The experience of the US Department of Homeland Security in fostering public-private partnerships in public health including the use of Artificial Intelligence to enhance antimicrobial resistance surveillance and treatment

Tammy Padilla, Program Manager, Public-Private Analytic Exchange Program, Department of Homeland Security, Office of Intelligence and Analysis, Washington DC, USA and **Dr Chandra Pauline Dinakar Daniel,** 2018 Researcher, Department of Homeland Security, Public-Private Analytic Exchange Program and Consultant, National Black Leadership Commission on AIDS, Research and Evaluation, New York, USA

The Department of Homeland Security (DHS), Office of Intelligence and Analysis (I&A), has been highlighting the critical importance of Public-Private Partnerships (PPP), in encountering the challenges to the national security of the United States. The Chief Cooperation and Partnerships Section of the United Nations Economic Commission for Europe (UNECE) takes a similar approach in meeting the challenge of sustainable development goals of a country. The UNECE reports that PPPs are complex and require skills which are usually found in the private not the public sector. This opens the door to a journey of exploring the complementary role of both players, working together in order to develop guidebook, training and advisory missions to governments. The DHS/I&A facilitates collaborative partnerships between members of the private sector and teams of experienced US government analysts to form a number of subcommittees. These collaborative partnerships led to a successful concoction of players who facilitated innovative programmes through their cross-cutting research ideas.

The DHS Public-Private Analytic Exchange Program (AEP), sponsored by the Office of the Director of National Intelligence, facilitates collaborative partnerships between members of the private sector and teams of experienced US government analysts to form a number of subcommittees. This annual program provides US government analysts and private sector partners with a better understanding of select national and homeland security issues. In today's dynamic and ever-evolving threat environment, it is not only important for both the public and private sector to maintain situational awareness, but also to actively coordinate and collaborate. It is only by building partnerships and proactively sharing information that we can grow our knowledge base and protect the United States – as well as the companies within it.

Cross-cutting topic teams

The AEP increases analysts' depth of expertise, provides new insights and perspectives, and offers a greater appreciation of open source information and analytic outreach. Private sector partners benefit from an increased understanding of the analytic process, how to engage with US Government analysts and what analysis means to them. The AEP enables US Government analysts and private sector partners to gain a greater understanding of how their disparate, yet complementary, roles can work in tandem to ensure mission success. Participants work to create joint analytic deliverables of interest to both the private sector and the US Government.

National security interests traditionally fall within the categories of defence of the homeland, economic well-being, favourable world order, and promotion of values, which are articulated in the 2017 National Security Strategy, National Defense Strategy, and the 2014 Quadrennial Homeland Security Review (1). In this article, security implications refer to the impact of cross-cutting research ideas implemented and tested by the public and private sector representation on each topic team. For example, the Artificial Intelligence (AI) topic-team focused on the use of standards to mitigate

the potential risks considering the malicious use of AI. The AI team developed an analytic deliverable that is published by the DHS and ODNI. The research materials can be accessed by visiting the webpage cited below: https://www.dhs.gov/publication/2018-aep

The participants on the 2018 AEP, have contributed to various research topics such as the following:
- ◗ Vulnerabilities of healthcare IT systems
- ◗ Threats to pharmaceutical supply chains
- ◗ Artificial Intelligence – using standards to mitigate risks
- ◗ Using blockchain to store and protect data and systems
- ◗ Cyber resilience and response
- ◗ Emerging technologies and national security
- ◗ Developments in global energy markets and US national security
- ◗ Going Dark: Intelligence impact and mitigation (Phase II)
- ◗ Threats to pecision agriculture

Research experience
The interesting, and most valuable, experience of participating in this research was to work with a team of experts from the world of technology, banking, law-enforcement and research – a distinctive mix of intelligence analysts and specialists who belonged to the public and private sectors. The outcome of the 2018 AEP was the quality of decision-making skills amongst the PPPs and the wealth of information shared regarding unique strategies to arrive at solutions to the complications encountered or potential unforeseen risks to the government and its ripple effect on the private sectors and vice versa. The brainstorming sessions and conference call discussions were led by two highly-skilled topic team-champions – James Sung (DHS) and Tao Nguyen (Department of Defense). A plethora of knowledge was made available on the Structured Analytical Gateway for Expertise, a collaborative analytic platform. The information-sharing between the public and private sectors led to the development of an interview schedule. As simple as it sounds, it was a revolutionizing experience to pour out ideas and see the interplay of thoughts, ideas and formulation of requests. In the hindsight of each participant, there were good ethical research approaches which were articulated; this was evident from the point of view, which stems from a private sector and a public sector point-of-view. We were able to effectively leverage the advantage of this rich research-soil of PPP to sow innovative ideas and cross-cutting themes to investigate.

Public-private partnerships and their impact in the public health realm
Collaboration between law-enforcement and technology experts is on the rise. However, in comparison to other scientific

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Box 1: Outcome of the analytic exchange programme 2018

The Director of Innovations of the UNAIDS, Pradeep Kakkattil had recently invited the DHS AEP 2018 participant Dr Chandra Pauline Daniel (Dinakar), to talk about her AI research experience. She delivered a speech on "AI in Public Health" at the UNAIDS internal meeting and shared the AEP AI-deliverable for 2018. Pradeep Kakkattil has taken the initiative to share the AEP 2018 deliverables to all the UNAIDS staff and officials who attended the meeting held on 4 October 2018. The Executive Director of UNAIDS Dr Michel Sidibé, who participated in this meeting, acknowledged the innovative work organized by the Partner Engagement division of the DHS I&A. This is another significant outcome of the AEP AI deliverable 2018.

The rich and collaborative research experience at the DHS extended into international projects. Dr Chandra Pauline Daniel applied the importance of partnership-building to integrate medical AI research in a developing country. Meetings were initiated between the UNAIDS and Harvard Medical School; partnership with the United Nations, required her to facilitate discussions between the Indian Council of Medical Research and the medical AI team from the United States (represented by the DHS AEP 2018 participant and Harvard Medical School team). The Director of Partnerships and Innovation (UNAIDS headquarters) Pradeep Kakkattil and the India UNAIDS Country Director Dr Bilali Camara, coordinated a high-level meeting for the US team and the ICMR (Indian Council of Medical Research) experts of India. The meetings culminated in the establishment of a strong relationship between the Harvard Medical School and the ICMR. The ultimate objective of the project is to end Tuberculosis by 2030 and to increase the use of AI in the radiographic detection of Tuberculosis. AI will propel instant diagnosis of complex TB cases and facilitate the onset of immediate treatment. There will be a tremendous reduction in the time or days lost in waiting for the results of the chest X-ray diagnostics, in order to commence treatment Medical AI tools will enhance the role of radiologists and expedite the onset of treatment regimen. As the AI infrastructure expands in India, the Harvard Medical School will also delve into a very important research suggestion given by Garance Upham, Vice-President of the World Alliance Against Antibiotic Resistance (WAAAR) on the need for in-depth research to differentiate between the drug-resistant Tuberculosis cases and the non-drug-resistant cases. This is an important area of research in the field of antimicrobial resistance (AMR), since early identification of a drug-resistant TB will lead to onset of a specialized treatment regimen for the patients with a drug-resistant TB, which is critical to end the epidemic.

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and law-enforcement disciplines, historically, public health has been behind the curve in terms of using advanced technologies *(2)*. An excellent outcome of the AEP is to undertake initiatives that cut through the challenges of collaboration between the government and private entities across all disciplines and deep-dive into collaborative research. This model, when simulated by the public health sectors, leads to the development of community working groups; this will eventually lead to the integration of the most recent technological devices into the digital realm of public health.

The 2018 AEP AI topic team was involved in interviewing many AI experts; one of the experts, Dr Synho Do from the health industry highlighted his medical AI-research findings. It has been an eye opener to understand the various strategies followed by Dr Synho Do (Director of the Laboratory of

Medical Imaging and Computation, Massachusetts General Hospital/Harvard Medical School) and his team, in the context of AI applications in the medical field (via our interviews as part of the AI topic team). The 2018 AEP has had a transforming outcome in research-contributions toward the integration of AI in the public health arena. Among one of the many outcomes of the AEP 2018, is the recent collaboration with Harvard Medical School/Massachusetts General Hospital and UNAIDS; this partnership paved a pathway to the establishment of a research partnership between two nations (India and the United States) for the sole purpose of enhancing medical AI research. It is evident that the impact has infiltrated across different disciplines by working collaboratively and harnessing the strengths of both the public and private sectors at the federal level and thereby impacting the State and its respective communities.

The 2018 AEP has played a tremendous role in enhancing PPPs utilizing a top-down line of influence by careful selection of applicants throughout the United States. The combination of public and private analysts on the team has boosted the effectiveness in arriving at an analytic deliverable submitted to the DHS and the Office of the Director of National Intelligence. This cross-cutting research has culminated with the dissemination of critical information, which is made available to over 10,000 government and private sectors partners.

Public health and artificial intelligence

Rubens et al., in his article "Public Health in the twenty-first century', points out the role of advanced technologies in the frontiers of public health (3). The field of public health has several ongoing studies targeting the use of AI for improving disease surveillance. The National Institutes of Health in the United States has several ongoing studies targeting the use of AI for improving surveillance of both communicable and noncommunicable diseases (4). Modern disease surveillance systems use AI to help automate the process of disease surveillance so that there is less reliance on human labour; to make the process more expedited so that real-time and predictive surveillance can occur; to allow for data to come from a much wider variety of sources than traditional systems; and to allow the results of such data to be disseminated to public health officials and the general public on a wider and faster basis (5).

Talking about public health, in today's world, academic institutions are working at enhancing the role of implementing AI to public health initiatives. For example, the detection of AMR in patients with Tuberculosis and predictive analytics in forecasting the increase in AMR rates, leads to building strong public health interventions on the accurate dosage and use of drugs. The consequences revealed in the diagnosis and incidence of AMR can be captured effectively by the utilization of AI. Natural Language Processing applied to medical reports will augment the practices of the physicians and nurses. This is made possible by PPPs which potentially could facilitate a private tech-savvy company (such as Google or IBM Watson) to work collaboratively with a hospital or public health unit and develop a strong system for health informatics. AI applications become easier on a well-organized data-sets and effective use of machine learning in order to make intelligent predictions about a County, State or Nation. This is critical in the context of enhancing the health security of a nation.

Conclusion

The analytic deliverables produced by the AEP inform policy-makers in both the public and private sector's decision support systems. The AEP team's recommendations are available for follow-up discussions for policy-makers, developers and researchers, and end-users to understand the governance and future development, current and future technology, decision-making algorithms, and potential standards. The goal of this article is to highlight the importance of a joint partnership between the public and private sectors in developing innovative analytic deliverables that provide the foundation for intelligence products. Analytic deliverables built as a result of working collaboratively on research through the DHS AEP is having a definite impact on establishing partnerships at a federal and state-wide level, to impede technological development and its applications in the United States and worldwide. ∎

Tammy Padilla is Program Manager at the Public-Private Analytic Exchange Program in the Department of Homeland Security, Office of Intelligence and Analysis, Washington DC. USA.

Dr Chandra Pauline Dinakar Daniel, PhD, was the 2018 researcher to the Department of Homeland Security's Public-Private Analytic Exchange Program, and is a Consultant to the National Black Leadership Commission on AIDS, Research and Evaluation, New York, USA.

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