% of the isolates of the most common *Salmonella* serotype, *S.* Enteritidis, were resistant to nalidixic acid in 2012 (CDC 2014b).

NARMS: National Antimicrobial Resistance Monitoring System

CARB: US National Strategy for Combating Antibiotic-Resistant Bacteria

FDA: Food and Drug Administration

Multidrug-resistant *Salmonella* is a major concern; 4% of nontyphoid *Salmonella* isolates in the NARMS 2012 Human Isolates Final Report were resistant to at least ampicillin, chloramphenicol, streptomycin, sulfonamides, and tetracycline (CDC 2014b). Multidrug-resistant *S.* Typhimurium cases are associated with increased risk of invasive infection, increased frequency and duration of hospitalization, and higher risk of death. This resistance can spread horizontally to other serotypes (WHO 2014a). In 2014, multidrug-resistant *S.* Typhimurium with a new multiple-locus variable-number tandem repeat analysis (MLVA) profile was identified in six European Union member states; meats were the suspected vehicle of transmission (ECDC-EFSA 2014).

In recent years, nontyphoid *Salmonella* incidence has increased. The majority of associated disease is concentrated in regions where resistance data are extremely limited (e.g., Southeast Asia and the western Pacific) (WHO 2014a). In the United States, the CDC estimates direct medical costs at $365 million annually, with 1.2 million cases, 23,000 hospitalizations, and 450 deaths (CDC 2013a). Drug-resistant infections are associated with 100,000 cases annually (CDC 2013a). Worldwide, cases are estimated at 94 million, with approximately 155,000 deaths (Majowicz et al. 2010, WHO 2014a).

Campylobacter jejuni

C. jejuni is a gram-negative curved bacillus that causes diarrhea, fever, abdominal cramps, and occasionally other complications such as Guillain-Barré syndrome. Humans become ill after ingesting contaminated food or water. Undercooked or raw chicken and unpasteurized milk are common routes of infection in the United States (CDC 2013a). Some cases are associated with foreign travel. The National Strategy for Combating Antibiotic-Resistant Bacteria (CARB) explains that "antibiotic use in food animals can and does result in resistant *Campylobacter* that can spread to humans" (White House 2015, p. 26). In the United States, approximately 1.3 million infections occur annually, with 13,000 associated hospitalizations and 120 deaths; 310,000 of the infections are caused by drug-resistant organisms (CDC 2013a).

Ciprofloxacin and azithromycin resistance is particularly concerning (CDC 2013a). According to a 2012 NARMS report, ciprofloxacin resistance levels increased from 21% to 25% between the years 2003 and 2007 but then held steady at 25% in 2012, likely reflecting the impact of a ban issued by the US Food and Drug Administration (FDA) on the use of enrofloxacin in poultry, which was implemented in 2005 (CDC 2014b).

Clostridium difficile

C. difficile is a serious healthcare-associated infection, and in recent years, community-associated infections have emerged as a concern. Transmission is fecal-oral, and infection typically occurs among people who have recently been treated with antibiotics or have had recent medical care, particularly those who have been hospitalized (CDC 2013a). Symptoms include fever, abdominal

pain, diarrhea, and in severe cases, development of pseudomembranous colitis. Resistance to fluoroquinolones has been observed in lineages of a current epidemic strain, 027/BI/NAP1 (CDC 2013a, He et al. 2013).

There is increasing evidence suggesting that *C. difficile* may be associated with food production and animal husbandry. A recent article reported that clonal *C. difficile* 078 strains in pigs and farmers were common, that identical streptomycin and tetracycline antibiotic resistance determinants were shared by the animal and human strains, and that there was a high *C. difficile* carriage rate among farmers in the Netherlands (Knetsch et al. 2014).

In the 2014 National Institute of Allergy and Infectious Diseases (NIAID) antibacterial resistance research agenda, *C. difficile* was described as causing particularly difficult infections to treat; current emerging epidemic strains cause more severe disease (NIAID 2014). Nearly all of the estimated quarter of a million *C. difficile* cases in the United States every year require hospital care, and approximately 14,000 *C. difficile* deaths occur annually. Between 2000 and 2007, deaths attributable to *C. difficile* increased by 400%. Economic costs amount to at least $1 billion. Half of *C. difficile* infections occur in those younger than 65 years old, but more than 90% of the deaths occur in those older than 65 years old (CDC 2013a). The clarification of the potential role of food in the transmission of *C. difficile* is a priority for future research.

NIAID: National Institute of Allergy and Infectious Diseases

LA-MRSA: livestock-associated methicillin-resistant *Staphylococcus aureus*

Methicillin-Resistant *Staphylococcus aureus*

Like *C. difficile*, MRSA can cause fatal infections in both healthcare-associated and community settings. *S. aureus* is a gram-positive organism that is often part of the normal skin and nasal flora in humans. Whereas healthcare-associated MRSA can cause pneumonia, severe bloodstream and bone infections, and surgical-site infections, community-acquired MRSA often leads to skin infections (CDC 2013a, WHO 2014a). Some strains produce specific toxins that can cause toxic shock syndrome or food poisoning (WHO 2014a).

Recently, community-acquired MRSA infections have increased (Choffnes et al. 2010). MRSA makes up more than 20% of *S. aureus* in all WHO regions and exceeds 80% in some areas (WHO 2014a). The organism colonizes humans and companion animals, including dogs, cats, and horses, and plasmid presence in companion animal MRSA has been linked to clindamycin resistance (Harrison et al. 2014). It has been hypothesized that companion animal/handler cross-species infection can occur without host adaptation (Harrison et al. 2014, WHO 2015a). Transmission of MRSA from livestock to farmers, veterinarians, and other individuals in close proximity with animals has been reported (WHO 2015a). Prior to 2005, MRSA strains were thought to have originated in humans, but one MRSA strain, livestock-associated MRSA (LA-MRSA, ST 398), has been linked to transmission from asymptomatic animals, particularly pigs (Barton 2014). In a cross-sectional North Carolina study of workers in industrial livestock operations compared with those in antibiotic-free livestock operations, LA-MRSA and multidrug-resistant *S. aureus* were present only in industrial operations (Rinsky et al. 2013). The potential role of contaminated meat in community transmission of MRSA requires further study. Studies of LA-MRSA have found that these strains are less likely to cause human infection and spread from person to person; however, there are not many prospective studies in this area (Smith 2015), and additional research on this issue is a priority.

Extended-Spectrum β-Lactamase–Producing *Enterobacteriaceae*

With the production of extended-spectrum β-lactamases, organisms like *Escherichia coli* become resistant to a range of penicillins and cephalosporins, including extended-spectrum cephalosporins

(CDC 2013a). In the United States, ESBLs are a major concern in the hospital setting. A total of 140,000 healthcare-associated *Enterobacteriaceae* infections occur yearly. Approximately 26,000 *Enterobacteriaceae* infections attributable to healthcare settings have an ESBL profile, which translates to 19% of hospital-acquired *Enterobacteriaceae* infections. Annually, ESBL infections cause 1,700 deaths; patients with ESBL bloodstream infections were 57% more likely to die of their infection than patients infected with non-ESBL organisms. According to recent CDC estimates, these bloodstream-associated infections result in more than $40,000 in excess hospital costs per case (CDC 2013a). Identical ESBL-producing organisms and genes have been found in food-producing animals, in farmers, and in hospitalized patients (Hammerum et al. 2014, Overdevest et al. 2011). More research needs to be conducted on potential foodborne transmission of these organisms.

OIE: World Organization for Animal Health

FAO: Food and Agriculture Organization of the United Nations

SURVEILLANCE SYSTEMS

An important aspect of antibiotic resistance as an EID threat is the "proliferation and distribution of resistant microbes, hosts, vectors, and genes through migration, travel, conflict, trade, and tourism" (Choffnes et al. 2010). Quantifying and monitoring trends in antibiotic resistance are critically important. Food supply interconnectedness will only increase with increased globalization, meaning that outbreak source tracing will continue to become more challenging.

Foodborne disease outbreaks crossing national boundaries are not uncommon. The 2011 outbreak of *Escherichia coli* O104:H4 affected a host of countries and was ultimately traced back to fenugreek seeds from Egypt that were distributed to locations across Europe (Buchholz et al. 2011). An outbreak of *Salmonella* Newport associated with watermelon from Brazil and confirmed by whole genome sequencing involved England, Wales, Northern Ireland, Scotland, Ireland, and Germany from October 2011 to January 2012 (Byrne et al. 2014).

The CDC WHO Global Foodborne Infections Network (GFN), formerly known as Salm-Surv, promotes laboratory-based surveillance and intersectoral collaboration involving human health, veterinary, and food disciplines (CDC 2013b). It also serves a capacity-building role, and some sites supported by the GFN are beginning to enter data into a specific WHONET software module (WHO 2014a, CDC 2013b). In response to the Terrestrial Animal Health Code and the Aquatic Animal Health Code, the World Organization for Animal Health (OIE) has established standards for combining human, food-producing animal, and retail meat bacterial isolate data. The WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR) helps WHO conduct integrated resistance surveillance. Recently, AGISAR collaborated with the Food and Agriculture Organization of the United Nations (FAO) to initiate integrated foodborne pathogen and antimicrobial resistance surveillance in Asian and African poultry, beef, pork, and aquaculture value chains (WHO 2014a).

Europe hosts some of the most integrated regional surveillance networks. The European Surveillance System launched a molecular surveillance service in 2012; it allows uploading of detailed molecular typing information for a range of organisms, including *Salmonella*, *Listeria*, and *E. coli* (verotoxin-producing *E. coli*/Shiga toxin–producing *E. coli*) (van Walle 2013). Recently, the platform was used to detect a monophasic cluster of *S.* Typhimurium with a new MLVA pattern in Denmark, Norway, and Sweden (ECDC-EFSA 2014). The Foodborne and Waterborne Diseases and Zoonoses Network (FWD-Net) managed by the European CDC (ECDC) collects antimicrobial resistance data for bacteria, including *Salmonella*. The European Union publishes an annual joint report by the ECDC and the European Food Safety Authority (ECDC-EFSA 2014) on antimicrobial resistance in zoonotic bacteria from humans, animals, and food products using data from FWD-Net. Since 2011, data on isolates from food and animals have been combined with human infection data (WHO 2014a).

In the United States, four major surveillance networks track foodborne disease and antibiotic resistance: FoodNet (Foodborne Diseases Active Surveillance Network), the National Animal Health Monitoring System (NAHMS), NARMS, and PulseNet. FoodNet consists of 10 population-based surveillance sites that track foodborne pathogens and trends, document resistance mechanisms, and perform susceptibility testing of outbreak isolates (CDC 1995, 2014b; Choffnes et al. 2012). NAHMS collects information on domestic livestock and poultry, including antibiotic resistance data (US Dep. Agric. Anim. Plant Health Insp. Serv. 2015). NARMS is an integrated human and animal health system that involves collaboration between the FDA, the US Department of Agriculture (USDA), CDC, and state and local public health departments to monitor antibiotic resistance in enteric bacteria, including *Salmonella*, *Campylobacter*, and other bacteria in humans, retail meat, and food animals (CDC 2013a, 2014b; Choffnes et al. 2012). In its most recent report, NARMS tried to facilitate international collaboration by using epidemiological cut-off values, the same parameters used by the European Committee on Antimicrobial Susceptibility (CDC 2014b).

NAHMS: National Animal Health Monitoring System

USDA: US Department of Agriculture

PulseNet is a molecular subtyping network that involves all state public health laboratories and was established by the CDC in 1996 (**http://www.cdc.gov/globalhealth/programs/pulsenet.htm**). Over the past 20 years, this system has detected numerous local, regional, and national foodborne disease outbreaks (CDC 2013c). More recently, PulseNet International, which involves a number of regional networks around the world, has been established (CDC 2011).

In Canada, two major networks track antimicrobial resistance: the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) and FoodNet Canada (**http://www.phac-aspc.gc.ca/foodnetcanada/index-eng.php**). A goal of the two networks is to conduct complementary surveillance to track resistance in foodborne pathogens (Choffnes et al. 2012). In 2005, CIPARS data led to a voluntary ban on ceftiofur use in poultry following the voluntary withdrawal by Quebec earlier that year after the development of ceftiofur-resistant *Salmonella* Heidelberg (Dutil et al. 2010, Parmley et al. 2012).

A number of other countries have national surveillance programs. In the United Kingdom and Ireland, the Food Standards Agency, the Health Protection Surveillance Center, and the Comprehensive Antibiotic Resistance Database all monitor foodborne disease and antibiotic resistance (Byrne et al. 2014) (**http://www.hpsc.ie**; **http://www.food.gov.uk/about-us**). Surveillance in France is conducted by the Ministry of Agriculture and the Industry Federation for Veterinary and Reactive Drugs (Minist. Agric. Agrofood For. 2012). In Denmark, the Danish Program for surveillance of antimicrobial consumption and resistance in bacteria from animals, food, and humans (DANMAP) and VetStat, a Danish Veterinary and Food Administration regulation and monitoring system, track and address foodborne disease and antibiotic resistance problems (Dan. Vet. Food Adm. 2015, DANMAP 2015, Wielinga 2013).

Antibiotic resistance monitoring has been extremely effective in Denmark. DANMAP monitors resistant pathogens, and VetStat tracks antibiotic usage. VetStat has instituted a Yellow Card Initiative, which imposes antimicrobial consumption limits and issues individual producers a yellow card warning if they exceed the threshold for nine months. They then have nine months to decrease their antimicrobial use (Wegener 2012).

In low- and middle-income countries, antibiotic resistance remains largely unaddressed. WHO states that "... large gaps in knowledge exist about the status of antibiotic resistance surveillance capacities worldwide, particularly in resource-limited settings" (WHO 2015c). GFN has identified a need for capacity building and has shown that integrated surveillance is possible using a stepwise approach (WHO 2014a). PulseNet International helps address this problem in some regions (CDC 2011). In 1998, WHO member states adopted the Integrated Disease Surveillance and Response strategy, which provided guidance on establishing laboratory-based bacterial disease

surveillance in Africa. This strategy came in response to official statements on regional gaps in antimicrobial susceptibility testing and lack of formal collaborative surveillance. According to WHO, there is a lack of legislation and enforcement in the eastern Mediterranean, whereas in Central Asia and Eastern Europe, there is a regional surveillance network: the Central Asian and Eastern European Surveillance of Antimicrobial Resistance (CAESAR). Through CAESAR, countries not participating in EARS-Net, the European Antimicrobial Resistance Surveillance Network, are helped to develop national surveillance systems (WHO 2014a). There is a critical need for standardization and harmonization of approaches to global surveillance of antimicrobial usage and resistance.

NATIONAL AND GLOBAL POLICIES

Globally, WHO is leading the effort to combat antibiotic resistance. In June 2000, WHO released the WHO Global Principles for the Containment of Antimicrobial Resistance in Animals Intended for Food (WHO et al. 2000). WHO took important steps toward addressing resistance in 2005 by identifying critically important classes of antimicrobials for humans, and updates were released in 2012. The highest-priority critically important antimicrobials identified for risk management were fluoroquinolones, third- and fourth-generation cephalosporins, macrolides, and glycopeptides (WHO Advis. Group Integr. Surveill. Antimicrob. Resist. 2012). Notably, three of these groups—fluoroquinolones, third-generation cephalosporins, and macrolides—were also listed as critically important by the FDA in 2003 (FDA Cent. Vet. Med. 2003).

WHO has recently intensified its focus on the issue of resistance. WHO selected antimicrobial resistance as the theme for World Health Day in 2011 (**Figure 2**). Their tagline succinctly characterizes the problem: "No action today, no cure tomorrow" (Chan 2011). WHO established a Strategic and Technical Advisory Group on antimicrobial resistance in 2013 (WHO 2013). In May 2014, antimicrobial resistance was an agenda item for the 67th World Health Assembly. WHO highlighted the need for increased collaboration between the FAO, the OIE, and WHO, which form a tripartite alliance meant to improve intersectoral collaboration among the public health, animal health, and food safety sectors (WHO 2014b, World Health Assem. 2014), consistent with a One Health approach to the problem. A draft global action plan on antimicrobial resistance for consultation with member states, developed in 2014, addressed resistant microbe circulation among humans, food, animals, and the environment (via manure or agricultural runoff) (WHO 2014b). The World Health Assembly endorsed the WHO global action plan on antimicrobial resistance in May 2015 (WHO 2015b). WHO member states committed to develop national action plans to address the problem by May 2017; the plans will address antimicrobial use in human health, animal health, and agriculture (WHO 2015b).

In April 2015, WHO released *Worldwide Country Situation Analysis: Response to Antimicrobial Resistance* (WHO 2015c). Many countries surveyed had a list of essential medicines, but global public awareness of antibiotic resistance was lacking. Surveillance was often inadequate, owing to a lack of laboratory capacity, of infrastructure, and of data management capability. In Southeast Asia, the western Pacific, the eastern Mediterranean, and Africa, antibiotic access was poor and there were problems with medication quality and production of counterfeit drugs. Many countries in these regions did not have a national regulatory authority, national standards, and/or the ability to enforce standards. Globally, the sale of antibiotics without a prescription is relatively common, and medications are widely available for purchase over the Internet. Stricter controls and strengthened surveillance would help curb unnecessary use; however, human migration and travel will complicate surveillance. The report stated that comprehensive national plans, improved laboratory surveillance capacity, access to safe, effective antibiotics, control of antibiotic misuse, increased public

awareness, and effective infection prevention and control programs are foundational in addressing nonjudicious antibiotic use. There are plans for a report to be developed in conjunction with the OIE and the FAO to assess antibiotic resistance in the context of animal health (WHO 2014a).

IDSA: Infectious Diseases Society of America

On the global level, the World Alliance Against Antibiotic Resistance, an organization that includes more than 700 people from more than 50 countries and is supported by more than 140 global medical societies, has helped highlight the problem and emphasize the necessary priority actions (Carlet 2015).

In the United States, the Infectious Diseases Society of America (IDSA) has been addressing antimicrobial resistance as its top priority for the past 10 years. In 2008, a Society journal, *Clinical Infectious Diseases*, published a "call to action for the medical community" written by authors representing IDSA (Spellberg et al. 2008). The article cited development of new antimicrobials and related therapeutic strategies as the only viable, long-term solution to resistance (Spellberg et al. 2008). They supported enhanced research and development, financial incentives for drug development, and inclusion of priority antibiotics in Biomedical Advanced Research and Development Authority (BARDA) countermeasure development efforts. They also encouraged development of complementary therapeutics and "a grassroots movement spearheaded by the medical community" to raise awareness (Spellberg et al. 2008). IDSA launched the 10 × '20 Initiative in 2010, which called for development and approval of 10 novel, effective, and safe systemically administered antimicrobials by 2020 (Boucher et al. 2013, Infect. Dis. Soc. Am. 2010).

In 2011, IDSA released a policy supplement titled "Combating Bacterial Resistance: Policy Recommendations to Save Lives," urging Congress to strengthen resistance surveillance and prevention programs in the United States and abroad. IDSA called for thorough and species-specific data collection in human, veterinary, and agricultural contexts; elimination of "nonjudicious antibiotic use in animals, plants, and marine environments"; and additional funding for NARMS (Infect. Dis. Soc. Am. et al. 2011, p. S403).

Antibiotic resistance is gaining increased attention in the United States, and many are calling for improved interdisciplinary collaboration (Metz & Shlaes 2014, World Health Assem. 2014). The list of organizations and programs working to combat resistance is long and includes the CDC Get Smart program (CDC 2013a), the Pew Charitable Trusts (Pew Charit. Trusts 2015), Trust for America's Health (Trust Am. Health 2014), BARDA (Metz & Shlaes 2014), the USDA's One Health Multiagency Coordination Group (Choffnes et al. 2012, One Health Work. Group 2010), the federal Interagency Taskforce for Antimicrobial Resistance (ITFAR) (Metz & Shlaes 2014), and the USDA's Cooperative Extension System (Choffnes et al. 2012, US Dep. Agric. 2014), among others. Because ITFAR already acts as a conduit for federal interagency communication, some have suggested that it be given greater authority and flexibility to increase transparency and cooperation among the various stakeholders (Metz & Shlaes 2014).

The US Stakeholder Forum on Antimicrobial Resistance (S-FAR) is a new IDSA interdisciplinary stakeholder group encouraging open discussion of issues affecting human and animal health. S-FAR consists of more than 75 national organizations and experts, primarily representing the human health perspective, that support collaborative action to address the negative effects of resistance on human, animal, and plant health (S-FAR 2014). The group calls for a well-designed, financed, coordinated, actionable national plan addressing resistance. It also aims to spur collaboration among groups such as farmers, researchers, the public health sector, industry, and patients (S-FAR 2014). A number of other organizations have recently convened interdisciplinary groups of animal and human health professionals to discuss related problems and strategies for addressing them [e.g., the Animal Health Institute (**http://www.ahi.org**), the International Food Information Council Foundation (**http://www.foodinsight.org/about**), and the National Institute for Animal Agriculture (**http://www.animalagriculture.org**)].

PCAST: President's Council of Advisors on Science and Technology

GFI: Guidance for Industry

In recent years, the antimicrobial resistance problem has received increasing attention from researchers; public and animal health professionals; clinicians; laboratory scientists; national and international professional societies, organizations, and agencies; policy makers; and the public. There has been a surge of US government activity to address the problem. Responses range from a statement on resistance released by acting US Surgeon General Boris D. Lushniak (Lushniak 2014) to an executive order issued by President Barack Obama (Exec. Order No. 13676), which was followed by the release of the US National Strategy for Combating Antibiotic Resistant Bacteria (CARB) (White House 2014) and a report with recommendations on the topic from the President's Council of Advisors on Science and Technology (PCAST) (Executive Off. Pres. Pres. Counc. Advis. Sci. Technol. 2014). The US National Action Plan for Combating Antibiotic-Resistant Bacteria was released in the spring of 2015 (White House 2015) (**Figure 3**). These documents have a number of important similarities in outlining the way forward, including an emphasis on the need for a One Health approach to enhance the effectiveness of surveillance, stewardship, and prevention programs.

President Obama's executive order (Exec. Order No. 13676) addresses policy, oversight and coordination, stewardship, national surveillance, outbreak and infection control, development of new antibiotics and diagnostics, and international cooperation related to antibiotic resistance. It emphasizes the importance of cooperation among governments, academia, industry, healthcare providers, the general public, the agricultural community, and international partners. It calls for the FDA and the USDA to eliminate use of medically important antibiotics for growth promotion in food-producing animals; it instructs the FDA, the USDA, and the Environmental Protection Agency to conduct surveillance of antibiotic use and resistance; and it advises those agencies to work together and with stakeholders to monitor antibiotic use in agriculture and the impact of use on the environment (Exec. Order No. 13676).

The PCAST report (Executive Off. Pres. Pres. Counc. Advis. Sci. Technol. 2014) on antimicrobial resistance was also released in September 2014. It highlights three priorities: antibiotic resistance surveillance, an increase in current antibiotic longevity, and an increase in the rate at which new antibiotics and interventions are developed. It also recommends increased federal investment in addressing antibiotic resistance, improving antimicrobial stewardship in human healthcare and animal agriculture, and increasing international cooperation. The report states that risks to human health posed by the agricultural use of antibiotics are a matter of very serious concern, and provides strong support for the implementation of Guidance for Industry (GFI) #209 and GFI #213 (Executive Off. Pres. Pres. Counc. Advis. Sci. Technol. 2014).

The White House also released CARB in September 2014 (White House 2014). Its vision statement states that the United States will work globally to "prevent, detect, and control illness and death related to infections caused by antibiotic-resistant bacteria . . . ." Five goals are specified: slowing resistance development and spread; improving national One Health surveillance efforts; improving diagnostic tests; bolstering therapeutics and vaccination research and development efforts; and accelerating international collaboration and capacity building for antibiotic resistance–related work. The plan calls for the cooperation of "public and private sector partners, healthcare providers, healthcare leaders, veterinarians, agriculture industry leaders, manufacturers, policymakers, and patients." (White House 2014, p. 6). The strategy calls for the use of the National Healthcare Safety Network Antimicrobial Use and Resistance Module or an equivalent to monitor and report progress, and it emphasizes the need to utilize the antibiotic susceptibility testing capability of at least twenty veterinary diagnostic laboratories in the National Animal Health Laboratory Network and/or the Veterinary Laboratory Investigation and Response Network (White House 2014).

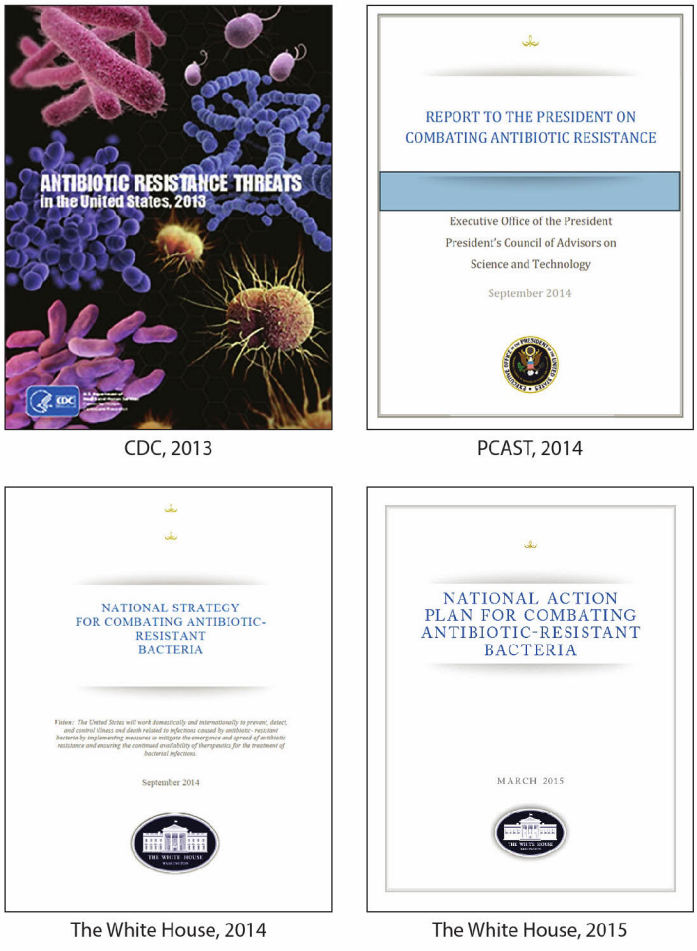


Figure 3

US antimicrobial resistance policy documents, 2014–2015. Abbreviations: CDC, Centers for Disease Control and Prevention; PCAST, President's Council of Advisors on Science and Technology.

From a policy perspective, CARB calls for increased global cooperation. It suggests using existing frameworks for communication, such as the Transatlantic Taskforce on Antimicrobial Resistance (CDC 2009) and the Global Health Security Agenda (GHSA), which was launched in 2014. The report calls for establishing with US assistance at least one antimicrobial resistance reference laboratory in each of the 30 member countries that are involved in the GHSA (White House Off. Press Secr. 2015). It suggests developing a system for sharing and analyzing data on resistance patterns from both the United States and the European Union, with a specific focus on the eighteen CDC priority pathogens, which also include the seven WHO priority pathogens (White House 2014).

In March 2015, the White House released the National Action Plan for Combating Antibiotic-Resistant Bacteria. The National Action Plan's vision statement involves working domestically and internationally to control antibiotic-resistant infections and creating

interventions to mitigate the impact of antibiotic resistance. Goals include slowing resistance emergence; improving national One Health surveillance efforts; developing rapid diagnostic tests; accelerating research and development on new antibiotics, other therapeutics, and vaccines; and improving international collaboration. The action plan encourages a One Health approach to every facet of addressing antibiotic resistance, and it aims to bring all forms of agricultural antibiotic use under veterinary oversight and to improve antibiotic stewardship in humans and in animals. It outlines improvements in the capacity of state and federal veterinary and food safety laboratories for antibiotic susceptibility testing and characterization of specified zoonotic and animal pathogens, with the goal of strengthened surveillance. The plan highlights the importance of research on environmental factors that influence resistance, on the spread of resistance genes, and on new therapeutic methods and strategies to reduce antibiotic-resistant outbreaks in human and animal populations. It calls for collaboration among the United States, WHO, the OIE, and other international agencies to develop integrated laboratory surveillance and antibiotic resistance detection for important foodborne pathogens in humans and animals. A call for cooperation among healthcare providers, healthcare leaders, pharmaceutical companies, public health professionals, veterinarians, medical and veterinary schools, the agricultural industry, patients, and the public is one of the document's most fundamental messages (White House 2015). In June 2015, the White House hosted a forum on antibiotic stewardship (Brayton 2015) to emphasize the critical importance of this priority component (Soc. Healthc. Epidemiol. Am. et al. 2012).

In 2014, NIAID released an updated research agenda for antibacterial resistance that included six areas for emphasis—basic research support; translation of research findings; clinical research; increased tool and resource availability; vaccines; and rapid diagnostics and therapeutics—and a multifaceted approach to solutions. It included seven strategic approaches: application of a holistic systems biology approach to problem solving, enhancement of immune response, identification of virulence factor targets for treatment, design of synthetic microbiota communities, development of rapid diagnostics to increase use of narrow-spectrum therapeutics, exploration of phage therapy, and optimization of the use of existing drugs, including drug combinations (NIAID 2014).

The PCAST report describes the FDA framework for improved stewardship of antibiotics in food-producing animals (Executive Off. Pres. Pres. Counc. Advis. Sci. Technol. 2014). In June 2014, the FDA released a progress report on its work toward ensuring prudent antibiotic use among food-producing animals. All drug manufacturers affected by GFI #209 and GFI #213 have agreed to phase out use of medically important antimicrobials for food production in food-producing animals, as well as phase in veterinary oversight of therapeutic drug use (FDA 2014; FDA Cent. Vet. Med. 2012, 2013). The companies have agreed in writing to implement these changes by December 2016 (FDA 2014).

GFI #209 was designed to promote judicious use of medically important antimicrobial drugs by restricting use to disease prevention and treatment and adding veterinary prescription-based oversight. GFI #213 called for voluntary label revision of medically important antibiotics to eliminate use for production purposes, enhancement of growth, or improved feed efficiency; it also triggered the change from over-the-counter access to veterinary oversight involving prescription requirements (Executive Off. Pres. Pres. Counc. Advis. Sci. Technol. 2014; FDA Cent. Vet. Med. 2012, 2013; White House 2014). Changes in the Veterinary Feed Directive are necessary to enact the required changes to drug labels. The deadline for full implementation is December 2016, with phased implementation occurring in the interim (Executive Off. Pres. Pres. Counc. Advis. Sci. Technol. 2014). Although industry compliance with GFI #209 and #213 is voluntary, once labels are changed, nonprescription use of medically important antimicrobial agents will be illegal (FDA 2014; **http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm449019.htm**). Monitoring the impact of these changes will be critically important. Relevant

information includes antimicrobial sales data, data on the prevalence of resistant bacteria in food, and representative data on farm-level usage (Executive Off. Pres. Pres. Counc. Advis. Sci. Technol. 2014).

In 2011, the Food Safety Modernization Act (FSMA) increased both the FDA's and the CDC's roles and responsibilities for protecting the public from foodborne diseases. The FSMA gave the FDA greater authority to improve food safety and directed the CDC to conduct foodborne disease surveillance to fulfill consumer, FDA, state and local regulatory agency, and food industry needs (Choffnes et al. 2012, Khabbaz et al. 2014, Taylor 2011).

The Generating Antibiotic Incentives Now Act, signed into law in 2012, was created to stimulate antibiotic production as part of the FDA Safety and Innovation Act. The aim was to give five extra years of market exclusivity and protection to new, promising antibiotics; to speed development and review of antibiotics; to require the FDA to issue updated guidelines for antibiotic development guidance; and to require the FDA to create a list of pathogens posing the greatest public health threat (Antibiot.Resist. Proj. 2013). This legislation provides incentives that support the IDSA 10 × '20 Initiative. Additional legislation addressing this problem is currently being considered.

In Europe, more progress has been made. Drug bans for antibiotic use in food animals have been implemented in Denmark, the United Kingdom, and across Europe. In the European Union, avoparcin use as a growth-promoting antibiotic was banned in 1997, followed closely by the banning of tylosin, spiramycin, virginiamycin, and bacitracin in 1999 (Wegener 2012).

Denmark has also led the way in ensuring judicious antibiotic use. Antibiotics banned or restricted in Denmark include fluoroquinolones, avoparcin, and virginiamycin. Avoparcin growth-promoter use was banned in 1995, followed by a ban on virginiamycin use in 1998. Fluoroquinolone use is allowed only if a "current laboratory test of resistance patterns shows that no other antimicrobial will be effective in treatment of the disease in question and this has been reported to the regional veterinary officer" (Choffnes et al. 2012, p. 341) and only via injection by a veterinarian. Prescription restrictions were placed on fluoroquinolones in 2002; success has been measured by a more-than-threefold reduction in use in animals between 2001 and 2006 (Choffnes et al. 2012).

The United Kingdom Department of Health and Department of Environment, Food and Rural Affairs proposed a five-year strategy in 2013 (UK Dep. Health 2013). Science Minister Greg Clark launched a major research initiative to be overseen by the Medical Research Council and to involve an Antimicrobial Resistance Funder's Forum to facilitate information sharing (**http://www.mrc.ac.uk/research/initiatives/antimicrobial-resistance/antimicrobial-resistance-funders-forum/**) (Watts 2014). Prime Minister David Cameron subsequently issued a call for an independent review of antimicrobial resistance, led by the economist Jim O'Neill and co-funded and hosted by The Wellcome Trust (Dep. Health Prime Minist. Off. 2014).

Five areas are being assessed: impact, potential for change, spurring of development, alternative therapies, and international action. As of October 2015, the Commission has issued three reports, each titled "The Review on Antimicrobial Resistance" and chaired by Jim O'Neill (Rev. Antimicrob. Resist. 2014, 2015a,b). The 2014 report found that global use of antibiotics rose nearly 40% between 2000 and 2010, with much variation between middle- and high-income country per capita consumption. Nearly three quarters of this growth occurred in Brazil, Russia, India, China, and South Africa, known as the BRICS countries. The report predicted that the current trajectory leads to 10 million deaths a year and a drop in gross domestic product of 2% to 3.5% by 2050, resulting in a total economic loss of between $60 and $100 trillion. The report estimated that delaying resistance development by 10 years would save the world $65 trillion between 2014 and 2050 (Rev. Antimicrob. Resist. 2014).

France recently published a National Action Plan for the Reduction of the Risk of Antibiotic Resistance in Veterinary Medicine. Since 1999, the country has funded a program to monitor

the sale of veterinary medical products containing antibiotics. The 2012 National Action Plan announcement included strategies to improve awareness, training, communication, surveillance and monitoring, vaccine use, research support, diagnostics, alternative treatments, hygiene and asepsis, and livestock farm environment impact. It also encouraged use of older antimicrobials in an attempt to protect newer agents and discussed the potential of a tax on antibiotic sales. The plan lists critical antibiotics and proposals to restrict their prescription. It also calls for increased efforts to identify illegal antibiotic use and trafficking, as well as European Union trade and importation surveillance (Minist. Agric. Agrofood For. 2012).

Low- and middle-income countries pose a greater challenge. Data on the magnitude of the problem are very limited. According to a Center for Disease Dynamics, Economics, and Policy (CDDEP) study, antibiotic use by the BRICS countries accounted for 76% of usage worldwide (Franko 2014, Van Boeckel et al. 2014). The study revealed that India used more antibiotics than any other country in the world in 2010 (Van Boeckel et al. 2014), and the Center for Science and Environment (CSE) recently published their findings on antibiotic residues in chicken in India. The CSE explained that the poultry industry in India misuses antibiotics, including ciprofloxacin (CSE Pollut. Monit. Lab. 2014). Despite these types of observations, or perhaps partly because of them, Indian public health professionals have recently made progress toward addressing the problem. In 2012, a group of Indian stakeholders and experts on antibiotic use issued the Chennai Declaration, a five-year plan to address India's antibiotic resistance challenge. The plan includes a roadmap for action in India in one-, two-, and five-year increments (Chennai Declar. Team 2014). The CSE reports that, as of 2014, the Indian government had not set any limits on antibiotic residues in chicken, nor had it regulated antibiotic use in poultry or controlled sales of antibiotics to the industry (CSE Pollut. Monit. Lab 2014).

The challenges faced by low- and middle-income countries are complex. In an interview, CDDEP Director Ramanan Laxminarayan explained that increased use in India represents increased access, which is positive, given India's high burden of bacterial disease; however, there needs to be improved enforcement of a recently-passed law for stricter regulation of over-the-counter sales of antimicrobial agents, as well as increased public awareness of the problem and campaigns to encourage appropriate use (Laxminarayan 2014).

CONSUMER AND FOOD INDUSTRY PERSPECTIVES

Public interest in antibiotic-free meat in the United States is likely influenced by reports such as the one released by *Consumer Reports* in January 2014, which revealed that 97% of 300 raw chickens sampled from grocery store[s] across the U.S. contained "potentially harmful bacteria." More than 50% of the chicken contained fecal contaminants, and approximately 50% contained bacteria resistant to three or more "commonly prescribed antibiotics" (Consum. Rep. 2014, p. 1).

Partly driven by public concerns over resistance, industry is slowly shifting away from meat raised with antibiotics as growth promoters. Leaders in the food-production industry and their consumers are driving innovation. Some of those companies include food-processing companies (Cargill), restaurant chains (Chipotle, McDonald's, Panera Bread, and Chick-fil-A), grocery stores (Trader Joe's, Whole Foods, Kroger, Safeway, Giant, Hannaford, Shaw's, Stop & Shop, Publix, and Jewel-Osco), and other retail stores (Walmart and Costco) (Antibiot. Resist. Proj. 2010, Choffnes et al. 2012, Krans 2014).

Labeling on meat to indicate that the animal's feed contained no antibiotics boosts the meat's market value (Metz & Shlaes 2014). Costco has plans to expand their antibiotic-free meat options (Layne 2015). Chipotle receives their meat from Niman Ranch (Antibiot. Resist. Proj. 2010), a company that bans antibiotic use in its animal feed (Krans 2014, Niman Ranch 2015). Many

other industry leaders, including Whole Foods and Panera Bread, have taken steps to obtain much of their meat from antibiotic-free suppliers (Antibiot. Resist. Proj. 2010, Krans 2014). Six large school districts recently announced switching to antibiotic-free chicken, including those in New York, Los Angeles, Chicago, Dallas, Miami-Dade County, and Orlando County, (Polansek 2014). A recent *Consumer Reports* poll showed that 86% of US consumers thought meat raised without antibiotics should be available in their local supermarket (Consum. Rep. 2012, Krans 2014).

RESEARCH GAPS, PRIORITIES, AND UNANSWERED QUESTIONS

There are many foodborne diseases and antibiotic resistance issues for which more information, data, or awareness is essential, and for which a One Health approach will be beneficial. Improved surveillance, standardized methods, and shared data are urgently needed. Work is necessary to monitor shared human and animal environments. Data on antibiotic use and resistance in animal shelters, for example, are lacking. The impact of antibiotic application to crop plants also merits increased research. The 2013 CDC report warned of using fertilizer or water containing animal feces contaminated with drug-resistant bacteria on crops, because of concern about subsequent transmission of these resistant bacteria to humans (CDC 2013a). Antibiotic-resistant organisms can be disseminated from cattle feed yards and by wastewater treatment plants (Choffnes et al. 2010, McEachran et al. 2015). The impact of environmental contamination with drug-resistant organisms needs to be assessed on a global level because the problem is likely to worsen as demand for meat increases as the population grows (Collignon & Voss 2015, Larson 2015).

The 2014 WHO *Global Report on Surveillance* (WHO 2014a) indicated that no common agreed methodology for global antibiotic resistance surveillance exists. WHO called for integration of foodborne bacteria surveillance and coordinated sampling and testing of bacteria from food animals, foods, environmental sources and clinically ill humans, in addition to evaluation of antibiotic resistance trends in food production, processing, and the supply chain. WHO suggests that WHONET be utilized to support laboratory-based surveillance, particularly in resource-limited areas (WHO 2014a). Perhaps an entirely new, user-friendly data integration platform could be designed by entrepreneurs whose skills have been honed by working for companies like Google or Facebook.

Human migration has the potential to contribute to the spread of resistance because it is easy to obtain antibiotics in one country and transport them to another. Immigration-related resistance problems have not been sufficiently studied. Poor healthcare access for illegal immigrants, among them some farmworkers, may mean procuring over-the-counter antibiotics from their country of origin and following inappropriate antibiotic regimens.

Increased research on foodborne and zoonotic infections is needed. The potential role of food in transmission of *C. difficile*, ESBL-producing and carbapenem-resistant *Enterobacteriaceae*, and MRSA in community settings needs further study. In many high-income countries, although some consumption is shifting to small-batch, locally produced items, food is also being mass-produced as never before. Solutions to address foodborne disease transmission are needed, and methods like food irradiation are still being explored. Given this flux in consumer patterns and preferences, more research on bacterial load and gut microbiota must take place. The US National Strategy for Combating Antibiotic Resistance calls for sequencing and characterization of the gut microbiome of at least one animal species raised for food (White House 2014), and the National Action Plan for Combating Antibiotic-Resistant Bacteria mentions the need to study resistance in commensal organisms (White House 2015).

Public health officials, the food industry, physicians, and veterinarians must grow accustomed to collaborating and sharing research findings. To facilitate this, some have proposed that

peer-reviewed scientific journals minimize disincentives to sharing information prior to publication (Metz & Shlaes 2014). A comparative medicine and One Health journal that is a collaborative effort of organizations such as the American Medical Association, the American Veterinary Medical Association, and the American Public Health Association could lead to increased exchange of ideas.

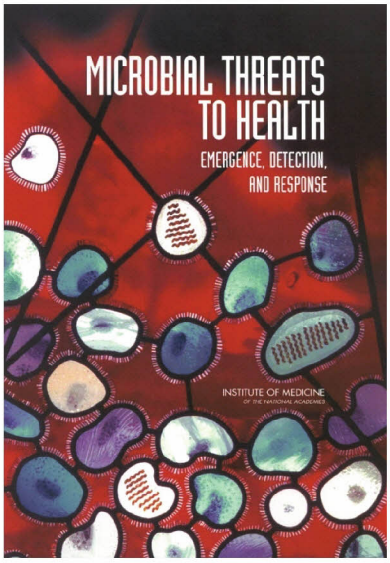
The CDC, NIAID, and WHO cite immunization as a tool for reducing resistance (Frieden 2013, NIAID 2014, WHO 2014b). In June 2013, Vaccines Europe released a draft statement on the role of vaccines in preventing antimicrobial resistance that mentioned bacterial colonization inhibition and reduced prevalence of infection as two positive effects (Vaccines Eur. 2013). They cited a study that found that prescriptions for influenza-associated respiratory antibiotics decreased 64% following universal influenza vaccination (Kwong et al. 2009). Preventing infections needing antibiotic treatment could lead to major decreases in both antibiotic use and resistance.

Additional priorities include further development and application of molecular epidemiologic tools, whole-genome sequencing, and other novel approaches to strengthen surveillance programs and to better delineate modes of transmission of resistant organisms; critical assessment of the relative importance of overuse and misuse of antimicrobial agents in human and animal settings; development of rapid point-of-care diagnostics, innovative therapeutic approaches (Nizet 2015) and new and improved vaccines to target resistant organisms; development of better data on use and resistance in low- and middle-income countries; assessment of approaches to address over-the-counter availability and counterfeit drug development in low- and middle-income countries; investigation of the extent and sources of environmental contamination with drug-resistant organisms; and development of better data on the economic impact of drug resistance.

ONE HEALTH OPPORTUNITIES AND POTENTIAL SOLUTIONS

One Health played a prominent role in the birth of modern-day medicine. Rudolf Virchow said "...between animal and human medicine there are no dividing lines—nor should there be" (Mackenzie et al. 2013b, p. 2). An IOM expert committee acknowledged the important role of the veterinary profession in addressing microbial threats to health (**Figure 4**) (Smolinski et al. 2003). The One Health concept has historically gotten attention through conferences and meetings organized primarily by the veterinary profession. One important conference, entitled "One World, One Health: Building Interdisciplinary Bridges to Health in a Globalized World," was organized by the Wildlife Conservation Society in 2004 and produced what are now known as the Manhattan Principles (Gibbs & Gibbs 2013). These twelve recommendations highlighted the links between human, domestic animal, and wildlife health and healthy ecosystems, and established a list of priorities for preventing epizootic and epidemic disease resulting from cross-species transmission from wildlife and for maintaining ecosystem health (**http://www.oneworldonehealth.org/**) (Mackenzie et al. 2013a).

Several organizations and collaborative groups that currently help drive the One Health agenda include the tripartite FAO-OIE-WHO collaboration, the One Health Commission, and the One Health Initiative (FAO et al. 2010, Mackenzie et al. 2013b; **http://www.onehealthinitiative.com**). Involvement in higher education represents a major opportunity for the One Health movement. Both the University of Edinburgh and the University of California-Davis have strong programs teaching One Health concepts (**http://www.ed.ac.uk/schools-departments/vet/studying/postgraduate/taught-programmes/one-health**; **http://www.vetmed.ucdavis.edu/ohi/index.cfm**). The Task Force on Antibiotic Resistance in Production Agriculture was recently formed by the Association of Public and Land-Grant Universities and the American Association of Veterinary Medical Colleges to further examine antibiotic use



IOM statement on microbial threats:

"A robust public health system—in its science, capacity, practice, and through its collaborations with clinical and veterinary medicine, academia, industry, and other public and private partners—is the best defense against any microbial threat."

Smolinski et al. 2003, p. xviii

Figure 4

Institute of Medicine (IOM) expert committee statement on microbial threats to health (Lederberg et al. 1992).

in agricultural animals and to provide advice on a research agenda and educational and outreach activities (Assoc. Public Land-Grant Univ. 2015a,b).

A One Health approach could lead to improved trust, transparency, communication, and collaboration among human, animal, and environmental health professionals; shared lessons learned in antimicrobial stewardship programs; and a collaborative research agenda that addresses important issues, needs, and concerns at the human, animal, and environmental health interfaces. Because the problem of antimicrobial resistance is multifaceted, it is critically important to acknowledge its extent and urgency and to avoid blaming others for causing it. Such a collegial approach could enhance the impact of the developing momentum in addressing this urgent threat nationally and globally. In 2014, Drs. Anthony Fauci and Francis Collins of the National Institutes of Health commented on White House recommendations for centralizing the National Database of Resistant Pathogens; they stated that this type of open-access forum would allow for comparison of outbreak strains to previously recognized strains (Fauci & Collins 2014).

Increased One Health instruction is needed for veterinarians, physicians, and other health professionals. Communication must improve between veterinarians and physicians treating members of the same household. Integrated training and increased venues for physician-veterinarian discussion are needed.

It is possible that a more integrated, One Health–oriented approach will lead to cost savings, but more data are needed to assess the cost effectiveness of such an approach. If it does yield long-term health and economic benefits, economic support by governments and others should follow.

CONCLUSIONS

It is time for antibiotic resistance to become a household term acknowledged by policy makers, academia, industry, and the public. More resources must be invested to define the problem, to

develop and strengthen surveillance and stewardship programs, to control antibiotic use, to open new avenues of communication, and to support educational campaigns.

The problem must be better characterized. The CDC has identified five barriers to fully understanding antibiotic resistance, and four of these include inadequate surveillance, detection systems, and technologies (CDC 2013a). Baseline data are needed on use in the human and animal realms and their shared environment. The economic impact of antibiotic resistance must be more accurately determined. Information on the prevalence, incidence, and transmission dynamics of pathogens that are traditionally or potentially foodborne is needed now more than ever because of pressures from antibiotic use, migration, travel, and changing ecosystems. With ongoing challenges in food preferences and consumption patterns, foodborne disease epidemiology will continue to change.

Education, communication, and cooperation are necessary for an adequate response to this urgent global problem. Data-sharing platforms—new, improved, or pre-existing, such as WHONET—can provide outlets for information dissemination. Educational programs, especially in veterinary and medical school training, are foundational for improving interprofessional interaction and research, which can lead to the development of new vaccines and to improved rapid diagnostic methods and thus contribute to better antibiotic stewardship. Monitoring the impact of industry compliance with GFIs #209 and #213 and the Veterinary Feed Directive is critically important (FDA 2015). Lastly, the public must be well informed; they play a large role in changing approaches to antibiotic use in the healthcare sector and industry.

Novel channels for communication, such as new journals focusing on One Health issues and comparative medicine studies, could spark greater interest in the One Health concept and improved communication between physicians and veterinarians. US government agencies and other organizations must act on approaches and recommendations in executive order 13676, CARB, the PCAST report, and the National Action Plan for Combating Antibiotic-Resistant Bacteria.

Ultimately, the threat of antibiotic resistance will require a coordinated global effort and sustained political will to find solutions and to provide the resources required to achieve sustainable change. The coordination and cooperation of all will be necessary to chart a new course to address the urgent global challenge of antimicrobial resistance.

DISCLOSURE STATEMENT

J.M.H. served as Director of the National Center for Infectious Diseases at the CDC from 1992–2005 and as President of IDSA from 2010 to 2011. He is a member of the Board of Directors of the EcoHealth Alliance and the One Health Commission. S.L.L. is not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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Contents

One Health Work Group Preliminary Background References – May 2017

The Business Case and Policy Implications for Investing in One Health

Background: Despite recognition of the importance of the One Health approach, the benefits of it have not been systematically elucidated. Clarity on the benefits of One Health would persuade decision makers to allocate and prioritize resources to invest in the approach. The economic benefits of One Health have been described through analyses of cost savings and effectiveness, while more indirect social and environmental benefits have been referenced but are not easily quantifiable. Limited data exists on specific areas where an integrated One Health approach is an investment (e.g. investing in control in animal health, which translates to human health cost savings and benefits for zoonotic diseases), but are crucial to arguments for greater One Health adoption.

The work group could explore this topic through 1) case studies, or 2) following up on existing commentaries and recommendations in this area.

1. Case Studies

The work group could create a value proposition of One Health through case studies, examining the national vs. regional vs. international One Health capacities and identifying where the value is added in each and where the gaps need to be filled.

The case studies below are examples that have explored operationalizing One Health programs in various settings and could help build further institutional support for the One Health approach.

- *National:* Canada is considered a unique example of a country that has fully implemented the One Health approach, when few countries have done so, through better integration of animal and human health sectors. The Canadian Science Centre for Human and Animal Health facility is the first joint laboratory in the world, with shared data systems, which a World Bank report has estimated to translate to US$14.5 million a year in cost savings as well as efficiency gains.

- *Regional:* A landscape analysis of One Health activities in the South Asian region showed a range of country capacities in their integration of One Health programs, with Bangladesh as a leader in having government support for their research programs, a 'OH Bangladesh' professional network across sectors, as well as the national development of a Strategic Framework for One Health Approach to Infectious Diseases. Under the tri-partite mechanism of the WHO, the FAO, and OIE, regional programs focus on facilitating cooperation through meetings. A number of programs led by USAID's PREDICT and the US CDC Epidemiology Training Programs are focused on building surveillance and workforce capacity in their operating countries.

- Also, refer to this booklet prepared by the PREDICT Consortium, which provides case studies from Emerging Pandemic Threats partner countries to demonstrate the type of approaches, partnerships and benefits that One Health can yield.

2. Recommend or follow up on commentaries related to the business case and policy implications

The work group could build on existing commentaries or recommendations that discuss the business case for One Health.

Subtopics to consider:

a. Follow up on the findings from World Bank/EcoHealth Alliance/USAID meeting on One Health Economics in Jan-Feb 2017

b. Comment on the potential metrics and assessments recommended to evaluate One Health interventions (e.g., Baum et al., 2017)
c. Build on work of Network for Evaluation of One Health
d. Comment on the World Bank's report on Economics of One Health that lays out data limitations and suggestions for future improvement, and then develop a roadmap for efforts to standardize data collection across sectors in order to strengthen the validity of One Health evaluations

Relevant Literature

"Evaluating One Health: Are we demonstrating effectiveness?"
(Baum, Machalaba, Daszak, Salerno, Karesh, 2017)
http://www.sciencedirect.com/science/article/pii/S2352771416300143
The authors conducted a review of One Health literature to determine the current status of One Health frameworks and case studies reporting One Health metrics. They found that the absence of a standardized framework to capture metrics across disciplines, even in a generic format, may hinder the more widespread adoption of One Health among stakeholders. The authors review possible outcome metrics suitable for the future evaluation of One Health, noting the relevance of cost outcomes to the three main disciplines associated with One Health.

"A review of the metrics for One Health benefits"
(Hasler, Cornelsen, Bennani, Rushton, 2015)
http://www.oie.int/doc/ged/D14080.PDF
This paper finds that most published work on One Health describes how this concept is valuable without trying to estimate the size of benefit or type of value. The authors argue that a framework for measuring the advantages of a One Health approach is needed and recommends ways of developing one.

"The Network for Evaluation of One Health: evidence-based added value of One Health"
(Haxton, Sinigoj, Riviere-Cinnamond, 2015)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590410/pdf/IEE-5-28164.pdf
The Network for Evaluation of One Health (NEOH), which is funded by the European Cooperation in Science and Technology (COST), is an open network that brings together various stakeholders to address the questions 'does One Health work?' and 'is One Health worthwhile?'. The overall objective of NEOH is to enable appropriate evaluations of One Health interventions through the elaboration of a methodological framework and guide that would motivate and encourage enablers and value chain actors to apply methods at the relevant scale. This will allow the comparison of results between different interventions on zoonotic diseases using the same methodological approach, and will point out the most cost-effective alternatives, helping the decision making process and public health policy formulation.

"The Business Case for One Health"
(Grace, 2014)
http://www.ojvr.org/index.php/ojvr/article/view/725/993
This article identifies five potential areas where One Health can add value and reduce costs. These are: (1) sharing health resources between the medical and veterinary sectors; (2) controlling zoonoses in animal reservoirs; (3) early detection and response to emerging diseases; (4) prevention of pandemics; and (5) generating insights and adding value to health research and development. The authors suggest that one dollar invested in One Health can generate five dollars worth of benefits and a global investment of US$25 billion over 10 years could generate benefits worth at least US$125 billion.

"Toward Proof of Concept of a One Health Approach to Disease Prediction and Control"
(Rabinowitz, Kock, Kachani, Kunkel, Thomas, et al., 2013)

https://wwwnc.cdc.gov/eid/article/19/12/13-0265_article
In 2010, a Stone Mountain Working Group assembled and evaluated the evidence regarding proof of concept of the One Health approach to disease prediction and control. Aspects examined included the feasibility of integrating human, animal, and environmental health and whether such integration could improve disease prediction and control efforts. They found evidence to support each of these concepts but also identified the need for greater incorporation of environmental and ecosystem factors into disease assessments and interventions. The findings of the Working Group argue for larger controlled studies to evaluate the comparative effectiveness of the One Health approach.

"Metrics for One Health Benefits: Key inputs to create an economic evidence base workshop"
(2013)
http://www.lcirah.ac.uk/sites/default/files/Metrics%20for%20One%20Health%20benefits%20workshop%20report%20final.pdf
Participants of this workshop recommend a set of metrics and associated methods that are most effective and practical for the standardized assessment of selected One Health benefits.

"Assessing Global Adoption of One Health Approaches"
(Hueston, Appert, Denny, King, Umber, Valeri, 2013)
http://link.springer.com/article/10.1007%2Fs10393-013-0851-5
The authors use a transformational change model as an evaluation tool and part of an overall assessment of the global adoption of One Health approaches. The assessment establishes a point of reference for measuring progress toward One Health approaches being the new operating normal.

"People, Pathogens and our Planet, Volume 2: The Economics of One Health"
(World Bank, 2012)
http://documents.worldbank.org/curated/en/612341468147856529/pdf/691450ESW0whit0D0ESW120PPPvol120web.pdf
This report analyzes and assesses the benefits and the costs of control of contagious diseases, and presents numerous examples of efficient and effective control of zoonotic diseases that is attributable to One Health. The authors calculate that investment in One Health systems of between US$1.9-3.4 billion per year is required. This report concludes that One Health systems for prevention and control of zoonotic diseases offers extraordinarily high expected benefits, with rates of return far above those of other public and private investments and provides recommendations on next steps.

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FORUM ON MICROBIAL THREATS

ONE HEALTH WORK GROUP CALL #3
May 15, 2017
12:00-1:00pm (ET)

PARTICIPANTS

Members: Jonna Mazet, Casey Barton Behravesh, Kitty Cardwell, Peter Daszak, Jeff Duchin, Gail Hansen, Jim Hughes, Billy Karesh, and Dave Rizzo
(Tentative: Jennifer Gardy, Eduardo Gotuzzo, and George Poste; Absent: Mary Wilson)

Staff: Ayano Ogawa and Anh Tran (Tentative: Ceci Mundaca-Shah)

PREPARATION FOR MEETING

- Review the following resources (all attached): background reference document on the business case for One Health; the PREDICT Consortium's One Health in Action Case Study Booklet; Jim's article on AMR, Food Safety, and One Health
- Be ready to discuss specific deliverables of work group

AGENDA ITEMS

1. Welcome (Ayano)
    - Brief introduction of new members: Drs. Casey Barton Behravesh and Gail Hansen
2. Discuss the policy implications and business case for investing in One Health approaches and how the work group can address some of these issues through its deliverable(s) (Jonna)
    - Discuss updates on work by the World Bank and EcoHealth Alliance on the economic dimensions of One Health (Billy)
    - Identify specific deliverable(s) and assign tasks
    - Develop a timeline for deliverable(s)
3. AMR and One Health (Jonna)
    - Review updates on Forum's upcoming AMR workshop agenda and speakers (Mary and Jim)
    - Discuss potential need for One Health antimicrobial use/resistance policy statement
4. Recap of the current progress of work group (Jonna)
5. Next steps and action items (Ayano)

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EMERGING PANDEMIC THREATS

ONE HEALTH IN ACTION

This publication was prepared by the PREDICT Consortium headquartered at the One Health Institute (OHI), School of Veterinary Medicine, University of California, Davis.

www.predict.global
predictonehealth@ecohealthalliance.org

EcoHealth Alliance
460 West 34th St, Fl 17
New York, NY 10001
(212) 380-4460

EDITED BY:
Catherine Machalaba, MPH
Program Coordinator for Health and Policy

Virginia Porter
Assistant to the Vice President for Health and Policy

William B. Karesh, DVM
Executive Vice President for Health and Policy, EcoHealth Allliance

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CONTRIBUTORS

PRESENTED IN ALPHABETICAL ORDER. Erika Alandia, Dara Carr, Peter Daszak, Nitish Debnath, Jon Epstein, Ariful Islam, Damien Joly, Abul Kalam, Matthew LeBreton, Jerry Martin, Jonna Mazet, Maureen Miller, Corina Monagin, Prime Mulembakani, Suzan Murray, Serge Nzietchueng, Kevin Olival, Joko Pamungkas, Melinda Rostal, Robert Salerno, Marcy Uhart, Supaporn Wacharapluesadee, Nathan Wolfe, and David Wolking.

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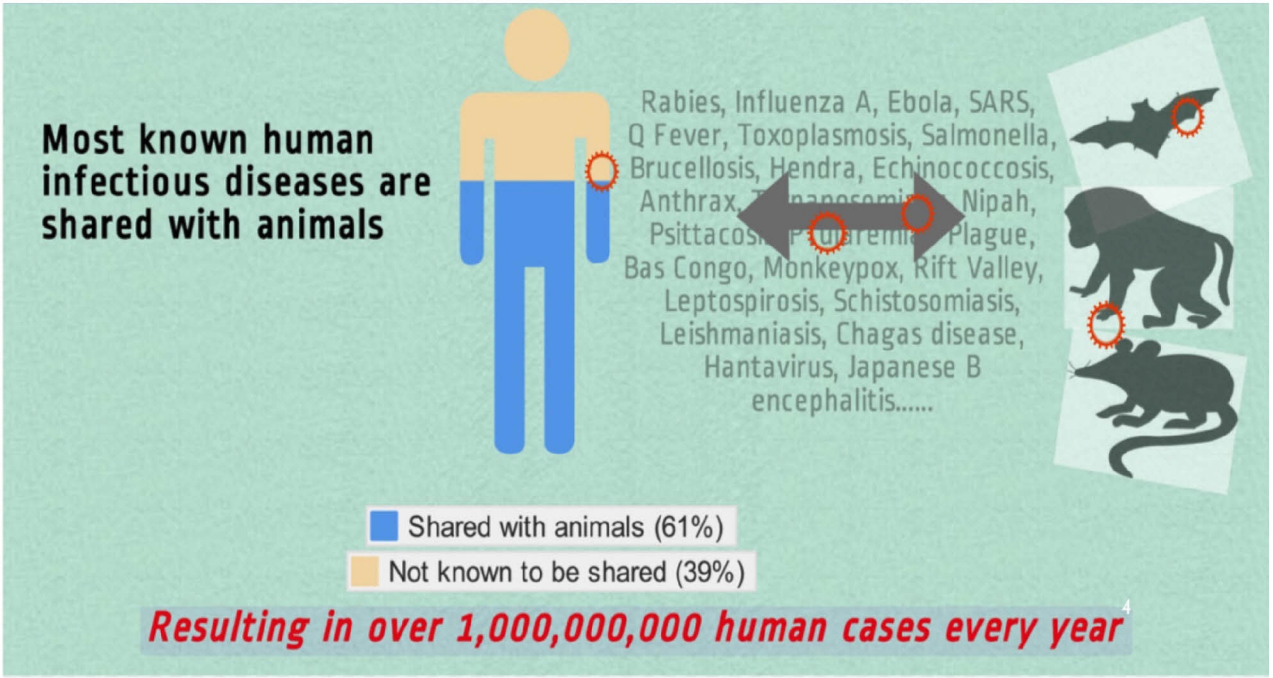
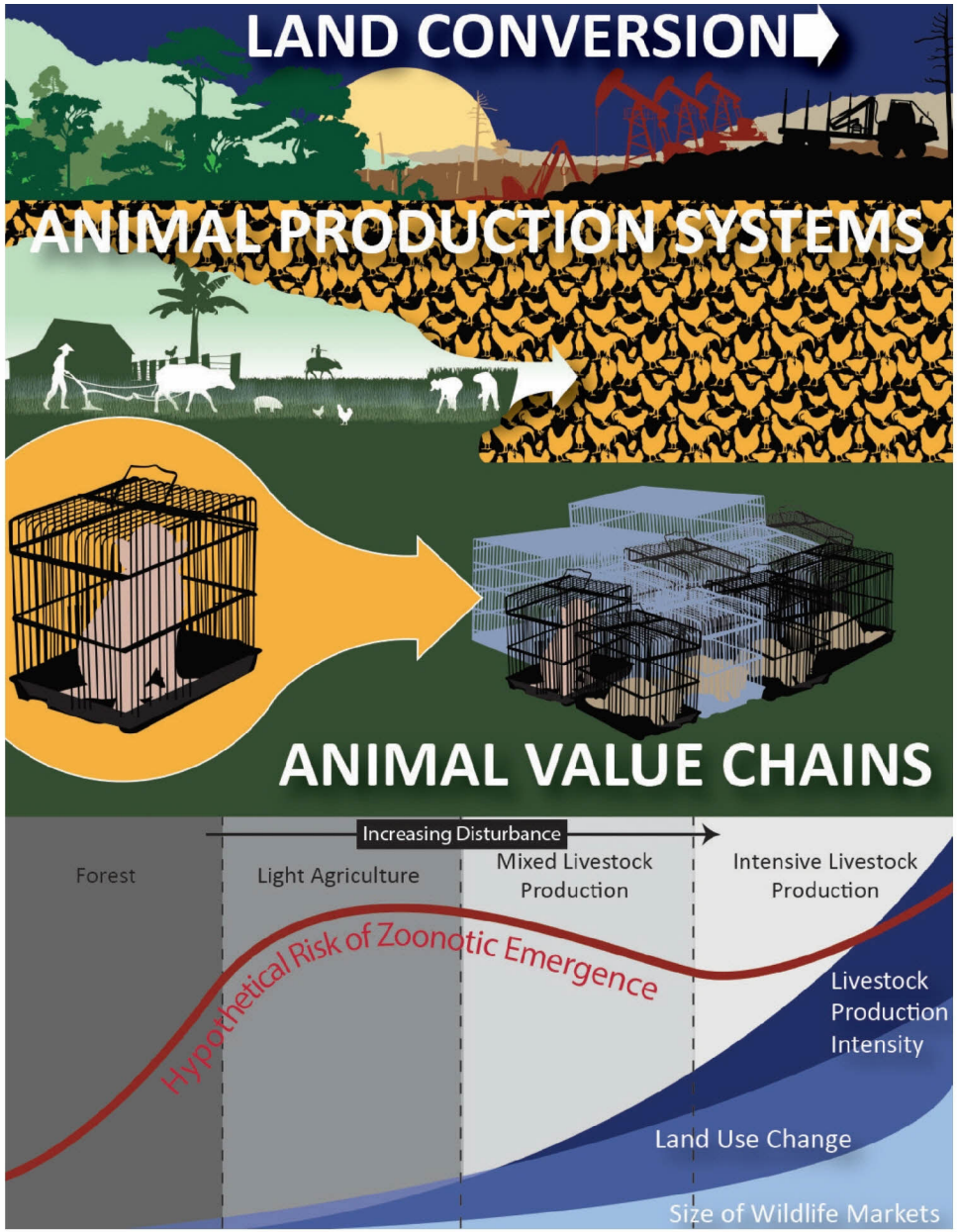
BRIDGING HUMAN, ANIMAL AND ENVIRONMENTAL HEALTH TO ADVANCE GLOBAL HEALTH AND DEVELOPMENT

Recent disease outbreaks have drastically threatened local and global health as well as country development. The Ebola outbreak in West Africa, beginning in late 2013 and continuing into 2016, resulted in over 28,600 cases, reducing gross domestic product growth in all three highly affected countries as well as disrupting progress in other key development priorities, including educational attainment, vaccination campaigns and management or treatment of disease such as HIV/AIDS, and malaria, food security, and poverty reduction.[1] Agricultural production has been heavily affected by past zoonotic disease outbreaks such as highly pathogenic avian influenza viruses, Nipah virus, and Rift Valley fever virus, resulting in economic impacts to the agricultural industry and livelihoods associated with it.

While focusing recovery efforts for affected countries is critical, the world still remains unprepared to tackle new disease outbreaks in the future. Ebola virus, avian influenza virus, SARS-Coronavirus, HIV and many other recent outbreaks have all been linked to infections from animals. But this trend is not new — in fact, the majority of known human infectious have originated at some point from animals ("zoonotic diseases").[2,3] The distinctions between so-called "emerging" diseases and established diseases are not static: as seen with HIV, a relatively new disease may quickly become established in human populations. The recent spread of Zika virus in the Americas represents the potential for new diseases to emerge and have rapid nation-level impacts.



WHAT IS CAUSING ZOONOTIC DISEASE OUTBREAKS?



Disease transmission events from animals or environmental sources to humans appear to be increasing. This has been prompted by major changes to ecosystems (brought on by human activities), and associated activities that increase human-animal contact. In turn, globalization's rapid trade and travel is enabling the spread of new diseases between countries and continents, resulting in pandemics.[4]

The underlying causes of diseases being transmitted from animals to humans include: conversion of landscapes, as often associated with deforestation for agriculture, timber logging, mining, oil extraction, changing agriculture and food production systems, and wildlife trade.[5] These pressures are providing more opportunities for pathogens to move between species and cause new outbreaks. They also are among main drivers of biodiversity loss.[6]

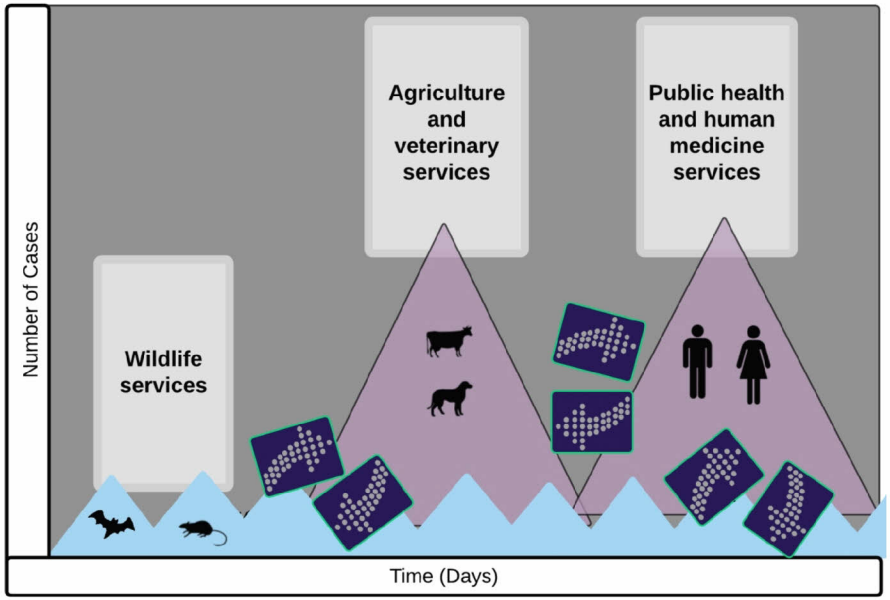
While wild and domestic animals may serve as sources for human disease, many also provide critical functions to ecosystems that support human health. Animals may also be affected by disease outbreaks (including, in some cases, diseases from humans). Past outbreaks of Ebola virus in Central Africa have taken their toll on humans as well as endangered great ape populations. Domestic animals, such as livestock, may also be affected by disease, threatening food production and food security.[6]

A HISTORICAL LOOK

Zoonotic disease outbreaks over recent decades have led to lasting public health and economic impacts. The 2003 outbreak of Severe Acute Respiratory Syndrome (SARS) cost the global economy an estimated US$30-40 billion.[7] HIV/AIDS, which was originally acquired from Great Apes (likely from hunting or butchering an infected animal), remains a public health crisis in several parts of the world, with 34 million infection-associated deaths to date.[8] Despite the ongoing impact of HIV/AIDS on public health and development, the systems in place to detect new diseases from other species have not changed significantly since the first detection of HIV/AIDS thirty-five years ago.

To date, only 1% of the estimated viruses in mammals have been detected.[9] While technological advancements have allowed us to discover pathogens more efficiently and affordably, to date there has been very limited screening of wildlife and livestock for pathogens they carry. Without knowing the pathogens circulating in our environments, we have limited information about diseases that may threaten our health in the future, thereby losing critical opportunities for prevention and risk reduction.

Health systems operate in a highly reactive fashion for emerging diseases, identifying and responding to a disease risk once an outbreak occurs. Human, veterinary/agriculture, and wildlife health sectors tend to work separately. This lack of coordination and information sharing limits our opportunities to prevent pathogens from 'spilling over' from one species to another.[10]



Gaps in authority and weak institutional capacity currently limit action in preventing the transmission of pathogens between humans, domestic animals, and wildlife. Each discipline typically responds once they see an outbreak in their own sector.

An alternate approach, with ongoing collaboration across sectors, could help identify critical transmission risks and potential solutions among these sectors.

ONE HEALTH GOES BEYOND ZOONOTIC DISEASE

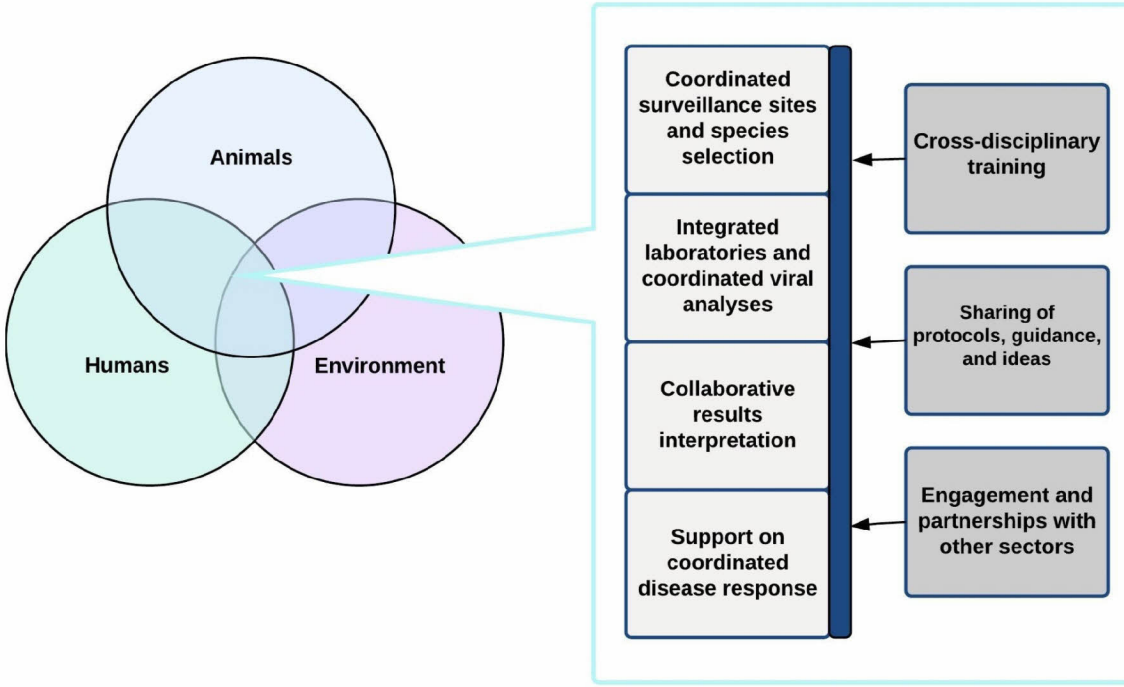
One Health is an interdisciplinary collaborative effort to attain optimal health for people, animals, and our environment.

One Health is founded on the need for a more integrated understanding of the connections among humans, animals and ecosystems within the political, economic and social systems in which they operate. By better understanding the full picture of disease transmission, the public health, veterinary, agriculture, and environmental communities can work together to identify more effective solutions. Their collaboration can result in more comprehensive, as well as cost-effective, outcomes than in single-discipline operations.

A One Health approach is especially needed in light of the rapid global environmental and agricultural changes that are presently occurring and expected to increase over the coming decades. These are creating pressures on natural systems and increasing contact between humans and other species, facilitating emergnce of both infectious and noninfectious disease problems.

Support for One Health has been expressed at high levels, but its implementation on the ground remains limited due to a wide range of competing priorities. Over the course of the past six years, the USAID Emerging Pandemic Threats program has advanced One Health operations in 30+ developing countries.[1] This booklet provides case studies from Emerging Pandemic Threats partner countries to demonstrate the type of approaches, partnerships and benefits that One Health can yield.

The folloiwng case studies represent a compiliation of examples to date, noting that One Health examples will be further established and refined in the work of Emerging Pandemic Threats projects and partners.



National One Health Networks

Bangladesh has a strong legacy of interest and leadership in One Health efforts, with participation from a wide range of collaborating institutions. A Pandemic Influenza Preparedness and Response plan was initiated in 2005 and involved veterinary, public health, and wildlife health sectors working together. One of the pillars of the plan was coordination. Experts at Chittagong Veterinary & Animal Sciences University (CVASU) began informal discussions with stakeholders from public health, animal health, wildlife, and environmental communities. The need for a One Health approach was identified based on Bangladesh's high population density, vulnerable food and water security, threatened ecosystems, close contact between humans and animals, and its identification as a "hotspot" for disease emergence.[4] A "One Health Bangladesh" organization was soon established, with representatives from 12 national and international organizations. One Health Bangladesh has co-hosted eight conferences since its establishment, including an event hosted by USAID Emerging Pandemic Threats program partners with participation by representatives of the Food and Agriculture Organization, the World Health Organization, the country's Public Health and Livestock Departments, and the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b).

In 2012 One Health Bangladesh — jointly with Ministry of Health and Family Welfare, Ministry of Fisheries and Livestock, Ministry of Environment and Forestry, and UN Agencies — developed a National One Health Strategic Framework and Action Plan for Infectious Diseases in Bangladesh. The Framework identified nine components

for undertaking various activities involving relevant stakeholders and has been officially approved by the aforementioned three Ministries, which have given instruction to the relevant agencies for its implementation. One component is One Health Governance under which a One Health Secretariat would be established to coordinate implementation of activities. One Health Bangladesh now has nearly 400 members — including physicians, veterinarians, agriculturists, environmentalists, wildlife experts, ecologists, anthropologists, economists, allied scientists and practitioners, and activists. One Health Bangladesh is also a member of the One Health Alliance of South Asia, a regional network of governmental and non-governmental scientists and policy makers working on human, animal and environmental issues. Partners report a "new professional culture is emerging" in the country that acknowledges the value of cross-sectoral collaboration.

ONE HEALTH PARTNERS: Institute of Epidemiology, Disease Control and Research, Bangladesh Ministry of Health and Family Welfare; Department of Livestock Services, Ministry of Fisheries and Livestock; Forest Department, Ministry of Environment and Forests; Chittagong Veterinary & Animal Sciences University; International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b); EcoHealth Alliance; FAO; WHO; U.S. CDC; Massey University; UNICEF; USAID Emerging Pandemic Threats PREDICT, PREVENT, Preparedness and Response.

One Health Partners: Ministry of Public Health; Ministry of Environment; Wildlife Conservation Society; EcoHealth Alliance; Pan-American Health Organization; Ambue Ari wildlife sanctuary; University of San Andres' Institute of Molecular Biology; the Vesty Pakos Zoo; USAID Emerging Pandemic Threats PREDICT.

Early Warnings from Wildlife and Effective Collaboration to Prevent Human Outbreaks

Yellow Fever is a mosquito-borne virus that infects humans as well as non-human primates, potentially resulting in hemorrhagic fever leading to death. Yellow Fever transmission can occur if infected monkeys and any of the mosquito vector species are present. In 2012, after One Health training by partners from the PREDICT program, staff at a wildlife sanctuary in Santa Cruz, Bolivia, reported six dead Howler Monkeys near the park. Early investigation during specimen collection and analysis at University of San Andres' Institute of Molecular Biology suggested that the infection was associated with a Flavivirus (a family of viruses transmitted from mosquitos or ticks). PREDICT partners alerted the Bolivian Ministry of Health while conducting further analysis for the specific pathogen — ultimately identified as Yellow Fever virus. A transdisciplinary, collaborative and coordinated response was undertaken in the region, including preventive human vaccination campaigns, mosquito control, and public outreach. Although infected monkeys had never been previously reported in Bolivia, the response to this outbreak was rapidly mobilized — within eight days from the detection to resolution of the outbreak. No human cases were reported, suggesting the benefit of awareness of risks, early warning systems in animals (including local laboratory capacity to screen for pathogens), and effective collaboration channels with a wide range of partners.

Collaboration for a Successful Outbreak Response

The monkeypox virus causes an infectious disease with clinical symptoms similar to smallpox. In parts of West and Central Africa, monkeypox virus has been found in small mammals including certain types of rats, mice, and squirrels, but can occasionally spill over into monkeys, chimpanzees, and human populations. Death occurs in about 10% of human cases, and there is no known treatment, and very little is known about transmission from animal reservoirs to human populations. Monkeypox is endemic to some countries in the region and there had been a single human case recorded in Cameroon in the past decades, but no recent cases had been observed in the country until March 2014. At this time, several chimpanzees fell ill at the Sanaga Yong Chimpanzee Rescue Center. Cameroon's newly adopted One Health Strategy and Zoonotic Program, with One Health focal persons appointed to four ministries, was put into action shortly after the suspected cases were reported to the Ministry of Health.

The cross-sectoral planning and response, which included literature reviews, on-site risk investigation, observations, sampling and laboratory diagnostics, as well as reporting to international agencies such as the World Animal Health Organisation (OIE) and the International Health Regulation of WHO, allowed for better knowledge sharing, faster response time, and decreased cost. Of the 72 chimpanzees in the sanctuary, the outbreak was limited to 6 cases of infection, with only one fatality and no spillover to human contacts. The PREDICT project and Cameroon Epidemiological and Veterinary Public Health Association provided support to the ministries during the investigation planning and response phases, helping to reinforce a One Health approach and practice.

After the outbreak ended and the investigation was complete, agencies compared this response to previous outbreak responses. The use of a One Health approach in this case was estimated to provide a two-third reduction in the total cost of the investigation and a response time that was a full 10 days faster. This was achieved through sending a single investigation team with representatives from multiple ministry sectors and requiring only a single government travel authorization.

One Health Partners: Sanaga Yong Chimpanzee Rescue Center; Ministry of Public Health; Ministry of Livestock, Fisheries and Animal Industries; Ministry of Forestry & Wildlife; U.S. CDC; U.S. National Institutes of Health; Centre de Recherche pour la Santé des Armées; Metabiota; Mosaic; Global Viral; Cameroon Epidemiological and Veterinary Public Health Association; USAID Emerging Pandemic Threats PREDICT and Preparedness and Response.

One Health Partners: Ministry of Enrivonment and Forestry; Ministry of Agriculture; Ministry of Health; Ministry of Research and Technology; Coordinating Ministry of People's Welfare; Indonesian Institute of Science (LIPI); KomNas Zoonosis Control; Primate Research Center at Bogor Agricultural University; Eijkman Institute for Molecular Biology; Universitas Sam Ratulangi (Manado Sulawesi Utara); Universitas Negeri Gorontalo, Padjadjaran University (Bandung, Javaz) EcoHealth Alliance; Metabiota; Smithsonian Institution; USAID Emerging Pandemic Threats PREDICT project.

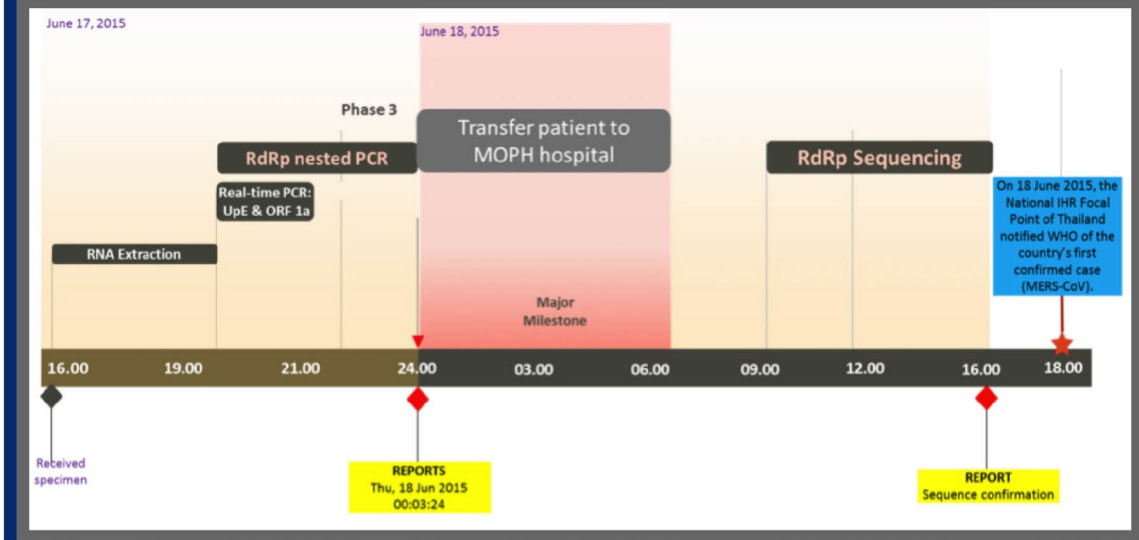
Coordinated Information Sharing and Interpretation

PREDICT developed a systematic One Health approach to surveillance results sharing, review, and approval for public release. The information flow process involved designated points of contact in each country at the ministries representing human health, livestock, and wildlife who received each results report. In many cases, sampling and/or laboratory screening occurred in partnership with Ministries, so surveillance results were directly relevant, but the routine results dissemination to all three ministries was emphasized as a way to showcase One Health intersections and opportunities for identifying coordinated solutions. Integrated discussions of results were encouraged in inter-ministerial forums (e.g. at task force meetings). In Indonesia, PREDICT's reporting efforts helped initiate a government mandate for a national reporting framework for wildlife and human disease surveillance. These streamlined and more comprehensive reporting systems assist the country in disease monitoring, as well as in meeting its reporting obligations to the World Health Organization (WHO) under the International Health Regulations as well as to the World Organisation for Animal Health (OIE).

Identifying Animal Reservoirs to Mitigate Risk

One Health efforts in Cameroon also helped identify gorillas as the animal reservoir for human T-lymphotropic virus type 4 (HTLV-4) in 2014.[12] The source of the first known human infection, discovered in a hunter in 2005, was unknown. In a strong collaboration with the Cameroonian ministry responsible for wildlife, the Limbe Wildlife Centre and Ape Action Africa who is responsible for managing primates in Mfou National Park sanctuary, and with rural communities throughout the country, PREDICT program partners tested specimens for HTLV-4, finding the virus in a number of captive and wild gorillas. Given that other HTLV strains are known to cause severe illness in humans, this finding was important for informing risk mitigation practices. Hunters were educated about risks of contact with wildlife and informed on protection measures. Given their critically endangered conservation status, as well as previous findings of other zoonotic viruses in gorillas, this finding provides further support for protection of gorillas from illegal hunting to promote both public health and conservation.

One Health Partners: Ministry of Forestry and Wildlife; Centre de Recherche pour la Santé des Armées; Limbe Wildlife Centre; Ape Action Africa; Mosaic; Global Viral; Metabiota; U.S. CDC; Ape Action Africa; USAID Emerging Pandemic Threats PREDICT.



One Health Partners: Ministry of Public Health; WHO Collaborating Center for Research and Training on Viral Zoonoses at Chulalongkorn University; World Health Organization; EcoHealth Alliance; Department of National Parks, Wildlife and Plant Conservation; USAID Emerging Pandemic Threats PREDICT.

Surveillance Preparedness

The Middle East Respiratory Syndrome Coronavirus (MERS-CoV), caused by a Coronavirus, is an emerging infectious disease that was first detected in 2012. MERS-CoV is thought to have an animal source, but infections may also be transmitted between humans through airborne spread or direct contact. In June 2015, Thailand saw its first case of MERS-CoV, brought into the country by an international traveler. As a result of prior preparedness efforts, including viral discovery for human infections as part of the PREDICT program, training on sampling for potential MERS-CoV infections, and MERS-CoV laboratory screening protocols, the country had strong capacities in place. Paired with infection control practices, intensive surveillance was rapidly implemented in high-risk settings including points of entry into the country and in healthcare settings. Specimens were rapidly tested (only 7 hours for first results and 24 hours for confirmation) at the WHO Collaborating Center for Research and Training on Viral Zoonoses at Thailand's Chulalongkorn University (which reports to the Ministry of Health). No secondary infections were detected in Thailand suggesting no human to human transmission occurred. Given the limited knowledge on coronaviruses, surveillance efforts have also been undertaken by the One Health partners involved in the human MERS outbreak to screen for coronaviruses in wildlife and domestic animals in the country to help improve understanding about this group of viruses.

Rapid Identification and Containment of Disease Outbreaks

In July 2014, in the midst of the Ebola virus crisis in Guinea, Liberia, and Sierra Leone, a separate outbreak of Ebola virus occurred in the Democratic Republic of Congo (DRC). When it occurred, several virology experts from DRC's Institut National de Recherche Biomédicale (INRB), the national infectious disease laboratory responsible for haemorrhagic fever diagnostics, were out of the country responding to the West African outbreak. However, the country had experienced prior Ebola virus outbreaks and had preparedness capacity in place. Through a long-standing INRB-PREDICT partnership, the PREDICT laboratory (which is hosted at INRB), was requested to assist with conducting the diagnostic testing. Samples were collected from suspected cases and screened, with preliminary confirmation of Ebola virus within a day of receiving the samples. Based on the early results of the laboratory tests, the DRC government was able to enact rapid disease control measures such as control of travel, dispatch of a mobile laboratory, and infected patient contact tracing, among other measures, leading to containment of the outbreak. Sequencing of the positive cases indicated that the DRC outbreak was an independent outbreak from the outbreak in West Africa, and the source of the outbreak (the butchering of an infected animal that had been found dead and collected for food) was identified through trace-back efforts, helping to elucidate the transmission chain and target high-risk practices to prevent future infections. The outbreak response demonstrated the value of strong partnerships between institutions as well as efficient and effective communication systems, diagnosis capabilities, and disease control measures. The PREDICT team was also requested to conduct wildlife sampling in the affected area to determine the presence of *Ebolaviruses* circulating in wildlife, and to participate in the training of health care providers and epidemiologists to be deployed in the Ebola affected countries of West Africa.

One Health Partners: Institut National de Recherche Biomédicale (INRB); Ministry of Health; Metabiota; Ministry of Environment; Institut Congolais pour la Conservation de la Nature (ICCN); Direction of animal production and health at the Ministry of Agriculture; USAID Emerging Pandemic Threats PREDICT.

WAYS FORWARD

One Health approaches have been employed in a range of situations in Emerging Pandemic Threats partner countries. These have helped enhance understanding of and solutions to emerging infectious disease threats. The case studies demonstrate the relevance and benefits of One Health to economic, public health, agricultural, and environmental issues, as well tourism and development, food and nutrition, climate and weather, and more.

Successful approaches include interdisciplinary surveillance, reporting and laboratory collaboration, coordinated data sharing and interpretation, and strong communication channels for disease reporting and rapid action. While One Health is adaptable to country-specific contexts, in addition to the direct contribution to global health security, best practices established abroad can provide valuable lessons for domestic health systems on efficiencies across sectors, outbreak preparedness, and overall greater focus on preventing disease.

Given the high economic and societal cost of recent outbreaks, policy decisions and global and local health capacity investments can be oriented to create incentives for advancing a One Health approach aimed at preventing, not just responding to, disease outbreaks.

Future case studies and evaluation, generated both within and outside of the context of the Emerging Pandemic Threats program, can offer further insight into other potential applications. In addition to predicting, preventing and preparing for pandemic threats, One Health may be beneficial for addressing many complex problems involving humans, animals, and their shared environments such as addressing pollution, food security, and sustainable development goals.




ADDITIONAL RESOURCES

To learn more about One Health and the Emerging Pandemic Threats program, please visit:

USAID Emerging Pandemic Threats program

- Program background: https://www.usaid.gov/what-we-do/global-health/pandemic-influenza-and-other-emerging-threats
- PREDICT: http://www.predict.global
- PREDICT project report: http://www.report.predict.global
- Preparedness & Response: http://dai.com/our-work/projects/worldwide—preparedness-and-response-pr

Additional One Health Case studies

- ISID competition: http://www.syndromic.org/cop/one-health-surveillance/957-ohs-resources
- Network for Evaluation of One Health: http://neoh.onehealthglobal.net/

Disease Monitoring Resources

- Subscribe to ProMED (Program for Monitoring Emerging Diseases) Mail: http://ww4.isid.org/promedmail/subscribe.php
- HealthMap: http://www.healthmap.org/en/
- HealthMap PREDICT: http://www.vetmed.ucdavis.edu/ohi/predict/predict_surveillance.cfm

Open Access Publications

- OIE Scientific and Technical Review: "One Health" edition: http://web.oie.int/boutique/index.php?page=ficprod&id_produit=1308&fichrech=1&lang=en

PHOTO CREDITS

Page 1- S. Osofsky/WCS, Mongolia; Page 7- K. Olival, Bangladesh; Page 8- E. Alandia, Bolivia; Page 9- M. LeBreton, Cameroon; Page 10- UC Davis, Thailand; Page 11- M. LeBreton, Cameroon; Page 12- K. Olival and S. Wacharapluesadee, Thailand; Page 13- V. Porter, Liberia; Page 14- S. Murray, Kenya; M. Miller, Egypt; M. LeBreton, Cameroon; UC Davis, Nepal

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From: predict-request@ucdavis.edu on behalf of "William B. Karesh" <karesh@ecohealthalliance.org>
Sent: 08/29/2019 8:54:33 AM (-07:00)
To: "David Wolking" <djwolking@ucdavis.edu>
Cc: "Julius Nziza" [redacted]; "Kirsten Gilardi" <kvgilardi@ucdavis.edu>; "predict@ucdavis.edu" <predict@ucdavis.edu>; "Catherine Machalaba" <machalaba@ecohealthalliance.org>
Subject: [predict] Re: ACTION REQUIRED: Congratulations! You've been nominated to lead a session at the PREDICT All-Country Meeting: Translating Data and Risk

Happy to help moderate with Julius.

The choices look fine to me.

One addition if you are not using him already would be Dr. Ehab Abu-Basha from Jordan. He used the PREDICT data as "content" for their national one health platform meetings 4-6 times a year, and also helped produce a video and exhibit showing at the Children's Museum which gets over 500,000 visitors a year. I know he is bringing the video, but you might have him showing it in another session.

BK

William B. Karesh, D.V.M
Executive Vice President for Health and Policy

EcoHealth Alliance
460 West 34th Street - 17th Floor
New York, NY 10001 USA

+1.212.380.4463 (direct)
+1.212.380.4465 (fax)
www.ecohealthalliance.org

President, OIE Working Group on Wildlife

Co-chair, IUCN Species Survival Commission - Wildlife Health Specialist Group

EPT Partners Liaison, USAID Emerging Pandemic Threats - PREDICT-2 Program

> On Aug 28, 2019, at 5:25 PM, David J Wolking <djwolking@ucdavis.edu> wrote:
>
> Hi Billy and Julius,

On behalf of the All-Country Meeting Coordinating Committee, we are really excited to see you in a few weeks in Bali! Due to your expertise and long-time working with PREDICT, we would like to nominate you both to co-moderate the panel session "**Translating Data and Risk into Communications for Policy and Stakeholders**". It's a 1 hour session on Day 2.

The structure is for two moderators to lead a discussion based on the theme of the session with a panel of participants from various PREDICT host countries. Below you will see details on your panel along with suggested participants. The countries and panelists listed in black are those best suited for the session. Countries/panelists in red are either featured heavily in other sessions or did not provide a strong proposed theme in the Google Form. We tried to pick participants keeping in mind a host of factors including Consortium partner representation, global geography, proposed theme and participation on other panels for overall balance in the program. Ideally, each session will have between 4-6 panelists depending on length and the structure and goals for the session, which are largely your decision as moderators.

First, please let us know if you are willing to lead the session. If so, we'd like you to review the theme and participants and get back to us with any questions or thoughts by this Friday, August 30th. On Monday (September 2nd) we plan to send out another email connecting you with your list of panelists to confirm their participation so you can begin preparations. After that, the rest is in your hands.

Please don't hesitate to reach out with any questions, happy to help!

David

Translating Data and Risk into Communications for Policy and Stakeholders - Billy Karesh and Julius Nziza (Rwanda)

Day 2; 1 hour

Countries/Panelists:

- Rwanda
  covered by moderator
- Nepal
  (Manisha) - no proposed theme in Google form so may need follow-up on their ideas

Suggestions:

-

Cameroon
(Moctar) - now with IDDS; national system, GHSA theme?

- Senegal
(Mustafa Lo) - very experienced with data and policy issues in West Africa

- Viet
Nam (Nga) - lots of experience with wildlife trade, policy, etc.

From: "Woutrina A Smith" <wasmith@ucdavis.edu>
Sent: 10/29/2019 3:58:24 PM (-07:00)
To: "Oladele Ogunseitan" <oladele.ogunseitan@uci.edu>; "Peter Daszak" <daszak@ecohealthalliance.org>; "William B. Karesh" <Karesh@ecohealthalliance.org>; "mr84@columbia.edu" <mr84@columbia.edu>; "alexandra zuber" <alexandrazuber@atahealthstrategies.com>; "Matthew Blake" <mblake@ucdavis.edu>; "Tracey Goldstein" <tgoldstein@ucdavis.edu>; "David John Wolking" <djwolking@ucdavis.edu>; "Terra Kelly" <trkelly@ucdavis.edu>; "Jaber Amine Belkhiria" <jabelkhiria@ucdavis.edu>; "Elizabeth Leasure" <ealeasure@UCDAVIS.EDU>; "Jonna Mazet" <jkmazet@ucdavis.edu>; "Corina Grigorescu Monagin" <cgmonagin@UCDAVIS.EDU>; "McNeil, Carrie S." <csmcnei@sandia.gov>; "Jutta Lehmer" <JLehmer@salud.unm.edu>; "Omar Romero-hernandez" <oromero@haas.berkeley.edu>; "Bruce Baird Struminger" <BStruminger@salud.unm.edu>; "Federico Castillo" <f.castillo@berkeley.edu>; "Ndola PRATA" <ndola@berkeley.edu>; "Tiffany Harris, PhD, MS" <th2604@columbia.edu>; "Costa, Cristiane" <co123@cumc.columbia.edu>; "Amaya, Idalia M." <ima2107@cumc.columbia.edu>; "Sam Halabi" <sfh9@georgetown.edu>
Cc: "onehealthnextgen Sympa List" <onehealthnextgen@ucdavis.edu>
Subject: Re: OHW-NG - No Executive Board call this week

Hi OHW-NG EB team,

A quick note that there is no OHW-NG Executive Board call this week but if there are important updates foliowing the Management Team call with USAID this week we will reach out by email to follow up. Given the every other week EB schedule, our next call is next Wednesday, Nov 6, from 11am-noon PST = 2-3pm EST. We will send zoom info and agenda in advance.

Best wishes, Woutrina

Woutrina Smith, DVM, MPVM, PhD
Professor of Infectious Disease Epidemiology
Associate Director, UCD One Health Institute
Technical Director, USAID One Health Workforce - Next Gen
Co-Director, UCGHI Planetary Health Center of Expertise
School of Veterinary Medicine, UC Davis
1089 Veterinary Medicine Dr
Davis, CA 95616 USA
wasmith@ucdavis.edu

Subject: Obj 3 Discussion with AfrOHUN
Location: https://zoom.us/j/124965216

Start: 11/25/2019 7:00:00 AM (-07:00)
End: 11/25/2019 8:30:00 AM (-07:00)

Organizer: alexandrazuber@gmail.com (alexandrazuber@gmail.com)
Required Attendees:
wasmith@ucdavis.edu;brpsmith@ucdavis.edu; REDACTED ;jklane@ucdavis.edu;oromero@haas.berkeley.edu; REDACTED ;aarmistad@salud.unm.edu;djwolking@ucdavis.edu; REDACTED ;jkmazet@ucdavis.edu;onehealthnextgen@ucdavis.edu; REDACTED REDACTED ;f.castillo@berkeley.edu;mr84@cumc.columbia.edu;Peter Daszak;ndola@berkeley.edu;Matthew Blake;oladele.ogunseitan@uci.edu;Terra Kelly;karesh@ecohealthalliance.org;sfh9@georgetown.edu

Dear all,
We are delighted to have this opportunity to have our first Objective 3 work group dialogue with AfrOHUN staff. \; If AfrOHUN staff are available, I'd like to make this meeting 90 minutes so we have time for substantive discussion. \;

The objective is to begin discussions on work plan priorities and activities for Year 1 in the area of Objective 3, organizational development. \; Agenda forthcoming. \;

Alexandra Zuber is inviting you to a scheduled Zoom meeting.
Join Zoom Meeting
<a href=" REDACTED Meeting ID: REDACTED

One tap mobile
+ REDACTED # US (New York)
+ REDACTED # US (San Jose)

Dial by your location
 \; \; \; \; \; \; \; \;+ REDACTED US (New York)
 \; \; \; \; \; \; \; \;+1 US (San Jose)
Meeting ID: REDACTED REDACTED
Find your local number: <a href=" REDACTED

-::~:~::~::~:~::-
Please do not edit this section of the description.

View your event at
REDACTED
-::~:~::~::~:~::-

From: onehealthnextgen-request@ucdavis.edu on behalf of "Elizabeth Leasure" <ealeasure@ucdavis.edu>
Sent: 01/09/2020 11:08:20 AM (-08:00)
To: "Peter Daszak" <daszak@ecohealthalliance.org>; "Woutrina A Smith" <wasmith@ucdavis.edu>
Cc: "Alison Andre" <andre@ecohealthalliance.org>; "Kevin Olival" <olival@ecohealthalliance.org>; "Katherine Leasure" <kaleasure@ucdavis.edu>; "onehealthnextgen Sympa List" <onehealthnextgen@ucdavis.edu>
Subject: [onehealthnextgen] RE: Checking in with ITAs

Thanks, Peter. I've copied Katie, who will be managing the ITA submission process on our end. She can provide more guidance as to the new process for OHW-NG, which is slightly different than for PREDICT.

Thanks,
Liz

Elizabeth Leasure
Financial Operations Manager
One Health Institute
530-304-1403 (cell)
530-754-9034 (office)
Skype: ealeasure

From: Peter Daszak <daszak@ecohealthalliance.org>
Sent: Thursday, January 9, 2020 10:56 AM
To: Woutrina A Smith <wasmith@ucdavis.edu>; Elizabeth Leasure <ealeasure@UCDAVIS.EDU>
Cc: Alison Andre <andre@ecohealthalliance.org>; Kevin Olival <olival@ecohealthalliance.org>
Subject: Checking in with ITAs
Importance: High

Woutrina and Liz,

Jon, Kevin, Hongying and myself will be traveling to the ISID meeting in Malaysia at the end of February and are aiming to meet with some of the INDOHUN, MYOHUN, and THOHUN folks who will also be there.

I just wanted to give you a heads up and I've asked Alison to file ITAs. We'll be respectful of budgets and not charge everyone and all expenses to OHW of course, but want to get the ITAs in now so we're not too late…

Cheers,

Peter

Peter Daszak
President

EcoHealth Alliance
460 West 34th Street – 17th Floor
New York, NY 10001

Tel. +1 212-380-4474
Website: www.ecohealthalliance.org
Twitter: @PeterDaszak

EcoHealth Alliance leads cutting-edge research into the critical connections between human and wildlife health and delicate ecosystems. With this science we develop solutions that prevent pandemics and promote conservation.

From: onehealthnextgen-request@ucdavis.edu on behalf of "Peter Daszak" <daszak@ecohealthalliance.org>
Sent: 01/09/2020 11:19:07 AM (-08:00)
To: "Elizabeth Leasure" <ealeasure@ucdavis.edu>; "Woutrina A Smith" <wasmith@ucdavis.edu>
Cc: "Alison Andre" <andre@ecohealthalliance.org>; "Kevin Olival" <olival@ecohealthalliance.org>; "Katherine Leasure" <kaleasure@ucdavis.edu>; "onehealthnextgen Sympa List" <onehealthnextgen@ucdavis.edu>
Subject: [onehealthnextgen] RE: Checking in with ITAs

Great – thanks!

Cheers,

Peter

Peter Daszak
President

EcoHealth Alliance
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Website: www.ecohealthalliance.org
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From: Elizabeth Leasure [mailto:ealeasure@UCDAVIS.EDU]
Sent: Thursday, January 9, 2020 2:08 PM
To: Peter Daszak; Woutrina A Smith
Cc: Alison Andre; Kevin Olival; Katherine Leasure; onehealthnextgen Sympa List
Subject: RE: Checking in with ITAs

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Skype: ealeasure

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To: Woutrina A Smith <wasmith@ucdavis.edu>; Elizabeth Leasure <ealeasure@UCDAVIS.EDU>
Cc: Alison Andre <andre@ecohealthalliance.org>; Kevin Olival <olival@ecohealthalliance.org>
Subject: Checking in with ITAs
Importance: High

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Twitter: @PeterDaszak

EcoHealth Alliance leads cutting-edge research into the critical connections between human and wildlife health and delicate ecosystems. With this science we develop solutions that prevent pandemics and promote conservation.

From: onehealthnextgen-request@ucdavis.edu on behalf of "Vipat Kuruchittham" <vipat@seaohun.org>
Sent: 08/13/2020 9:50:52 PM (-07:00)
To: "Giles Sioen" <giles.sioen@futureearth.org>
Cc: "Catherine Machalaba" <machalaba@ecohealthalliance.org>; "Fumiko Kasuga" <fumiko.kasuga@futureearth.org>; "Ratsuda Poolsuk" <ratsuda@seaohun.org>; "Peter Daszak" <daszak@ecohealthalliance.org>; "Kevin Olival" <olival@ecohealthalliance.org>; "Tracey Goldstein" <tgoldstein@ucdavis.edu>; "Alison Andre" <andre@ecohealthalliance.org>; "OHW NG" <ohw-ng@seaohun.org>; "onehealthnextgen Sympa List" <onehealthnextgen@ucdavis.edu>; "Josh Tewksbury" <josh.tewksbury@futureearth.org>; "Olesya Kochkina" <olesya@seaohun.org>
Subject: [onehealthnextgen] Re: Belmont Forum "Climate, Environment and Health"- Scoping Process for Asia

Dear Giles,

Thank you for the update. We look forward to having further dialogues with you when the time comes.

Best regards,

Pat

Vipat Kuruchittham, PhD
Executive Director

On Fri, Aug 14, 2020 at 11:33 AM Giles Sioen <giles.sioen@futureearth.org> wrote:

> Dear Pat and all
>
> Thank you for your inputs here and my sincere apologies for the silence until now while I was trying to get a better grasp of the situation. I have to clarify that the current phase is still preliminary before the formal scoping work will begin; however, it seems the timing around COVID-19 is causing several delays. As things move forward very slowly, I think the information we have gathered until now has been extremely useful and we can continue to keep our eyes and ears open for potential events and partners so that we can engage efficiently when things speed up again.
>
> Looking forward to continued talks in the near future!
>
> Best wishes
> Giles
>
> On Mon, Jul 27, 2020 at 2:59 PM Vipat Kuruchittham <vipat@seaohun.org> wrote:
>
> > Dear Giles,
> >
> > Thank you for the background information. I or SEAOHUN Secretariat is pleased to support and facilitate the engagement with our group of universities from 8 Southeast Asian countries. I will be happy to connect in the week of 10 August or after. I am happy to find time if it is urgent for us to connect.
> >
> > As for the events, I can share some details on the GHSA Ministerial Meeting as I am involved in one of the working groups. The GHSA Ministerial Meeting will go virtual on 19-20 November 2020 (tentative). The save-the-date should be announced on https://ghsagenda.org/ soon. There will be a call for side meetings

for the group to conduct virtually using the platform given by the organizer. Then, each side meeting will present its summary on 18 November (Day 0) to be further summarized and presented to the Ministerial Meeting on Day 1.

A conference you may consider is the Global Health Security Conference on 22-25 June 2021 in Australia (https://www.ghsconf.com/).

A big event that has been posted from 2020 to 2021 is the 20th International Congress for Tropical Medicine and Malaria (https://ictmm2020.org/). It is now scheduled for 17-21 August 2021 in Bangkok.

Best regards,

Pat

Vipat Kuruchittham, PhD
Executive Director

On Mon, Jul 27, 2020 at 8:28 AM Giles Sioen <giles.sioen@futureearth.org> wrote:

> Dear Catherine, thank you for the very valuable introduction to Pat and Tuck from SEAOHUN!
>
> Dear Pat,
>
> It's a pleasure to meet you and thank you very much for the helpful background information. My name is Giles Sioen and I am a Science Officer/Interim Lead for Research and Innovation based at Future Earth's Japan Global Hub. My main activity among others is supporting theHealth Knowledge-Action Network (Health KAN) and I work with Fumiko Kasuga, our Global Hub Director in Japan who has a strong health background. Josh Tewksbury, who is the Global Hub Director in the US is also very much engaged in this process. Our Knowledge-Action Networks bring together academia, policy, business, civil society and more to address the world's most pressing sustainability challenges. Several of the Health KAN Steering Committee members, such as Peter Daszak, have a One Health approach and are also part of the oneHEALTH Global Research Project.
>
> Most recently, the Belmont Forum approached us to support the second scoping activity for the call on Climate, Enviornment and Health (first one can be found here). The first round was fully facilitated by the Development team of the Health KAN and had a global focus. This time around, they are aiming for a more inclusive and improved process, including partnership building in the various regions. Several organizations have been approached and Future Earth was specifically requested to support the Asia region. Most recently, we had the first call with our contacts from across the region and this is where we think your added expertise in the region will be extremely valuable for a more comprehensive scoping of the important topics in the region.
>
> At this stage, we are building the network and still looking for some preliminary information to better plan this task. For this purpose, it would be extremely helpful to tap into your expertise and knowledge about relevant planned online events in the region where we can potentially organize a side-event (see table below). Furthermore, it would be helpful if your network is aware of some country-specific priorities in the region. General research needs/ questions? And key actors you think should be included in this process going forward.
>
> Here are a few of the currently identified events:

Name of Event	Dates	Location	Weblink	POC
Prince Mahidol Conference (PMAC)	January 2021	Thailand	http://pmac2021.com/site	
Global health ministerial conference		Thailand		
3rd Asia Pacific Conference and Meeting on Mental Health	8-9 October 2020	Singapore		
6th Global Public Health 2020	1-2 December 2020	Indonesia	https://health3000.org/	

Thank you very much in advance for your engagement. Your help is much appreciated. If you are happy to further support this process then I will add your contact information to the key actor's list and I suggest we have a call so that we can align and better engage for the upcoming next steps (details are still to be determined).

Best regards and wish you a pleasant week
Giles

On Sun, Jul 26, 2020 at 1:14 AM Vipat Kuruchittham <vipat@seaohun.org> wrote:

> Dear Catherine, thank you very much for connecting us with Fumiko and Giles.
>
> Dear Fumiko and Giles,
>
> Established in late 2011, with support from the United States Agency for International Development (USAID), Southeast Asia One Health University Network (SEAOHUN) is a regional network of universities in Southeast Asia working together to build a sustainable and competent One Health workforce to address One Health issues. Its members comprise subject matter experts of multiple disciplines of One Health in 81 universities in 7 Southeast Asian countries: Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Thailand, and Vietnam. Myanmar will soon join SEAOHUN as the 8th country. SEAOHUN and its members aim to improve One Health workforce capacity with cross-sectoral competencies to effectively prevent, detect and respond to infectious disease threats. Currently, we are supported by the USAID One Health Workforce Next Generation project led by University of California Davis and its consortium including EcoHealth Alliance. You may learn more about us at https://www.seaohun.org/ or https://www.facebook.com/seaohun
>
> We will be pleased to provide inputs on priorities and also explore other possible areas of collaboration with your group.
>
> Best regards,
>
> Pat
> ---
> **Vipat Kuruchittham, PhD**
> Executive Director

On Mon, Jul 20, 2020 at 10:23 AM Catherine Machalaba <machalaba@ecohealthalliance.org> wrote:

Dear Pat and Tuck,

I wanted to make the connection with Dr. Giles Sioen and Dr. Fumiko Kasuga from the Future Earth hub based in Tokyo. They are supporting the scoping process in Asia for the Belmont Forum's 2nd Collaborative Research Action on Climate, Environment and Health (https://www.belmontforum.org). This is a funding mechanism to support transdisciplinary research partnerships.

The scoping process is intended to gain input on funding priorities. I think the call for proposals will be released in April 2021 or later, but the scoping process has just started. SEAOHUN is a highly relevant stakeholder group. Country eligibility to apply will ultimately depend on whether a country's science foundation signs on, so the list of countries has not yet been determined. I hope that several SEAOHUN countries will be eligible and SEAOHUN members will apply.

Fumiko and Giles may reach out to you over the coming months to participate in scoping calls or events. This is not intended to be time-intensive, but SEAOHUN's input will be valuable to inform the scope and focus of the call for proposals.

Fumiko and Giles: Dr. Vipat Kuruchittham is Executive Director and Ms. Ratsuda Poolsuk is Operations Manager for the Secretariat of the Southeast Asia One Health University Network, which has a membership of 70+ universities in Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand, The Philippines, and Vietnam. There are many exciting training and research initiatives through this network, contributing to workforce capacity strengthening and reinforcing many of the One Health coordination platforms that governments are establishing. Their office is in Chiang Mai, Thailand.

Thank you all very much!

Kind regards,
Catherine

Catherine Machalaba, MPH, PhD
Policy Advisor and Research Scientist

EcoHealth Alliance
520 Eighth Avenue, Suite 1200
New York, NY 10018

1.212.380.4472 (direct)
REDACTED (mobile)
1.212.380.4465 (fax)
www.ecohealthalliance.org

Immediate Past Chair, Veterinary Public Health Special Primary Interest Group, American Public Health Association

Program Officer, IUCN SSC Wildlife Health Specialist Group

Science Officer, Future Earth oneHEALTH Project

--
Giles Bruno SIOEN, Ph.D.
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Science Officer
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Research. Innovation. Sustainability.
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Subject: Obj 3 Work Planning Call
Location: [redacted]

Start: 12/12/2019 9:00:00 AM (-07:00)
End: 12/12/2019 10:00:00 AM (-07:00)

Organizer: [redacted])
Required Attendees:
alexandrazuber@atahealthstrategies.com;wasmith@ucdavis.edu;jklane@ucdavis.edu;oladele.ogunseitan@uci.edu;mr84@cumc.columbia.edu;oromero@haas.berkeley.edu;[redacted];Elizabeth Leasure;djwolking@ucdavis.edu;[redacted].castillo@berkeley.edu;Matthew Blake;Terra Kelly;kaleasure@ucdavis.edu;brpsmith@ucdavis.edu;aarmistad@salud.unm.edu;Peter Daszak;sfh9@georgetown.edu;karesh@ecohealthalliance.org;cgmonagin@ucdavis.edu

Hi all,
This call is an opportunity to discuss the global consortium work plan draft for Obj 3 activities and MEL plan. \; You can also send your comments to me eletronically in advance of this meeting if you can't make the meeting. \; I'll be sending the documents as soon as I receive the PPT slides from the AfrOHUN meeting- hopefully late today or tomorrow. \; I'll also send a proposed agenda.

Thanks all!

Alexandra Zuber is inviting you to a scheduled Zoom meeting.
Join Zoom Meeting

Meeting ID: [redacted]

One tap mobile
+[redacted]# US (New York)
+[redacted]# US (San Jose)

Dial by your location
 \; \; \; \; \; \; \; \;+1 [redacted] US (New York)
 \; \; \; \; \; \; \; \;+1 [redacted] US (San Jose)
Meeting ID: [redacted] 9[redacted]
Find your local number: <a href="[redacted]

-::~:~::~::~:~::-
Please do not edit this section of the description.

View your event at
[redacted]
-::~:~::~::~:~::-

From: onehealthnextgen-request@ucdavis.edu on behalf of "Vipat Kuruchittham" <vipat@seaohun.org>
Sent: 07/25/2020 9:14:11 AM (-07:00)
To: "Catherine Machalaba" <machalaba@ecohealthalliance.org>; "Giles Sioen" <giles.sioen@futureearth.org>; "Fumiko Kasuga" <fumiko.kasuga@futureearth.org>
Cc: "Ratsuda Poolsuk" <ratsuda@seaohun.org>; "Peter Daszak" <daszak@ecohealthalliance.org>; "Kevin Olival" <olival@ecohealthalliance.org>; "Tracey Goldstein" <tgoldstein@ucdavis.edu>; "Alison Andre" <andre@ecohealthalliance.org>; "OHW NG" <ohw-ng@seaohun.org>; "onehealthnextgen Sympa List" <onehealthnextgen@ucdavis.edu>
Subject: [onehealthnextgen] Re: Belmont Forum "Climate, Environment and Health"- Scoping Process for Asia

Dear Catherine, thank you very much for connecting us with Fumiko and Giles.

Dear Fumiko and Giles,

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We will be pleased to provide inputs on priorities and also explore other possible areas of collaboration with your group.

Best regards,

Pat

Vipat Kuruchittham, PhD
Executive Director

On Mon, Jul 20, 2020 at 10:23 AM Catherine Machalaba <machalaba@ecohealthalliance.org> wrote:

> Dear Pat and Tuck,
>
> I wanted to make the connection with Dr. Giles Sioen and Dr. Fumiko Kasuga from the Future Earth hub based in Tokyo. They are supporting the scoping process in Asia for the Belmont Forum's 2nd Collaborative Research Action on Climate, Environment and Health (https://www.belmontforum.org). This is a funding mechanism to support transdisciplinary research partnerships.
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foundation signs on, so the list of countries has not yet been determined. I hope that several SEAOHUN countries will be eligible and SEAOHUN members will apply.

Fumiko and Giles may reach out to you over the coming months to participate in scoping calls or events. This is not intended to be time-intensive, but SEAOHUN's input will be valuable to inform the scope and focus of the call for proposals.

Fumiko and Giles: Dr. Vipat Kuruchittham is Executive Director and Ms. Ratsuda Poolsuk is Operations Manager for the Secretariat of the Southeast Asia One Health University Network, which has a membership of 70+ universities in Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand, The Philippines, and Vietnam. There are many exciting training and research initiatives through this network, contributing to workforce capacity strengthening and reinforcing many of the One Health coordination platforms that governments are establishing. Their office is in Chiang Mai, Thailand.

Thank you all very much!

Kind regards,
Catherine

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Science Officer, Future Earth oneHEALTH Project

From: onehealthnextgen-request@ucdavis.edu on behalf of "Giles Sioen" <giles.sioen@futureearth.org>
Sent: 07/26/2020 6:27:48 PM (-07:00)
To: "Vipat Kuruchittham" <vipat@seaohun.org>
Cc: "Catherine Machalaba" <machalaba@ecohealthalliance.org>; "Fumiko Kasuga" <fumiko.kasuga@futureearth.org>; "Ratsuda Poolsuk" <ratsuda@seaohun.org>; "Peter Daszak" <daszak@ecohealthalliance.org>; "Kevin Olival" <olival@ecohealthalliance.org>; "Tracey Goldstein" <tgoldstein@ucdavis.edu>; "Alison Andre" <andre@ecohealthalliance.org>; "OHW NG" <ohw-ng@seaohun.org>; "onehealthnextgen Sympa List" <onehealthnextgen@ucdavis.edu>; "Josh Tewksbury" <josh.tewksbury@futureearth.org>
Subject: [onehealthnextgen] Re: Belmont Forum "Climate, Environment and Health"- Scoping Process for Asia

Dear Catherine, thank you for the very valuable introduction to Pat and Tuck from SEAOHUN!

Dear Pat,

It's a pleasure to meet you and thank you very much for the helpful background information. My name is Giles Sioen and I am a Science Officer/Interim Lead for Research and Innovation based at Future Earth's Japan Global Hub. My main activity among others is supporting theHealth Knowledge-Action Network (Health KAN) and I work with Fumiko Kasuga, our Global Hub Director in Japan who has a strong health background. Josh Tewksbury, who is the Global Hub Director in the US is also very much engaged in this process. Our Knowledge-Action Networks bring together academia, policy, business, civil society and more to address the world's most pressing sustainability challenges. Several of the Health KAN Steering Committee members, such as Peter Daszak, have a One Health approach and are also part of the oneHEALTH Global Research Project.

Most recently, the Belmont Forum approached us to support the second scoping activity for the call on Climate, Enviornment and Health (first one can be found here). The first round was fully facilitated by the Development team of the Health KAN and had a global focus. This time around, they are aiming for a more inclusive and improved process, including partnership building in the various regions. Several organizations have been approached and Future Earth was specifically requested to support the Asia region. Most recently, we had the first call with our contacts from across the region and this is where we think your added expertise in the region will be extremely valuable for a more comprehensive scoping of the important topics in the region.

At this stage, we are building the network and still looking for some preliminary information to better plan this task. For this purpose, it would be extremely helpful to tap into your expertise and knowledge about relevant planned online events in the region where we can potentially organize a side-event (see table below). Furthermore, it would be helpful if your network is aware of some country-specific priorities in the region. General research needs/ questions? And key actors you think should be included in this process going forward.

Here are a few of the currently identified events:

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Global health ministerial conference		Thailand		
3rd Asia Pacific Conference and Meeting on Mental	8-9 October 2020	Singapore		

Health				
6th Global Public Health 2020	1-2 December 2020	Indonesia	https://health3000.org/	

Thank you very much in advance for your engagement. Your help is much appreciated. If you are happy to further support this process then I will add your contact information to the key actor's list and I suggest we have a call so that we can align and better engage for the upcoming next steps (details are still to be determined).

Best regards and wish you a pleasant week
Giles

On Sun, Jul 26, 2020 at 1:14 AM Vipat Kuruchittham <vipat@seaohun.org> wrote:

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Sent: 07/26/2020 10:59:08 PM (-07:00)
To: "Giles Sioen" <giles.sioen@futureearth.org>
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Subject: [onehealthnextgen] Re: Belmont Forum "Climate, Environment and Health"- Scoping Process for Asia

Dear Giles,

Thank you for the background information. I or SEAOHUN Secretariat is pleased to support and facilitate the engagement with our group of universities from 8 Southeast Asian countries. I will be happy to connect in the week of 10 August or after. I am happy to find time if it is urgent for us to connect.

As for the events, I can share some details on the GHSA Ministerial Meeting as I am involved in one of the working groups. The GHSA Ministerial Meeting will go virtual on 19-20 November 2020 (tentative). The save-the-date should be announced on https://ghsagenda.org/ soon. There will be a call for side meetings for the group to conduct virtually using the platform given by the organizer. Then, each side meeting will present its summary on 18 November (Day 0) to be further summarized and presented to the Ministerial Meeting on Day 1.

A conference you may consider is the Global Health Security Conference on 22-25 June 2021 in Australia (https://www.ghsconf.com/).

A big event that has been posted from 2020 to 2021 is the 20th International Congress for Tropical Medicine and Malaria (https://ictmm2020.org/). It is now scheduled for 17-21 August 2021 in Bangkok.

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