

D-MOSS: Dengue forecasting MOdel Satellite-based System for Vietnam

Midline case study - Executive summary



Executive summary

The Dengue MOdel forecasting Satellite-based System (D-MOSS) project has developed a scalable, reliable and cost-effective dengue fever forecasting system incorporating Earth Observation (EO) data and seasonal climate forecasts to predict cases of dengue fever on a monthly basis up to six months in advance in Vietnam. The D-MOSS prototype covers the whole of Vietnam and produces dengue forecasts for each of the country's 63 provinces. The project focused on four provinces for Monitoring and Evaluation, capacity building and engagement with local-level end users and communities.

D-MOSS became operational in June 2019. Since then we have been documenting the extent to which the early warning system helps to prevent disease outbreaks and infections. The system demonstrates a clear and positive impact and added value (in terms of efficiency and reliability) with respect to existing programmes. Value adding metrics, such as the number of people reached and early evidence of a reduction of new infections in the pilot areas are included in this report. Technological, administrative and social aspects are also analysed. The operational potential and added value of the D-MOSS solution is discussed.

Established links with local/national health systems are a critical aspect of this project, and as such, evidence of appropriate cooperation with existing control programmes in the pilot areas, together with evidence of effective communication, promotion and local involvement is presented.

The forecasts of dengue outbreaks provided by D-MOSS have helped the Vietnamese Government to implement early actions at community, district and national scales, depending on the forecast lead time, as shown in Figure S.1.

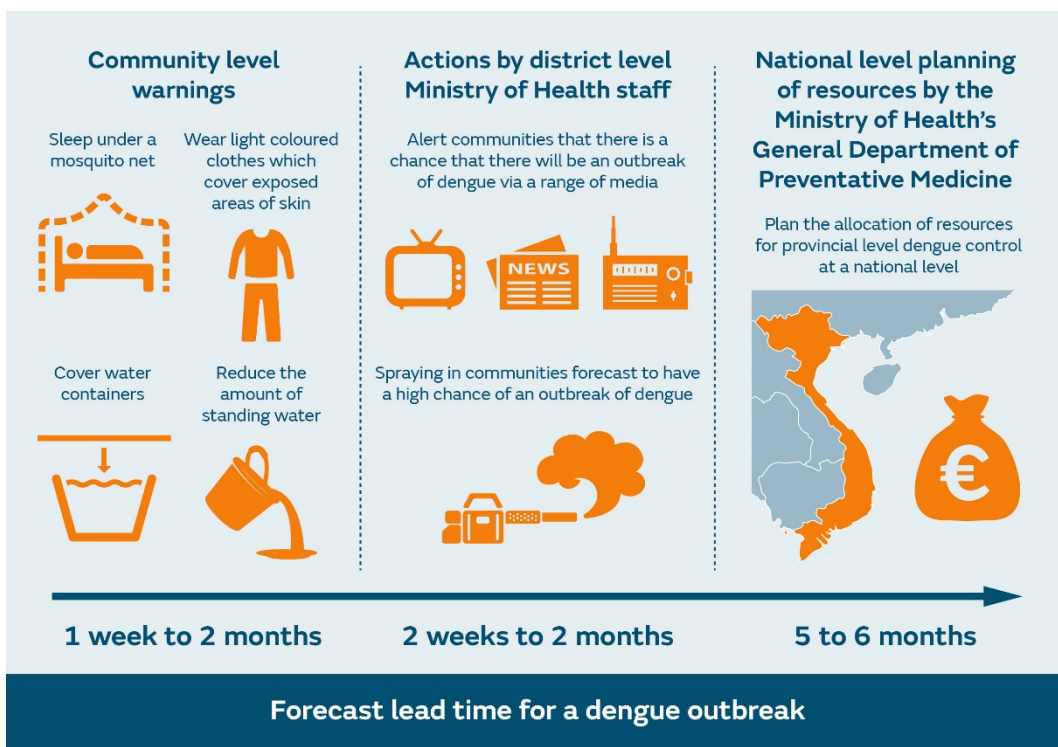


Figure S.1: Early actions which can be put in place to prevent a dengue outbreak at different spatial scales for the different forecast lead times provided by D-MOSS

The key Vietnamese stakeholders (Box 1) have all expressed the need for an operational system to allow them to forecast dengue outbreaks as many months in advance as possible, allowing them and communities to proactively plan in advance for dengue outbreaks. D-MOSS has helped to fill this gap.

Box 1 Key stakeholders in Vietnam

The General Department of Preventative Medicine (GDPM) is the Vietnamese Ministry of Health department that is responsible for prevention and control of communicable and non-communicable diseases. GDPM is responsible for dengue surveillance and control in Vietnam.

Under GDPM, the four following institutes oversee the prevention and control of dengue fever in different regions of Vietnam: **the National Institute of Hygiene and Epidemiology (NIHE); the Tay Nguyen Institute of Hygiene and Epidemiology (TIHE); the Pasteur Institute in Ho Chi Minh City (PIHCMC); and the Pasteur Institute in Nha Trang (PINT)**. These four institutes also lead the community data collection activities for dengue in different parts of Vietnam and are key partners for testing D-MOSS, as well as ensuring the key stakeholder requirements are met.

D-MOSS is piloted in four provinces (Hanoi, Khanh Hoa, Dak Lak and Dong Nai). Key stakeholders from the pilot provinces include Dengue prevention and control officials from the **Centres of Disease Control (CDC)** and officials from the **Provincial Departments of Health**.

Value adding metrics

Table S.1 presents a summary of some key value adding metrics.

Table S.1: Comparison of the agreed M&E indicators between March 2018 and November 2020

| Indicator | Baseline in March 2018 | Result at review November 2020 |
|---|------------------------|--------------------------------|
| Number of trained government officials with improved understanding of the drivers of dengue outbreaks | 0 | 65 |
| Number of knowledge sharing products accessed and downloaded from a project or related website | 0 | 86 |
| Number of people within government health authorities accessing forecasts on the portal | 0 | 65 |
| Number of dengue forecasts produced to support prevention of dengue outbreaks | 0 | 17 |
| Number of organizations with staff members trained | 0 | 13 |
| National dengue guidelines revised to include D-MOSS as a dengue control tool | Not applicable | Yes |

Whilst it is difficult to assess the impact on dengue incidence over the project timescales and rigorous scientific justification is required, the dengue incidence observations in Table S.2 have been made in the pilot provinces which may provide an early indication that D-MOSS is having an impact.

Table S.2: Comparison of incidence rates in pilot provinces

| Pilot province | Incidence rate (average of October 2017 to September 2019) | Incidence rate (average of October 2019 August 2020) |
|----------------|--|--|
| Dak Lak | 38.9 | 20.6 |
| Dong Nai | 33.2 | 25.0 |
| Hanoi | 8.0 | 8.5 |
| Khanh Hoa | 54.3 | 47.9 |

Proven use of results

D-MOSS is now supporting budget planning processes and dengue prevention and control: Since D-MOSS became operational in June 2019, stakeholders have reported that “*D-MOSS helps us to proactively develop action plans, develop budget estimates, and prepare chemicals and equipment needed to address dengue outbreaks*” (CDC Khanh Hoa) and that it “*provides us with more information to advise disease prevention and control committees at various levels. It informs our annual disease prevention and control plans*” (CDC Hanoi).

D-MOSS has changed Vietnam’s reactive approach to dengue prevention to a more proactive one: Historically, the management of dengue in Vietnam has been largely reactive. A response to dengue was triggered when there was a high chance of outbreaks and was tied to the number of reported cases. Since D-MOSS became operational, stakeholders have reported that “*the D-MOSS forecast informs prevention and control plans and interventions in advance, before outbreaks happen or dengue fever cases increase*” (CDC Khanh Hoa). The Pasteur Institute Nha Trang has stated that “*D-MOSS provides scientific information to inform dengue prevention and control plans and budget estimates, so these plans can become more practical and feasible.*” CDC Dong Nai stated that the “*D-MOSS system helps Dong Nai CDC to predict dengue situation in the province and nationwide in advance. It helps Dong Nai CDC to prepare and be ready to implement dengue prevention measures*”.

Conclusions

Proactive approaches to dengue control are commonly underfunded and as a result poorly executed. The use of accurate and affordable early warning systems for dengue, such as D-MOSS, helps to engender proactive approaches from national government to community levels.

The application of D-MOSS in Vietnam has confirmed that it provides suitably accurate forecasts of dengue, (i.e. 90% accuracy for an outbreak one month in advance and 70% accuracy for an outbreak six months in advance), and is a reliable and cost-effective solution to help stakeholders take early actions.

D-MOSS’s architecture and modular design help to ensure it can be replicated in other countries and at a range of scales, be that in South-East Asia or other countries around the world. Owing to its success in Vietnam, prototype D-MOSS systems are being implemented in Malaysia and Sri Lanka.

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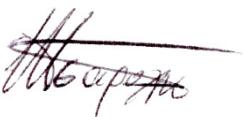
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