WEEKLY EPIDEMIOLOGICAL REPORT

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Climate change and dengue transmission: Evidence and inferences

Introduction

Climate change is one of the most significant environment alterations so far the populations face. As much as the environment, climate changes threaten individuals in relation to all aspects of their health with the strongest relations being between climate and mosquito borne diseases. Climate effects dengue virus (DENV) ecology both directly and indirectly by affecting vector dynamics such as biting rate, egg and immature mosquito development, the development time of virus in the mosquito (Extrinsic Incubation Period: EIP), mosquito -human interactions and survival at all stages of the mosquito life cycle. The most affected environment factors are the temperature, precipitation and humidity.

Temperature

Temperature is a crucial factor in the ecology of DENV as seen from its numerous interactions with the mechanisms of disease cycle affects both direct and indirect pathways. The increase of ambient temperature is associated with a faster rate of viral replication within the vector allowing a shorter EIP. Reproductive cycle of the female mosquito is also governed by the ambient temperature and evidence says, at <20^{0}C, fertilization declines, proven that increased minimum temperature resulted in accelerated ovulatory cycles. Female *Ae. aegypti* need a blood meal for ovarian development. Selection of breeding containers is also based on temperature and sun exposure. Temperature also influences the feeding behaviour and is flawed or ended at the temperature <15^{0}C and >36^{0}C.
Indirectly temperature impacts on vector development rates, mortality, and behaviour and controls viral replication within the mosquito by interacting with rain falls as the main controller of evaporation, thereby also affecting the availability for *Ae. aegypti* and *Ae. albopictus* larvae and pupae. Also rainfall, temperature and humidity influence land use and land cover which can stimulate or inhibit the growth of vector populations.

Precipitation and humidity

Precipitation is often required to create and maintain breeding sites and has a strong impact on vector distributions. Studies showed that installing domestic water

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reservoirs to combat drying from warmer temperature and decreased precipitation, in fact, provides additional breeding sites for *Ae. aegypti.* Precipitation offers important habitat for all aquatic stages of the mosquito cycle. Both dry and wet containers common in urban and rural environments are often an important habitat for them. Some studies revealed that higher precipitation was associated with increased *Ae. aegypti* population and man-made containers were the most important pupae habitat. However, intense rainfall washout the breeding sites and thus has a negative effect on the population.

Climate pattern in Sri Lanka

Being an island with a mountainous central-region, Sri Lanka has been generally affected by floods, droughts, landslides, coastal storms and erosion, cyclones and storm surges. Due to the location of Sri Lanka, within the tropics between 5° 55' to 9° 51' North latitude and between 79° 42' to 81° 53' East longitude, the climate of the island could be characterized as tropical. Rainfall in Sri Lanka has multiple origins such as Monsoonal, Convectional and expressional rain accounts for a major share of the annual rainfall. The country gets rain from two monsoons: the South West monsoon prevails from April to September and the North East monsoon prevails from December to February. In between, there are inter-monsoons in March to April and a second inter-monsoon in October and November. The mean annual rainfall varies from under 900mm in the driest parts (south-eastern and north-western) to over 5000mm in the wettest parts (western slopes of the central highlands). The mean monthly temperatures differ slightly depending on the seasonal movement of the sun, with some modified influence caused by rainfall. The mean annual temperature in Sri Lanka manifests largely homogeneous temperatures in the low lands and rapidly decreasing temperatures in the highlands. In the lowlands, up to the altitude of 100 m to 150 m, the mean annual temperature varies between 26.5 °C to 28.5 °C, with an annual temperature of 27.5 °C. Therefore, it can be concluded that climate pattern in the country is more favour to DENV ecology throughout the year.

Control of Dengue disease in terms of climate variability

Though environment factors affect more, human factors and agent factors also play a major role in the transmission of Dengue. Predominantly environmental variables can be used to forecast epidemics and numerous parameters have been used to attempt to forecast outbreaks of Dengue. It is beneficial to strengthen the early warning systems to predict dengue outbreaks with sufficient lead time for implementation of the public health interventions.

Sources

Ebi KL, Nealon J. Dengue in a changing climate. Environmental research. 2016 Nov 30; 151:115-23.

UNDP, Coping with Climate Change and Variability: Lessons from Sri Lankan Communities. Available on: http://reliefweb.int/report/sri-lanka/coping-climate-change-and-variability-lessons-sri-lankan-communities

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Table 1: Selected notifiable diseases reported by Medical Officers of Health 01st- 07th July 2017 (27thWeek)

RDHS Division	Dengue Fever		Dysentery		Encephalitis		Enteric Fever		Food Poisoning		Leptospirosis		Typhus Fever		Viral Hepatitis		Human Rabies		Chickenpox		Meningi-tis		Leishman-iasis		WRCD	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	T*	C**
Colombo	1779	20155	0	40	1	3	2	21	1	24	1	66	0	1	0	10	0	0	11	224	0	18	0	1	**22**	**100**
Gampaha	1802	16535	0	20	0	12	0	16	0	8	0	33	0	9	0	7	0	1	2	179	0	20	0	2	**6**	**100**
Kalutara	598	5396	1	37	0	3	0	9	2	40	5	182	0	5	0	2	0	0	9	349	0	77	0	0	**2**	**100**
Kandy	1002	5455	1	51	0	3	0	4	0	9	0	28	0	88	0	9	0	0	2	147	1	27	0	7	**14**	**100**
Matale	204	1302	2	15	0	1	0	1	0	6	3	26	0	2	0	5	0	0	0	33	2	40	1	4	**12**	**100**
NuwaraEliya	80	392	0	16	0	6	2	21	0	9	3	22	7	125	0	14	0	0	1	232	4	33	0	0	**45**	**100**
Galle	287	3432	2	31	0	7	0	9	0	12	17	178	3	28	0	1	0	1	12	244	7	43	0	0	**15**	**100**
Hambantota	117	1971	0	15	0	5	0	6	0	16	1	32	2	35	0	6	0	1	5	137	0	15	0	183	**9**	**100**
Matara	464	3037	0	21	0	8	0	1	1	5	17	128	0	16	0	4	0	1	4	137	0	4	4	77	**10**	**100**
Jaffna	86	3140	8	156	1	12	0	27	0	51	1	23	2	391	0	3	0	0	8	126	1	29	0	0	**36**	**88**
Kilinochchi	27	289	0	10	0	1	0	8	0	1	0	3	0	12	0	2	0	0	0	3	0	7	0	2	**23**	**100**
Mannar	8	484	0	5	0	0	0	1	0	0	0	2	0	2	0	0	0	0	1	12	0	0	0	0	**14**	**100**
Vavuniya	44	550	0	11	0	0	1	22	2	5	0	23	0	7	0	1	0	0	2	19	0	2	0	9	**9**	**100**
Mullaitivu	25	195	0	8	0	1	0	3	0	1	0	11	0	4	0	1	0	1	0	11	0	5	0	1	**7**	**100**
Batticaloa	85	4111	1	63	0	8	0	13	0	18	2	17	0	0	0	4	0	1	3	121	0	21	0	1	**20**	**100**
Ampara	55	468	1	14	0	2	0	1	0	0	0	8	0	1	0	3	0	0	4	121	1	28	0	3	**31**	**100**
Trincomalee	33	4423	0	13	0	2	1	5	0	16	1	15	0	12	0	17	0	0	1	99	0	18	0	3	**16**	**100**
Kurunegala	564	5793	4	47	0	6	0	0	0	14	1	41	1	24	0	15	0	1	6	357	4	33	3	92	**10**	**100**
Puttalam	341	2594	4	28	0	2	0	2	0	0	0	16	0	11	0	1	0	0	1	105	4	30	0	3	**7**	**100**
Anuradhapur	244	1632	0	25	1	2	0	1	1	10	3	47	1	13	0	9	0	0	3	275	5	42	6	153	**8**	**100**
Polonnaruwa	123	861	0	11	0	5	0	9	5	5	1	30	1	5	1	6	0	0	5	154	1	11	2	83	**2**	**100**
Badulla	278	1512	1	53	1	5	0	7	1	2	1	56	10	69	1	44	0	1	10	229	5	114	0	10	**6**	**98**
Monaragala	168	1213	2	39	0	3	0	0	0	9	7	89	1	74	1	16	0	1	3	55	8	40	0	11	**27**	**100**
Ratnapura	920	5814	1	94	0	62	0	6	1	8	25	388	1	22	1	50	0	0	2	216	1	120	0	16	**9**	**100**
Kegalle	632	4426	0	25	0	8	0	4	1	17	2	48	1	51	0	10	0	0	12	169	0	44	0	6	**11**	**100**
Kalmune	52	1784	11	43	0	4	0	3	2	274	0	6	0	0	0	2	0	0	3	111	1	11	0	0	**11**	**100**
SRILANKA	**9974**	**95868**	**39**	**883**	**5**	**172**	**6**	**199**	**17**	**560**	**92**	**1517**	**30**	**997**	**4**	**242**	**0**	**9**	**111**	**3854**	**4**	**83**	**16**	**667**	**14**	**99**

Source: esurveillance.epid.gov.lk

*T=Timeliness refers to returns received on or before 07thJuly , 2017 Total number of reporting units 344 Number of reporting units data provided for the current week: 342 C**-Completeness

Table 2: Vaccine-Preventable Diseases & AFP

01st– 07thJuly 2017 (27thWeek)

Disease	No. of Cases by Province									Number of cases during current week in 2017	Number of cases during same week in 2016	Total number of cases to date in 2017	Total number of cases to date in 2016	Difference between the number of cases to date in 2017 & 2016
	W	C	S	N	E	NW	NC	U	Sab					
AFP*	00	00	00	00	00	00	00	00	00	00	01	40	33	21.2%
Diphtheria	00	00	00	00	00	00	00	00	00	00	00	00	00	0%
Mumps	02	02	01	02	01	00	01	00	01	11	07	190	222	- 14.1%
Measles	00	05	01	01	00	00	00	00	00	06	02	132	288	- 54.2%
Rubella	00	00	00	00	00	00	00	00	00	00	00	05	06	- 16.6%
CRS**	00	00	00	00	00	00	00	00	00	00	00	01	00	0%
Tetanus	00	00	00	00	00	00	00	00	00	00	00	08	04	100%
Neonatal Tetanus	00	00	00	00	00	00	00	00	00	00	00	00	00	0%
Japanese Encephalitis	00	00	00	00	00	00	00	00	00	00	02	21	07	200%
Whooping Cough	00	00	00	00	00	00	00	00	00	00	01	09	31	- 71%
Tuberculosis	105	24	31	25	21	11	11	10	72	310	198	4259	4932	-13.6%

Key to Table 1 & 2

Provinces: **W**: Western, **C**: Central, **S**: Southern, **N**: North, **E**: East, **NC**: North Central, **NW**: North Western, **U**: Uva, **Sab**: Sabaragamuwa.

RDHS Divisions: **CB**: Colombo, **GM**: Gampaha, **KL**: Kalutara, **KD**: Kandy, **ML**: Matale, **NE**: Nuwara Eliya, **GL**: Galle, **HB**: Hambantota, **MT**: Matara, **JF**: Jaffna, **KN**: Killinochchi, **MN**: Mannar, **VA**: Vavuniya, **MU**: Mullaitivu, **BT**: Batticaloa, **AM**: Ampara, **TR**: Trincomalee, **KM**: Kalmunai, **KR**: Kurunegala, **PU**: Puttalam, **AP**: Anuradhapura, **PO**: Polonnaruwa, **BD**: Badulla, **MO**: Moneragala, **RP**: Ratnapura, **KG**: Kegalle.

Data Sources:

Weekly Return of Communicable Diseases: Diphtheria, Measles, Tetanus, Neonatal Tetanus, Whooping Cough, Chickenpox, Meningitis, Mumps., Rubella, CRS,

Special Surveillance: AFP* (Acute Flaccid Paralysis), Japanese Encephalitis

CRS** =Congenital Rubella Syndrome

Dengue Prevention and Control Health Messages

Look for plants such as bamboo, bohemia, rampe and banana in your surroundings and maintain them

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Comments and contributions for publication in the WER Sri Lanka are welcome. However, the editor reserves the right to accept or reject items for publication. All correspondence should be mailed to The Editor, WER Sri Lanka, Epidemiological Unit, P.O. Box 1567, Colombo or sent by E-mail to **chepid@sltnet.lk. Prior approval should be obtained from the Epidemiology Unit before publishing data in this publication**

ON STATE SERVICE

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