DENGUE AMIDST THE PANDEMIC 2022

Improving preparedness and response for multi-hazard scenarios

• international research & innovations symposium •

16th–17th March 2022

Water's Edge, Colombo, Sri Lanka

http://pandemic-mhew.org/index.php/symposium-2022

Hybrid Symposium

Book of Abstracts and Proceedings

Editors:

Professor Dilanthi Amaratunga
Professor Richard Haigh
Mr Thushara Kamalrathne
Dr Sudath Samaraweera
Dr Nimalka Pannila Hetti
Dr Shilanthi Seneviratne
Dr Lahiru Kodituwakku

March 2022

International Research and Innovations Symposium on

DENGUE AMIDST THE PANDEMIC

Improving preparedness and response for multi-hazard scenarios - 2022

BOOK OF ABSTRACTS

Edited by

Professor Dilanthi Amaratunga
Professor Richard Haigh
Mr Thushara Kamalrathne
Dr Sudath Samaraweera
Dr Nimalka Pannila Hetti
Dr Shilanthi Seneviratne
Dr Lahiru Kodituwakku

March 2022

Professor Dilanthi Amaratunga, Professor Richard Haigh, Mr Thushara Kamalaratna, Dr Sudath Samaraweera, Dr Nimalka Pannila Hetti, Dr Shilanthi Seneviratne, Dr Lahiru Kodituwakku (*edited by*)

International Research and Innovation Symposium on Dengue amidst the Pandemic

16th -17th March 2022

BOOK OF ABSTRACTS

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ABOUT THE SYMPOSIUM

International symposium of research and innovations on dengue amidst the pandemic; Improving preparedness and response for multi-hazard scenarios - 2022

Recent events, including the COVID-19 pandemic, have highlighted the importance of improving the performance of health systems in combination with other disaster preparedness and response mechanisms. The impact of the pandemic reflects changes in our lifestyles and society. This has meant that hazards are spread throughout communities, societies, and economies in complex ways, which contribute to systemic and cascading risks. The impact of COVID-19 has also had a disproportionate impact on disadvantaged groups, including people in poverty and those with underlying health conditions.

COVID-19 has also overwhelmed health systems and caused widespread social & economic disruption. Government and non-governmental agencies are already stretched trying to manage the COVID-19 response, but how would they cope if other natural or biological hazards occurred concurrently?

For example, dengue is one of the communicable diseases that incurs a high disease burden. Alongside the COVID 19 pandemic, control of dengue has also become more challenging. These challenges include co-existence of both diseases with similar clinical features during the early stages. They also include hesitancies among the public to seek medical care and barriers in premise inspection and source reduction campaigns due to fear in contracting COVID 19.

Similarly, the recent COVID-19 response has resulted in a shift of priorities, alterations in work processes and venues (home office), physical distancing, self-isolation and quarantine measures, as well as temporary lockdowns of entire communities. This may create ambiguity or confusion with regards to tsunami warning services and response actions like evacuation, under co-existing COVID-19 protocols.

In order to address such challenges, there is a need for better stakeholder participation and to share research evidence, best practices, and innovations, and develop competencies among all health professionals and other key stakeholders. These will help support the translation of research evidence into practice that can enhance preparedness and response for multi-hazard scenarios.

With this backdrop, this high-level, international symposium will debate and discuss: the impact of COVID-19 pandemic and other communicable diseases, such as dengue and malaria; their role as part of overall multi-hazard scenarios, integrating both natural biological hazards; opportunities for pandemic preparedness, and response to make better use of the existing infrastructure and early warning protocols; and, multi-stakeholder approaches to collectively examine impacts, coordinate health, social, and economic measures, share practices and to learn lessons.

This symposium has been organized by: The project consortium of the UKRI/EPSRC funded research collaboration *Improving COVID-19 and pandemic preparedness and response through the downstream of multi-hazard early warning systems*, led by University

of Huddersfield, UK, Ministry of Health Sri Lanka (National Dengue Control Unit, Anti Malaria Campaign, Disaster Preparedness & Response Division), University of Colombo, University of Moratuwa and National Science Foundation of Sri Lanka.

This Symposium will further improve research collaborations among stakeholders nationally and internationally. It will strengthen the partnership among stakeholders in risk communication, preparedness, and early response to combat epidemics, pandemics and other health hazards.

Sub-themes of the symposium

1. Epidemiology and surveillance of dengue and response mechanisms amidst the pandemic
2. Control of dengue and prevention of re-introduction of malaria
3. Clinical management of dengue and covid-19 during the pandemic
4. Complex and interconnected multi-hazard risks: the nature of cascading impacts and relationships
5. Integrated pandemic and multi-hazard preparedness planning strategies: national to community empowerment and social mobilization
6. Early warning and risk communication strategies on multi-hazard scenarios for concurrent and cascading hazards
7. Built environment resilience and innovation in addressing biological hazards and multi-hazard scenarios

Conference co-chairs:

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ABOUT THE EDITORS

Professor Dilanthi Amaratunga

Professor Dilanthi Amaratunga holds the chair in Disaster Risk Management at the University of Huddersfield, UK. She is a leading international expert in disaster resilience with an extensive academic career that has a strong commitment to encouraging colleagues and students to fulfil their full potential. She provides expert advice on disaster resilience to national and local governments and international agencies including the United Nations Office for Disaster Risk Reduction. She is engaged in many significant research engagements around the world, in partnership with key academic and other organisational stakeholders. To date, she has produced over 400 publications, refereed papers and reports, and has made over 100 keynote speeches in around 30 countries. Among many leadership roles, she is the joint chief editor of the International Journal of Disaster Resilience in the Built Environment and the chair of the International Conference on Building Resilience (ICBR) series, which she co-created. She is a member of the European Commission and UNDRR's European Science & Technology Advisory Group representing the UK, a member of the Steering Committee of the UNISDR "Making Cities Resilient" Campaign, and a Steering Committee member of the Frontiers of Development programme, a Collaborative Programme of The Royal Academy of Engineering, The Academy of Medical Sciences, The British Academy and The Royal Society. She is a Fellow of the Royal Institution of Chartered Surveyors (RICS), a Fellow of The Royal Geographical Society, and a Fellow and a Chartered Manager of the Chartered Management Institute, UK. She can be contacted on: d.amaratunga@hud.ac.uk

Professor Richard Haigh

Richard Haigh is Professor of Disaster Resilience and Co-Director of the University of Huddersfield's Global Disaster Resilience Centre in the UK. His research interests include multi-hazard early warning, disaster risk governance and resilience in the built environment. He is the Editor-In-Chief of the International Journal of Disaster Resilience in the Built Environment and Co-Chair of the International Conferences on Building Resilience, which started in 2008. He is an expert member of Working Group 1 of Intergovernmental Coordination Group on the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS). Richard and his team won the Newton Prize for Indonesia, celebrating best research innovation partnership for the project Mainstreaming Integrated Disaster Risk Reduction and Climate Change Adaption Strategies into Coastal Urban Agglomeration Policy. He has led and successfully delivered research grants funded by the UK Natural Environment Research Council, the European Commission's Horizon 2020, Erasmus+, Framework Seven Programme, Lifelong Learning, Asia Link and European Social Fund,

the UK Newton Fund, the UK Foreign and Commonwealth Office, British Council and UK Parliamentary Under Secretary of State for Business, Energy and Industrial Strategy. Many of these projects were carried out in close collaboration with government, non-government organisations and industry partners. He has published widely, including an edited book by Wiley Blackwell, fifteen edited book chapters and forty-five peer reviewed journal articles, the majority of which are in ISI or SCOPUS indexed journals. He has delivered over 80 invited speeches and keynote presentations for audiences in twenty-five countries across North America, South America, Europe, Asia, Africa and Australasia.

Mr Thushara Kamalrathne

Thushara Kamalrathne is a senior lecturer in Sociology attached to the Department of Sociology, University of Peradeniya, Sri Lanka. He has been serving in the department since 2007 as an academic member. Thushara is a researcher at the Global Disaster Resilience Centre, University of Huddersfield, UK. Currently, he is reading his PhD at the Global Disaster Resilience Centre, School of Applied Sciences, University of Huddersfield, on developing an effective community-based approach for pandemic preparedness and response in the context of multi-hazard. Thushara completed his MPhil in Sociology in 2015 at the Post Graduate Institute of Humanities and Social Sciences (PGIHS), University of Peradeniya. His MPhil research was on social determinants of child malnutrition in the estate sector in Sri Lanka. He holds a first-class degree in Bachelor of Arts, Sociology, at the faculty of Arts, University of Peradeniya. He is a member of the research project of improving COVID-19 and pandemic response through the downstream of multi-hazard early warning systems, funded by the UKRI. Thushara has contributed as an editor for several refereed journals and research compilations including Samaja Vimasuma, annually published by the Department of Sociology, University of Peradeniya.

Dr Sudath Samaraweera

Dr Sudath Samaraweera is the Director of the National Dengue Control Unit of the Ministry of Health, Sri Lanka. He is a Board-Certified Specialist in Community Medicine after obtaining the MSc (Community Medicine) and MD (Community Medicine) from the Post Graduate Institute of Medicine, University of Colombo. He has obtained the PhD (Health Services and Population Studies) from King's College, London. Dr Samaraweera has held several key positions in the Ministry of Health before being appointed to the current position. Chief Epidemiologist of the Epidemiology Unit, Director of the National Cancer Control Programme and National Programme for Tuberculosis Control & Chest Diseases, Consultant Community

Physician of the National Programme for Tuberculosis Control & Chest Diseases and the Epidemiology Unit are some of these positions. He also had covered up duties of the Deputy Director General (Education, Training & Research) and Project Director of the GFATM Project of the Ministry of Health for some time. In addition, Dr Samaraweera is a trainer, supervisor, and examiner in post graduate programmes in Community Medicine and Medical Administration. He has successfully supervised several MSc and MD research projects in Community Medicine and Medical Administration. Dr Samaraweera is also a member of the Research Management Committee of the Ministry of Health. He is also a member of Board of Study in Multidisciplinary Studies related to Health, Faculty of Graduate Studies, University of Kelaniya and Career Guidance Unit of the Post Graduate Institute of Medicine. Dr Samaraweera has actively involved in several research projects and is the first author or co-author of a number of peer reviewed publications and many of published abstracts.

Dr Nimalka Pannila Hetti

Dr. Nimalka Pannila Hetti is attached to the National Dengue Control Unit, Ministry of Health as Consultant Community Physician. Having obtained M.B.B.S. from the Faculty of Medicine of the University of Colombo, she has obtained M.D. in Community Medicine followed by post-doctoral attachment at Department of Public Health, Monash University, Australia.

Her public health experience spans over 25 years attached to different vector-borne diseases control programmes and Epidemiology Unit until she joined the National Dengue Control in 2009. During her tenure, she has served as the Editor – "National Strategic Plan for Prevention and Control of Dengue Fever in Sri Lanka, 2011-2015" by National Dengue Control Unit, member of the Editorial Board for "National Strategic Plan for Prevention and Control of Dengue Fever in Sri Lanka, and 2018-2023" by National Dengue Control Unit, Ministry of Health.

Dr Shilanthi Seneviratne

Dr. Shilanthi Seneviratne (MBBS, MSC-Community Medicine, MD Community Medicine) is a consultant working in the National Dengue Control Unit of the Ministry of Health Sri Lanka. In addition to being worked as a medical doctor in hospitals, she has tremendous work experience as a public health professional at the district level involving disease control and prevention activities at remote areas in Sri Lanka and in the field of epidemiology and disease surveillance at the national level. She has undergone several international trainings related to public health including cost-effective health management system at the Center for Professional Management and Human

Resources Education in Vietnam, Community based Health Operation and Management in Japan and Health System Development at Asian Institute for Health Development Mahidol University Thailand. In addition, she has working experience in the Melbourne School of Population and Global Health, the University of Melbourne in Australia, mainly working on research areas on how primary health systems can be strengthened especially in low-income and middle-income countries (LMICs). Her research area also focused on studies assessing patient-reported outcomes manifesting societal perspectives targeting marginalized populations.

Dr Lahiru Kodituwakku

Dr. Lahiru Kodituwakku is a medical officer at the National Dengue Control Unit, Ministry of Health, Sri Lanka. He obtained his Bachelor of Medicine and Bachelor of Surgery from the University of Science and Technology, Chittagong, Bangladesh followed by a Postgraduate Diploma in Health Sector Disaster Management from the Postgraduate Institute of Medicine (PGIM), University of Colombo. He also obtained his Master of Science degree in Community Medicine from PGIM, University of Colombo. Currently, he is reading for his Master of Science in Disaster Risk Reduction and Development from General Sir John Kotelawala Defense University.

Dr. Kodituwakku has held numerous positions related to disaster management including disaster management focal point medical officer at Base Hospital Deniyaya and Medical Officer at the Ministry of Health coordination center, National Operations Center for Prevention of COVID-19 outbreak, Sri Lanka (NOC PCO). He was the Epidemiological Officer at the Wolbachia Project of World Mosquito Programme, a collaborative project between Monash University, Australia, and the Ministry of Health, Sri Lanka. Currently, he is a project member of 'Improving COVID-19 and pandemic preparedness and response through the downstream of multi-hazard early warning systems, a collaborative project between Huddersfield University UK, Ministry of Health, and Universities of Colombo and Moratuwa.

He has undergone numerous international training related to disaster management including Hospital Preparedness for Emergencies (HOPE) by Asian Disaster Preparedness Center (ADPC) and Health Emergencies in Large Populations (HELP) by ICRC/University of Hawaii. He is also a curriculum evaluator for the Community Action for Disaster Response (CADRE) of ADPC and a life member of the College of Community Physicians, Sri Lanka.

ACKNOWLEDGEMENTS

We as co-chairs of the "International symposium of research and innovations on dengue amidst the pandemic; Improving preparedness and response for multi-hazard scenarios" are delighted to have the opportunity to hold this symposium. This took place on March 16-17 2022, in Colombo, Sri Lanka. In organizing this event, several institutions, and persons, including academics and professionals, joined forces in making this event a reality.

The Conference organising committee met regularly and together we made an array of, hopefully better, key decisions! All involved have provided a willing source of on-going support and guidance that is very much appreciated.

We thank the keynote speakers for their willingness to stimulate invaluable discussions and debate around the conference theme. We also thank session chairs and panelists for agreeing to ensure the conference is as challenging, exciting and rewarding as possible. Our thanks go to the International Scientific Committee members who made extensive efforts in reviewing papers to tight time scales in ensuring the high quality of the conference.

A total of selected 36 oral presentations and 50 poster presentations involving over 150 scientists and professionals took part in the conference despite the pandemic and its associated difficulties, and their contribution under these circumstances is truly commendable and appreciated.

Our heartfelt thanks are also due to UKRI/GCRF (UK Research and Innovation through the UK Government's Global Challenges Research Fund) (GCRF) the Newton Fund [grant number EP/V026038/1] funded project entitled: "Improving COVID-19 and pandemic preparedness and response through a multi-hazard early warning system" which aims at creating opportunities for pandemic preparedness and response to make better use of the existing infrastructure, including other hazards' early warning protocols.

We extent our sincere gratitude towards all sponsors and partners of this international conference. Without their support, and event of this extent wouldn't have been possible to plan and hold.

Most of all, we want to thank our colleagues who worked very hard for the professional undertaking of the work involved in the tasks that are so often unseen and unrewarded for a conference of this scale. We thank Thushara Kamalrathne for his unconditional efforts towards the conference, and for all his efforts, and Asitha de Silva, Thisara Perera, Dr Nuwan Dias, Shavindree Nissanka, Malith Senevirathne, for being there whenever we needed help, from Global Disaster Resilience Centre, University of Huddersfield, UK

We also want to thank our colleagues who worked very hard for the professional undertaking of the work involved in the tasks that are so often unseen and unrewarded for a conference of this scale:

Organisations that have acted as conference partners are especially thanked. The efforts involved with a conference of this scale are significant and it would not have been possible to organise this conference without their assistance. We particularly thank: University of Colombo, Sri Lanka; University of Moratuwa Sri Lanka; and National Science Foundation, Sri Lanka.

We are grateful to Mr. Chameera Randil, a freelancer for his attractive and creative designs.

Finally, we would not have been able to make this event without the support of our Events Manager based in Sri Lanka, Aitken Spence Travels Ltd. Ziyan Ameen & Nadeeka Leeniyagoda deserve special thanks from us for the professional way in which they have managed the complex accommodation arrangements for delegates, all internal transport, printing assignments, and coordination.

We are so much thankful to Dr Lahiru Kodituwakku and Dr Shilanthi Seneviratne from the National Dengue Control Unit Ministry of Health Sri Lanka who acted as a bridge connecting the all stakeholders together and for his dedicated contribution to the scientific community. We would like to express our special thanks of gratitude to the technical staff of National Dengue Control Unit and other units of the Ministry of Health Sri Lanka for their great support and continuous collaboration to make this great symposium a reality.

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Conference Co- chairs,

"International symposium of research and innovations on dengue amidst the pandemic; Improving preparedness and response for multi-hazard scenarios" March 16-17, 2022, Colombo, Sri Lanka.

CONFERENCE ORGANISATION

Organised by

National Dengue Control Unit, Anti Malaria Campaign, and Disaster Preparedness and Response Division
Ministry of Health, Sri Lanka

Global Disaster Resilience Centre
University of Huddersfield, UK

In collaboration with

University of Colombo, Sri Lanka
University of Moratuwa, Sri Lanka
National Science Foundation of Sri Lanka
The Federation of Sri Lankan Local Government Authorities

Linked research projects

Improving COVID-19 and Pandemic Preparedness and Response through the Downstream of Multi-Hazard Early Warning Systems (UKRI/GCRF)

Embedding COVID-19 Preparedness into Local Disaster Risk Reduction (Newton fund)

Integrating Pandemic Preparedness and Disaster Risk Reduction to Protect Economic Assets and People in the 'New Normal' for the Greater Bandung Metropolitan area of Indonesia (Newton Fund)

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Dr. Chandana Siriwardana
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Dr. Ashani C. Hewage
Dr. Banuga Satchithanandan
Dr. Nagoor Ariff

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THEME 1-EPIDEMIOLOGY AND SURVEILLANCE OF DENGUE AND RESPONSE MECHANISMS AMIDST THE PANDEMIC

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Dr Himali Herath
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THEME 2-CONTROL OF DENGUE AND PREVENTION OF RE-INTRODUCTION OF MALARIA

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Members
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THEME 3-CLINICAL MANAGEMENT OF DENGUE AND COVID-19 DURING THE PANDEMIC

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Dr Indika Weerasinghe

THEME 4-COMPLEX AND INTERCONNECTED MULTI-HAZARD RISKS: THE NATURE OF CASCADING IMPACTS AND RELATIONSHIPS

Leader
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University of Huddersfield, UK

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Mr Ravindu Jayasekera
Mr Asitha De Silva
Dr Ashani Hewage

THEME 5-INTEGRATED PANDEMIC AND MULTI-HAZARD PREPAREDNESS PLANNING STRATEGIES: NATIONAL TO COMMUNITY EMPOWERMENT AND SOCIAL MOBILIZATION

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THEME 6-EARLY WARNING AND RISK COMMUNICATION STRATEGIES ON MULTI-HAZARD SCENARIOS FOR CONCURRENT AND CASCADING HAZARDS

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THEME 7-BUILT ENVIRONMENT RESILIENCE AND INNOVATION IN ADDRESSING BIOLOGICAL HAZARDS AND MULTI-HAZARD SCENARIOS

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CONFERENCE PARTNERS

Global Disaster Resilience Centre, University of Huddersfield, UK

A leader in inter-disciplinary research, education and advocacy to improve the resilience of nations and communities

What would it be like to live in a world in which government authorities, businesses, communities and individuals work together to create a society that is able to withstand the effects of unforeseen events and threats? At the Global Centre for Disaster Resilience we are working with stakeholders at the global, national and local level to make this happen.

The Global Disaster Resilience Centre (GDRC) is committed to excellence in research, education and advocacy to improve the resilience of nations and communities to disasters.

With growing population and infrastructures, the world's exposure to hazards is increasing. When disaster strikes, communities may need to be rebuilt physically economically and socially. At the same time, it is vital that any reconstruction activity pro-actively considers how to protect people and their environment, and reduce a community's vulnerability.

At the Global Centre for Disaster Resilience, our vision is for a society that has the capacity to resist or change in order to reduce hazard vulnerability, and to continue functioning physically, economically and socially when subjected to a hazard event.

We seek to achieve our vision by undertaking work that crosses the traditional boundaries between academic disciplines and schools of thought. We provide strategic advice and practical guidance based on rigorous, stakeholder informed research. We are also supported by a worldwide network of partners from policy, government, industry and academia.

GDRC is part of the School of Art, Design and Architecture at the University of Huddersfield in the UK. In November 2013, the University of Huddersfield was awarded the Times Higher Education University of the Year. The University excels in enterprise and innovation and in 2012, was named the Times Higher Education Entrepreneurial University of the Year.

Professor Dilanthi Amaratunga and Professor Richard Haigh together with their tema have actively contributed towards establishing better informed and more socially inclusive public policy-making and implementation towards the development of a disaster resilient built environment in Sri Lanka, since 2004. This impact has occurred in Sri Lanka through their input to the capacity development of national and local stakeholders. In doing so, their research is contributing to a reduction in the vulnerability of communities to the threat posed by hazards of natural and human origin. If our research is to benefit both research users and society as a whole in Sri Lanka, it is essential that it not only has the potential to make a practical difference, but is disseminated and effectively used. This is what we have been doing in Sri Lanka (We started contributing to the disaster management domain since 2004 even though our wider involvement tin Sri Lanka goes back to 1997):

- Producing excellent research outcomes that advance knowledge and understanding across all sectors of the economy and society;

- Exchanging knowledge and ideas with business and professional partners, especially through effective use of communications, to make sure as much of my best research as possible is translated into powerful services and products;
- Conducting research that underpins high-quality teaching and learning, equipping our students with the intellectual and practical skills they need in an increasingly competitive employment market:
- Carrying out research that has a focus on social, economic, cultural, scholarly or scientific impact, the value of which is recognised by the external community through support from funders and users of research;
- Producing research outcomes that have a major, visible impact and showcasing them through the media and our website to benefit regional, national and international stakeholders, as well as society at large.

Key activities that have been carried out by the University of Huddersfield team in Sri Lanka can be categorised under the following themes:

- International Conferences
- International research collaborations
- Partners in the capacity building Making Cities Resilient campaign in Sri Lanka
- Working with the local authorities
- Engagement with industry
- Make risk knowledge, assessments and risk reduction part of the university curricular
- PhD projects
- Key note speeches and other sessions linked to Sri Lanka
- International Conference presentations

The following are some of the current/recent DRR programs being implemented by University of Huddersfield in the country, with academia, policy and practice:

BEACON (Built Environment leArning for Climate adaptation)

Start date: September 2020

Duration: 3 years

Value: € 449,455.00

HUD team: Dilanthi Amaratunga (PI), Chamindi Malalgoda (PI) and Richard Haigh (COI)

Scheme: European Commssion Erasmus+ Strategic Partnerships for higher education

Partnerhsip: University of Huddersfield (lead); Lund University, Sweden; Universidad De Cantabria, Spain; Universita Ta Malta, Malta; University of Colombo, Sri Lanka and University of Moratuwa, Sri Lanka

Aim: BEACON aims to develop trans-disciplinary and innovative research-based learning in the built environment to tackle climate change in coastal regions

Improving COVID-19 and pandemic preparedness and response through the downstream of multi-hazard early warning systems

Start date: September 2020

Duration: 2 years

Value: £ 187,000

HUD team: Dilanthi Amaratunga (PI) and Richard Haigh (COI)

Scheme: EPSRC/GCRF

Partnerhsip

Lead: Global Disaster Resilience Centre, University of Huddersfield, UK

Co-Investigators: University of Colombo, Sri Lanka; University of Moratuwa, Sri Lanka

Lead Partner: Ministry of Health and Indigenous Medical Services, Sri Lanka

Other associate partners: Disaster Management Centre, Sri Lanka; Federation of Sri Lankan Local Government Authorities, Sri Lanka; The Asian Disaster Preparedness Centre (ADPC) , Thailand; The Association of Disaster Risk Management Professionals of Sri Lanka (ADRiMP); UNDRR (The United Nations Office for Disaster Risk Reduction); Greater Manchester Combined Authority (GMCA), UK; Public Health England; The Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS) of The Intergovernmental Oceanographic Commission of UNESCO (IOCUNESCO), Working Group 1: Tsunami Risk, Community Awareness and Preparedness

Aim: This project aims to examine how pandemic threats are integrated within national and local DRR strategies, and how public health actors can be embedded within a MHEW environment.

Strengthening University-Enterprise Collaboration for Resilient Communities in Asia (SECRA)

Start date: January 2021

Value: € 1 million

HUD budget: € 137,500

Lead partner: Mid Sweden University, Sweden

HUD team: Dilanthi Amaratunga (PI) and Richard Haigh

Scheme: European Commission Erasmus+ CBHE

SECRA aim: The overarching aim of SECRA is to contribute to more resilient communities in Asia through institutionalized, systematic, monitored, innovative, and inclusive university–enterprise collaboration (UEC) in climate change action and disaster resilience (DR).

Partnership

Universities: Mid Sweden University (Lead partner) , Sweden
University of Central Lancashire, UK
University of Huddersfield, UK
Tallinn University of Technology, Estonia
University of Ruhuna, Sri Lanka
University of Sri Jayewardenepura, Sri Lanka
University of Peradeniya, Sri Lanka
Chiang Mai University, Thailand
Naresuan University, Thailand
Mahasarakham University, Thailand
Ateneo de Manila University, Philippines
Philippine Normal University, Philippines
Malayan Coleges Laguna, Philippines

Associate partners: University Grants Commission (UGC), Sri Lanka
Ministry of Plantation Industry, Sri Lanka
State Ministry of Urban Development, Sri Lanka
Green Building Council of Sri Lanka, Sri Lanka
Institution of Engineers Sri Lanka, Sri Lanka
Chamber of Construction Industries, Sri Lanka
The Ceylon Chamber of Commerce, Sri Lanka
Dialog Axiata, Sri Lanka
Horizon College of Business & Technology, Sri Lanka
Lego International, Sri Lanka
International Center for Sustainable Built Environment, Sri Lanka
The Thai Chamber of Commerce, Thailand
Foundation of Asian Disaster Preparedness Center, Thailand

United Nations Office for Disaster Risk Reduction, Thailand
Local Governments for Sustainability (ICLEI – South East Asia), Philippines

Research Training Network on Tackling Climate Change as an Underlying Disaster Risk Driver (CCA-DRR)

Start date : March 2021

Value: € 148,6801

HUD team: Chamindi Malalgoda (PI), Dilanthi Amaratunga (COI) and Richard Haigh (COI)

Scheme: European Commission Erasmus+

Duration: 3 years

Project aim: CCA-DRR is designed to develop research capacities amongst academic staff members of UK and Sri Lanka, in "tackling climate change as an underlying disaster risk driver".

Project partners: University of Huddersfield (lead); University of Moratuwa; University of Colombo; University of Peradeniya; University of Ruhuna; South Eastern University of Sri Lanka; University of Sri Jayewardenepura; University of Kelaniya; Sabaragamuwa University of Sri Lanka

Integrating Pandemic, Tsunami and Other Multi-Hazard Preparedness into Early Warning and Urban Planning

Scheme: QR/GCRF internal round

HUD team: Richard Haigh (PI): Dilanthi Amaratunga (PI)

Value: £ 55,000.00

Start date: August 2020

Partnership: Disaster Management Centre, Sri Lanka**;** Ministry of Health, Sri Lanka; University of Colombo, Sri Lanka**;** University of Peradeniya, Sri Lanka**;** University of Moratuwa, Sri Lanka**;** State Ministry of Urban Development, Sri Lanka **;** Federation of Local Government Authorities, Sri Lanka; Intergovernmental Oceanographic Commission (IOC) of UNESCO: Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS)**;** Chamber of Commerce, Sri Lanka ; Bandung Institute of Technology, Indonesia**;** Asian Disaster Preparedness Centre (ADPC), Thailand**;** United Nations Office for Disaster Risk Reduction (UNDRR)

Aim: This project will address two specific challenges: 1)the integration of COVID-19, pandemic and biological hazard preparedness as part of multi-hazard early warning; and, 2) mainstreaming tsunami, biological and multi-hazard preparedness into urban planning for coastal regions.

Localising Tsunami Early Warning Systems

Funded by: QR/GCRF.

Partners in this initiative include: UNESCO (IOC-UNESCO) ICG/IOTWMS WG 1 on Tsunami Risk, Community Awareness and Preparedness; ITB, Indonesia; Ministry of Public Administration and Disaster Management, Sri Lanka; Disaster Management Centre, Sri Lanka; National University of Maldives, Maldives; National Disaster Management Center (NDMC), and Maldives Meteorological Services, Maldives; University of Yangon, Myanmar; National Disaster Management Agency and the Department of Meteorology and Hydrology (DMH), Myanmar; Asian Disaster Preparedness Center, Thailand.

Building Resilience in Tropical Agro-Ecosystems (BRITAE)

Value: € 910,000

Lead partner: University of Ruhuna, Sri Lanka

University of Huddersfield team: Dilanthi Amaratunga (PI) and Richard Haigh (COI)

Scheme: European Commission Erasmus+ CBHE

Partnership: University of Central Lancashire, UK; University of Huddersfield, UK; Tallinn University of Technology, Estonia; VGTU, Lithuania; University of Ruhuna (leading), University of Sri Jayewardenepura, Sabaragamuwa University, University of Peradeniya, University of Colombo, University of Moratuwa from Sri Lanka

Technological Applications Associated With Multi-Hazard Early Warning Systems In Sri Lanka

Value: £ 6000.00

Partnership: A collaboration with University of Moratuwa, Sri Lanka

The Impact of the Disaster Induced Relocation on the Affected People due to Landslides in 2016 in Sri Lanka

Funder: URF

Value: £ 4260

Lead partner: Global Disaster Resilience Centre, University of Huddersfield

HUD Team: Professor Richard Haigh (PI), Prof. Dilanthi Amaratunga (PI)

Partners: University of Colombo, Sri Lanka and National Building Research Organisation of Sri Lanka (NBRO)

Governance of the Upstream-Downstream Interface in End-to-End Tsunami Early Warning Systems

Funder: GCRF/QR/URF

Value: £ 45,000

Lead partner: Global Disaster Resilience Centre, University of Huddersfield

Partners: Disaster Management Centre, Sri Lanka; Ministry of Disaster Management, Sri Lanka; Department of Meteorology, Sri Lanka; Intergovernmental Oceanographic Commission of UNESCO, Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS); University of Yangon, Myanmar; National University of Maldives, Maldives; Asian Disaster Preparedness Centre (ADPC), Thailand.

Start: October 2018 for 1 year

Disaster Risk Reduction Impact Support

Funding: University of Huddersfield URF Scheme

Amount: £ 8000

Integrating Education with Consumer Behaviour Relevant to Energy Efficiency and Climate Change at the Universities of Russia, Sri Lanka and Bangladesh (BECK)

Scheme: European Commission, CBHP

Lead: Vilnius Gediminas Technical University, Lithuania

HUD Team: Prof. Dilanthi Amaratunga (PI), Professor Richard Haigh (COI)

Grant value: € 892,955

Duration: 3 years commencing November 2018

Partnership: Vilnius Gediminas Technical University, Lithuania**;** University of Huddersfield; Tallinn University of Technology, Estonia; Moscow State University of Civil Engineering, Russia**;** Kaliningrad State Technical University, Russia; University of Ruhuna, Sri Lanka; Alma Mater Studiorum – University of Bologna; Peter the Great St.Petersburg Polytechnic University, Russia; Association of Educational Civil Engineering Institutions, Russia; Lomonosov Moscow State University, Russia; Patuakhali Science and Technology University, Bangladesh; University of Colombo, Sri Lanka

REGARD – Rebuilding AfteR Displacement

Scheme: Euripean Commssion Erasmus+ Strategic Partnerships for higher education

Lead partner: Global Disaster Resilience Centre, University of Huddersfield

Grant value: € 449,000 (approx)

In partnership with: Tallinn University (Estonia), Lund University (Sweden) and University of Colombo (Sri Lanka)

Duration: 3 years comencing November 2018

CABARET (Capacity Building in Asia for Resilience EducaTion)

Scheme: Erasmus+ Call: Capacity Building in the Field of Higher Education EAC/A04/2015

Lead partner: Global Disaster Resilience Centre, University of Huddersfield

Value: € 993,340.00

Duration: January 2017 to January 2020

Partnership: 15 partners:

From Programme Countires (from the EU) - University of Huddersfield, UK (leading); University of Central Lancashire, UK**;** IHC Cantabria - Environmental Hydraulics Institute, Spain**;** Mining and Geology University, Sofia, Bulgaria**;** University of Malta, Malta**;** Riga Technical University, Latvia:

From Partner Countries (Asia) - University of Moratuwa, Sri Lanka; University of Peradeniya (UoP), Sri Lanka**;** ITB Bandung, Indonesia; University of Andalas, Indonesia**;** Maldives National University, Maldives**;** De La Salle University, Philippines; Ateneo de Manila University, Philippines**;** Mandalay technology University, Myanmar; Yangon University, Myanmar

Disaster Resilience and Sri Lanka

Scheme: Erasmus + ICM

Lead partner: Global Disaster Resilience Centre, University of Huddersfield

Partnership: 5 universities - University of Moratuwa, Sri Lanka; University of Colombo, Sri Lanka; University of Ruhuna, Sri Lanka; University of Peradeniya, Sri Lanka; South Eastern University, Sri Lanka

University of Huddersfield Value: € 103,000.00

Start: July 2017 for 2 years

CRESCENDO (CRESCENDO: Community Resilience Engaging Society, Culture, and ENvironment against Disaster Outcomes)

Value: £ 30,000.00

Lead partner: Global Disaster Resilience Centre, University of Huddersfield

Duration: 3 years commencing 2016.

Partners: Global Disaster Resilience Centre, University of Huddersfield, UK (lead)**;** University of Moratuwa, Sri Lanka**;** University of Colombo, Sri Lanka**;** University of Peradeniya, Sri Lanka; Institutions in the region (Universiti Teknologi Malaysia, Malaysia; Institute of Technology Bandung, Indonesia; RMIT, Australia; Griffith University, Australia; University of Auckland, New Zealand; Chiang Mai University, Thailand; Kyoto University, Japan)

ASCENT – Advancing Skill Creation to ENhance Transformation

Scheme: Erasmus+ programme – European Commission

Value: € 983,089.00

Duration: 36 months, starting March 2016

Lead partner: Global Disaster Resilience Centre, University of Huddersfield, UK

Partnership: 16 international collaborators - Global Disaster Resilience Centre, University of Huddersfield, UK (Lead); University of Central Lancashire, UK; Lund University, Sweden; Mid Sweden University, Sweden; Vilnius Gediminas Technical University, Lithuania; Tallinn Institute of Technology, Estonia; University of Moratuwa, Sri Lanka; University of Colombo, Sri Lanka; University of Ruhuna, Sri Lanka; University of Naresuan, Thailand; Chiang Mai UniversityUniversity, Thailand ; Dhaka University, Bangladesh; PSTU University, Bangladesh; BRAC University, Bangladesh; Federation of Sri Lankan Local Government Authorities, Sri Lanka (associate partner - industry); Asian Disaster Preparedness Centre, Thailand (associate partner – industry)

A Study of the Upstream-Downstream Interface in End-to-End Tsunami Early Warning and Mitigation Systems

Scheme: RCUK/GCRF

Lead partner: Global Disaster Resilience Centre, University of Huddersfield

Partnership: 8 partners - University of Colombo, Sri Lanka; ITB, Indonesia; Asian Disaster Preparedness Centre, Thailand; National Disaster Management Agency (BNPB), Indonesia; Meteorology, Climatology and Geophysical Agency (BMKG), Indonesia; The Federation of Sri Lankan Local Government Authorities (FSLGA), Sri Lanka; Ministry of Disaster Management, Sri Lanka; Department of Meteorology, Sri Lanka

Value: £ 70,000.00

Start: October 2017 for 1 year

CADRE (Collaborative Action towards Disaster Resilience Education)

Scheme: LLP Multi-lateral projects

Lead partner: Global Disaster Resilience Centre, University of Huddersfield

Value: € 569 078 (2013 - 2016)

Partnership: 7 partners from EU and third countries – UK, Estonia, Italy, France, Sri Lanka - University of Huddersfield, UK (lead); Northumbrian University, UK; Tallinn Institute of Technology, Estonia; Vilnius Gediminas Technical University (VGTU), Lithuania; Federation of Sri Lankan Local Govt. Authorities (FSLL), Sri Lanka; University of Moratuwa, Sri Lanka; UNISDR, Switzerland

They have provided very large number of PhD study opportunities for Sri Lankan students. Recently, three students have successfully defended their PhDs and at the moment 4 other Sri Lankan students are reading for their PhDs at the University of Huddersfield.

For more information about our research, teaching and advocacy, please contact: Professor Dilanthi Amaratunga & Professor Richard Haigh, Global Centre for Disaster Resilience, University of Huddersfield, Queensgate, Huddersfield, HD1 3DH, United Kingdom.

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Improving COVID-19 and Pandemic Preparedness and Response through the Downstream of Multi-Hazard Early Warning Systems

PROBLEM BEING ADDRESSED

Many countries now recognise the need for improved pandemic preparedness. The WHO has declared COVID-19 a pandemic, but its underlying factors, vulnerabilities and impacts go far beyond the health sector.

COVID-19 has overwhelmed health systems and caused widespread social & economic disruption in Sri Lanka, including an estimated Rs 900billion / 6% GDP to the economy, especially the tourism, agriculture, garment and service sectors.

By putting societies and economies on hold, Sri Lanka has curtailed the virus' spread. These defensive measures have helped to limit the short-term impacts of the virus, but also resulted in a shift of priorities that disproportionately affect disadvantaged groups, including people in poverty, displaced people and refugees, who most often live in overcrowded and under resourced settings.

Current COVID-19 measures have also exposed gaps in the country's DRR (disaster risk reduction) strategies, which have failed to address pandemics and other biological hazards. Government agencies are already stretched trying to manage the COVID-19 response, but how would they cope if another natural hazard occurred concurrently, such as the seasonal Southwest Monsoon which is expected to increase dengue cases? COVID-19 protocols may create ambiguity or confusion with regards to other hazard warning services, as well as with response actions like evacuation for tsunami.

There are also opportunities for pandemic preparedness and response to make better use of the existing infrastructure, including other hazards' early warning protocols. Addressing these will require the integration of pandemics into a multi-hazard, national and local strategy for DRR, advocated in SFDRR, but not implemented. It will also necessitate a multi-stakeholder approach to collectively examine impacts, coordinate fiscal, monetary, and social measures, share practices and lessons learned.

OBJECTIVES

1. To identify the key actors and what are the processes involved in the preparation of COVID-19 and other pandemic warning and dissemination processes
2. To propose recommendations to mainstream COVID-19 and other pandemic threats to be integrated within national and local disaster risk reduction strategies
3. To explore the impact of COVID-19 on the response capabilities for other hazards, either multiple simultaneous events, or cascading impacts and to understand what components of early warning system are greatly affected due to dual challenges associated with COVID-19
4. Develop and implement a synergised COVID-19 and public health surveillance system with "the last mile" of MHEW
5. To identify how would pandemic response measures impact the downstream response to other hazards, including mass evacuations with increased capacity of shelters, camps and to identify measures to overcome these tensions in an emergency situation
6. To propose how the COVID-19 and public health surveillance system can be synergised with "the last mile" of multi-hazard early warning systems, where community networks, communication systems, and citizen behaviours can be utilised for pandemic EWS at the community level

KEY OUTPUTS

1. Develop a conceptual framework on the key actors and processes involved in COVID-19 and other pandemic warning and dissemination processes.
2. Conduct public engagement events and round table dialogues.
3. Outcomes will be disseminated through at least five high quality, peer reviewed multi-institution, multi-disciplinary journal papers in high-impact journals lead to a briefing paper and a policy dialog on current status and recommendations on the integration of pandemics within the national/local DRR strategies
4. A vision paper will set out the future integration of pandemics into a MHEW environment.
5. At least four oral presentations in leading international conferences.
6. Publish project activities through project flyer and project website

PLANNED OUTCOMES/IMPACT:

The research will help Sri Lanka and the wider region to better prepare, respond and recover from disruptions caused by pandemic threats. The study results will influence the IOC-UNESCO ICG/IOTWMS on approaches to assessing tsunami hazard preparedness and priorities for capacity development of member states, and benefits will extend to the 28 member states of the IOTWMS, 23 of them DAC.

Huddersfield's Amaratunga and Haigh are expert members of the ICG/IOTWMS "WG1 Tsunami Risk, Community Awareness and Preparedness", which is Chaired by Dr Rahayu, an Advisory Board member. The results will change the understanding and awareness/ attitudes of national and subnational actors, in particular the impact of COVID-19 on the response capabilities for other hazards. It will change decision-making and behaviour of national and subnational actors through improved standard operating procedures for natural/pandemic early warning and contribute to progress with the SDGs: 13 Climate action; 11 Sustainable cities and communities; and 10 Reducing inequalities.

Project partners:

Lead: Professor Dilanthi Amaratunga, Global Disaster Resilience Centre, School of Applied Sciences, University of Huddersfield, UK

Professor Richard Haigh, Global Disaster Resilience Centre, School of Applied Sciences, University of Huddersfield, UK

Co-Investigators: University of Colombo, Sri Lanka (Lead, Dr Nishara Fernando)

University of Moratuwa, Sri Lanka (Lead: Dr Chandana Siriwardana)

Lead Partner: Ministry of Health, Sri Lanka;

Other partners: Disaster Management Centre, Sri Lanka; Federation of Sri Lankan Local Government Authorities, Sri Lanka; The Association of Disaster Risk Management Professionals of Sri Lanka (ADRiMP); The Asian Disaster Preparedness Centre, Thailand; UNDRR (The United Nations Office for Disaster; Risk Reduction) & ESTAG (Science & Technology Advisory Group) of UNDRR; Greater Manchester Combined Authority (GMCA), UK; Public Health, England; The Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS) of The Intergovernmental Oceanographic Commission of UNESCO (IOCUNESCO), Working Group 1: Tsunami Risk, Community Awareness and Preparedness

Key contact: Professor Dilanthi Amaratunga,

Global Disaster Resilience Centre, School of Applied Sciences, University of Huddersfield, UK (D.Amaratunga@hud.ac.uk)

Professor Richard Haigh

Global Disaster Resilience Centre, School of Applied Sciences, University of Huddersfield, UK (R.Haigh@hud.ac.uk)

Embedding COVID-19 Preparedness into Local Disaster Risk Reduction

Risk has become systemic. Our approach cannot be divided into categories that are then assigned to health authorities, disaster management agencies or early warning centres. A better understanding of these issues will lay the foundation for better approaches for epidemic and pandemic preparedness.

THE SPECIFIC OBJECTIVES OF OUR PROJECT ARE TO:

1. Explore the extent to which COVID-19 preparedness planning is currently embedded at national level DRR planning as a biological hazard
2. Identify how public health aspects be better integrated into DRR and resilience planning, in combatting the dual challenges of other disasters and COVID-19
3. Identify mechanisms on how public health aspects (including COVID preparedness planning) can be "localised" with other hazards
4. Develop guidelines to consider COVID-19 risks from many angles and work in a collaborative way, linking national to local stakeholders in order to fight systemic risks, which is joined up and cascading

ANTICIPATED OUTCOMES

Short-term impacts of our research will increase awareness of the role of the public health system in DRR preparedness planning. A literature review of Covid-19 will give an overview of the position of Co-19 preparedness planning in DRR framework in Indonesia.

Planned deliverables of this project will generate impacts via: promoting systematic integration of health into national, sub-national and local DRR policies and plans; enhancing cooperation between health authorities and other relevant stakeholders to strengthen country capacity for DRR and pandemics nexus; Integrating DRR into health education and training and strengthen capacity building of health workers in DRR; incorporating health-related mortality data into national and local DRR prepared and planning systems; Advocating for, and supporting cross-sectoral, transboundary collaboration including information sharing; and promoting coherence and further development of local and national policies and strategies, legal frameworks, regulations, and institutional arrangements.

A policy paper that is proposed will provide direct input towards the Indonesian National Disaster Management Agency (BNPB) to create action plans in the DRR for widespread and systemic hazards. Experiences from handling Covid-19 has emphasised the gaps on how the public health sector needs to integrate with other disasters. Padang City, where the project will take place, will benefit from the proposed improvement of the DRR system for the city.

In situations where disaster managers are dealing with crises on multiple fronts, responding to one disaster may exacerbate the impact of another. There need to be redesigning its approach to disseminating early warnings at the community level to ensure physical

distancing and greater use of mass communication tools including public address systems and social media. These are some of the long term impacts that this project will generate.

Implementing partners: University of Huddersfield, United Kingdom; University of Andalas, Indonesia; National Disaster Management Authority (BNPB); West Java Province Local Disaster Management Organization (BPBD); Public Workers Office of West Sumatra Province; Health Office of West Sumatra Province; Social Office of West Sumatra Province

Co-funded by: UK Newton Fund

The Newton Fund builds outstanding research and innovation partnerships with select countries in Africa, Asia and Latin America to support economic development and social welfare, tackle global challenges and develop talent and careers. The fund is managed by the UK's Department for Business, Energy and Industrial Strategy (BEIS), and delivered by UK and international partners. UK investment is matched by investment and resources from partner countries. (www.newton-gcrf.org)

RISTEK-BRIN (https://international.ristekbrin.go.id)

Delivery partner: British Council

The British Council builds connections, understanding and trust between people in the UK and other countries through arts and culture, education and the English language. British Council connect the best of the UK with the world and the best of the world with the UK. These connections lead to an understanding of each other's strengths and of the challenges and values that we share. This builds trust between people in the UK and other nations which endures even when official relations may be strained. (www.britishcouncil.org)
Further information about the project is available at: http://covid19liaise.info

Integrating Pandemic Preparedness and Disaster Risk Reduction to Protect Economic Assets and People in the 'New Normal' for the Greater Bandung Metropolitan area of Indonesia

Metropolitan areas, such as Greater Bandung in Indonesia, are a vital geographic unit for nations to sustain economic growth and development. However, they blur the boundaries between cities and peripheral regions, and make traditional city boundaries, often imposed by administrative needs, essentially obsolete. The importance of an integrated approach to development and disaster preparedness is particularly acute when they are threatened by a range of natural, technical and biological hazards, including pandemics such as COVID-19.

Greater Bandung is located in a mountainous plateau region in the central-west portion of West Java province and has the third highest population of any metropolitan area in Indonesia. It is surrounded by active volcanoes, a number of faults and complex river systems that pose significant hazards, including earthquakes, volcano eruptions, frequent floods and landslides.

In this project, researchers in the UK and Indonesia will work with actors at the National, Provincial and City levels in the Bandung Metropolitan area, and build upon the results of

a previous study that won the 2019 Newton Prize for Indonesia. They will map and seek to better integrate the key actors involved in disaster risk reduction, climate change, and pandemic preparedness. They will also increase the capacity of provincial and local actors in the Greater Bandung Metropolitan area to address the threats to economic assets and people posed by disaster risk, including developing threats such as pandemics and climate change, that are creating a 'new normal'.

We will build upon previous work to:

1. Map the key actors involved in COVID-19 and pandemic preparedness, and develop a multi-stakeholder transition pathway for the vertical and horizontal integration of disaster risk, climate change and pandemics into development planning to address the 'new normal' in the Greater Bandung Metropolitan area

2. Increase the capacity of provincial and local actors in the Greater Bandung Metropolitan area to address the threats to economic assets and people posed by disaster risk, including pandemics and climate change

Anticipated outcomes

The project addresses the Disaster Management and Climate Change thematic priority areas of the UK – Indonesia Science Technology Fund. It will develop novel, integrated risk reduction strategies that can protect centres of economic growth and development outcomes in urban agglomerations within the Bandung Metropolitan area, while also having wider relevance across Indonesia.

Through a stakeholder map of DRR, CCA and with disaster management actors as well as with health actors at the West Java Provincial and related City/Regency levels (i.e. City of Bandung, City of Cimahi, Regency of Bandung, Regency of West Bandung and Regency of Sumedang), and a series of multi-actor dialogues, the project will adapt the multi stakeholder transition pathway and develop a clear policy brief on mainstreaming DRR, CCA and pandemic preparedness into Greater Bandung's urban agglomeration development plan.

A systematic review of the global literature base on pandemic preparedness, drawing upon COVID-19 but also experiences from MERS and SARS, will be used to inform the dialogue, and ultimately the pathways and policy brief. The pathway will provide a framework to support the Ministry of Agrarian and Spatial Planning, and DRR, CCA and health actors at the Provincial and City level in the Greater Bandung Metropolitan area, including communication and collaboration channels between these communities, action plans and capacity building that can be adapted locally.

Implementing partners: University of Huddersfield, UK; Bandung Institute of Technology, Indonesia; Ministry of Agrarian and Spatial Planning; National Disaster Management Authority (BNPB); West Java Province Local Disaster Management Organization (BPBD); Agency of Meteorology, Climatology, and Geophysics (BMKG); Indonesian Disaster Expert Association (IABI)

Co-funded by: UK Newton Fund

The Newton Fund builds outstanding research and innovation partnerships with select countries in Africa, Asia and Latin America to support economic development and social welfare, tackle global challenges and develop talent and careers. The fund is managed by the UK's Department for Business, Energy and Industrial Strategy (BEIS), and delivered by UK and international partners. UK investment is matched by investment and resources from partner countries. (www.newton-gcrf.org)

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Further information about the project is available at: http://covid19liaise.info

The National Dengue Control Unit, Ministry of Health, Sri Lanka

The National Dengue Control Unit is the focal point for the control and prevention of dengue in Sri Lanka. It was established in the year 2005 as a decision taken by the Ministry of Health following the major dengue outbreak in the year 2004. When dengue illness increasingly expanded in high magnitude in 2011 it was upgraded to a directorate as the National Dengue Control Unit (NDCU) with a dedicated annual budget allocation for activities at the district level.

The main trajectory of the NDCU falls under the strategies of epidemiological surveillance to detect dengue patients in real-time, entomological surveillance to forecast vector density and to take appropriate control measures, apply appropriate integrated vector management (IVM) strategies to interrupt dengue transmission, provide facilities for evidence-based clinical care, continuous inter-sectoral coordination and social mobilization, detect epidemics early and to respond to potential epidemics effectively including effective risk communication strategies and facilitating innovative research.

The goal of the NDCU is to reduce the endemicity of dengue in Sri Lanka to such an extent that it is no longer a major public health problem in the country. To achieve the goal, the work targets of the NDCU are: to achieve case incidence below 100/100,000 population by the year 2023 and to reduce and maintain a case fatality rate below 0.1% by the year 2023.

The NDCU is located in a part of the 7th floor of the public Health Complex in Narahenpita since its establishment in 2005. The staff of the NDCU includes the director, consultants, medical officers, entomologists, public health inspectors, health entomological officers, and other staff categories exceeding 60 in total. The NDCU has grown and diversified its scope into many components moving from a reactive response to proactive preventive measures through advocacy, resource mobilization, strategic partnerships, capacity building and monitoring, and evaluation. In addition, the planned establishment of the molecular diagnostic laboratory at the NDCU, with a molecular biologist will cater to the growing demand for timely identifying the virus serotypes circulating in the country in different time periods which has been recognized as a good predictive indicator of dengue outbreaks in the country.

Disaster Preparedness and Response Division (DPRD), Ministry of Health, Sri Lanka

Sri Lanka is a country exposed to different kinds of natural hazards. As a direct or indirect effect of these hazards, disasters and emergencies are experienced leading to much human suffering. The foremost concern in any type of disaster/ emergency is to minimize this human suffering where the health sector has a critical role to play. Therefore, it is of utmost importance that the heath sector of the country is prepared to respond effectively and efficiently in the event of a disaster.

To achieve a vision of a resilient health sector for safer communities, Disaster Preparedness and Response Division (DPRD), Ministry of Health was formed alien with the disaster management act no 13 of 2005. DPRD is responsible for creating a safer Sri Lanka through improving health sector functioning in relation to disasters, integrating disaster risk reduction into health sector and empowering communities as supporters on health sector disaster response.

DPRD is headed by a National Coordinator and comprised of public health specialists, medical officers trained in disaster management and other technical categories related to disaster preparedness and response. As the national focal point for health sector disaster management, DPRD is active in the areas of improving disaster preparedness in hospitals and public health institutions, coordinating with relevant stakeholders in disaster response and capacity building of health professionals in health sector disaster management. It also has an extended reach across the island through several health sector Emergency Operations Centers (EOC) in disaster prone districts in the country. DPRD conducts disaster simulation drills in hospitals through out the island to augment their capacities in responding to disasters, on a yearly basis.

This institution was at the forefront of health response during major disasters in recent history including the internal displacement of refugees following the conflict in Northern and Eastern provinces, Easter Sunday bombings and COVID-19 pandemic. It's strong commitment towards building multi stakeholder collaborations in disaster risk reduction is evident through projects like adaptation of WHO Safe Hospital Initiative to Sri Lanka together with Department of Civil Engineering University of Moratuwa and Hospital Preparedness for Emergencies (HOPE) training together with Asian Disaster Preparedness Center (ADPC).

During the COVID-19 outbreak situation in Sri Lanka, DPRD played a significant role by coordinating with the different agencies with in the Ministry of Health and other partners and stakeholders for health response, through its Public Health Emergency Operations Center (PHEOC) operating 24 X 7, throughout the year.

Anti Malaria Campaign, Ministry of Health, Sri Lanka

Malaria is a disease with a high morbidity and mortality rate. Prior to independence in 1948, the need for an effective malaria response was recognized. Malaria control activities have been organized since the establishment of the Anti Malaria Campaign in Kurunegala in 1911. Several outbreaks necessitated the establishment of additional Anti Malaria Campaign units in other high-risk areas of the country. Some of the major accomplishments were the control of a massive outbreak in 1934/1935 and the dramatic reduction in malaria incidence in the country after the introduction of dichlorodiphenyltrichloroethane (DDT) in 1946. In accordance with WHO recommendations, the government launched a malaria eradication program in 1958 that covered the entire island of Sri Lanka.

During the eradication phase, remarkable achievements were reported, and near-eradication status was achieved in 1963. (with 17 reported cases of which 11 were imported cases). However, due to a number of technical and other flaws, a major setback occurred, culminating in a massive malaria epidemic in 1967–1969, which began in the Matale and Monaragala districts. Several factors were thought to have contributed to the failure, including the persistence of several undetected malaria transmission foci, extensive intra-country population movements, particularly related to gem mining, and the complacency of many malaria control personnel. The program, however, continued on eradication principles for several years before being re-oriented as a control program that included many elements of the earlier eradication program. Until 1989, the AMC operated as a vertical program with a centralized structure. The program was decentralized in 1989, with nine provincial health authorities implementing it under the technical supervision of the National Anti Malaria Campaign Directorate. The AMC Directorate reports to the Line Ministry of Health, while the Provincial Programs are managed by the Provincial Health Authorities, which report to the Provincial Councils. The AMC directorate is divided into several units, each led by a Consultant Community Physician, with a well-established parasitology and entomology unit comprised of parasitologists and entomologists. Regional Malaria Officers are the point people in charge of preventing malaria reintroduction in provinces and districts. Administratively, they report to the Provincial and Regional Directors of Health Services, but they receive technical guidance from the AMC Directorate. Following the end of the separatist war in the country's northern and eastern provinces in 2009, Sri Lanka embarked on a phased malaria pre-elimination program, which was followed by the malaria elimination program in 2011. The last case of indigenous malaria was reported in October 2012, well ahead of the deadline of the end of 2014. Sri Lanka was the first country in the South East Asian region to achieve World Health Organization malaria elimination certification in 2016.

The elimination program's success is largely due to the sustained action made possible by the AMC's existing structure and the evidence-based approach used. Sri Lanka is currently in the Prevention of Reintroduction (PoR) phase, with a stringent surveillance and monitoring system in place to identify and manage any cases that arise.

Social Policy Analysis and Research Centre (SPARC), Faculty of Arts, University of Colombo, Sri Lanka

Founded in 1921, University of Colombo is the oldest university in Sri Lanka, consisting of 9 faculties, 59 academic departments, a campus, a school, 7 institutes and over 20 centres and units. This renowned university provides unmatched knowledge, skills, and timely research exposure to its student population of more than 11,000 in number. The university also has a well-recognized team of academic experts with national and international experience and exposure in their respective fields. The university has a strong commitment towards research and academics in various disciplines engage in high quality research of local and international relevance.

The Faculty of Arts is the largest faculty in the university in terms of student enrolment. Its vision is to be a Centre of excellence in creative thinking, teaching, research and community outreach in the South Asian region while its mission is to promote collective scholarship, critical inquiry, competencies and skills in the social sciences and humanities, keeping in line with the highest academic and ethical standards of teaching, research, training and evaluation. The faculty has 11 academic departments and several teaching units which offer courses in the field of Social Sciences and Humanities. Apart from undergraduate BA courses, several departments offer courses for diplomas, masters and Ph.D. degrees.

The Social Policy Analysis and Research Centre (SPARC) is a research Centre of the Faculty of Arts, University of Colombo. It is a pioneering force in multi-disciplinary research. Professor Nishara Fernando is the director of the Centre. The establishment of SPARC is the culmination of a process set in motion at the university several years ago with the launch of the Improving Capacities for Poverty and Social Policy Research (IMCAP) in the late 2000s. IMCAP was a staff and student development programme which was implemented to strengthen the skills of younger academics from different social science backgrounds on poverty and social policy analysis and research.

The Centre conducts its research in diverse fields including disaster management, disaster resilience, built environment, climate change, disaster relocation, development induced relocation, vulnerable groups in post war situations, impact assessments, vulnerability assessments, youth studies, violence against children and women, and cyber violence. These focal areas are reviewed from time to time, keeping with new experiences gained within the university and emerging critical issues that require expert attention.

For more information about SPARC visit: https://sparc.cmb.ac.lk/

University of Moratuwa, Sri Lanka

The University of Moratuwa Sri Lanka is an independent state university located at Katubedda, Moratuwa overlooking the picturesque Bolgoda Lake. It was established as the University of Moratuwa (UoM), Sri Lanka on 22 December 1978 under the Universities Act No.16 of 1978 and operates under the general direction of the University Grants Commission. The institution was known as Ceylon College of Technology, Katubedda (Katubedda Tech) before gaining university status. Its roots go back to the Institute of Practical Technology founded in 1960 to provide technical education. University of Moratuwa, consists of six faculties namely, Architecture, Business, Engineering, Graduate Studies, Information Technology and Medicine with thirty five (35) academic departments offering thirteen (13) Bachelor's degree programs to students selected by the University Grants Commission (UGC) and fifty-six (56) postgraduate programs together with MSc, MPhil & PhD research-based postgraduate degrees. The university has an undergraduate student population of 10654, and 1050 NDT diploma students of the Institute of Technology of University of Moratuwa (ITUM). University of Moratuwa has a highly qualified academic staff of 443 with an administrative staff of 30. It must be highlighted that the University has been increasing the annual intake of students over 70% overall and 31% in the Faculty of Engineering, 83% in the Faculty of Architecture and 77% in the Faculty of Information Technology during the last ten years to meet the increasing demand for the degree programmes and thereby catering the human resource development of the nation. In 2020, 1388 (90%) of 1550 students, who sat the final examinations graduated within the minimum stipulated time period to obtain the first degree. The number of degrees conferred, including postgraduate, at the General Convocation in the year 2020 was 1877 of which 1491 were bachelors degrees and 386 were postgraduate degrees. Employment Pattern Survey done at the Convocation 2020, on employment patterns of graduates, reported that 71.1% of all graduates, 93.0% of Architecture graduates, 81.1% of Facilities Management graduates, 82.5% Quantity Surveying graduates, 73.4 % of the Engineering graduates, and 71.1% of Information Technology graduates were employed at the time of the convocation, showing that the graduates of UOM are much sought after by the industry and its employers even during the Covid-19 pandemic situation.

The Federation of Sri Lankan Local Government Authorities

The Federation of Sri Lankan Local Government Authorities (FSLG) is the umbrella organisation for local government associations in Sri Lanka and its objectives include: To co-ordinate a unified approach among Local Government Authorities in Sri Lanka to resolve common issues and develop participatory governance for the well being of citizen; To increase the voices and effective participation of councillors in Local Government planning, development and decision making within the framework of participatory democracy and an associative spirit; and to strengthen the functioning and capacity of Local Government Authorities, and facilitate co-operation among all tiers for effective service delivery and development at all levels.

National Science Foundation of Sri Lanka

NSF is the premier national institution in Sri Lanka mandated to promote R&D and scientific literacy for the socio-economic development and wellbeing of its people. To this end, it provides support and opportunities through a wide range of activities and programmes, including funding R&D, popularization of science, S&T policy studies, scientific communication and knowledge dissemination, capacity building and competency enhancement and building partnerships and networks. NSF works closely with academia, R&D institution and industry at home and abroad with strong linkages established with relevant international institutions such as GRA, GRC, ISC, ICGEB, UNESCO, TWAS, FABA, SAARC, IUBNB, JST, DAAD, PSF and NSFC which provides global exposure and perspectives to R&D personnel. NSF offers a wide range of programmes supporting research, training, capacity building, publications, overseas travel and scientific events such conferences, workshops, symposia etc. However, in order apply for such programmes, it is a prerequisite to be registered with the S&T Management Information System (STMIS) database. Consequently around 6,000 S&T personnel in Sri Lanka have registered with the database. Besides, a large number of high-profile scientists in higher education and R&D institutions are serving as resource persons in a multitude of committee including editorial boards. And as a matter of fact, NSF has contributed immensely to the professional growth and development of the most of the senior scientists in universities Sri Lanka

PRE AND POST CONGRESS SESSIONS

Pre Congress Session - 1

Title: Empowering communities through effective communication in dengue scenario-based training for Public Health Midwives in Sri Lanka

This pre-congress session was held in the regional health training center Kadugannawa on 25th February 2022. Public Health Midwives and Supervising Public Health Midwives from Kandy and Kegalle districts participated in the programme.

Public Health Midwives (PHM) are the ground-level Community Health Workers who cater to the maternal and child health care services at the doorstep of people in Sri Lanka. Their unique service delivery model allows them to understand community perception like no other grass root level service in Sri Lanka. Hence, incorporating their services into Dengue prevention and control at the village level would be a game-changer. In this backdrop, it was decided to enhance their skills and knowledge in risk communication and empower them to deliver an effective message to mothers and children.

The aim of this session was to develop the capacity of PHM on community empowerment for effective risk communication in dengue and other hazards mainly utilizing the services of 'Mother Support Groups' through active engagement of local networks catered by the Public Health Midwife.

Pre-Congress Session - 2

Title : Vector Bionomics and Integrated Vector Management in Malaria and Dengue

The pre-congress session-2 was held on the 2nd March 2022 at the Auditorium of National Blood Transfusion Service Center, Colombo 05. It was held with the participation of Reginal Malaria Officers (RMO), Entomologists and Health Entomology Officers (HEO), and technical staff of Anti Malaria Campaign (AMC) and National Dengue Control Unit (NDCU). The pre-congress session-2 was jointly organized by the AMC and the NDCU.

Malaria and dengue are two important vector-borne diseases. Understanding vector bionomics and conducting rational focused vector control activities are essential for both malaria and dengue. They form an integral part of the prevention and control activities of both diseases at the field level. Therefore, capacity building of the RMOs, entomologists and HEOs on entomology and vector control was the main objective of this pre-congress session. It also provided a common platform for staff of both campaigns to understand and explore complementing and supporting dengue and malaria activities when needed. Adapting to pandemic situations and carrying out entomological activities even during these Covid-19 pandemic times is very important.

Pre-Congress Session - 3

Title: Workshop on improving preparedness and response for multi-hazard scenarios for Public Health Inspectors- Southern Province Sri Lanka

The pre-congress session-3 was held on 8th March 2022 at the Auditorium of Regional Director of Health Services (RDHS) office, Matara with the participation of Public Health Inspectors of Matara, Galle, and Hambantota districts.

Public Health Inspectors (PHI) are the grass-root level health workers who are involved in disease prevention and control activities in the community. They are the health workers who bridge the gap between the community and the health service delivery institutions. Skill development and increased knowledge on effective risk communication and community empowerment are very important among PHI to effectively facilitate the communities for preparedness and response to diseases like dengue and other hazards. The COVID 19 pandemic has taught us the importance of responding to community needs despite unprecedented difficulties.

This session will further facilitate PHI to effectively communicate the risks of multiple hazards to the community through engagement of all stakeholders and also to empower the people to control their own behaviour and health to mitigate the effects of diseases and other hazards.

Community Engagement Workshop - 1

Pre conference session

Significance of public engagement in pandemic preparedness and response has been largely highlighted during the COVID-19 pandemic. The aim of this preconference session is incorporating citizens perspective on pandemic preparedness and response amidst a multi hazard situation in Sri Lanka. Objectives of the workshop are Dissemination of essential knowledge, best practices, and skills for preventing covid-19 and co current hazards and Sharing community experience and practices on pandemic preparedness and response. The program was organized by the global disaster resilience centre, University of Huddersfield in collaboration with National Dengue Control Unit, Sri Lanka. More than 50 members those who are engaged in multi-hazard preparedness and response at the grass root level including Public Health Inspectors, Public Health Midwives, community leaders, members from faith-based organizations, mother support groups of different Medical Officer of Health (MOH) areas, village committees and representatives of different community-based organizations actively participated in the workshop. Further, resource persons and officials from GDRC, University of Huddersfield, Ministry of Health, National Dengue Control Unit, University of Moratuwa and Sarvodaya contributed as facilitators. The event was held on 10th March 2022 at Kethumathi Hotel, Rathnapura.

Session was designed to facilitate discussion and experience sharing among the participants which was augmented by simulation exercises of real-life scenarios related to pandemic and disasters. At the end of the scenario based learning each group was requested to make a presentation on their discussion and simulation, ensuring a debate and exchange of ideas among the resource persons and the participants. Key outcomes of this presentations were

documented under thematic areas of community empowerment, community mobilization and risk communication to ensure further learning and knowledge exchange.

Community Engagement Workshop - 2

Post conference session

The second community engagement workshop will be held on 25th and 26th at Sarvodaya Neyham training centre, Nawattakulam, Jaffna. The aim of this workshop is incorporating citizens perspective on pandemic preparedness and response amidst a multi hazard situation in Sri Lanka. Objectives of the workshop are Dissemination of essential knowledge, best practices, and skills for preventing covid-19 and co current hazards and Sharing community experience and practices on pandemic preparedness and response. The program was organized by the global disaster resilience centre, University of Huddersfield in collaboration with National Dengue Control Unit, Sri Lanka. 50 members representing informal community leaders in the area, Sarvodaya, faith-based organizations, volunteers and grassroot level health officers will be participating in the event. Recourse persons and experts from GDRC, University of Huddersfield, University of Jaffna, University of Colombo, University of Moratuwa, National Dengue Control Unit and Sarvodaya will facilitate the programme. Further, an awareness program for the young secondary school students in the area on sustainable waste management will be conducted with the technical inputs of local council, regional environmental practitioners and national dengue control unit.

D-MOSS Workshop

Post conference session

The D-MOSS early warning system is a satellite based innovative model to predict dengue outbreaks by utilizing climatological, epidemiological, and related earth observation data. This model is already live in Vietnam and is being initiated to implement in Cambodia, Laos, Malaysia, Thailand, The Philippines and Sri Lanka. It gives beneficiaries several months advance warning of likely outbreaks of dengue fever. It allows local communities to mobilize to eliminate mosquito-breeding sites thus reducing incidence of dengue.

HR Wallingford, the lead technical agency behind the project will be conducting two knowledge dissemination workshops on this model for Regional Epidemiologists and Medical Officers of Health in dengue high risk areas on 21st and 22nd March at Hotel Blue Waters, Wadduwa and Cinnamon Lakeside, Colombo.

Stakeholder Seminar on Climate Change and Its Impacts on the Built Environment

Post conference session

The first stakeholder seminar of the BEACON (Built Environment leArning for Climate adaptation), Project will be held on 23rd March 2022. BEACON is a collaborative research project co-funded by the EU Erasmus+ programme of the European Union aims to develop transdisciplinary and innovative research-based learning in the built environment to tackle climate change in coastal regions. This seminar will discuss the resilience of the built environment to the impacts of climate change, with a specific focus on the coastal built environment. The target audience will be climate change and disaster management practitioners, academics, policymakers, built environment professionals in Sri Lanka.

CORE THEMES OF THE SESSION:

- Climate change, its future projections, impacts and disaster risk reduction
- The holistic view of climate change adaptation approaches in the built environment and links between climate change and the way forward in climate change adaptation for a sustainable green built environment targeting a policy briefing
- Importance of identifying these impacts in decision-making related to the built environment planning, construction, design, and maintenance phases and mainstreaming climate change adaptation in the built environment through policy frameworks
- Policy framework on the nexus of climate change and the built environment in coastal regions

EXPECTED OUTCOMES:

- Comprehend the broader nexus among climate change, climate change adaptation and disaster risk reduction
- Comprehend the impacts of climate change on the built environment
- Identify the real actions and actors addressing the challenge of implementation and achievement of global agendas on minimizing climate change-induced damages on the built environment, especially in coastal zones

PROJECT TEAM:

- University of Huddersfield, UK (project lead)
- University of Cantabria, Spain
- Lund University, Sweden
- University of Malta, Malta
- University of Colombo, Sri Lanka
- University of Moratuwa, Sri Lanka

Private Sector Preparedness for Pandemics and Multi-Hazard Scenarios

Post conference session

The effects of the pandemic have undoubtedly transgressed the health sector causing a significant economic downturn both in Sri Lanka and globally. Further, the pandemic has considerably altered response measures for other hazards and in turn made evident the complexity of risk together with the need to prepare for multi-hazard scenarios. In acknowledgement of the importance of building economic resilience and enhancing economic preparedness for pandemics and multi-hazard scenarios featuring pandemics, the Ceylon Chamber of Commerce; the Social Policy Analysis and Research Centre (SPARC) of the Faculty of Arts, University of Colombo and the Global Disaster Resilience Centre (GDRC) of the University of Huddersfield are organising an event to create a dialogue on 'Private Sector Preparedness for Multi-Hazard Scenarios'. The event will be held on 31st March 2022 from 2pm to 6pm in the Crystal Upper Room, Taj Samudra Hotel. The event will focus on the presentation of key findings and recommendations derived from a recent research study titled 'Integrating pandemic, tsunami and other multi-hazard preparedness into early warning and urban planning' which is a collaborative research effort among University of Huddersfield, UK; University of Moratuwa, University of Peradeniya, University of Colombo and the Ceylon Chamber of Commerce, Sri Lanka. This will involve a discussion on the current discourse on the status on private sector preparedness and response to the COVID-19 pandemic and multi-hazard scenarios featuring pandemics. The event is also aimed at gaining fresh perspective on the developments since April 2021 in private sector responses to, and recovery from the effects of the COVID-19 pandemic in Sri Lanka to further enhance the findings from the research study. This event will further serve as the launch for two position papers which have captured the impacts of the 1st and 2nd waves of COVID-19 in Sri Lanka, and the degree of pandemic preparedness within four key sectors of the Sri Lankan economy: 1) textile and apparel; 2) tourism; 3) agriculture and 4) construction.

KEYNOTE SPEAKERS

Professor Virginia Murray

FRCP, FRCPath, FFPH, FFOM

Head of Global Disaster Risk Reduction, UK Health Security Agency, Wellington House, UK

Virginia Murray is a public health doctor committed to improving health emergency and disaster risk management. She was appointed as Head of Global Disaster Risk Reduction (GDRR) for UK Health Security Agency (formerly Public Health England) in April 2014. She is a member of the Integrated Research on Disaster Risk (IRDR) scientific committee and Co-Chair of IRDR's Disaster Loss Data (DATA). She is currently co-chair of the WHO Thematic Platform Health and Disaster Risk Management Research Network, and by working in collaboration with this network, she is one of the editors of the WHO Guidance on Research Methods for Health and Disaster Risk Management, published in October 2021. She is currently a member of CODATA Executive Committee and a member of the UNSDSN TReNDS network. She is a visiting/honorary Professor and fellow at several universities.

SYNOPSIS OF THE TALK

Health Emergency and Disaster Risk Management

The COVID-19 pandemic is a timely reminder of how hazards within the complex and changing global risk landscape can affect lives, livelihoods and health. It provides a compelling case for an all- hazards approach to achieve risk reduction as a basis for sustainable development. The broad range of hazards of relevance to risk reduction and resilience building, and the increasingly interconnected, cascading and complex nature of natural and human-induced hazards, including their potential impact on health, social, economic, financial, political and other systems, are all interlinked in the discussions on sustainable development and climate change adaptation. And with the COVID-19 pandemic there is now wide recognition that biological hazards must be included in our understanding of hazards.

The UNDRR/ISC Sendai Hazard Definition and Classification Review Technical Report and the UNDRR-ISC Hazard Information Profile Supplement supports the 2015 UN landmark agreements of the Sendai Framework for Disaster Risk Reduction 2015–2030 along with the Sustainable Development Goals of Agenda 2030 and the Paris Agreement on Climate Change by providing a common set of hazard definitions for monitoring and reviewing implementation which calls for a data revolution, rigorous accountability mechanisms and renewed global partnerships. Hazard information when combined with exposure, vulnerability and capacity is fundamental to all aspects of disaster risk management, from multi-hazard risk assessments for prevention and mitigation to warnings and alerts, to disaster response and recovery, long-term planning and public awareness.

WHO 's Health Emergency and Disaster Risk management Framework (Health EDRM) emphasizes the critical importance of an all hazard approach to prevention, preparedness and readiness, together with response and recovery, to save lives and protect health. It outlines the need to work together – because Health EDRM is never the work of one sector or agency alone. It shows how the whole health system is fundamental in all of disaster risk management efforts. While emergencies affect everyone, they disproportionately affect those who are the most vulnerable. The needs and rights of the poorest, as well as women, children, people with disabilities, older persons, migrants, refugees and displaced persons, and people with chronic diseases must be at the centre the delivery of the WHO Health EDRM Framework and the WHO Health EDRM Research Network. By sharing experience gained in the UK Health Security Agency cases studies demonstrate partnership working.

Our understanding of hazards is shifting as we move from managing disasters as events to managing risks, as called for in the Sendai Framework by addressing the systemic drivers of risk in relation to climate change, health, sustainable development and resilience building. As hazards are expected to intensify with the effects of complex challenges, such as climate change and in the current COVID-19 pandemic, enhancing resilience to hazards is key for disaster risk reduction. This requires robust hazard and risk information as well as strengthening the science-policy-society interface to achieve better risk informed public and private decision-making and investment for long-term resilience.

Professor Dilanthi Amaratunga

BSc, PhD, FHEA, FRICS, FRGS, CMgr FCMI
Professor of Disaster Risk Reduction and Management
Head, Global Disaster Resilience Centre, School of Applied Sciences, University of Huddersfield, UK

Prof. Amaratunga a leading international expert in disaster resilience with an extensive academic career that has a strong commitment to encouraging colleagues and students to fulfil their full potential. Dilanthi's vision has always been to be an international leader in disaster risk reduction and management with specific emphasis on the built environment, and to champion the under representation of women in this key research area. Currently she is leading University of Huddersfield, UK's Global Disaster Resilience Centre.

She has project managed to successful completion a large number of international research projects (over 20 million) generating significant research outputs and outcomes. She provides expert advice on disaster resilience to national and local governments and international agencies including the United Nations Office for Disaster Risk Reduction. She is engaged in many significant research collaborations around the world, in partnership with key academic and other organisational stakeholders. To date, she has produced over 400 publications, refereed papers, and reports, and has made over 100 keynote speeches in around 40 countries. Among many leadership roles, she is the joint chief editor of the International Journal of Disaster Resilience in the Built Environment and the Chair of the International Conference on Building Resilience (ICBR) series, which she co-created. In 2019, she won the prestigious Newton Prize which recognises the best research and innovation projects which create an impact socially and economically, between Indonesia and the United

Kingdom from 2016 to 2019. Newton Prize is supported by the UK's Department for Business, Energy, and Industrial Strategy (BEIS). She is a member of the European Commission and UNDRR's European Science & Technology Advisory Group representing the UK, a Steering Committee member of the Frontiers of Development programme, a Collaborative Programme of The Royal Academy of Engineering, The Academy of Medical Sciences, The British Academy and The Royal Society, and a Steering Committee member of the UK Alliance for Disaster Research, motivation of which is to bring together the UK's rich and diverse disaster research community to facilitate collaboration and partnership. She is a Fellow of the Royal Institution of Chartered Surveyors (RICS), a Fellow of The

Royal Geographical Society, and a Fellow and a Chartered Manager of the Chartered Management Institute, UK.

SYNOPSIS OF THE TALK

Missing Insights on COVID-19: The Intersectionality of Disaster Risks, Epidemic and Pandemics Informed Decision Making

A pandemic such as COVID-19 constitutes a systemic risk, in the sense that, it not only poses adverse effects on certain parts, components or aspects of a system but disrupts the functioning of the entire system. For instance, the COVID-19 pandemic has caused unprecedented cascading effects that transcend sectors and nations and levels including social, economic, political and particularly health sector. It has led to a set of unexpected, interwoven risks that are characterised by complex, non-linear cause and effect relationships. The primary adverse effects on health accompanied by the lock down measures imposed to curtail the spread of the virus, have cascaded into considerable economic losses and deterioration of social wellbeing. In several countries, educational activities were disrupted in response to which the government continued the provision of educational services online. This widened inequalities in access to education and fuelled social unrest as some population groups, specifically those residing in rural areas, did not have access to the facilities and infrastructure necessary for online learning

Cascading impacts of the COVID-19 pandemic show that the need of a broader and a more comprehensive approach to risk management and impact identification. Current policies that are designed to address conventional risks are unable to capture and deal with the complexity and interconnectedness of systemic risks. This represents a significant policy challenge that needs to be addressed in governing pandemics. An inclusive approach which strengthens the collaboration among diverse stakeholders including the state, private sector, academic institutions, the civil society and even international organizations, seems to be required to mitigate systematic risk spreading over each sector in the pandemic context. Hence, a policy mechanism that facilitates 'systemic risk governance' is much called for. Systemic risk governance requires a network/systems approach to gain a more comprehensive understanding of the system and its interconnections.

Given the capacity of systemic risks to transcend sectorial and national boundaries, an inclusive approach that supports collaboration among diverse stakeholders including the state, private sector, academic institutions, the civil society and even international organizations is recommended to be followed in addressing systemic risks.

Professor Neelika Malavige

MBBS (Col.), MRCP (UK), AFHEA, DPhil (Oxon), FRCP (Lond), FRCPath (UK)

Professor and Head, Department of Immunology and Molecular Medicine, Faculty of Medical Sciences, University of Sri Jayewardenepura, Sri Lanka

Neelika Malavige is a Professor and Head of the Department of Immunology and Molecular Medicine, University of Sri Jayewardenepura, Sri Lanka and also an academic visitor at the University of Oxford since 2008 after completing her doctoral studies at the MRC Weatherall Institute of Molecular Medicine, University of Oxford. She is a member of the Executive Committee of the International Society of Infectious Diseases since 2020 and a member of the technical advisory group to the WHO-COVID-19 technology access pool. She is Fellow of the Royal College of Physicians in London the Royal College of Pathologists in 2015. She serves as an expert member on several government COVID-19 related technical advisory groups.

She leads a large research group working on dengue, and COVID-19. Her work on dengue has focused on factors that lead to severe dengue, identification of biomarkers and mediators of vascular leak in dengue. Her work on COVID-19 is mainly related to immune responses to COVID-19 vaccines, immunopathogenesis and determining correlates of protection against COVID-19. She has strong research collaborations with University of Oxford and her laboratory is a part of the A2CARES, which is one of the Centers for Research in Emerging Infectious Diseases. She has won many awards and received many local and international grants.

SYNOPSIS OF THE TALK

Challenges for dengue in the times of COVID-19

Dengue is one of the most rapidly emerging vector borne viral infections with the global number of cases increasing five fold from 1990 to 1990. Unfortunately, the mortality rates for dengue have increased parallelly and the case fatality rates are approximately 2.6% in some countries such as India. Due to better understanding of the disease pathogenesis, and careful monitoring and meticulous fluid management, the dengue case fatality rates are less than 0.2% in Sri Lanka. However, careful monitoring of patients to determine those who develop complications such as dengue haemorrhagic fever (DHF), poses a huge burden to the scare health care resources in developing countries. There are no biomarkers that can predict who will develop DHF, not specific treatment nor a safe and effective vaccine for this infection.

Due to the similarities in presentation, dengue can sometimes be mis-diagnosed as COVID-19, which can have devastating consequences in some individuals. Both severe dengue and severe disease in COVID-19, occur due to a dysfunctional immune response leading to a surge in inflammatory mediators (the cytokine storm). However, there are many differences. Vascular leak in the hall mark of severe dengue, which usually occurs during day 3 to 6 of illness, and if untreated, may progress to shock and fatalities. Many have been trying to understand the pathogenesis of vascular leak in order to find out therapeutic agents that can be used to treat this complication. Vascular leak has shown to occur due to multiple factors such as inflammatory mediators such as platelet activating factor, leukotrienes and cytokines released from mast cells, monocytes and other immune cells and also due to viral factors such as dengue NS1 protein. Many clinical trials have been conducted, which while most have been unsuccessful, some have shown some promise.

As the threat of dengue is on the rise, it is crucial that a coordinated effort is made to further understand disease pathogenesis, correlates of protection, vector control methods and viral factors that lead to severe disease, to find long lasting solutions.

PANEL DISCUSSION – TACKLING THE COMPLEXITY AND INTERDEPENDENCIES OF SYSTEMIC DISASTER RISK

BACKGROUND

Current approaches to disaster risk reduction are being challenged in a world of more frequent and compounding hazards. As the population and economy continue to grow, increasing exposure is creating complex interdependencies that are leading to more systemic vulnerabilities.

Cascading impacts, of the type we have experienced during the pandemic, are often poorly understood and somewhat unpredictable in terms of cause and effect. They are also transboundary and global in nature, challenging our decision makers as they don't fit easily into existing administrative or sectoral structures. The pandemic has also exposed existing vulnerabilities, including weaknesses in existing healthcare and support structures, but also disproportionately affecting the poorest members of our communities. Underlying drivers of disaster risk have been exposed, including human rights, poverty, inequality and global supply chains.

SESSION OBJECTIVES

The Covid-19 pandemic has challenged our existing disaster and emergency management policies and strategies. Now is an opportunity to rethink the intersectoral nature of disaster risk management and consider how we can better address multiple and cascading hazard threats.

The following key questions will be addressed by the speakers:

- What is driving the changing disaster risk landscape?
- What are the challenges associated with this emerging and complex disaster risk landscape?
- How can we better organise our institutions and society to tackle the complexity and interdependencies of systemic disaster risk?

EXPECTED OUTCOMES

This panel discussion will provide a rich discussion around the challenges associated with an emerging and increasing complex disaster risk landscape. It will also explore some of the experiences and approaches that can be used to strengthen disaster risk governance and tackle this complexity.

LIST OF SPEAKERS

- Professor Rangika Halwathura, University of Moratuwa, Sri Lanka
- Ms Naduni Jayasinghe, University of Colombo, Sri Lanka
- Dr Lahiru Kodituwakku, National Dengue Control Unit, Ministry of Health, Sri Lanka
- Professor Richard Haigh, University of Huddersfield, UK (Moderator)

BOOK OF ABSTRACTS

Introduction

This section contains all abstracts being published and presented at the International Research and Innovation Symposium on Dengue amidst the Pandemic.

Authors were invited to submit abstracts that address the symposium themes:

1. Epidemiology and surveillance of dengue and response mechanisms amidst the pandemic
2. Control of dengue and prevention of re-introduction of malaria
3. Clinical management of dengue and covid-19 during the pandemic
4. Complex and interconnected multi hazard risks: the nature of cascading impacts and relationships
5. Integrated pandemic and multi-hazard preparedness planning strategies: national to community empowerment and social mobilization
6. Early warning and risk communication strategies on multi-hazard scenarios for concurrent and cascading hazards
7. Built environment resilience and innovation in addressing biological hazards and multi-hazard scenarios

Abstracts address the approach, results, concepts, and applicability of the research studies conducted in the aforementioned fields. All abstracts have been blind refereed for quality, originality and relevance by the Scientific Committee.

This book includes over 80 abstracts by scholars, policy makers and practitioners around the world. An abstract ID number (e.g., 10) is identified under each abstract. This ID number was assigned at the start of the abstract submission process. Papers are listed sequentially according to their ID number. The detailed conference programme, which details the timing of paper presentations, identifies the associated abstract ID number and can be used to locate the abstract being presented. An index of authors is provided towards the end of this book.

Symposium Theme 1

Epidemiology and surveillance of dengue and response mechanisms amidst the pandemic

ABSTRACT ID: 08

STRATEGIC PLANS DEVELOPED IN EACH PHI AREA TO CONTROL DENGUE BY ANALYSING CASE DISTRIBUTION, GEOGRAPHICAL PATTERNS, SEASONAL CONDITIONS, AND HIGH-RISK LOCALITIES IN THE LAST FIVE YEARS

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Abstract

INTRODUCTION

Dengue is the most common viral infection transmitted by mosquitoes and it is especially distributed in urban and suburban areas. This study focuses on a MOH area which consists of 6 PHI areas and 21 GN areas. It was noticed that the number of dengue cases reported during the last five years is significantly high when compared. Hence, we saw the importance of implementing a strategic plan to reduce the number of dengue cases. Dengue transmission may increase due to geographic factors and changes in weather throughout the year. Therefore, the study was divided into two main parts, spatial analysis and time series analysis, to discover both factors and recognize suitable strategies for the prevailing situation.

OBJECTIVES

The main objective of this project is to study case distribution within each GN area, identify vulnerable localities and perceive reasons for the increase in the number of cases.

METHODOLOGY

Each PHI conducted a detailed analysis separately for their own area, considering the number of cases for the last five years. Next, all the data regarding the places where cases reported were plotted on a map. Using the data map PHIs were able to pick out hot spots and cold spots of their respective areas and observe clusters of dispersed cases. Moreover, a time series analysis was conducted to see if there is a trend or seasonal component in disease transmission with the time. This analysis is based solely on historical patterns in the data. Basically, a time series plot is drawn to observe the monthly variation of the number of dengue cases in each area for the last five years. According to the time series component of the plotted data, PHIs got an idea about the conditions expected in the future. Finally, suitable action plans were compiled to address the identified problems and bottlenecks.

RESULTS

There was a significant decrease in reported dengue cases for all GN areas, reducing the total number of cases in the MOH area. After 2020, the total number of cases in the

Piliyandala MOH area has decreased by 76.7%, reducing the average number of cases per year from 282 to 65.

CONCLUSIONS

It is important to study case distribution within each GN area to identify high-risk localities and seasonals in order to control dengue transmission.

Keywords: ***Dengue, Time Series Analysis, Strategic Plan***

ABSTRACT ID: 27

STATUS OF ROUTINE SURVEILLANCE OF DENGUE IN TEACHING HOSPITAL JAFFNA DURING COVID-19 PANDEMIC

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Abstract

BACKGROUND AND OBJECTIVE

Teaching hospital Jaffna is the only teaching hospital that provides care to the entire Northern Province with major subspecialties. Around 80-90% of total notification of Jaffna District comes from teaching hospital Jaffna. From the past data, more dengue cases have been observed during the months from October to March due to the effect of the northeast monsoon. This pattern has not been observed during 2020-2021. The aim of the study is to describe the status of routine surveillance of dengue in teaching hospital Jaffna during the COVID 19 pandemic period from October 2020 to March 2021.

METHODS

A descriptive cross-sectional study was conducted using convenient sampling of 254 admitted patients with fever to the teaching hospital, Jaffna from October 2020 to March 2021. Data was extracted from bedhead tickets and institutional notification register with the help of a data extraction sheet. Data were entered and analysed using simple descriptive statistics with the help of SPSS 21.

RESULTS

Out of 254 patients, 131(51.6%) were female and 148(58.3%) were in the 0-36 years age group. Clinical presentation of 254 patients were headache (n=138, 54.3%), muscle/joint pain (n=103, 40.6%), abdominal pain (n=102, 40.2%), eschar (n=54, 21.3%), other rash (n=6, 2.4%) and bleeding (n=5, 2%). Among 254 patients, 74(29.1%) had WBC count 5000 or less and 155 (61%) had platelet count 150000 or less. Out of 254 patients, 31 (12.2%) underwent both dengue antigen and antibody tests. Among tested, one (3.2%) and three (9.7%) were positive for antigen and antibody respectively.

Final diagnoses of 254 patients were dengue (n=8, 3.1%), typhus (n=159, 62.6%) and others (n=87, 34.3%). Out of 254 patients, 111 (43.7%) were notified of some type of infectious disease. Out of 254 patients, 61 (24.0%) had low WBC and platelet counts. However, only 12 (19.7%) were tested for antigen/antibody, and five (8.2%) were notified as dengue. At the same time, only 62.5% of diagnosed dengue cases (5 out of 8) were notified.

CONCLUSION AND RECOMMENDATION

It was observed that certain extent of routine surveillance activities for dengue even during COVID-19 Pandemic in Teaching Hospital Jaffna. However, adherence to case surveillance definition was lacking and resulted in a low number of notifications in dengue suspected/ probable cases. Virtual In-service training of IMO and MO and periodical evaluation at the institutional level may improve the surveillance activities during the pandemic.

Keywords: ***Dengue, Routine Surveillance, COVID 19 Pandemic***

ABSTRACT ID: 32

GEO-SPATIAL ANALYSIS OF RECORDED DENGUE CASES IN THE RATNAPURA DISTRICT OF SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Sri Lanka is a developing country, which has been experiencing dengue epidemic outbreaks very frequently in Colombo, Gampaha, and Kalutara districts. Recently it was observed that more dengue patients are being reported in Rathnapura district as well. The aim of the study is to identify the highest and the lowest dengue risk divisional secretariat divisions (DSD) of the Rathnapura District from 2017 to 2021 and to identify if there is a correlation between dengue cases with precipitation and temperature.

METHODS

The study was carried out in the 17 DSDs of Ratnapura district having a population of 1,179,566 from January 2017 to December 2021. Monthly recorded dengue cases of the Ratnapura district were obtained from the Epidemiology Unit. The monthly rainfall and temperature of the agrometeorological station in Ratnapura were obtained from the Department of Meteorology. ArcMap 10.8.1 was used to identify the geospatial distribution of the reported dengue cases in the district. Shapiro-Wilk test was carried out to check whether data were normally distributed. In order to identify whether there is a correlation between the reported cases and the rainfall, minimum and maximum temperature, spearman's rank correlation was carried out using the Minitab 17 software.

RESULTS

The reported cases in the Embilipitiya DSD in the year 2021 were 15% greater than that of 2020. The highest number of dengue patients were recorded in the Embilipitiya in 2018 (16.6%), 2019 (15.3%), and 2021 (25.7%). Throughout the study period, Weligepola and Opanayaka DSDs recorded significantly lower dengue cases. According to the statistical analysis, it was identified that there was a positive, statistically not significant correlation between the recorded dengue cases and the rainfall distribution (r_s = 0.046, p = 0.726), whereas a negative, statistically non-significant correlation between recorded dengue cases and measured maximum temperature (r_s = - 0.145, p = 0.270).

CONCLUSIONS AND RECOMMENDATIONS

It is recommended to reduce the breeding places throughout the year in all the DSDs of the Ratnapura district especially paying attention to the high risk DSD Embilipitiya by

conducting community awareness programmes and introducing bacterium Wolbachia to detected mosquitoes breeding locations.

Keywords: ***Divisional Secretariat Divisions, Epidemiology, Shapiro-Wilk Test, Correlation***

ABSTRACT ID: 35

IMPACT ASSESSMENT OF COVID-19 LOCKDOWNS ON DENGUE VECTOR PREVALENCE IN A PRIORITY HIGH RISK AREA IN KURUNEGALA DISTRICT

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Abstract

INTRODUCTION AND OBJECTIVES

Dengue is a major health problem in Sri Lanka and it is mainly controlled by intense measures taken in controlling vector mosquitoes *Aedes aegypti* and *Ae. albopictus*. Health officials could attend only to limited vector control activities due to lockdowns, house quarantines, and other government COVID prevention guidelines. The objective of the present study was to assess the impact of the covid-19 pandemic on dengue vector prevalence in an urban locality in Kurunegala. Vector surveillance data for the pre-COVID 2019 were compared with that of COVID-affected 2020/2021 data.

METHOD

The study was conducted in Bandaranayakapura in the Kurunegala MOH division from January 2019 to December 2021. Monthly ovitrap surveys were conducted in 50 randomly selected houses and the larval surveys were conducted in 100 premises selected by a systematic sampling approach. Entomological indices were calculated for both vector species.

RESULTS

Kurunegala district has reported 1792 cases of COVID-19 in 2020 and 63,408 cases in 2021. Total dengue cases in Kurunegala district for the years 2019, 2020 and 2021 were 2874, 386 and 1870 respectively. Time-series analysis showed an increased trend in *Ae. albopictus* abundance with significant variations of Ovitrap Index (OVI), Container Index (CI), and Breteau Index (BI) for the three years. Mean values of indices for *Aedes albopictus* respectively for 2019, 2020 and 2021 were OVI: 25.5±19.29, 12.10+_6.76 and 54±14.3; CI: 3.45±2.01, 2.45±1.95 and 10.23±2.45; BI: 7.46± 5.26, 5.93±4.89 and 13.74±3.69. Mean annual rainfalls were 147.5±136.3 mm, 172.4±151.9 mm and 211.6±24.16 mm respectively. Rainfall had a strong positive correlation with BI. The prevalence pattern predicted for *Ae.*

albopictus according to the rainfall for the year 2019 could be successfully fit into the years 2020 and 2021 showing that rainfall is mainly responsible for increased vector abundance.

CONCLUSIONS AND RECOMMENDATIONS

COVID 19 pandemic dramatically restricted vector control activities by the health sector which may have been compromised by enhanced breeding site elimination activities by householders during isolations. Heavy rainfalls during 2021 have significantly contributed to increased vector populations demanding urgent control measures to prevent dengue outbreaks. Future control programmes should seriously consider incorporating prediction models for unexpected weather patterns and epidemic situations.

Keywords: ***Aedes aegypti, Aedes albopictus, Vector Abundance, Vector Control, Rainfall, COVID-19 Lockdown***

ABSTRACT ID: 41

DEVELOPMENT OF AN AREA-SPECIFIC MONTHLY DENGUE CASE TARGET CALCULATOR FOR DENGUE CONTROL IN SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVE

According to the National Action Plan, the National Dengue Control Unit (NDCU) has set a national target to achieve the incidence of dengue below 100 per 100,000 population by 2023. However, repeated dengue outbreaks in recent years highlight the necessity of more efforts at the district level and below to achieve the set target. Dengue outbreaks can be clearly described by their seasonal variations related to the two monsoons, while outbreaks with increasing magnitude at intervals of two to three years.

The objective of the study is to develop an area-specific monthly dengue case target calculator for the districts and medical officer of health areas (MOH) taking into consideration the seasonal variations, historical trends, and the national target.

METHODOLOGY

The seasonal index (SI) can be considered the best available indicator to calculate monthly dengue case targets.

The SI for each district and MOH was calculated for a consecutive monthly period from 2012 to 2019 using Minitab 2020 statistical software. However, cases of 2017 and 2019 were detected as extreme outliers by outlier test of Grubbs' and excluded. This adjustment improved the accuracy of the forecasting by reducing the Mean Absolute Percentage Error.

Furthermore, the average annual burden of dengue cases of each district and MOH was calculated for the period 2015 to 2019 based on historical trends.

Thereafter, a calculator was developed using a spreadsheet with multiple formulae to calculate the monthly targets for each district and MOH in line with seasonal variations, historical trends, and national targets with a graphical presentation to illustrate and compare the reported cases with the set monthly targets.

RESULTS

The NDCU expected maximum annual dengue incidence for Sri Lanka was 150 (a total of 33055 patients) in 2021. Accordingly, the expected target for MOH area Badulla in the

month of September was 18 whereas the reported was 23. However, in October, the set target was 22 whereas reported was 81 patients. This warranted many control actions at MOH Badulla with the support of the NDCU. The same mechanism of monitoring was used in other districts and MOHs as well.

CONCLUSION AND RECOMMENDATION

This calculator can be used to enumerate the deviation of each district and MOH from the national target thus enabling effective outbreak control and achieving targets.

Keywords: ***Dengue Seasonal Index, Dengue Target Calculator, Dengue Historical Trends***

ABSTRACT ID: 42

DEVELOPMENT OF A RAPID DATA ANALYZER TO SUPPORT DENGUE SURVEILLANCE AND CONTROL

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Abstract

INTRODUCTION

Dengue is a major public health problem in Sri Lanka. The Dengue Sentinel Site Surveillance System (DenSys) is the real-time e-surveillance system to report suspected dengue inward patients from all major hospitals. However, the data analysis function is limited in DenSys.

The DenSys has options to identify the number of suspected patients belonging to medical officer of health (MOH) areas, districts, and provinces on a periodic basis. However, it has no options to provide the percentage burden or periodic incidence of a MOH, a district, and a province. Furthermore, there is no mechanism for ranking a MOH or a district by cases or incidence. This information gap may disturb decision-making in dengue prevention and control including control of potential outbreaks.

OBJECTIVE

The objective of developing the rapid data analyzer was to analyze DenSys data rapidly and easily to provide information for decision making.

METHODOLOGY

To address the identified deficiencies, a multiple formulae-based calculator using Microsoft Excel software was developed. The exported data from the DenSys that contains the list of names of the MOHs with the reported dengue patients are required to be pasted as it is in the given cells of the tool.

When the data is pasted, the tool automatically analyzes and provides the following information: provincial, district, and MOH dengue burden as percentages with ranks and the incidence of dengue of districts and MOHs with ranks. It also captures the total percentage burden of the highest reported 10% and 20% of MOHs of Sri Lanka which was developed concerning the concept 'Pareto rule'.

RESULTS

The MOHs, districts, and provinces were provided with disease burden information during reviews or via emails. As an example, the MOH Negombo reported 293 patients in January 2022 which is 19.8% of the Gampaha district (rank 1) and 3.87% of the national burden with rank second in Sri Lanka by cases but first by monthly incidence (196 patients per

100,000). For the same month, 1481 patients were reported from the Gampaha district with 19.5 % of the national burden (rank 2) and a monthly incidence of 61 (rank 3).

CONCLUSION AND RECOMMENDATION

The rapid data analyzer can be used at the national, provincial, district, and MOH levels for easy and rapid analysis of raw data to generate meaningful information.

Keywords: ***DenSys Data Analysis, Rapid Data Analyzer, Disease Burden Ranking***

ABSTRACT ID: 44

DATA FOR ACTION: DEVELOPMENT OF A SOFTWARE TOOL FOR INSTITUTIONAL RESOURCE ALLOCATION BASED ON BURDEN OF DENGUE

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Abstract

INTRODUCTION

Sri Lanka provides free healthcare despite many economic challenges and hardships. Medical equipment, of which almost all are imported, needs rational decisions on procurement and distribution to the most needed institutions considering disease burden and many other factors.

The National Dengue Control Unit (NDCU) provides medical equipment to hospitals for the clinical management of dengue. This requires identifying the equipment needs of the hospitals based on multiple factors including the institutional requests, disease burden, minimum essential requirement, and previous provision of equipment or finances by the NDCU. Hence, relevant information should be readily available with the ability to retrieve and visualize for appropriate decision-making easily and rapidly.

OBJECTIVE

To develop a simple but comprehensive tool using Microsoft Excel software to support the NDCU to make rational decisions in equipment distribution to hospitals.

METHODOLOGY

Annual equipment requirement of institutions is collected using a pre-formed format. The previous provisions of the same type of equipment to relevant institutions were identified. Furthermore, average annual dengue admissions to the respective hospitals (2019, 2020, and 2021), average daily midnight count (DMNC), and the average DMNC of the highest reported month in 2021 were calculated using developed formulas and entered into different columns in a spreadsheet.

Upon the data viewer's selection of the institution and the equipment type, the following data will appear in the dashboard: institutional dengue burden, equipment requests from NDCU, previous provisions by the NDCU, and any funds provided by the NDCU. Accordingly, a new allocation of equipment can be entered into the datasheet.

Multiple Excel-based formulas were used in the development of the tool to easily capture the above data including transforming data from other databases.

However, the lack of data on the availability of total functional medical equipment in the relevant units of the hospitals is a constraint in decision making.

RESULTS

A Microsoft Excel software-based tool is now available at the NDCU for rational decision-making on need-based resource allocation to hospitals for clinical management of dengue. Hence, decisions on preparing equipment procurement and distribution list by the NDCU are well supported.

CONCLUSION

This is a useful tool to support decision-making in resource allocation for hospitals for clinical management of dengue with justifications.

Keywords: ***Need-Based Resource Allocation, Medical Equipment Distribution, Hospital Dengue Burden***

ABSTRACT ID: 47

DENGUE OUTBREAK AMIDST COVID 19: AN EXPERIENCE IN BATTICALOA DISTRICT, SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Dengue is one of the leading public health problems in Sri Lanka, and the district of Batticaloa is one of the most affected districts. Yearly, during the North-East monsoonal rains, the dengue caseload tends to rise significantly and fall after the monsoon with a number of cases; twenty-five to thirty (25 - 30). In 2020, both dengue and COVID 19 outbreaks affected six Medical Officers of Health (MOOH) areas out of 14 MOOH areas of the district. This situation overburdened both the curative and preventive health sectors in the Batticaloa district.

This analysis aims to describe the epidemiology of the dengue outbreak amidst the COVID 19 pandemic in Batticaloa District.

METHODS

A desk review was done using the data of the routine disease and entomological surveillance from October 2020 to March 2021 by the Regional Epidemiology Unit, Regional Director Health Services office, Batticaloa. Descriptive analysis was carried out using SPSS version 25.

RESULTS

Three thousand eight hundred and eleven (3811) Dengue patients, 850 COVID 19 patients, and nine (09) deaths were reported over this period. Of the deaths, four (04) and five (05) fatalities are from Dengue and COVID 19, respectively. No coinfected patients were reported. The majority of the dengue-affected patients were children under 19 years (63%). Males and females were affected equally. Dengue vector survey shows nearly 21% of the breeding sites comprised temporary removals and non-degradable items, mainly found inside and outside of the houses.

CONCLUSIONS

The spread of COVID 19 and Dengue in any part of Sri Lanka is a new experience amidst the COVID 19 pandemic, and this has caused a burden to the already stretched health system. Equal disease proportions among both genders, higher proportions among children and evidence from vector surveys suggest its most probable household exposures.

The reasons for inattentiveness for household breeding amid COVID 19 pandemic could be multifactorial and need further study.

Keywords: ***Dengue, COVID 19, Outbreak, Batticaloa, Sri Lanka***

ABSTRACT ID: 49

CHANGE IN DENGUE SEROTYPES BEFORE AND AFTER THE ONSET OF COVID19 PANDEMIC

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Abstract

INTRODUCTION AND OBJECTIVES

The dengue virus (DENV) serotype 2 was the predominant serotype until the end of 2019, where DENV3 was seen to emerge in the Western province, coinciding with a rise in cases. However, since the onset of the COVID-19 pandemic in early 2020, the frequency and magnitude of the dengue epidemic declined until the end of 2021. Therefore, we sought to analyse the changes in dengue case numbers and serotypes during this time.

METHOD

The DENV serotype was determined by RT-qPCR in 293 serum samples collected from acute dengue patients from June to December 2021 from the Western Province. The dengue number of cases of suspected dengue infection was obtained by surveillance of sentinel hospitals and confirmed case numbers were obtained from epidemiological surveillance reports (DenSys-http://www.dengue.health.gov.lk/web/index.php/en/#) . The stringency index data was taken from Our World in Data (https://ourworldindata.org/covid-stringency-index).

RESULTS

A total of 34151 dengue cases were reported in 2020 and 36120 in 2021, which was a 70% decline from case numbers reported in 2019 (114240). Although the majority of dengue cases are reported each year from May to July, coinciding with the monsoon season in the Western Province, in 2020 and 2021 the number of cases reported during these months was 18.7% and 21.4% from the total cases respectively and a seasonal variant was not observed. Although during early 2020, the predominant serotype in the Western province was DENV3, during the last 6 months of 2021 DENV2 (72.5%) was found to be predominantly followed by DENV3 (16.48%) and DENV1 (10.98%). DENV3 prevalence gradually rose from June to December 2021. Dengue case numbers seen from March 2020-December 2021

were inversely proportional to the stringency index of Sri Lanka (Spearman correlation coefficient r = -0.5089, p = 0.0781, Pearson correlation coefficient r = -0.5362, p = 0.0048)

CONCLUSIONS AND RECOMMENDATIONS

The rise in dengue cases towards the end of 2021, coincides with the rise of DENV3 and also with the lowering of the stringency index. The factors that lead to the changes in dengue epidemiology should be further studied to implement timely control measures.

Keywords: ***Dengue Virus, Dengue Serotypes, Dengue Surveillance, Dengue Transmission, SARS- CoV2***

ABSTRACT ID: 66

IDENTIFYING THE STRAINS OF DENGUE CIRCULATING IN THE WESTERN PROVINCE OF SRI LANKA

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Abstract

BACKGROUND

Dengue is considered endemic to Sri Lanka since 1989 and subsequently affected by regular dengue epidemics. Although dengue epidemiology has been extensively studied in Colombo, the COVID-19 pandemic has affected ongoing research. We sought to identify the dengue strains and the circulating serotypes within a time span of July 2019 to January 2021.

METHODS AND MATERIALS

277 consenting patients presenting with febrile illness were recruited from an ongoing study at the Colombo North Teaching Hospital (CNTH), National Institute for Infectious Diseases (NIID), and University Hospital- Kotelawala Defence University (UH-KDU) of the western province. All samples were tested by Reverse transcriptase-polymerase chain reactions (RT-PCR) and/or Real time-PCR tests to determine dengue positivity and serotype. Sequencing was carried out on samples with adequate viral load followed by phylogenetic analysis using the Geneious software.

RESULTS

The testing showed 51.6% were positive for the dengue virus. The serotyping showed 14.0 % of the positives were DENV-1, 44.1% DENV-2, 37.1% DENV-3, and 4.9% DENV-4 respectively. Two genotypically distinct variants were identified from sequencing of the DENV-3 and DENV-1 containing samples, but the DENV-2 and DENV4 samples are yet to be sequenced. One of the identified DENV-3 variants was similar to that reported in 2017/18 in Sri Lanka while the other variant was similar to the variant reported in India in 2016. One of the identified DENV- 1 variants was similar to the 2018 strain found in Sri Lanka while the other was similar to the variant reported in China in 2016.

CONCLUSION

According to our data, two genotypically distinct variants of DENV-3 and two DENV-1 serotypes were simultaneously circulating in this area from July 2019 to January 2021. The DENV-1 strain similar to the 2018 DENV-1 from India and the DENV-3 strain similar to the one reported from China in 2016 has not been previously reported in Sri Lanka. Our data suggest that during the COVID-19 pandemic multiple strains have been circulating in the western province even though no serious epidemic has been reported. It is important to continue monitoring the DENV strains in circulation.

Keywords: ***Dengue, Serotypes, Phylogenetics, DENV1, DENV3***

ABSTRACT ID: 67

THE BURDEN OF DISEASE DUE TO DENGUE IN THE DISTRICT OF COLOMBO, SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Dengue is endemic in all districts in Sri Lanka, and the incidence of dengue has risen significantly during the last decade. The highest proportion of cases are reported from Colombo district, which is the most populated and urbanised district in the country. Assessing the underlying dengue disease burden in Colombo is key to policy decision making on the introduction of a successful vaccination strategy in the future.

METHODS

We evaluated the dengue disease burden by estimating the disability-adjusted life-years (DALYs) using an incidence-based approach of morbidity and mortality surveillance data from 2015 to 2017 in the Colombo district and at the national level.

RESULTS

In 2015 and 2016, the dengue incidence rate in Colombo was 473.5 and 742.4, while it was 128 and 242 cases per 100,000 population for the whole country. In 2017, when a severe dengue outbreak was experienced in all parts of Sri Lanka, the incidence rate was 883 cases per 100,000 population for the whole country while it was 1,901 in Colombo.

The dengue disease burden in Colombo district was estimated at 918 DALYs (39.49 per 100,000 population) in 2015, 978 DALYs (42.08 per 100,000 population) in 2016, and 2,203 DALYs (133.84 per 100,000 population) in 2017.

The national disease burden was estimated at 1,918 DALYs (9.42 per 100,000 population) in 2015, 3,270 DALYs (16.06 per 100,000 population) in 2016, and 13,635 DALYs (66.97 per 100,000 population) in 2017.

CONCLUSION AND RECOMMENDATIONS

Our findings show a notable increasing trend of dengue burden with time, which was particularly seen with the massive dengue outbreak in 2017. The findings of this research serve as a catalyst for future countrywide disease burden assessments and have the potential to inform the implementation of a future dengue vaccination strategy and monitoring of other control activities within and outside the country.

Keywords: ***Dengue Disease Burden, DALYs, Colombo, Dengue Vaccination Strategy***

ABSTRACT ID: 68

SEROPREVALENCE OF ASYMPTOMATIC DENGUE BURDEN IN THE DISTRICT OF COLOMBO

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Abstract

INTRODUCTION AND OBJECTIVES

Those infected but remaining asymptomatic play a major contribution to the viraemic pool and continuous transmission of dengue. Also, previous exposure to dengue virus is a known parameter which enhances the severity of any secondary infections and the efficacy of dengue vaccines. Information on previously infected proportion of dengue would significantly influence a future vaccine strategy. This study determines the seroprevalence of asymptomatic dengue infections in the Colombo district, which will assist in successful vaccination strategy policy decision making.

METHODS

A community-based cross-sectional descriptive study was carried out in the Colombo district in 2017 using an age-stratified multistage random cluster sampling method of 1,625 samples aged 1- to 60-year-olds to assess the seroprevalence of dengue. Demographic details and a blood sample for serological analysis were collected along with a recollection of any past dengue infection which was verified with available clinical documents. Dengue IgG serological findings were cross analysed with these previous dengue exposure details.

RESULTS

The serological analysis revealed an overall 72.1% IgG seropositivity with high seroconversion rates seen in metropolitan areas (85.9%) of the Colombo district compared to urban (70%) and rural (62.4%) areas. Of those seroconverted, 85.7% in the metropolitan, 84.8% in the urban and 84.2% in the rural areas had denied any history of dengue infection. Among those who had denied past dengue infection (n=1,428), 69.5% were IgG seropositive, and those who recalled a past infection (n=178), 91% were seropositive. Therefore, the ability to recall any past dengue infection had a 91% sensitivity and 30.4% specificity.

CONCLUSION AND RECOMMENDATIONS

Nearly 85% of those who were dengue IgG seroconverted recalled no previous exposure or illness implying a high asymptomatic disease burden. There is a high asymptomatic disease burden and the ability to recall a past dengue exposure has a lower specificity (30%) and a very low positive predictive value (14%). These findings should enable health policymakers to decide on the importance of a seroprevalence study against recalling of past infections in the planning, implementation, and operationalization of a future vaccination strategy.

Keywords: ***Asymptomatic Dengue Disease Burden, Recall Previous Infection, IgG Seropositivity, Dengue Vaccination Strategy***

ABSTRACT ID: 70

MONITIORING OF DENGUE CASES USING "KVD DENGUE MAPPING"- A MOBILE APP IN MOH AREA KARAVEDDY DURING COVID-19 PANDEMIC

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Abstract

INTRODUCTION

Medical Officer of Health Area, Karaveddy in Jaffna district has around 50,000 population. With the recent outbreaks in Dengue fever, the supervising officers need information about geographical distribution for decision making on cleanup programmes, fogging and other mosquito control activities.

From mid-2021, higher numbers of Covid 19 cases were reported. However, as PHII were involved with carrying out PCR/RAT, quarantine and vaccination in response to COVID 19, there were delays in attending the dengue notifications and dengue control activities. These made us think of an innovative idea to monitor the dengue cases after being notified.

Introduction of "KVD Dengue Mapping" (KVD - Karaveddy) - a mobile application, enabled to monitor dengue cases by ensuring timely investigations and interventions.

METHODS

The Mobile app "KVD Dengue Mapping" was created by the MOH, free of charge using Epicollect 5, which is a free web-based tool that enables the collection of customized data, supported by the University of Oxford and Big Data Institute. All 5 Public Health Inspectors in our MOH area were trained on how to use this application using their smartphones. Questions such as the Name of the patient, Date of onset of symptoms, Date of received medical treatment, Date of notification, and Location of the patient's resident were recorded. PHII records the relevant data on their smartphones when they visit houses to investigate every case. The information can be collected offline and can be updated when data is available. At the MOH office, the received information is combined to Google map showing terrain and street view and analysed by MOH and SPHI. Fogging, deployment of SKS on the following day, and other mosquito control activities are planned according to this. The delay in getting the communicable disease report part I (H411) is compensated by using this application.

RESULTS

From 01.01.2022 to 22.02.2022 we received 41 data points. These data points were analysed according to PHI Areas as mentioned above using Epicollect 5, Microsoft Excel, and Google Map.

After the introduction of this mobile application, we were able to make sure that all 41 cases of the dengue cases notified to our MOH Office during the Covid 19 pandemic have been investigated within 3 days compared to 5-7 days earlier.

CONCLUSION AND RECOMMENDATIONS

This customized data collecting application created using Epicollect 5 is user-friendly, free of charge and satisfactorily used by the PHII. This method of monitoring dengue cases using a mobile app will help in effectively controlling the Dengue disease in our area especially during the Covid 19 pandemic period. We are able to investigate the dengue cases within 3 days instead of 5-7 days. Other MOH divisions who have dengue cases amidst the Covid 19 outbreak can also implement this mobile app which can be customizable according to their need.

Keywords: ***Monitoring Dengue Cases, Mobile App, GIS Mapping, Covid 19 Pandemic***

ABSTRACT ID: 74

IMPACT OF PROPORTION OF *AEDES AEGYPTI* AND *AEDES ALBOPICTUS* ON THE DENGUE INCIDENCE IN HIGH BURDEN DISTRICTS OF SRI LANKA

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Abstract

INTRODUCTION

Sri Lanka, a tropical island in the Indian Ocean with a population of around 22 million, has reported dengue cases since the 1960s. In Sri Lanka, all the districts are potentially suitable for the survival and establishment of the primary vector, *A. aegypti* and secondary vector, *A. albopictus*. Both vectors are reported in considerable proportions in all areas of the island despite the geological differences and climatic changes. However, the disease transmission and epidemic patterns are different when the proportion of vector availability and the number of cases in different districts are compared. The present study focused on vulnerability indicators (number reported cases, incidence rate) and receptivity indicators (vector availability) to analyse this scenario.

METHODOLOGY

Dengue vector larval data were generated by systematic entomological surveillances in all districts by following standard procedures. The data were analysed to produce vector availability for both *A. aegypti* and *A. albopictus*, which then comparatively analysed with reported dengue cases in 2020 and 2021 from all 25 administrative districts consisting of Colombo Municipal Council area, National Institute of Health Sciences area, and 26 Regional Directorates of Health Services.

RESULTS

In Colombo, Kaluthara, Gampaha, and Kandy districts (Incidence 200-400/100000), the main vector was *A. albopictus* with more than 65% of vector availability. In Batticaloa, Trincomalee, Kalmunai, and Mannar, a shifting of vector availability was observed with the presence of *A. aegypti* more than 60%. In Trincomalee and Kalmunai even with the high availability of primary vectors, the incidence rates were lower (<150 per 100,000) when compared with the previously mentioned areas. However, In Batticaloa and Mannar, incidence rates were similar or greater than to that of Western province districts (300-500 per 100,000). In other areas with high proportions of *A. albopictus*, the caseload and the longevity of outbreaks were significantly low compared with areas where the proportion of *A. aegypti* was high.

CONCLUSIONS

The high availability of both vectors (receptivity is high) and high vulnerability for the virus in the areas of Western province, has led to its consistency for the increased incidence rates. However, In the latter areas, even though the primary vector is comparatively dominant (high vectorial capacity and receptivity), the incidence rates were low, probably due to the low availability of the infected population (low vulnerability). However, in these areas upon a given vulnerability greater incidence rates and extended outbreaks can be observed due to the high receptivity and high vectorial capacity.

Keywords: ***Dengue Incidence, Outbreak, A. aegypti, A. albopictus, Sri Lanka***

ABSTRACT ID: 75

DENGUE EPIDEMIOLOGICAL SITUATION IN THE CONTEXT OF THE COVID-19 PANDEMIC IN GUATEMALA

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Abstract

INTRODUCTION

The first case of Covid-19 was identified on 13 March 2000 in Guatemala. 2019 was the last epidemic year of dengue reporting an increase of 6 times more cases compared to year 2018 (50886 in 2019 compared to 7592 in 2018). The objective of this analysis is to characterize and analyze trends from 2012 to 2021, considering the impact of the COVID-19 pandemic.

METHODOLOGY

A descriptive analysis was made, using data from the network of public establishments of the epidemiology department of the Ministry of Health; averages, cumulative incidence estimations, and bar and linear graphs were elaborated to analyze trends. The software used for analysis was Microsoft Office Excel.

RESULTS

The highest incidence in the last 10 years was shown in 2019. In 2020 there was an 88% (6075 vs 50886) decrease in incidence compared to the previous year. A decrease of cases by nearly 1/3 (2861/9449) was observed in 2021, compared to the median of the evaluated period and the lowest incidence in the last 10 years.

During the first weeks of 2020 an increase of 42% (3018 vs1760) is observed compared to 2019, but while COVID-19 registered more cases, a noticeable decrease was identified in reported dengue cases with a decrease by 15% (182 vs 155). This trend continued during 2020 and 2021. In 2021, a nearly 50% reduction of incidence rate (34.4 per 100,000 vs 16.7 cases per 100,000) of cases was reported, compared to 2020. The case fatality rate for dengue was 0.17%, which was higher than the last epidemic year (0.15%). According to geographical distribution, the highest notification rates occurred in the northern and southern regions. Since 2012, a trend has been observed in the population under 15 years old, during 2020 and 2021, the group with the highest risk was children under 1-year-old. In the country, there is the circulation of the 4 serotypes, a predominance of serotype DEN-2.

CONCLUSIONS

During the COVID-19 pandemic in 2021, a remarkable decrease in Dengue incidence was observed; the most affected ones were those under 1 year of age.

RECOMMENDATIONS

Intensify the frequency of epidemiological analysis to identify trends considering the context of COVID-19 vaccines and the entry of other arboviruses.

Keywords: ***Dengue, Incidence, Epidemic, Decrease***

ABSTRACT ID: 86

TREND ANALYSIS OF THE INCIDENCE OF DENGUE IN SRI LANKA 2015-2020

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Abstract

INTRODUCTION AND OBJECTIVES

Dengue has been reported in Sri Lanka since the early 1960s and is now endemic island-wide. Surveillance reports indicate that the annual burden of dengue has increased gradually over the 2015-2020 period, with the highest incidence reported in 2017 and 2019. However, the case fatality rate of Dengue illness remains low.

This desk study aims to describe and assess the trends of dengue prevalence in Sri Lanka by sex, age group, administrative area(district/province) and seasonal trend, which are essential to facilitate decision making and planning for prevention and mitigation activities.

METHOD

Dengue incidence data for the years 2015-2020 were obtained from the DenSys database, and the respective population data from published data of the Department of Census and Statistics, Ministry of Finance and Planning, Sri Lanka and from the RDHS office-Kalmunai. Yearly incidence rates were calculated by sex, age group, and administrative area (Province/District). Seasonal incidence rates were calculated by amalgamating the incidence in May, June, and July for the South-Western (SW) monsoon and November, December and subsequent January for the North-Eastern (NE) monsoon.

RESULTS

The national incidence rate of dengue increased gradually from 123 cases per 100,000 population in 2015 to 157 cases/100,000 population in 2020, with the highest incidences reported in 2017(838 cases/100,000 population) and 2019(529 cases/100,000 population). The seasonal pattern of incidence associated with the SW and NE monsoons shows a higher incidence of dengue patients being reported following the NE monsoon seasonal rains in Eastern and Northern Provinces in 2017-2020 compared to 2015-2016. The geographical distribution of dengue has spread to include an increased incidence of patients from the Eastern and Northern Provinces. The incidence of dengue among males remained higher than among females throughout the period. There is a steady increase in the incidence of dengue fever in the ≥65y age group from 3.4% in 2015 to 8.4% in 2020. The incidence of cases among children of school-going age(5-19y) has decreased from 46.6% in 2015 to

41.1% in 2020. The case fatality rate was low, fluctuating between a maximum of 0.24 (2017) and a minimum of 0.11(2018).

CONCLUSION AND RECOMMENDATIONS

The changing geographical spread of dengue, seasonal pattern, the male predominance, and the presence of more elderly patients need to be further analysed, identifying the root causes and addressed with refined and targeted methods of control.

Keywords: ***Epidemiology of Dengue, Sri Lanka, Trends***

ABSTRACT ID: 96

CREATING A DENGUE-FREE ENVIRONMENT AT RELIGIOUS INSTITUTIONS WITH AN INTRINSICALLY-MEDIATED MECHANISM AND A MULTISECTORAL APPROACH

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Abstract

Control of both COVID-19 and dengue must be given priority considering the incurred disease burden. Source-reduction is an effective control strategy for dengue. As found with entomology surveys, religious institutions were among the top five hotspots for mosquito-breeding sites with 25% of those with potential breeding places and 6.5% being positive for larvae, at the beginning of 2022. The dire need for an intrinsic institutional mechanism was highlighted for the elimination of mosquito-breeding places. In this regard, a novel intervention was planned by the Provincial Directorate of Health Services- Western Province (PDHS-WP) and the National Dengue Control Unit within the Western Province.

Advocacy meetings were carried out with all Departments of religious affairs to organize an orientation programme, to implement the checklist in all the religious institutions in the province. Expert opinion was obtained in creating a checklist for inspection of mosquito breeding places with an intrinsically-mediated mechanism within each religious institution. A weekly inspection checklist was designed to fit the lifecycle of the mosquito and pre-tested in two religious institutions.

The series of programmes for awareness to create dengue-free religious institutions began with the session done among the Buddhist religious leaders on 18/01/2022. The programme provided an orientation to the essential facts on dengue, possible mosquito breeding sites within temples and related institutions, instructions to the conduct of inspection according to the inspection checklist, and a live demonstration on the possible breeding sites at each institution. The same was done for the Muslim trustees on 20/01/2022 and for the Catholic/ Christian leaders on 31/01/2022. The Hindu programme was planned for the 01/02/2022 to orient the Hindu religious leaders on the customized format of the checklist.

As evident by the qualitative feedback, the programme was successful in providing the baseline knowledge among the religious leaders, which enabled improvement on the checklist to be implemented at each religious institution within the province on a weekly basis. The religious departments are working on informing institutions under their purview

on this. The PDHS-WP will link the relevant offices of Medical-Officers of Health with this program.

Keywords: ***Dengue, Prevention, Religious Institutes***

Symposium Theme 2

Control of dengue and prevention of re-introduction of malaria

ABSTRACT ID: 13

LARVICIDAL AND OVICIDAL ACTIVITY OF *PHYLLANTHUS EMBLICA* LEAF EXTRACT AGAINST *Aedes* SPECIES

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Abstract

INTRODUCTION AND OBJECTIVES

Dengue is one of the commonest arboviral infections worldwide. *Aedes* vectors transmit DENV. The main approach to control dengue involves targeting both larval and oval stages of the primary vectors due to their ability to reduce the mosquito density before developing into adults. Chemical larvicides are toxic to humans and non-target organisms that may lead to the development of resistance. Natural products with bio-origin are safe and eco-friendly. Hence, the larvicidal and ovicidal activity of *Phyllanthus emblica* leaf extract against *Ae. aegypti* and *Ae. albopictus* larvae were tested in the present study.

METHOD

Different concentrations of *P.emblica* leaf extract were prepared using fresh leaves. The larvicidal activity was tested against the fourth instar larvae and the number of dead larvae was recorded every 12 hours up to 48 hours. The ovicidal activity was tested using *Aedes* eggs and the hatched eggs numbers were recorded after 12 hours. Four replicates were used for each experiment. Percentage larval and oval mortality and the relevant LC50, LC90 values were calculated.

RESULTS

According to the larvicidal test results, 93% mortality was observed for *Ae. Aegypti* and *Ae. albopictus* larvae after 12 hours at the highest concentration of *P. emblica* leaf extract, 20% (v/v). For *Ae. aegypti*, the LC50 and LC90 values were 2.88% (v/v) and 19.5% (v/v), respectively. For *Ae. albopictus*, the LC50 and LC90 values were 7.92% (v/v) and 31.75% (v/v), respectively. For the ovicidal test, 96% and 97% mortality were observed for *Ae. aegypti* and *Ae. albopictus* respectively, after 12 hours at the highest concentration of *P. emblica* leaf extract, 20% (v/v). For *Ae. aegypti*, the LC50 and LC90 values were 3.58% (v/v) and 27.41% (v/v), respectively. For *Ae, albopictus*, the LC50 and LC90 values were 1.18% (v/v) and 7.67% (v/v), respectively.

CONCLUSIONS AND RECOMMENDATIONS:

P. emblica leaf extract showed larvicidal and ovicidal activity against *Ae. aegypti* and *Ae. albopictus* at different concentrations. As a recommendation, *P. emblica* leaf extract can be developed as an eco-friendly substitute for synthetic larvicide and ovicide. The outcomes

reported here show the possibility of further efficacy investigations on the synergistic larvicidal/ ovicidal properties of plant extracts.

Keywords: ***Ae. aegypti, Ae. albopictus, Larvicidal Activity, Ovicidal Activity, P. emblica Leaf Extract***

ABSTRACT ID: 33

PREPAREDNESS OF THE HEALTH SECTOR FOR AN OUTBREAK OF MALARIA IN SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Sri Lanka is in the prevention of reintroduction phase following the elimination of malaria in 2016. However, annually around 50 imported malaria cases are being recorded. This continuous inflow of malaria cases can trigger an outbreak because the malaria vector is prevalent in many parts of the country. In the current phase, even one locally acquired case of malaria of any species is defined as an outbreak. Until global eradication is achieved, the health sector should be more vigilant of the disease. The aim of the study was to assess the preparedness of the health sector for an outbreak of malaria.

METHOD

A descriptive cross-sectional study was conducted at four hospitals in Badulla district, Regional Malaria Office and Anti Malaria Campaign from March 2021 to assess the preparedness for malaria outbreak. A self-administered questionnaire and a checklist were used to collect data from all the available medical officers in four hospitals which was 303 Medical Officers and the staff of the malaria program. The checklist was designed based on the nine key components of preparedness as given in the National Strategic Plan for Malaria in Sri Lanka 2018-2022.

RESULTS

Of the sample of 303 total respondents, the majority were Medical Officers/Senior House Officers (n=180, 59.4%) and 229 (75.6%) had no experience in treating malaria. Most (n=212, 70.0%) did not have prior training on malaria and 59.7% (n=181) did not consider malaria as a differential diagnosis in febrile patients. The majority had poor knowledge ofmalaria (n=170, 56.1%). A statistically significant association was observed between the knowledge on malaria and their training ($\chi 2=18.967$, df=1, p=0.001). Overall preparedness of the hospital sector and Regional Malaria Office of Badulla were unsatisfactory, while the Anti Malaria Campaign headquarters had satisfactory preparedness. Buffer stocks of anti-malarial drugs were not adequate (10%) at the regional level.

CONCLUSIONS AND RECOMMENDATIONS

This study demonstrated considerable gaps in preparedness in the hospitals and the malaria control program at the district level. The level of knowledge on the diagnosis and

management of malaria cases is not satisfactory. Proper training of Medical Officers and adequate buffer stock maintenance along with proper infrastructure is recommended.

Keywords: ***Malaria, Outbreak, Preparedness, Health Sector, Anti Malaria Campaign***

ABSTRACT ID: 34

POST-IMPLEMENTATION RESEARCH ON THE DENGUE SCHOOL CARD PROGRAMME AMONG GRADE 9 SCHOOL CHILDREN IN HORANA EDUCATIONAL ZONE, KALUTARA DISTRICT, SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Dengue is a vector-borne viral infection that is hyper-endemic in Sri Lanka. Routine surveillance data indicates that 30% of the affected patients are of school-going age. The Dengue School Card (DSC) was introduced to schools in 2016 as a collaboration between the Ministries of Health and Education to foster lasting behavioural change among students through awareness and repetitive action.

This study aims to describe the level of utilisation of the DSC and the associated factors among grade-9 students in the Kalutara District, Sri-Lanka, three years post-intervention.

METHOD

A descriptive cross-sectional study was conducted among 782 grade-9 students using a multi-stage cluster sampling technique from September-November 2019. The utilisation of the DSC was assessed individually by the Principal Investigator among those who brought the DSC to school on the day of assessment. A pretested self-administered questionnaire was used to collect information on the factors associated with DSC utilisation. The questions were weighted by five independent subject experts. The analysis was done using frequencies and the Chi-square test.

RESULTS

Approximately 53% (n=179) of those that brought the DSC to school on the day of assessment (44%,n=341) had good levels of utilisation of the DSC. The good utilisation of the DSC was statistically significantly associated with being a student of a Type-2 school ($\chi2=11.877$, $p=0.003$), good levels of knowledge ($\chi2 =12.855$, $p<0.001$) and reported practice ($\chi2=8.950$, $p<0.003$) on Dengue and dengue control. The majority (85.7%; 95%CI= 83.1-88.1) demonstrated adequate knowledge on Dengue and its control. The overall attitude on Dengue control in relation to the burden, human behaviour, and source reduction was good among 85.7% (95%CI=83.2-88.0). Levels of reported practice were

good among 86.2%(CI=83.6-88.5) with a good understanding of the dynamics of Dengue mosquito vectors.

CONCLUSIONS AND RECOMMENDATIONS

The majority of study participants (53%) whose DSC was assessed had good utilisation of the DSC, which was significantly associated with attending a Type 2 school and levels of knowledge and practices regarding Dengue.

Continuous targeted improvement of knowledge among students based on identified gaps, regular sustained supervision of the DSC activity by a defined authority, and incentive-based recognition of good utilization are recommended to improve the utilization.

Keywords: ***Behaviour-change, Utilization, Dengue, Dengue School Card***

ABSTRACT ID: 40

WATER QUALITY CHARACTERISTICS OF DENGUE VECTOR BREEDING HABITATS IN GAMPAHA DISTRICT, SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Despite the lack of measures to target dengue control in Sri Lanka, eliminating vector mosquito larvae and their breeding sites is a viable way of battling the disease. The water quality characteristics of dengue vector breeding habitats are among the critical criteria that determine female mosquito oviposition and breeding. Thus, the current study was conducted to provide better knowledge on vector breeding habitats in household settings in the Gampaha District, Sri Lanka.

METHOD

Indoor and peri-domestic larval sampling was done in randomly selected 100 households in the Gampaha District each month from April 2017 to December 2019. The water quality characteristics; temperature, pH, Total Dissolved Solids (TDS), turbidity, conductivity, and dissolved oxygen (DO) were analyzed in-situ in breeding habitats positive for *Aedes* larvae.

RESULTS

Out of the 4,812 breeding habitats, 15.7% (n=755) were found positive for *Aedes* larvae at 2,250 randomly selected premises. Kruskal-Wallis statistics ($p<0.05$) followed by Dunn's tests showed that all water quality parameters varied significantly between *Aede*s breeding habitats categories in the Gampaha District. The temperature of *Aedes* breeding water ranged between 25.3^{0}C-39.8^{0}C and they bred at temperatures as high as 39.8^{0}C in discarded receptacles. The results showed that *Aedes aegypti* thrived in alkaline water (pH 7.5-8.5), while *Aedes albopictus* thrived in 6.5-7.5 pH. *Aedes* preferred low turbidity and TDS of water ranged between 250 ppm and 350 ppm. However, *Aedes albopictus* was found in water with higher turbidity such as tree holes and gutters. The mosquito breeding water had a mean conductivity of 228.3 63.9 µs/cm. The study revealed *Aedes* larvae thrive in water with high dissolved oxygen levels ranging from 6.35 mg/L to 7.28 mg/L.

CONCLUSIONS AND RECOMMENDATIONS

The findings of this study conclude that water quality characteristics are vital to consider when planning the dengue vector control programme. *Aedes aegypti* must be targeted on

clear water collecting habitats with high DO and alkaline pH, while that of *Aedes albopictus* on moderately turbid breeding places to achieve an effective dengue vector controlling programme in the future.

Keywords: ***Aedes aegypti, Aedes albopictus, Water quality, Gampaha***

ABSTRACT ID: 48

TRAINING MODALITIES FOR HEALTH CARE WORKERS USED TO PREVENT AND CONTROL DENGUE DURING THE PANDEMIC IN SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Training on prevention and control of dengue for health care workers is one strategy used by the National Dengue Control Unit (NDCU) to control dengue in Sri Lanka. Conducting conventional face-to-face training was not possible during the COVID-19 pandemic due to difficulties in maintaining the social distance and due to travel restrictions. The objective of this study was to describe the types of training modalities used during the pandemic for health care workers to control dengue in Sri Lanka.

METHOD

Data were collected through analyses of documents filed in the training section of the NDCU from 2020 to 2021 to describe the types of training modalities used during the pandemic.

RESULTS

The data revealed that the NDCU has developed a hybrid model of training including didactic lectures, online training and face-to-face scenario-based simulations. The training programmes were for both preventive and curative health workers. Health workers from the preventive sector included Medical Officers of Health, Entomologists and Public Health Inspectors while Medical Officers and Nursing Officers from hospitals represented the curative health sector. The trainers for the preventive sector were specialists and medical officers expert in public health and those of the curative sector were consultant physicians and senior nursing officers from major hospitals having experience in managing dengue patients with a wider range of the clinical spectrum. Training time did not exceed three hours per day. Didactic lectures followed by question-and-answer sessions were used as training methods for curative sector trainees. The use of distance learning methodology through web conferencing enabled the participation of a larger number of participants in training sessions. Content of the training consisted of clinical management of dengue patients with real-life examples from local settings. For the preventive health sector trainees, didactic lectures, interactive and problem-based case scenarios, and group discussions were used as the training methods. Case scenarios were based on issues identified during field supervisions by the NDCU team before the training sessions were held. These training

sessions were conducted face to face at their respective local settings to a smaller group of participants.

CONCLUSIONS AND RECOMMENDATIONS

The results show that training programmes targeted at a larger group could be successfully conducted online, while the training programmes targeted at a smaller group with hands-on training could be conducted face-to-face while abiding with COVID-19 control measures such as wearing masks, maintaining social distance, and practising hand hygiene.

Keywords: ***Training, Dengue Control, Health Workers***

ABSTRACT ID: 53

COMPARISON OF THE CHARACTERISTICS OF IMPORTED MALARIA CASES BEFORE AND DURING THE COVID-19 PANDEMIC

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Abstract

INTRODUCTION AND OBJECTIVES

Key strategies have been implemented to prevent the re-establishment of malaria since Sri Lanka eliminated malaria in 2016. However, approximately 50 imported cases are diagnosed annually. Due to the COVID-19 pandemic, and introduction of mandatory quarantine for all disembarking passengers, the Anti Malaria Campaign (AMC) implemented new screening policies to screen travellers during quarantine to ensure diagnosis of imported malaria. This study aimed at comparing the characteristics of imported malaria cases before and during the COVID-19 pandemic.

METHOD

Demographic and malaria related variables were collected and categorised, and a comparative analysis was carried out using the Chi Square test, amongst the diagnosed malaria patients during the pre-COVID-19 period (July 2018 to March 2020) and the COVID-19 period (April 2020 to December 2021) to assess the changes in characteristics of imported malaria cases.

RESULTS

Ninety-four malaria positives were diagnosed pre-COVID-19 as compared to 47 during the COVID-19 period. In both periods, the majority (88.3% and 93.6% respectively) were males. More Sri Lankans than foreigners were detected with malaria in both groups with the higher proportion in the COVID-19 period (n=42, 89.4%) than in the pre-COVID-19 period (n=75, 79.8%). *Plasmodium vivax* cases were significantly lower (p=0.0187) during the COVID-19 period (n=13, 27.7%) compared to pre-COVID-19 period (n=47, 50.0%). The parasite density difference was also statistically significant (p=0.0013), between the two groups in categorized parasite density results, with higher density categories of more of than 10000 parasites/µl being evident more in the pre-COVID-19 period (n=32, 34.1%) compared to that in the COVID-19 period (n=3, 6.4%). Contribution from

African countries to imported malaria cases was higher in the COVID-19 period (n=40, 85.1%) compared to the pre-COVID-19 period (n=55, 58.5%). Over 70% of malaria cases were detected in the government sector (77.7% and 74.5%) in both pre-COVID-19 and COVID-19 periods. More patients were detected in different districts than resident districts, during the COVID-19 period (n=27, 57.4%) compared to the pre-COVID-19 period (n= 25, 26.6%), which was also statistically significant (p=0.0003).

CONCLUSIONS AND RECOMMENDATIONS

The decline in imported malaria cases during the COVID-19 period implies reduced foreign travel. The increased number of cases from African countries during the COVID-19 period could possibly be due to the relative decrease of travellers from India during the lockdown. There are significant differences in the type of malaria and the parasitic density during the two periods. More cases detected outside their resident district in the COVID-19 period could possibly be due to the mandatory quarantine. Periodic assessment of malaria screening procedures is required for the early diagnosis of imported malaria cases.

Keywords: ***Imported Malaria, Quarantine, Diagnosis, COVID-19, Elimination of Malaria***

ABSTRACT ID: 56

EFFECTIVE USE OF A MONTHLY DENGUE UPDATE AS AN EARLY WARNING TOOL

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Abstract

INTRODUCTION AND OBJECTIVES

Communicating the risk and the potential for impending outbreaks early to the public health practitioners and clinicians is of utmost importance in dengue prevention and control. Two important parameters namely, epidemiological, and entomological surveillance data are used to achieve this objective. Therefore, the National Dengue Control Unit has developed a comprehensive Monthly Dengue Update (MDU) incorporating these surveillance data as an early warning tool for health care professionals.

METHOD

A monthly summary of epidemiological data is analysed by compiling suspected dengue cases in the respective high-risk Medical Officer of Health (MOH) areas and illustrated as a trend analysis comparing data from the same month for the previous three years. Monthly entomological surveillance data is depicted as number of premises inspected, percentage of premises positive for dengue larvae, types of positive containers, and percentage positivity. Subsequently, high-risk MOH areas in relation to entomological findings are identified.

RESULTS

A dengue forecast and an early warning were issued according to analysed epidemiological and entomological data illustrating the high-risk MOH areas. Up to now, 11 issues of MDU and 650 copies of each in a month have been distributed among central, provincial, and district level curative and public health institutions across the country. In addition, e-copies of the MDU are also disseminated for a wider audience. Moreover, a feature article describing novel interventions in dengue outbreak preparedness and response, integrated vector management, diagnosis and treatment of dengue, behaviour change communication, and multisectoral partnership in dengue control activities were also published on the MDU. This analysis and information on up-to-date interventions have empowered health workers to assess their own performance in comparison to other respective settings and, with national level indicators, a facility that was not available for them earlier.

CONCLUSIONS AND RECOMMENDATIONS

Effective and timely use of entomological and epidemiological data through a monthly update for early warning and forecasting is a novelty in dengue prevention and control. Therefore, such a cohesive, simple, and easy-to-understand update could be a trendsetter for effective early warning mechanisms for other diseases of public health interest.

Keywords: ***Monthly Dengue Update, Epidemiological and Entomological Surveillance Data, Early Warning Tool***

ABSTRACT ID: 58

AGGRESSIVE VECTOR CONTROL AND AWARENESS PROGRAMMES IN PREVENTING RE-ESTABLISHMENT OF MALARIA DURING COVID-19 AND DENGUE EPIDEMICS IN JAFFNA DISTRICT

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Abstract

INTRODUCTION AND OBJECTIVES

Since malaria elimination, around 50 imported cases are annually detected in Sri Lanka. In Jaffna District, a case was reported last December after a three-year lapse from Sandillippai. A 20-year-old male returnee from Central Africa was diagnosed with *Plasmodium falciparum* malaria 2-weeks after the arrival. The objective of this study was to describe the impact of aggressive vector control and awareness programmes in preventing malaria re-establishment during COVID-19 and dengue epidemics in Jaffna District.

METHOD

Initial entomological surveys revealed two main vectors *Anopheles culicifacies* and *Anopheles subpictus* in and around the patient's house through human-landing night collection (HLNC) after 9.00 p.m. Larval surveys yielded larva. Parasitic ring forms were detected in microscopy; however, submicroscopic gametocytes could not be excluded. As the area is highly endemic with recent reporting of *Anopheles stephensi* (a new vector mosquito with potential for urban malaria spread), the Anti-Malaria Campaign immediately launched aggressive vector control activities. Fogging was done immediately and larval source management, the next day. Indoor residual spraying was done on indoor and outdoor walls and within the first 500 m of the patient's house. Long-lasting impregnated nets were distributed for next 500 m using Google mapping. Bio assay tests were scheduled. Within 1 km of his house, all possible mosquito breeding sites were destroyed. Fever surveillance was activated to continue until March 2022. Awareness sessions for clinicians, general practitioners and the general public were conducted immediately.

RESULTS

Despite close proximity of the primary vector, and a symptomatic patient whose malaria diagnosis was delayed for two weeks, robust activities minimized the threat of malaria re-establishment in Jaffna District within 48-hours of patient detection. Rigorous and timely action combined with awareness sessions enabled detection of two further cases within Jaffna District with minimum delay.

CONCLUSIONS AND RECOMMENDATIONS

Despite the ongoing COVID-19 pandemic, along with rising dengue cases and malaria patients presenting with fever and low platelets similar to dengue, awareness enables rapid detection and swift management of subsequent malaria cases. Awareness sessions and reactive surveillance involving full-night HLNC instead of partial-night HLNC are recommended for adequate malaria control.

Keywords: ***PoR Phase, Malaria Elimination, Sri Lanka, Vector Control, Reactive Surveillance***

ABSTRACT ID: 59

MALARIA ENTOMOLOGICAL SURVEILLANCE AND VECTOR CONTROL INTERVENTIONS IN QUARANTINE CENTRES DURING THE COVID19 PANDEMIC

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Abstract

INTRODUCTION AND OBJECTIVES

Entomological surveillance and evidence-based vector control are essential to sustain prevention of re-establishment (PoR) of malaria in Sri Lanka. Sri Lanka is highly receptive with malaria vectors being present and vulnerable because of imported malaria. COVID-19 pandemic posed a great challenge for PoR of malaria in Sri Lanka, including for entomological surveillance and response. During early stages of the pandemic all foreign travellers were to undergo a mandatory 10-day quarantine in established quarantine centres (QC). Therefore, assessing prevalence of malaria vectors around QCs, which housed travellers from malaria endemic countries and implementing appropriate vector control was a high priority.

METHOD

QCs were mapped by Regional Malaria Officers (RMO) followed by proactive entomology surveys. Based on receptivity and vulnerability, appropriate vector control interventions were applied. Reactive entomology surveys and appropriate responses were implemented when cases were detected from QCs in line with interim guidelines published during the pandemic.

RESULTS

Total of 121 QCs in 19 RMO regions were covered by 152 entomology surveys in year 2020 and 2021. Of which, 28 QCs in 8 RMO regions, 33 QCs in 14 RMO regions and 60 QCs in 14 RMO regions were identified respectively as high, moderate and low receptive based on the presence or absence of primary and secondary malaria vectors. Eleven (36.6%) and 8 (30.7%) imported malaria cases were detected from QCs in 2020 and 2021 respectively. In relevant 14 reactive surveys, primary vector was not detected, however, secondary vectors namely, *Anopheles subpictus* in Cattle Baited Trap Collection (CBTC) (n=4, 14.8%) and Larval Surveys (LS) (n=5, 31.3%), *Anopheles annularis* in CBTC (n=1, 3.7%) and LS (n=1, 6.25%), *An.varuna* in CBTC (n=4, 14.8%) and LS (n=6, 37.5%), *An.vagus* in CBTC (n=8, 29.6%), LS (n=6, 37.5%) and Human Landing Night Collections (HLNC)(n=1, 9%), *Anopheles tessellatus* in CBTC (n=4, 14.8%), LS (n=1, 6.25%) and HLNC (n=1, 9%) were detected. In response, larval source management (n=5, 55.5%), long lasting insecticidal

nets (n=4, 44.4%), application of larvivorous fish (n=3, 33.3%), application of Temephos (n=3, 33.3%) and space spraying (n=2, 22.2%) were conducted in 7 QCs in 9 instances.

CONCLUSIONS AND RECOMMENDATIONS

Many QCs were found to have primary and/or secondary malaria vectors around them, thus, assessing the receptivity in QCs and applying vector control during the pandemic greatly benefitted keeping Sri Lanka malaria-free.

Keywords: ***Entomological Surveillance, Receptive, Quarantine Centres, Malaria, Vectors***

ABSTRACT ID: 60

EFFECTIVENESS OF LARVIVOROUS FISH, GUPPY (*POECILIA RETICULATA*) FOR CONTROL OF POTENTIAL MALARIA VECTOR *ANOPHELES STEPHENSI* IN THREE DISTRICTS OF NORTHERN SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Sri Lanka has been certified as a malaria free country since 2016. However, reporting approximately 50 imported cases annually, reported introduced case from Monragala (2018) and presence of invasive potential malaria vector *Anopheles stephensi* in northern and eastern provinces of the country highlight the risk of malaria re-establishment in Sri Lanka. Reported resistance of *Anopheles stephensi* adult to all four major classes of insecticides leads to study the effectiveness of introducing larvivorous fish Guppy (*Poecilia reticulata*) as an environmentally friendly control method for control of *Anopheles stephensi* larvae in wells.

METHOD

The study was conducted in three districts, where *Anopheles stephensi* is currently present, namely Mannar, Vauniya and Jaffna in Northern province of Sri Lanka, (where fish introduction is done as a routine larval control measure) from December 2020 to November 2021. Prevalence of *Anopheles stephensi* in wells (13078, 7626 and 6556 wells in Mannar, Vauniya and Jaffna respectively) when Guppy fish was present and absent was checked by anopheline larval surveys. Presence or absence of Guppy fish in the wells was determined by observing visually. The Chi square test was used to assess whether there is a significant association between the presence of *Anopheles stephensi* and the presence of Guppy in the wells. Further, survival of Guppy was assessed, three months after its introduction to wells to identify the sustainability of the intervention.

RESULTS

Results showed *Anopheles stephensi* positivity in wells with fish was lower than in wells without fish in all three districts and the association was found to be statistically significant ($p = 0.00001$, 0.000907, and 0.00001 for Mannar, Vauniya, and Jaffna respectively). Fish

survival rate was75.4% (n=9558), 50.2% (n=7626) and 38.2% (n=13403) for Mannar, Vauniya and Jaffna Districts respectively.

CONCLUSIONS AND RECOMMENDATIONS

Larvivorous fish (*Poecilia reticulata*) can be used as an effective environmentally friendly vector control tool to control *Anopheles stephensi* mosquito larvae in Mannar, Vauniya and Jaffna Districts. Since the sustainability of the intervention depends on the survival of introduced fish in wells, further studies should be conducted to assess factors responsible for low fish survival, with a view of improving survival.

Keywords: ***Malaria, Anopheles stephensi, Larvivorous Fish, Sri Lanka***

ABSTRACT ID: 62

EARLY DIAGNOSIS OF IMPORTED MALARIA CASES THROUGH PARASITOLOGICAL SCREENING IN QUARANTINE CENTRES

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Abstract

INTRODUCTION AND OBJECTIVES

Early diagnosis of a malaria case is of utmost importance to treat the patient immediately and prevent spread of the malaria parasite to another person as the vector mosquito is present in Sri Lanka. Over the last decade, parasitological screening at ports of entries has been carried out for selected travellers arriving from malaria-endemic countries. With the onset of the COVID-19 pandemic, in addition to the island-wide lockdown, Sri Lanka initiated screening for COVID-19 at the port of entries and a compulsory 14-day quarantine in dedicated centres for all the people returning from overseas. This narrative describes the early diagnosis of imported malaria cases through parasitological screening in quarantine centres.

METHOD

The Anti-Malaria Campaign (AMC) carried out screening for malaria on the 10th day of quarantine to diagnose early imported malaria cases, mainly in passengers returning from Africa or India. Screenings were carried out by the staff of the AMC headquarters and Regional Malaria Offices by both Rapid Diagnostic Test kits and microscopy. Data of the cases diagnosed with malaria during the year 2020 were analysed.

RESULTS

More than 10000 returnees were screened for malaria at quarantine centres (QC) in 2020. Thirty cases of imported malaria were diagnosed of which 20 were diagnosed in hospitals and 10 during routine screening at QCs. Seven cases (70%) were detected at Pelwehera QC in the Matale district and three (30%) were diagnosed at Hotel Jetwing in Gampaha district. Six out of seven (85%) patients at Pelwehera QC and all three at Jetwing hotel were asymptomatic at the time of diagnosis. Their countries of origin were six from Uganda, three from Madagascar and one from Kenya. Five cases were diagnosed with *Plasmodium* ovale, four had *Plasmodium falciparum* and one was a mixed infection. Six were gem traders and four were working in another field. The patients were admitted to a hospital

and treated for three days until completely cured. They were followed up regularly in their respective resident districts. None of the patients had taken prophylaxis.

CONCLUSIONS AND RECOMMENDATIONS

Diagnosis of these cases reiterates the importance of screening all the returnees coming from African countries and India irrespective of the symptoms. This will enable us to identify malaria cases early and prevent onward transmission of the disease to other people via the vectors. Prophylaxis is available free of charge to all overseas travellers to malaria endemic countries and their regular intake should be further promoted.

Keywords: ***Malaria, Quarantine Centres, Screening, Prophylaxis***

ABSTRACT ID: 69

DENGUE PREDICTION MODELLING AND DEVELOPMENT OF AREA-SPECIFIC THRESHOLDS FOR EPIDEMIC MANAGEMENT IN URBAN SETTINGS OF GAMPAHA DISTRICT, SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

The growing global threat of dengue in both endemic and non-endemic countries have shifted the attention to establishing an early warning system to assist in dengue control and effectively allocating scarce public health resources to manage outbreaks. Thus, the current study was designed to develop localized thresholds to aid in sustainable dengue vector control measures in three Medical Officer of Health (MOH) areas (Negombo, Wattala, Kelaniya) in the Gampaha District.

METHOD

The cross-correlation function analysis (CCF) was performed to check the effects of climatic variables (average rainfall, rainy days, average temperature, humidity) and Breteau Index (BI) with dengue case incidence from 2014 to 2019. The dengue incidence at time t, BIs with a one-month lag; *Aedes aegypti*; BIA(t-1), *Aedes albopictus*; $BIB_{(t-1)}$ and monthly average rainfall; $RFavg_{(t-2)}$, rainy days; $RD_{(t-2)}$, Average relative humidity; $RHavg_{(t-2)}$ at two-month lag and monthly average temperature; Tavg at three-month lag were checked. Area-specific thresholds were derived from multiple linear regression. The model was validated for the Jaela MOH area for the same period.

RESULTS

Stepwise regression has excluded temperature, rainfall and BIB in urban areas and a statistically significant strong association (r= 0.775) was displayed with BIA(t-1) and $RHavg_{(t-2)}$. When the incidence of the cases exceeded 25, it reached an alarming situation while exceeding 44 was classified as an epidemic in urban areas. BIA>1, RHavg >85%, BIA>2; RHavg>81%, the model implies an early outbreak scenario and when BIA >3; RHavg > 88%, BI>4; RHavg>84%, BIA>5; RHavg>81%, and whenever BIA > 6; RHavg>77% it reached up to severe epidemics. The model accurately predicted all outbreaks in the Jaela MOH area.

CONCLUSIONS AND RECOMMENDATIONS

The common thresholds utilized for vector control entities remain ineffective and cannot be applied throughout the country. Therefore, early warning indications can plan a prior month source reduction in a low-risk zone. In contrast, government-led source reduction programs should be maximized and an intense integrated vector control method must be implemented before it reaches an epidemic.

Keywords: ***Aedes, Dengue, Breteau Index, Climate, Entomological Threshold***

ABSTRACT ID: 97

DESIGN OF A CUSTOMIZED CHECKLIST FOR INSPECTION OF MOSQUITO BREEDING PLACES AT RELIGIOUS INSTITUTIONS

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Abstract

Dengue has been a continuous public health problem in the country, with high morbidity despite low mortality across all age groups. The spread of dengue is influenced by environmental factors, mostly neglected by the community. Among the susceptible environments, religious institutions were identified as with a higher prevalence of mosquito breeding sites. The Provincial Directorate of Health Services of the Western Province and the National Dengue Control Unit established a mechanism to intrinsically monitor religious institutions for mosquito-breeding places with multisectoral involvement.

Consultative meetings were held with religious leaders and community members of each religion in deciding the potential mosquito breeding places of each type of religious institution. The preferred language was also explored from the respective stakeholders. Checklist for Buddhist institutions was in Sinhalese while the Hindu and Muslim were in Tamil. The Catholic/Christian one was in English. The face, content and consensual validity was ensured by circulating the drafted checklists using the modified-Delphi technique to medical personnel of each religion. Depending on their responses, the checklists were revised. Best method of recording of the frequency of the breeding places was also explored by the respective stakeholders. Pre-testing was done in two religious institutions and minor adjustments in the modes of presentation were done.

Thus, four customized final checklists were prepared. The recording system of the breeding places was presented in a user-friendly check box system. The final template included 5 components, namely demarcation of areas, area map, checklist, summary note section and a section for the MOH staff. The third component included 20 categories of potential mosquito-breeding sites segregated in a scientific manner. The check box system included marking the number of breeding sites as 1,2,3, or ≥4. The summary section had space to enter any specific matter that required expert support, for the whole month.

The customized checklists prepared for the religious institutions are with judgemental validity and are user-friendly. Though the reliability was not explicitly tested as the checklists

were service-oriented than research-oriented, the qualitative feedback was suggestive of checklists being with satisfactory reliability.

Keywords: ***Dengue, Mosquito Breeding Places, Inspection, Checklist, Religious Institutions***

ABSTRACT ID: 98

ASSESSMENT OF THE KNOWLEDGE, ATTITUDE AND HOUSEHOLD PRACTICES ON PREVENTION AND CONTROL OF DENGUE AMONG URBAN COMMUNITY IN THE COLOMBO DISTRICT

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Abstract

INTRODUCTION AND OBJECTIVES

Dengue is a public health problem and cases and deaths reported from the Colombo District are high according to secular trends within the last two decades. The majority of people in the district live in urban areas and exploring the public perspective is important to develop effective vector control strategies. The objective of this study was to assess the knowledge, attitude, and household practices on prevention and control of dengue among a selected urban community in the Colombo District.

METHOD

A cross-sectional study was conducted in five urban areas in the Colombo District. Four hundred houses were selected using two-stage cluster sampling. Sample size calculation was done with a statistical formula using a proportion of householders with satisfactory knowledge as reported in literature and with an estimated design effect. One adult from each selected household was invited to participate. A pre-tested, content validated, self-administrated questionnaire was used. Multiple-choice questions were used to assess the knowledge and a Likert scale was applied to assess the attitudes and practices. Descriptive statistics and Chi-square tests were performed.

RESULTS

The response rate was 96.0% (n=384) and 70.8% (n=272) were females and, 61.9% (n=238) were between the age of 31-50 years. The mean scores for knowledge and attitudes were 72.3% and 80.2% respectively. Fewer participants indicated gastrointestinal symptoms as features of dengue (abdominal pain-19.6%, diarrhea-14.9%) and the severity of the reinfection (6.2%). There was a statistically significant association between the knowledge of the participants and their level of education [Chi(15)=28.442, p=0.019]. Approximately, 69.0% (n=265) of participants disagreed that the people have the responsibility to control dengue. Most participants (n=315,82.0%) stated that, night-time announcing is more effective and it is not associated with profession [Chi(10)=13.015, p=0.223]. 42.4% (n=161) and 70.8% (n=272) had a positive attitude on home composting and biological control methods respectively. Regarding the practices, 21% (n=80) do the home composting

and 4.2% (n=15) houses had the larvivorous fish. Three-quarters (n=284,73.9%) of the participants used mosquito repellents and 88.2% (n=338) handed over the garbage to the local government.

CONCLUSIONS AND RECOMMENDATIONS

This selected community has a good knowledge on prevention and control of dengue, but having a negative attitude on taking responsibility is a serious issue, even though their overall attitude was better. More targeted interventions are needed to improve the poor practices. As well as knowledge, attitude and practices should be considered when integrated vector control strategies are planned.

Keywords: ***Knowledge, Practices, Dengue***

Symposium Theme 3

Clinical management of dengue and covid-19 during the pandemic

ABSTRACT ID: 14

CLINICAL OUTCOMES OF DENGUE VIRUS INFECTION IN PATIENTS ADMITTED TO A TIRTIARY HOSPITAL IN SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Dengue causes a large number of hospitalizations in Sri Lanka overburdening the healthcare system, despite implementation of guideline-based admission criteria. Evaluation of clinical outcomes of patients hospitalized with dengue is a preliminary need to support triaging for ambulatory management in the future.

METHODS

We enrolled 1064 consecutive patients admitted to Teaching Hospital Karapitiya, from June 2017- December 2018 with fever within 7 days and >2 WHO clinical criteria for dengue and platelet count ≤100,000/μL, (threshold platelet count for hospital admission). Acute dengue was confirmed with a positive NS1 antigen (<5 days) or IgM antibodies (>5 days). Serotyping was done using PCR. Ultrasound detected plasma leak and findings were classified as significant (pleural effusion, ascites) or minor. Serial blood counts and transaminases were recorded. Clinical outcomes were defined according to 1997 and 2009 WHO classification criteria: DHF; WHO 1997, DSS; WHO 1997, and SD; WHO 2009.

RESULTS

Among1064 patients, 994 (93.4%) were adults, 704 (66.2%) were male. All four serotypes were isolated and the majority (73%) was DEN-2. Median nadir platelet count was 21.5 x 106/ μL (IQR 8-51) at day six. Overall, 428 (40%), had transaminitis (AST/ALT >120U). Total 120 (11.3%) patients developed significant plasma leakage as pleural effusions (105, 9.9%) or ascites (32, 3.0%). Minor plasma leakage manifested as fluid in pericholecystic space (110 ,10.3%), Morrison's pouch (244,22.9%) or pelvis (42 ,3.9%). Overall, 600 (56.4%) patients developed DHF, 544 (54%) were adults and 56 (80%) were children. Only 2 (2%) adults and 6 (8.6%) children developed DSS. Severe dengue was present in 113 (11.4%) adults and 10 (14.3%) children. Few patients received colloids (5.8%), blood (1.7%), platelets (0.5%), FFP (0.4%) or vasopressors (<1%). Seventeen (1.6%) received ICU care. Two (0.2%) patients died from multi-organ failure and shock.

CONCLUSIONS AND RECOMMENDATIONS

The fluid leak in dengue is clinically significant only in a minority. Only half of hospitalized patients progressed to DHF. Among them only a small number developed DSS or SD needing advanced care. Severe disease was commoner among children than adults. Accordingly, ambulatory management could be a goal in dengue management but further focused studies in this area is needed. Separate triage algorithms for children and adults are desired to reduce hospitalization.

Keywords: ***Dengue, Sri Lanka, Outcomes, Ambulatory Management***

ABSTRACT ID: 17

IN-VITRO ANTI-DENGUE VIRAL ACTIVITY OF *AEGLE MARMELOS* (BAEL) DRIED FLOWER AQUEOUS EXTRACT

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Abstract

INTRODUCTION AND OBJECTIVES

Dengue is an arboviral disease of global concern. No specific anti-dengue viral agent exists. We investigated the in-vitro anti-dengue viral activity of *Aegle marmelos* (AM; Common name: Bael) dried flowers, which is used as a fever remedy in traditional medicine. Method:

Cytotoxicity of AM for Vero cells was tested using 4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) to identify the maximum non-toxic dose (MNTD) and the 50% cytotoxic concentration (CC_{50}) at 37°C in 5% carbon dioxide. Chloroquine diphosphate (CQ) was used as the control drug.

Plaque reduction assay for quantifying infectious viral particles was used to determine the half-maximum inhibitory concentration (IC_{50}). Vero cells were infected using dengue virus types 1 (DV1), 2 (DV2), 3 (DV3) and 4 (DV4) and treated with AM extracts at concentrations of 2.08-33.32 µg/ml. Dose-response curve was plotted using GraphPad Prism (9.0.0) software. Selectivity Index (SI) was calculated as the ratio of CC_{50}/IC_{50}.

RESULTS

MNTD and CC_{50} of AM were 33.32 µg/ml and 455.0 (CI 371.8- 564.8) µg/ml respectively. IC_{50} values of AM for dengue serotypes were, DV1 30.16 (CI 24.97-39.08) µg/ml, DV2 8.64 (CI 6.99-10.72) µg/ml, DV3 36.60 (CI 31.93-44.42) µg/ml and DV4 9.36 (CI 6.94-12.81) µg/ml respectively. SI values were DV1 15.09, DV2 52.67, DV3 12.43 and DV4 48.59.

MNTD and CC_{50} of CQ was 10 µg/ml and 17.03 (CI 15.74-18.36) µg/ml respectively, while IC_{50} values were DV1 2.48 (CI 2.20-2.80) µg/ml, DV2 7.98 (CI 6.11-11.74) µg/ml, DV3 2.41(CI 2.11-2.74) µg/ml. CQ did not inhibit DV4. SI values of CQ were DV1 6.86, DV2 2.13, DV3 7.06.

CONCLUSIONS AND RECOMMENDATIONS

A. marmelos dried flower aqueous extract inhibited all four dengue viruses *in vitro* displaying moderate cytotoxicity to Vero cells. Inhibitory activity was serotype dependant. DV2 and DV4 IC_{50} values indicated good inhibitory activity (<10 µg/ml) and DV1 and DV3 demonstrated moderate inhibitory activity (10-50 µg/ml). Compared to chloroquine, SI values for all four dengue serotypes were higher and were >10, indicating that this plant extract should be investigated further to identify biologically active compounds with good anti-dengue viral activity.

Keywords: ***Dengue, Aegle marmelos, Vero Cells, Half-maximum Inhibitory Concentration, Selectivity Index***

ABSTRACT ID: 26

DENGUE AND COVID-19 CO-EPIDEMIC: DIAGNOSTIC CHALLENGES-A REVIEW

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Abstract

INTRODUCTION AND OBJECTIVES

Tropical countries including Sri Lanka are endemic to Dengue over decades with seasonal outbreaks. COVID-19, being a pandemic, has currently captured the attention worldwide. Accurate and timely diagnosis of both is crucial since each has different clinical management and prevention /outbreak control measures. This review is aimed at finding the evidence on challenges of disease diagnosis during a co-epidemic.

METHOD

A literature survey was conducted up to December 2021 on COVID-19 and Dengue co-epidemic in similar settings as in Sri Lanka using Google Scholar and PUBMED search engines.

RESULTS

Fifteen articles were selected and five of them were from tropical middle-income countries as same as Sri Lanka.

Dengue and COVID-19 co-infection poses a diagnostic challenge with similar symptoms, blood investigations and observed cross-reactivity between serological antibody tests. Both COVID- 19 and dengue exhibit mild to moderate symptoms or are asymptomatic in 80% of cases. And they share the symptom profile of fever, headache, muscle aches or fatigue in adults. Chest radiographs can be normal at the onset in both. In addition, skin manifestations such as rashes and petechiae have been reported in COVID-19 adult patients as in Dengue. Common laboratory results include thrombocytopenia, lymphocytopenia, elevated transaminases, and leukopenia. Both infections exhibit prolonged prothrombin time and partial thromboplastin time although a hypercoagulable state was evident in 65-70 years old patients with COVID-19.

Misdiagnosis can be due to serological cross reaction between DENV and SARS-CoV-2. It is hypothesizing that patients with previous DENV exposure have antibodies that are cross reactive with SARS-CoV-2 antigens. And antigenic similarities between the two viruses where comparable antibodies are generated resulting in false positive serological tests.

The importance of development and internal validation of clinical scoring system to differentiate the two infections is underscored in the current context.

CONCLUSION AND RECOMMENDATIONS

Diagnosing one disease will not rule out the possibility of having another infection concomitantly. And overlapped clinical features will lead to primary clinical misdiagnosis. The need for more escalated diagnosing clinical scores, laboratory tests and research on co-infection is emphasized for Dengue endemic countries.

Keywords: ***Dengue, Covid-19, Coepidemic***

ABSTRACT ID: 29

DISEASE RELATED KNOWLEDGE, TREATMENT SEEKING BEHAVIOUR AND CLINICAL SPECTRUM AMONG ADULT DENGUE PATIENTS ON ADMISSION TO NATIONAL HOSPITAL, COLOMBO, AND THEIR ASSOCIATION WITH CLINCAL OUTCOME

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Abstract

INTRODUCTION AND OBJECTIVES

Disease related knowledge on dengue is vital for prompting public for early treatment seeking behaviour, influencing better clinical outcome thus preventing complications.

The study objective was to describe the disease related knowledge, treatment seeking behaviour and clinical spectrum among adult Dengue patients on admission to National Hospital of Sri Lanka, Colombo, and their association with clinical outcome

METHODS

A descriptive cross-sectional study was conducted among 384 adult Dengue patients admitted to 13 medical wards over a period of six months in 2020. A convenient sampling method was used to recruit all adult dengue patients from Ward Admission Registers who fulfilled the inclusion criteria.

Data collection was conducted through an interviewer administered questionnaire under four sections i.e., socio-demographic factors, medical profile, knowledge on Dengue and treatment seeking behaviour. A checklist was used to extract data from the BHT, on clinical spectrum on admission and the clinical outcome on discharge.

Statistical significance for associations were explored by Chi squared test. Severity level of the clinical outcome was categorized as 'Good outcome' (DF and DHF without complications) and 'Bad outcome' (DHF with complications and Complicated dengue).

RESULTS

Males comprised of 56.8% (n=218) of the respondents, while one third of the study population (36.5%, n=140) was from Colombo Municipal Council area. Mean age was 34.1 years (median=29.0, mode=19.0, SD=13.7).

Only 27.9% (n=107) had adequate knowledge on dengue ($\geq 75^{th}$ percentile for the total knowledge score). Early first medical consultation (on or before 48 hours of the onset

of fever) was observed among 77.3% (n=297) of the respondents. Approximately, 50.5% (n=194) respondents had fever for three to five days prior to current admission. Majority of the respondents (89.1%, n=342) had a good clinical outcome.

Statistically significant associations were observed between several independent variables and the severity level of the clinical outcome, including level of knowledge (P=0.005, X^2=7.892, df=1), presence of co morbidities (P=0.003, X^2= 8.546, DF=1), time of first medical consultation (P=0.001, X^2=57.918, df=1), use of NSAIDS and steroids prior to admission (P=0.003, X^2=8.637, df=1).

CONCLUSIONS AND RECOMMENDATIONS

Adequate knowledge on disease and early treatment seeking behaviour were associated with good clinical outcomes. Provision of vital information to general public on appropriate time to seek medical attention at the points of service including the family medical practices would promote good clinical outcomes.

Keywords: ***Knowledge on Dengue, Treatment Seeking Behaviour, Dengue in Adults***

ABSTRACT ID: 31

INVESTIGATION OF SECRETORY PHOSPHOLIPASE A2 INHIBITORS FROM SELECTED SRI LANKAN MEDICINAL PLANTS AS POTENTIAL THERAPEUTIC AGENTS FOR DENGUE FEVER

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Abstract

INTRODUCTION AND OBJECTIVES

Secretory phospholipase A2s (sPLA2s) are inflammatory lipid mediators, which result in generation of platelet activating factor, leukotrienes and prostaglandins. As sPLA2 activity was found to be significantly higher in patients with dengue hemorrhagic fever (DHF, WHO 2011 dengue disease classification guidelines), we screened several medicinal plants to identify potential sPLA2 inhibitory activity.

METHODS

Tragia hispida, *Cyperus rotundus* and *Justicia adathoda*, used traditionally for fever were screened for the presence of active substances that inhibit sPLA2. Three commercially available sPLA2 inhibitors (CAY 10590) were used as the positive controls. The sPLA2 activity was measured using a commercial sPLA2 assay kit and aqueous and 80% ethanol extracts of each plant were screened for the ability to inhibit sPLA2 of bee venom. The sPLA2 inhibitory effect on the plant extract was measured in sera of patients with acute dengue (n=31) and cytotoxicity was measured using mammalian cells.

RESULTS

Aqueous extract of *Tragia hispida* (THA) and the 80% ethanol extract of *Tragia hispida (*THE) showed the highest ability to inhibit sPLA2 in bee venom compared to other plant extracts. THA when further fractionated with butanol (THB) also showed an inhibition of sPLA2 activity with bee venom (sPLA2 group III) of 59.3% at 0.1µg/mL and 84.9% at 0.2 µg/mL THB significantly inhibited ($p<0.0001$) the sPLA2 activity in patients with acute dengue, which had a median activity level of 5.17 to 0.45 at a concentration of 0.1µg/mL. This reduction in the sPLA2 activity dengue was significantly more ($p<0.0001$) with THB (median sPLA2 activity 0.45 nmol/min/mL) compared to the commercial sPLA2 inhibitor

(median sPLA2 activity 3.8 nmol/min/mL). The Sulforhodamine B colorimetric assay using MRC 5 cells showed that the aqueous extract of *Tragia hispida* (THA) has very low toxicity to normal human cells (IC_{50} =4400, 445, 199 μg/mL for 24, 48 and 72 hrs respectively).

CONCLUSIONS

THA, THE and THB extracts of *Tragia hispida* appear to have potent sPLA2 inhibitory activity and less cytotoxic to mammalian cells. It would be important to explore the usefulness of this in the treatment of acute dengue.

Keywords: ***Dengue, Secretory Phospholipase A2, Tragia hispida, Inhibition***

ABSTRACT ID: 38

COVID INFECTION IN DENGUE ENDEMIC COUNTRY; A CASE OF COVID 19 INFECTION MISLED AS DENGUE HEMORRHAGIC FEVER.

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Abstract

BACKGROUND

Acute febrile illness is the commonest presentation of both Covid-19 and Dengue which are single stranded RNA viruses of Coronaviridae and Flaviviridae. We are reporting a case of covid-19 infection with false positive NS-1 antigen test and peri-cholecystic fluid which made a diagnostic perplexity where possibility of cross reactions of serological markers are reported in the literature between above infections

CASE REPORT

A 24-year-old male presented with fever associated with chills, rigors and loss of appetite for 2 days to Teaching Hospital Peradeniya without cough, shortness of breath, diarrhoea or vomiting. His physical examination was unremarkable except the mild tachycardia and fever. His initial blood investigations revealed significant neutropenia ($0.6*10^3$µl), lymphopenia ($0.8*10^3$ µl), thrombocytopenia ($145*10^3$µl), mild transsaminitis (SGPT: SGOT = 57:54) and positive NS-1 antigen test while haematocrit ranges 43-45.8%. Patient was started on standard dengue monitoring. Development of upper respiratory symptoms on the 4th day, he was subjected to Covid RT-PCR which became positive (Ct = 18). He was managed as dengue with Covid-19 co-infection. On the 5th day of illness patient complained of right upper-abdominal pain and tenderness but no other warning symptoms of leaking. Ultrasonography of abdomen showed smoothly distended gall-bladder with a layer of peri-cholecystic fluid without calculi which suggestive of early dengue leaking. Since patient was clinically stable with rising leucocytes ($4.6*10^3$ µl) and static platelet count ($142*10^3$ µl) and absence of associated wall oedema which expected to be present with peri-cholecystic fluid in dengue leaking, collective decision was made to repeat the scans in 6h, 12h and 24h and observe. It revealed no interval changes where confirmed it was not dengue leaking. Negative both dengue IgM and IgG on 7th and 10th day of illness verified this patient has not had Dengue and final diagnosis concluded as Covid-19 infection with possibility of mild acalculous cholecystitis.

CONCLUSION

This patient with Covid-19 infection had false positive NS-1 antigen test and sonographic evidence of peri-cholecystic fluid make the diagnosis a challenge. There is a possibility of cross-reaction of Covid-19 antigens with rapid NS-1 test kit and covid associated acalculous cholecystitis mimicking as dengue leaking. Diagnostic conundrum can be prevented by proper clinical correlation and awareness of serological cross-reactions.

Keywords: ***Dengue Haemorrhagic Fever, Covid-19, Acalculous cholecystitis***

ABSTRACT ID: 50

CHARACTERIZING MEMORY B CELL RESPONSES TO DENGUE AND SARS-COV-2 IN THE SRI LANKAN POPULATION

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Abstract

INTRODUCTION AND OBJECTIVES

B cells responses to pathogens are generally assessed by measuring specific antibody levels. As memory B-cell (Bmem) responses are not vastly studied, a B-cell ELISpot assay was developed to study Bmem responses to dengue (DENV) envelope and NS1 protein and SARS-CoV-2 viral proteins.

METHODS

B cell ELISpots were developed by optimising the proteins needed to measure antigen specific Bmem responses. Responses were assessed to NS1 and envelope of DENV1-4 in individuals with past dengue fever (DF=22), past dengue haemorrhagic fever (DHF=14) and seronegative individuals (n=7). Bmem responses to S1, S2 and N protein of SARS-CoV-2 was assessed in 45 individuals after ≥16 weeks post first dose of AZD1222 vaccine, and in 24 individuals at 4, 6 weeks post first dose of the Sinopharm/BBIBP-CorV vaccine. The mean±2 SD of background responses was defined as the threshold for positive response of antibody secreting cells (ASCs)/1 million cells.

RESULTS

Bmem responses to NS1 were significantly higher than envelope in individuals with past DF for DENV1 (p=0.008), DENV2 (p=0.0001) and DENV4 (p=0.0479), and higher in NS1 than envelope for DENV1 (p=0.0007) and DENV2 (p=0.005) in past DHF. Those who received AZD1222 had significantly higher responses to S1 and S2 than N. Frequency of responses to S1 (p=0.0017) and S2 (p=0.046) were significantly different between age groups, with a higher frequency in individuals between 40-60 years and >60 years, than younger individuals. Bmem responses to Sinopharm/BBIBP-CorV showed a significant increase in the frequency of ASCs from 4 to 6 weeks for S1 (p=0.008) and N (p=0.016).

No difference was seen in between the frequency of ASCs in individuals <50 years and >50 years of age for S1, S2 and N.

CONCLUSIONS AND RECOMMENDATIONS

Limited studies have been conducted on Bmems in DENV, but not on NS1 and envelope in a single cohort. Bmem responses were higher to DENV1 and DENV2 NS1 than envelope in those with past DHF. Bmem responses following SARS-CoV-2 vaccinations have not been extensively investigated. AZD1222 induced potent Bmem responses to SARS-CoV-2 spike, following a single dose. Sinopharm/BBIBP-CorV induced Bmem responses in those who received both doses of the vaccine.

Keywords: ***Dengue, SARS-CoV 2, B Cell, B Cell ELISpots, Vaccine, Viral Infection***

ABSTRACT ID: 51

PROSTAGLANDIN D_2 AND E_2 IN ACUTE DENGUE AND THE ROLE OF NON- STRUCTURAL PROTEIN 1 IN INDUCING THEIR PRODUCTION IN MONOCYTES

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Abstract

INTRODUCTION AND OBJECTIVES

Platelet-activating factor (PAF) and leukotrienes are generated by phospholipase A_2 (PLA_2) enzymes, which have been shown to cause vascular leak. As prostaglandins are also generated by PLA_2 enzymes, we sought to investigate if prostaglandin metabolites are associated with clinical disease severity in acute dengue and if so, the factors that result in their generation.

METHODS

Urinary prostaglandin metabolites of PGD_2 and PGE_2 were measured by quantitative ELISAs, in single mid-morning urine samples collected from healthy individuals (n = 10), patients with dengue fever (DF = 25), and dengue haemorrhagic fever (DHF = 27) in the febrile phase of illness (duration of illness ≤ 4 days) and thereafter. Urinary PG metabolite levels were normalized for urinary creatinine values for each individual. To explore the possible role of dengue non-structural protein 1 (NS1) in inducing prostaglandins, primary human monocytes from healthy adults (n=6) were co-cultured with HEK29 cells derived 95% pure recombinant DENV-1 NS1. DENV-1 NS1 was tested for endotoxin contamination using LPS ELISA. The cell culture supernatants were harvested at 12 and 24 hours, and PGE_2 and PGD_2 metabolite levels were measured. (Ethics approval; ERC, University of Sri Jayewardenepura/ ref no. 741/13)

RESULTS

Urinary PGE_2 metabolite levels were elevated in early illness in both DF and DHF patients compared to the healthy individuals, with significantly higher PGE_2 metabolite levels ($p= 0.025$) in patients with DF. PGE_2 metabolite levels rose over time in patients with DF and DHF during days 3 to 6 of illness. PGD_2 metabolite levels rose in patients with DHF but declined in patients with DF over time. In patients with DHF, PGE_2 metabolite levels were

significantly higher in the critical phase compared to the febrile phase (p = 0.017). Both PGD_2 and PGE_2 metabolites were significantly higher in monocyte culture supernatants co-cultured with NS1 compared to the controls. While both metabolites were significantly higher in supernatants at 12 hours following culture (PGD_2, p=0.04 and PGE_2, p=0.02), PGE_2 metabolite levels were also significantly higher at 24 hours (p=0.04).

CONCLUSIONS AND RECOMMENDATIONS

Prostaglandin metabolites are elevated during the critical phase in patients with DHF suggesting that they have a possible role in vascular leak. As dengue NS1 appears to induce their production, it would be important to explore therapeutic targets that modulate prostaglandins in the treatment of DHF.

Keywords: ***Dengue, Prostaglandin, NS1 antigen***

Symposium Theme 4

Complex and interconnected multi hazard risks: The nature of cascading impacts and relationships

ABSTRACT ID: 16

DEPRESSION AND PSYCHOLOGICAL DISTRESS DURING CONVALESCENCE OF DENGUE FEVER – A CASE-CONTROLLED STUDY

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Abstract

INTRODUCTION AND OBJECTIVES

The estimated average global deaths from dengue fever (DF) is 9221 per year. DF has been reported to be associated with psychological morbidity but is little explored in Sri Lanka. Thus, mental health associated with DF is little addressed despite the significant interrelation.

The aim of this study is to determine the rates of psychological distress and depression at one month follow up after DF.

METHOD

The study included 285 cases and 309 controls. All prospective patients presenting to two medical units of Teaching Hospital Peradeniya (THP), with DF confirmed with a positive NS-1 antigen test were considered as cases and were reviewed at one-month after discharge. The General Health Questionnaire (GHQ30) and Patient Health Questionnaire (PHQ9) were used to screen for psychological distress and depression respectively. All patients who presented for review at one-month post discharge participated in an ICD-10 based clinical interview to assess for depression, conducted by a psychiatrist or a senior registrar in psychiatry. Controls were hospital attendees of THP with illnesses other than DF, matched for gender. Controls were similarly screened using the GHQ30 and PHQ9.

RESULTS

At one-month follow-up, according to the PHQ9, 22.45% of cases screened positive for depression, compared to 1.7% of controls and this difference was statistically significant ($p=<0.0001$). On further clinical interview by the psychiatrist, 9.7% of the cases were diagnosed to be depressed, and this too was significantly higher than the proportion that screened positive for depression in the control group ($p=<0.0001$).

With regards to psychological distress measured by the GHQ30, at one month follow-up, 36.5% of cases and 15.2% of controls were found to be experiencing distress. This difference was statistically significant ($p=<0.0001$).

CONCLUSIONS AND RECOMMENDATIONS

The findings of this study further confirm that there is considerable psychological morbidity following DF. Increased awareness about this issue will facilitate early detection and provision of appropriate psychological support for such patients.

Keywords: ***Dengue, Depression, Psychological distress***

ABSTRACT ID: 36

IS HUMAN MOBILITY A MAJOR DRIVER FOR DENGUE OUTBREAKS? ANALYSIS DURING COVID19 PANDEMIC

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Abstract

INTRODUCTION

The epidemiology of Dengue depends on three key factors, the dengue virus, the vector and the human host. The host factors such as human movement and behaviour are significant when planning preventive strategies such as risk communication and behaviour modification but frequently overlooked. Exploring the relationship of these drivers with Dengue is therefore worthwhile. We conducted secondary data analysis to study the change in Dengue epidemiology over the year 2020 to formulate a hypothesis, whether the drop in Dengue cases could be linked to limited human mobility and adverse human behaviour under the COVID19 pandemic.

METHODS

We analysed the secondary data of Dengue disease surveillance from 2016 to 2020 to demonstrate the changing epidemiology of Dengue, mainly emphasizing the Western province. For the potential drivers, we analysed human mobility from the COVID 19: google mobility trends and routine premise inspection data as a proxy for human behaviour. The rainfall pattern from the Department of Meteorology was also used for comparison. Finally, descriptive analysis was performed and compared with previous years.

RESULTS

The monthly trend of Dengue cases showed a decline since the lockdown. Western Province (WP), which experienced the most extended lockdown, contributed only to 28% of the national burden in 2020, while in other years, it ranged from 38% to 49%. Colombo district always showed higher incidence from 2016 to 2019(420 to 1416 per 100,000 population), dropping to 170/ 100,000 in 2020. The incidence gap between Colombo and Gampaha (33/100,000) and Colombo and Kalutara (73/100,000) was found to be the minimum in 2020. Nevertheless, from 2016 to 2019, it ranged between 93 to 398/100,000 and 193 to 423/100,000 in Gampaha and Kalutara, respectively, against Colombo.

Corresponding with the drop in monthly trend, the google mobility trend for 2020 also demonstrated a considerable reduction in human movement since March 2020. Furthermore, human movement in all places except residential areas [retail and recreation (77%), workplaces (64%) and transit stations (73%)] has dropped dramatically (varied from -24% to -77%). This finding was supported by a reduction in larvae positivity in high premises such as schools, government institutions, private institutions, and factories compared to 2019. Further, the WP showed a 36% and 26% reduction in overall and South-West monsoonal rainfall, respectively, compared to a 423% reduction in caseload in 2020 as opposed to 2019.

CONCLUSIONS

The drop in the monthly trend of Dengue cases since the lockdown, reduction in the Dengue incidence, especially in the WP and Colombo district, together with the evidence of reduced breeding places support the hypothesis that the decrease in Dengue cases in 2020 could be due to restricted human mobility and adverse behaviour. Moreover, a relative reduction in the rainfall was noted in the WP in 2020 compared to 2019, but the decrease in the caseload is considerably higher.

Keywords: ***COVID19, Dengue, Human Mobility/Movement, Human Behaviour, Outbreak***

ABSTRACT ID: 45

A LEGAL NARRATIVE FOR THE COVID 19 PANDEMIC: A COMPARATIVE ANALYSIS ON INDIA AND SRI LANKA

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Abstract

COVID-19, is the novel addition to the biological hazards discourse in the post 2020 world. The spread of the pandemic around the world has infected more than 60 million people and has resulted in over 1.4 million deaths. The landscape and the geographical positioning of the South Asian region has been recognized as a main breeding spot for the COVID-19 pandemic. With the overall alteration of the living fabric through the pandemic, this study explores the legal issues that have arisen from the COVID-19 pandemic in the context of South Asia. The study employs a comparative method to compare the jurisdictions of Sri Lanka and India in the terms reviewing legal issues aroused due to the COVID-19 pandemic. The study reviews both primary sources of legislature and policies and secondary sources. Both jurisdictions hold similarities in pandemic governance in terms of having pandemic and public health related laws that have been introduced during the British rule, having penal code penalties in relation to public health and having Disaster Management Acts with provisions in relation to biological hazards. The review suggests that the legal issues pertaining to the pandemic of the selected jurisdictions can be addressed under the thematic orientations of public health crisis discourse, criminal liabilities, human rights concerns and disaster management. In the Sri Lankan context, while colonial pieces of legislation have been utilized in governing the pandemic, imposing curfew as a public safety measure has attracted criticism. On the other hand, the Indian central government has been criticized for not coordinating with state governments as per the codified law. Given that the both jurisdictions consisted of multi-ethnic cultural settings, hate speech against other ethnic communities in the disguise of pandemic was a prominent concern. Even though there are international standards which justify derogation of human rights during public emergencies, both jurisdictions have been criticized for curtailing the religious rights of the minorities and freedom of expression. In terms of the disaster management context, it is notable that Sri Lanka has quitted exploring the possibilities of managing the pandemic as a disaster. However, while India has implemented the provisions of the Disaster Management Act, a fallacy has been recognized as not incorporating internal displacement into the Act to provide relevant protection to the migrant workers. Hence, this study concludes that the selected jurisdictions are in need of an overall legal framework integrating the above discussed thematic orientations.

Keywords: ***COVID-19 Pandemic, Criminal Liability, Disaster Management, Governance, Human Rights and Public Health***

ABSTRACT ID: 55

MANAGING COMPOUND EVENTS IN THE COVID-19 ERA: A CRITICAL ANALYSIS OF POLICING AND PLANNING, EXECUTION AND GAPS

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Abstract

INTRODUCTION AND OBJECTIVES

Since the beginning of 2020, predominant attention has been paid to the prevention and control of the COVID-19 pandemic. Adding to this, the risk posed by the pandemic is compounded by the concurrent occurrence of natural hazards [E.g., floods, cyclones and landslides] and other biological hazards [E.g. Dengue and Leptospirosis]. The 'new normal' has drastically transformed responses to multiple hazards thereby instating the need to prepare and plan for complex, multiple-risk scenarios. This study aims to critically examine the 1) ongoing preparedness measures for natural hazards that occur against the backdrop of the COVID-19 pandemic and 2) preparedness planning measures for anticipated compound events featuring pandemics undertaken in Sri Lanka.

METHOD

This study draws on a desk-based policy analysis that was carried out across key disaster risk management and health related policies and plans in Sri Lanka. The findings of this study have also been informed by data gathered through key informant interviews conducted with 20 officials representing the disaster management and the public health sectors in Sri Lanka. In addition, primary data has been collected through four focus group discussions carried out with Public Health Inspectors of four selected districts namely Ratnapura, Jaffna, Badulla and Monaragala.

RESULTS

The findings reveal that several key steps have been taken by disaster management officials in conjunction with public health officers at the national and sub-national levels to prepare for the South West and North East monsoons amidst the COVID-19 pandemic in the past year. These steps have included updating the National Emergency Operations Plan [NEOP] to incorporate COVID-19 guidelines; conducting district regional committee meetings; convening district and divisional disaster management committees, altering evacuation and camp management plans, establishing mechanisms to handle resistance to evacuation and executing and testing preparedness measures. However, it was revealed that there have

been minimal planning measures underway for anticipated compound scenarios and that there's a need for 1) more research to be carried out on multi-hazard scenarios; 2) scenario planning to be undertaken; 3) strengthening data on vulnerable groups and 4) identifying hot-spots where multiple disasters occur.

CONCLUSION AND RECOMMENDATIONS

The findings demonstrate that effective preparedness for compound scenarios in the context of the 'new normal' calls for a more forward-looking approach that is supported by scientific data, concise documentation and multi-sectoral collaboration.

Keywords: ***Compound Events, COVID-19, Pandemics, Sri Lanka***

ABSTRACT ID: 61

DISASTER GOVERNANCE AND ASSOCIATED CHALLENGES: A CASE STUDY OF COVID 19

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Abstract

Coronavirus (COVID 19) is one of the most challenging contemporary biological hazards experienced across the world irrespective of the region, ethnicity, economy, or otherwise. Statistics of the WHO reveals that around 349,641,119 cases were reported, and commutative total deaths have reached 5,592,266 by January 25, 2022. Based on up-to-date secondary data, this paper attempts to explore the concept of disaster governance within the context of COVID 19 pandemic. As UNDRR (2020) defines, disaster risk governance is a system of institutions, mechanisms, policy and legal frameworks, and other arrangements to guide, coordinate and oversee disaster risk reduction, and related areas of policy. The problem arises that, while some of the developed countries such as the USA, UK, Australia, and New Zealand have reasonably governed the disaster situation, why is that the developing countries especially in the South Asian, African, and Latin American regions show a deficiency in governing positively the pandemic situation? Literature reveals that despite the developed countries reporting high numbers in terms of recorded cases and deaths, and damage to the economy, they succeed in bouncing back to normalcy. New policy interventions, good governance practices, multi-stakeholder approaches, decentralized fiscal policies, a stable economy, and the discipline of the public are instrumental in this regard. Further, developing countries struggle to overcome this challenge due to several reasons: politicization of pandemic governance process, bad governance practices especially lack of accountability and transparency, personal agendas of the rulers, cultural and religious beliefs, weaknesses in mobilization campaigns, and state-society relations are prominent among them. In this context, belief in science rather than myths, strengthening mobilization of the public on good health practices, division of labour, accommodating expert knowledge into decision making, strengthening good governance practices are key for better disaster governance and resilient society.

Keywords: ***Disaster Governance, Resilience COVID 19, Pandemic, Good Governance***

ABSTRACT ID: 71

IDENTIFYING AND ANALYSING CRITICAL INFRASTRUCTURE INTERDEPENDENCIES DURING DISASTER EVENTS: A CASE STUDY

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Abstract

Undoubtedly, Critical Infrastructures (CIs) have become the central nervous system of the built environment providing essential services to the community. Past disaster events have caused significant damages to CIs. Also, biological hazard events such as dengue and Covid-19 have posed a significant threat to CIs' functionality. Also, the magnitude and extent of the damages to the built environment through disruption of CIs have been exacerbated by the interdependencies of the CIs. Furthermore, interdependencies have caused systematic behaviour among the CI sectors. In the case of the disaster, it is evident that interdependencies triggered the cascading failure of whole CI systems. Therefore, identifying systemic behaviour among CI sectors is crucial for building the resilience of the CIs yet challenging for the decision-makers. This study aims to portray the systemic nature of the CIs. Utilizing the systems thinking approach, the present study considered CIs as complex systems operating in the context of broader societies and disaster situations. As the initial step of this study, the interdependencies between the CIs were identified utilizing several case studies of recent devasting disaster events. Hurricane Katrina (2005), Haiti earthquake (2010), Fukushima-Daiichi Nuclear disaster (2011) and Hurricane Sandy (2012) were used as the case points for identifying the interdependencies among the CI sectors. Scientific journal articles, news articles and reports by governments and NGOs were used to collect data on cascading effects. The causal loop diagramming technique was used to demonstrate the identified interdependencies among the CI sectors. Causal loop diagrams for each case study were developed. As the next step of this study, the developed causal loop diagrams were analysed using social network analysis to identify the most prioritized CI sectors. Findings show the electricity sector as the key sector among the CI sectors. The causal loop diagrams show that CI systems are complex in nature. With more data-driven approaches, causal loop diagrams can be converted into system dynamics models to assess the current level of the resilience of CI systems incorporating systematic behaviour. Also, developing such models helps visualize reducing possible drawbacks in CI management during disasters and improving resilience within them.

Keywords: ***Critical Infrastructure, Causal Loop Diagrams, Interdependencies, Systems Dynamics, Disasters***

ABSTRACT ID: 78

DEVELOPING A FRAMEWORK TO INTEGRATE PANDEMIC PREPAREDNESS INTO TSUNAMI EVACUATION PLANNING: WHAT ARE THE KEY COMPONENTS AND FUNCTIONS?

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Abstract

The health precautions and physical distancing measures that emerged at different scales with the COVID-19 pandemic made the world develop and adhere to novel guidelines to respond and maintain the daily activities in function. However, within the COVID-19 emergency, the response to other natural hazards is identified as in chaos as there was no sufficient preparedness in the emergency management discipline. The compound hazards which occur with rapid-onset natural incidents are highlighted amongst the other incidents as there is only a limited time left for response activities. The increased number of COVID-19 incidents followed by most of the natural disasters explains the seriousness of the problem. Therefore, integrating pandemic management into disaster response, especially to rapid onset-disaster evacuation planning can be identified as a crucial need in the disaster management discipline. Having identified the research need this research aims to evaluate the key components to integrate pandemic preparedness in tsunami evacuation planning. The research conducted an integrative literature review to explore the key components related to the areas of tsunami evacuation, road network connectivity and COVID-19 pandemic management (Ex: tsunami inundation, demographic factors, geographic factors, road network centrality, network capacity, COVID-19 hotspots, transmission of disease). The key components were verified and distinguished into three categories (risk identification, risk assessment and risk reduction) using the expert opinion to composite the conceptual framework to integrate pandemic preparedness into tsunami evacuation planning. Tsunami evacuation is considered as a case study for this research as a tsunami can be considered as the most devastating rapid onset hazard with a minimum lead period. The framework consists of the avenues of linking common characteristics of the key components such as the linkage of road network centrality with transmission of COVID-19 and tsunami risk. Based on the expert opinion six scenarios of connectivity-based tsunami evacuation studies are identified to apply the process of conceptual framework and identify the relationship among the key components. The prioritized key components are applied in each scenario to identify effective relationships of the key components in developing the framework to integrate the pandemic preparedness in the tsunami evacuation planning process.

Keywords: ***COVID-19, Emergency Management, Rapid Onset Hazards, Risk Assessment, Connectivity Analysis***

ABSTRACT ID: 93

INVOLVEMENT OF NON-GOVERNMENTAL ORGANIZATIONS IN DISASTER PREPAREDNESS AND RESPONSE ACTIVITIES IN MULTI-HAZARD SCENARIOS: A CASE STUDY OF SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

The complexity and systemic nature of disaster risks have defied traditional approaches in disaster risk management which have a hazard-by-hazard perspective. Therefore, there is a need for countries to adopt multi-hazard and multi-sectoral disaster risk reduction (DRR) practices. Within a multi-sectoral approach towards dealing with disasters, the role of international organizations, local non-government organizations (NGOs) is considered crucial in a disaster-prone world. Past studies conducted in Sri Lanka have highlighted that although the external interventions considerably contribute to the effectiveness of DRR activities, their involvement in plans and policies are not included adequately. This study is aimed at further investigating the role of NGOs in disaster risk management mechanisms, taking Sri Lanka as a case study.

METHODOLOGY

Since the concurrent hazards amidst the pandemic have depicted the gravity of systemic risks, disaster response activities in Sri Lanka for concurrent hazard events during COVID-19 were investigated during the study. A series of key informant interviews were conducted with twenty-seven professionals who were actively engaged in disaster preparedness and response activities during the said period. These professionals were selected from agencies that represent the National Early Warning System in Sri Lanka since it allowed them to capture the organizations engaged in disaster management mechanisms in the country from national to district levels.

RESULTS

The findings of the study reveal both strengths and weaknesses in the engagement of NGOs and donor agencies within the existing disaster management mechanism in the country. Established structure and availability of required monetary and human resources are the main strengths that NGOs are equipped with. During recent hazard events that occurred amidst COVID-19, NGOs have collaborated with Sri Lankan government stakeholders in disaster preparedness and response activities, especially in addressing the needs of vulnerable communities. However, the findings have revealed that the involvement of

NGOs is not adequately mandated in existing legal policies and frameworks. Therefore, the strengths of NGOs and donor agencies are not adequately received by the government.

CONCLUSIONS AND RECOMMENDATIONS

The study highlights the need for emulating a sound legal framework for coordinating with NGOs in disaster management activities. Elimination of legal and administrative barriers can streamline the engagement of NGOs in the DM mechanism in Sri Lanka. Resources of NGOs and donor agencies can be effectively used for strengthening the existing DM practices in the country.

Keywords: ***Disaster Risk Reduction, Multi-Sectoral Approach, Multi-Hazard, Non-Governmental Organizations***

ABSTRACT ID: 94

HOW DID THE CONCURRENT HAZARDS AMIDST COVID-19 BECOME AN EYEOPENER IN RESPONDING TO MULTI-HAZARD EVENTS: AN EPIDEMIOLOGICAL ANALYSIS ON IMPACTS OF COMPOUND HAZARDS

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Abstract

INTRODUCTION AND OBJECTIVES

Currently, the frequency and intensity of climate-related hazards have become unpredictable and extreme because of climate change. For instance, 389 hazard events have been recorded in 2020, which is a value greater than the average number of hazard events per year during the last decade. It is predicted that the likelihood of occurring simultaneous compound hazards, especially biological hazards concurred with climate-related hazards, will be increased in the future. In addition to this, the impacts of COVID-19 adversely affected the response capabilities for other weather-induced disasters that occurred during the pandemic. Preparedness and response planning for multiple hazards plays a key role in reducing the vulnerabilities in a community for these compound hazard events. In such a context, this study is aimed to evaluate the impacts of COVID-19 on preparedness and response planning for compound hazard events taking the situation in Sri Lanka as a case study.

METHODOLOGY

A series of key informant interviews which include thirty-three professionals representing disaster management authorities, public health agencies, government offices, non-government and private organizations, were carried out during the data collection. This study utilized a tailor-made the descriptive epidemiological analysis method which is used to analyse disease dynamics, for investigating disaster risk management activities. Accordingly, hazard prediction and forecasting, early warning and risk communication, preparedness planning and response mechanisms were analysed for their timeliness (Time attributes), identification of vulnerable populations (Person) and selection of the best possible localities for response (Place). It has mainly focused on southwest monsoon seasons in 2020 and 2021 and Burevi Cyclone in 2020.

RESULTS

The results highlight that the relevant authorities took anticipatory actions in risky geographical locations to mitigate impacts on vulnerable communities timely during Southwest monsoon season 2020 and Burevi Cyclone. However, preparedness and response mechanisms were delayed during the Southwest monsoon season in 2021 which occurred during the third wave of COVID-19 in the country. Furthermore, the study highlights those delays in hazard prediction and forecasting, inadequate preparedness, breakdowns in risk communication, lack of resources, and negligence of compound hazard events in risk assessments are the main reasons behind the delay in timely preparedness and response measures.

CONCLUSIONS AND RECOMMENDATIONS

There is a need for strengthening the existing multi-hazard early warning systems with accurate and timely hazard forecasting methods; comprehensive risk assessments for compound hazard events; effective risk communication strategies, and adequate resources in preparedness and response measures.

Keywords: ***Compound Hazards, Climate Change, Biological Outbreaks, Multi-Hazard Early Warning Systems***

ABSTRACT ID: 95

IMPACT OF BIOLOGICAL HAZARDS ON CLIMATE CHANGE-RELATED RISKS IN THE COASTAL REGIONS

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Abstract

INTRODUCTION AND OBJECTIVES

Coastal regions are often highly populated, well connected, and focal points of trade, fishing, and tourism. As a consequence, coastal cities have tended to become indispensable to the economy of many countries. However, coastal regions also face serious climate risks due to sea-level rise and the increased severity of cyclones, coastal flooding, and other hazards.

Biological hazards, which impose severe threats to human life as they attack living organisms of humans, can multiply the climate risks faced by the coastal communities. In light of this, the study will investigate how the climate risks in the coastal regions will be affected by biological hazards.

METHODS

The study adopted a narrative literature synthesis and conducted a descriptive mapping review to identify how the biological hazards affect the coastal regions' climate change-related risks. Initially, the analysis identifies the impact of biological hazards, referring to the secondary data available on the previous biological hazard situations. Subsequently, these impacts are linked to the climate change-related risks in the coastal regions.

RESULTS

During biological hazards, the coastal industries' livelihoods such as fisheries, tourism, freight services will be interrupted due to loss of demand, restriction movements, fear of contamination and transmission. These conditions will increase the socio-economic vulnerabilities of the coastal communities towards climate change-related disaster risks. Climate conditions and associated natural hazards such as coastal flooding cyclones will increase the prevalence and distribution of vectors, pathogens, hosts, and allergens transmitting the biological hazards. In addition, during a biological hazard, handling climate change-related hazards such as coastal flooding and tsunami will have complications in the evacuation and disaster recovery processes due to movement restrictions and social distancing requirements.

On the other hand, reducing sectorial pressure that causes environmental pollution, greenhouse gas emissions will reduce the climate change inducing factors in coastal regions.

However, in the long term the economic impact of biological hazards will have restraining impacts on the climate change adaptation efforts in the coastal regions.

CONCLUSIONS AND RECOMMENDATIONS

The results indicate that biological hazards have both positive and negative impacts on the climate change-related risks in the coastal regions. Accordingly, identifying the cascading impacts of biological hazards and climate-related risks in coastal regions will facilitate addressing complex and interconnected multi-hazard risks in the coastal regions.

Keywords: ***Climate Change, Coastal Regions, Biological Hazards***

Symposium Theme 5

Integrated pandemic and multi-hazard preparedness planning strategies: National to community empowerment and social mobilisation

ABSTRACT ID: 01

DEVELOPMENT OF A COMMUNICATION FOR BEHAVIOUR IMPACT PLAN ON DENGUE PREVENTION

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Abstract

INTRODUCTION AND OBJECTIVE

Communication for Behaviour Impact (COMBI) is a methodological process that blends strategically a variety of communication interventions intended to engage individuals and families in adopting healthy behaviours and maintaining those behaviours. Dengue is a leading public health problem in Sri Lanka as the effect of dengue on Sri Lanka is increasing in the last two decades. For better development of an intervention, clear methods, outcomes, and activities, which bring about change with a coherent theoretical basis, are required. There is lack of evidence for systematically developed intervention packages for dengue prevention. Therefore, a need to develop a package systematically and evaluate the effectiveness with minimum risk of bias is raised. The objective was to develop a COMBI plan to change the behaviour to prevent dengue in Kurunegala district, Sri Lanka.

METHOD

The plan was developed according to World Health Organization (WHO) COMBI planning 10 steps with the scientific evidence and expert opinion. The situation analysis was conducted using mixed-methodology from January to March 2019 among the adults in a highly dengue-endemic area in Kurunegala District, Sri Lanka.

RESULTS

The overall goal of the plan was to contribute to the reduction in morbidity and mortality from dengue disease in the Kurunegala district by improving the dengue prevention behaviours by three months. After finalizing Specific Behaviour Objectives (SBOs) by conducting Situational Market Analysis for Communication Keys, the plan was developed. The SBOs for the plan were to improve the proper waste management practices according to 'Three R concept' (Reduce, Reuse and Re-cycling) and to improve the dengue prevention practices by 30 minutes weekly cleaning. The strategies were to conduct a community empowerment program to improve household waste management and weekly practices on dengue prevention by conducting administrative mobilization and public relationship,

public advocacy, community-mobilization, personal selling, advertising, point of service promotion during follow up.

CONCLUSION

Developing a COMBI plan with specific behavioural objectives for an area after the identification of specific behavioural objectives would be feasible to implement in order to empower the community to prevent dengue in the area.

Keywords: ***Dengue, Communication for Behaviour Impact, Waste management***

ABSTRACT ID: 02

PILOT INTERVENTION TO ASSESS THE EFFICACY OF A COMPLEX- INTERVENTION PACKAGE TO PREVENT DENGUE IN KURUNEGALA DISTRICT, SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVE

Dengue is a seasonal vector-borne disease which is increased with the onset of the inter-monsoonal rains. It has become a major public health problem in Sri Lanka during the last two decades. Development and evaluation of community-based intervention on behavioural changes are identified as key functional areas to prevent dengue outbreaks. Therefore, this study aimed to assess the COMBI-based complex-intervention package on changing household behaviour to prevent dengue.

METHOD

A community-based pre-post pilot-intervention was conducted to assess the efficiency of a COMBI-based complex-intervention among 121 adults, aged between 18 to 70 years in households in highly endemic areas in the Kurunegala district. Improvement of proper waste management practices according to the 3R concept (Reduce, Reuse and Re-cycling) was the finalized specific behavioural objectives of the COMBI plan. The pre interventional outcomes were compared with paired t-test and McNemar test following post-interventional three months.

RESULTS

The response-rate of the pilot-study was 97.5% (n=118). The result revealed that the adequate post-interventional knowledge on dengue prevention of the intervention group, positive attitude towards dengue prevention, adequate health-seeking behaviour and the overall community capacity was significantly improved by 37.3%, 39.9%, 31.3% and 16.3% in the post-interventional assessment than the pre-intervention assessment respectively. Notably, adequate dengue prevention behaviours were improved by 51.7% in the post-intervention assessment than the pre-intervention assessment.

CONCLUSION AND RECOMMENDATION

A COMBI planning process based interventional approach to change the behaviour for sustainable dengue control is feasible, implementable and efficient. it was able to achieve the significant improvement of the desired outcome of interest including knowledge,

attitudes, practices, health seeking behaviours, community capacity and dengue prevention behaviour following the pilot intervention.

Keywords: ***Dengue, Complex-Intervention, Behaviour***

ABSTRACT ID: 03

A COMPLEX-INTERVENTION TO CHANGE DENGUE PREVENTION BEHAVIOURS OF THE HOUSEHOLDERS IN KURUNEGALA DISTRICT, SRI LAKA: A CLUSTER RANDOMIZED TRIAL

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Abstract

INTRODUCTION AND OBJECTIVE

Complex interventions are widely used in public health practices in the other social areas with prominent health consequences. There were 167,198 reported dengue cases in Sri Lanka by November 2017. Out of total, 10,087 cases were reported in Kurunegala District which is the fourth rank in National level. In 2017, the managing capacity of the district was exceeded due to the unbearable number of dengue patients which became a disaster for the curative sector healthcare institutions in Kurunegala district. Evaluation of community-based intervention on behavioural change is identified as the key functional areas to prevent future outbreaks. Moreover, strategies to encourage implementation of evaluation findings should be based on a scientific understanding of the behaviours that need to change, the relevant decision-making processes, and the barriers and facilitators of change. Therefore, the study was aimed to assess the complex intervention package on changing the behaviour of the householders to prevent dengue in Kurunegala district, Sri Lanka.

METHOD

A community-based parallel group cluster randomized trial was conducted to assess the effectiveness of the Communication for Behavioural Impact (COMBI) based behavioural change intervention (n=167) versus routine standards of dengue control activities (n=166) among the householders in highly dengue endemic area in Kurunegala district from May to September 2019 following 3 months after completion of the intervention. The COMBI theory is an effective method directed at enacting behavioural change to benefit health and social development which encourages precise behavioural outcomes and is effective in planning a behavioural change for dengue control. The specific behavioural objectives for the plan were to improve the proper waste management practices according to 'Three R concept' (Reduce, Reuse and Re-cycling) and to improve the dengue prevention practices by 30 minutes weekly cleaning. The strategies were to conduct a community empowerment program to improve household waste management and weekly practices on dengue prevention by conducting administrative mobilization and public relationship, public advocacy, community-mobilization, personal selling, advertising, point of service

promotion during follow up. A pre-tested, validated, interviewer-administered tool was used to collect data. Intention to treat analysis was applied using Logistic Regression with Generalized Estimating Equations.

RESULTS

There were significant improvements of the overall dengue prevention behaviour (27.4%, 95% CI: 17.1% - 37.7%), knowledge (12.3%; 95% CI: 1.7% - 22.9%), attitude (7.3%; 95% CI: -1.77% - 16.4%), practices (29.2%; 95% CI: 18.9% - 39.5%), health-seeking behaviour (14.7%; 95% CI: 4.12% - 25.3%), and reduction of Pupal-Index (49.3%; 95% CI: 39.7% - 58.9%), House-Index (30.8%; 95% CI: 28.3 - 47.1%), Container-Index (17.7%; 95% CI: 8.8% - 26.6%) and Breteau-Index (52.2%; 95% CI: 43.5% - 60.9%) in the intervention group in comparison with the control group after three-months of the intervention.

CONCLUSION

A COMBI planning process based interventional approach to change the behaviour for sustainable dengue control is effective. Importantly, it contributed to a significant reduction in the density of dengue vectors (Pupal Index and HI, CI, BI) and a number of potentials.

Keywords: ***Dengue, Cluster Randomized Trial, Behavioural change***

ABSTRACT ID: 04

ANNONA MURICATA: AN ALTERNATE CONTROL OF DENGUE TRANSMITTING COMPETENT VECTOR *AEDES AEGYPTI*

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Abstract

Given prevention is better than cure. Oh my god, even we found the utmost effective vaccine in the midst of COVID19 pandemic but not to DENV Why? The currently available (not recommended to all over country) vaccine (Dengvaxia) only provides immunity against one serotype and does not generate lasting immunity against the other three making it only less effective. As its higher complications in dengue vaccination etc. Currently we have the only higher possibility to control dengue by controlling that dengue transmitting vector *A. aegypti*. The study was aimed to investigate an effectual level of *Annona muricata* (soursop) extract on mosquito vector namely, *Aedes aegypti* along with its toxicity study on non-target organism and other important biochemical marker enzymes is to find and illustrate the exact mechanism of specific enzymes responsible for detoxifying allelochemicals. Among the various soursop seed kernel extracts tested for larvicidal activity, the physiological saline extract exhibited maximum mortality (100%) against dengue transmitting vector at a lowest concentration for 24 h exposure. Based on these findings, the extract was opted for further studies including toxicity on non-target organism and systemic effects on important biochemical constituents in the larvae *A. aegypti* at the lethal threshold time (18 h) with LC_{50} concentration (9.05 µg/ml). The tested extract against non-target aquatic fourth instar larvae *Chironomus costatus* was safe up to 28 µg/ml for 24 h exposure and the mortality was observed only above the concentration 28 µg/ml used in the study. The systemic effects on main neurotransmitter Acetylcholinesterase ($p \leq 0.01$), xenobiotics detoxifying enzyme of α-and β-carboxylesterase ($p \leq 0.05$; $p \leq 0.01$) and antioxidant enzyme glutathione S-transferase ($p \leq 0.05$) were reduced significantly in quantitative analysis.

Analysis of such biochemical constituents of proteins and enzymes α-and β-carboxylesterase were considerably down regulated in the resolving native-PAGE. In contrast, acid and alkaline phosphatase were upregulated in both quantitative and qualitative analysis. This investigation clearly demonstrates the soursop extract has potent larvicidal agent with alterations in biochemical constituents of exposed larvae of *A. aegypti*. Use of this insecticidal effective molecule in integrated pest management in the future to protect people globally on the basis of prevention of dengue is better than cure.

Keywords: ***Annona muricata, Mosquito, Chironomus costatus, Esterase, Phosphatase***

ABSTRACT ID: 15

ASSESSING THE KNOWLEDGE ON DENGUE DISEASE AND PREVENTION AMONG HOUSE HOLDERS IN ATTIDIYA NORTH GRAMMA NILADHARI (GN) AREA AT COLOMBO DISTRICT

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Abstract

The World Health Organization classifies Dengue as a disease important in public health. The epidemiology and ecology of dengue infections are strongly associated with human habits and activities. The present study aimed to evaluate the knowledge and practice regarding dengue infection among Urban Residents in Attidiya GN area at Colombo District.

PROBLEM STATEMENT

Why is the number of reported dengue patients in Attidiya North Grama Niladhari Divison decreasing as compared to the other GN Divisions in the Ratmalana Medical Officers of Health area?

OBJECTIVES

1. This investigation was undertaken to evaluate the knowledge and practices regarding dengue infections among Urban residents in Attidiya North GN Division.
2. There are identified misconceptions among the public regarding dengue mosquito breeding grounds.

METHODOLOGY

A cross sectional study was adopted for this investigation among the different type of descriptive studies. A convenience sample of 100 residents who were visiting the Attidiya North GN area. Data collected using a questionnaire and personal interview the data include dengue disease and prevention the suitable method for relevant mosquito biting at household level.

RESULTS

A cross sectional design was adopted for this Investigation. Convenience sample of hundred (100) residents who were visiting the different house holders of Attidiya North GN were taken as participant in study. More than half of the respondents had good knowledge (92%) mode of transmission about dengue. More than half of the respondents used dengue preventive measures, such as covering premises (58%) bed nets (84%) mosquito replants (30%). There was source of information on knowledge about dengue and prevention such as, television (94%), newspapers (50%), public health officers (36%).

CONCLUSION

According to the current study, it can be clearly seen that satisfactory knowledge about dengue disease caused to better practice for dengue. It may be the cause of the declining number of reported dengue patients in this locality. But to improve knowledge Health education program should give more emphasis dengue transmissions and on cost effective ways of reducing mosquito and preventing dengue such as environmental measures and control. Furthermore, wide range of information, skills and support must be provided by the government to increase dengue awareness among residents.

Key words: ***Dengue Fever, Dengue Preventive Practice, Dengue Knowledge***

ABSTRACT ID: 28

AN ASSESSMENT OF THE USE OF DEVELOPING TECHNOLOGIES TO IMPROVE PREPAREDNESS AND RESPONSE FOR MULTI-HAZARD SCENARIOS

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Abstract

Disaster Management (DM) is not a new concept and is typically presented diagrammatically as a cyclical process in the Disaster Management Cycle (DMC). This representation of DM has been criticised in recent years for conceptualising disasters in an overly simplistic way. Traditional methods utilised by disaster managers, such as field monitoring, physics-based models, expert surveys, and multi-criteria decision-making methods, are applied to identify hazards and risk factors. These methods tend to be used in isolation and in practice may lead to each phase of the DMC being treated as distinct yet interrelated entities rather than as one continuous system which may impact on the preparation for and the response to crisis events, including multi-hazard scenarios. Any perceived lack of continuity between the DMC phases in real disaster events may also impact on learning from disasters to achieve continuous improvements in DM processes and procedures.

This study researches the literature focused on three developing technologies: artificial intelligence (AI), virtual reality (VR) and blockchain. Articles from the literature and from health organisations were selected based on their relevance to the health crises focus of this study. The study makes an assessment of the utility of information and communication technologies in preparing for and responding to multi-hazard scenarios and focuses on health crises. It examines whether developing technologies can be applied to create and enhance disaster scenarios and used in simulation exercises that create immersive environments to assist understanding and preparations for future disasters and reduce the challenges for the DMC in terms of spatial dimensions and considerations, such as improving the inter-connection between the DM actors, as well as the temporal dimensions, such as making quicker decisions. The authors argue that this is especially important when preparing for and responding to concurrent crises, such as concurrent infectious disease emergencies or when responding to hurricanes and/or landslides during a pandemic.

The authors conclude that this will require the application of developing technologies such as AI, Blockchain and Virtually Reality to exercise simulations and scenario building to maximise the advantages and reduce the challenges and limitations that multi-hazard scenarios with health impact present.

Keywords: ***Preparedness, Simulations, Technology, Multi-Hazard Scenarios***

ABSTRACT ID: 39

COVID-19 THE GLOBAL PANDEMIC; KNOWLEDGE AND FACTORS ASSOCIATED WITH, AND INFECTION PREVENTION CONTROL PRACTICES AMONG MEDICAL DOCTORS AND NURSING OFFICERS OF SELECTED TEACHING HOSPITALS IN THE DISTRICT OF COLOMBO, SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

COVID-19 pandemic is one of the most devastating pandemics occurring since 2020. Although it is a novel disease, infection prevention and control (IPC) practices and epidemiological knowledge effectively prevent the spread. In addition, hospitals act as the first encounter point for COVID-19 patients. Therefore, the knowledge on COVID-19 and the IPC practices among front-line health staff are paramount in curtailing the pandemic. Hence, this study aimed to assess the level of knowledge, the factors associated with the knowledge, and IPC practices among the selected health staff.

METHODS

A descriptive cross-sectional study was carried out among the doctors and nursing officers of the National Hospital of Sri Lanka (NHSL) and the Colombo South Teaching Hospital (CSTH) in November 2020. A total of 461 participants were chosen through a multistage stratified sampling technique. A self-administered questionnaire based on the most up-to-date literature on COVID-19 and IPC practices was developed with experts' inputs ensuring face and content validity and amended accordingly after pretesting. The knowledge on COVID-19, the factors associated with the knowledge, and practices on IPC were assessed. In the knowledge component, each question was weighted for importance and relevance using a scale ranging from 1 to 5 for the correct answer by a five-member expert committee. The average score from the five experts was taken as the standard score for each correct response, while each incorrect response was given a value of zero. A similar scoring was done for the component on IPC practices. Based on literature and experts' opinion, the cut-off point for categorising the participants having satisfactory levels of knowledge and IPC practices were decided. It was decided to take the cut-off as 70% of the maximum score, and hence 140 and 70.7 were set as the cut off points for knowledge and practices, respectively. The factors associated with the knowledge on COVID-19 were analyzed using Chi-square test (χ^2). The $p<0.05$ was taken as the significant level.

RESULTS

A total of 386 participants responded with a response rate of 83.7%. A 40.3% (95 % CI =35.8% - 45.6%) of participants had a satisfactory level of knowledge. However, most of the participants (90.4%; 95% CI=87.0% - 92.9%) had a satisfactory level of IPC practices.

A statistically significant association was noted between; being a doctor (χ^2=7.203, df=1, p<0.05), being a doctor at NHSL (χ^2=4.374, df=1, P<0.05), aged more than 40 years (χ^2=7.672, df=1, p<0.05), having children (χ^2=4.880, df=1, p< 0.05), having read any research articles/publications on COVID-19 (χ^2=13.697, df=1, P<0.05), and the service experience more than ten years (χ^2=11.333, df=1, P<0.05), and the satisfactory level of knowledge.

CONCLUSIONS

A relatively lower proportion of doctors and nurses of the two study settings had a satisfactory level of knowledge on COVID-19. However, a majority had an acceptable level of IPC practices.

Furthermore, being a doctor, being a doctor at NHSL, aged more than 40 years, having children, reading research articles/publications on COVID-19, and the service duration of more than ten years showed a statistically significant association with a satisfactory level of knowledge on COVID-19.

Targeted training to improve knowledge on COVID-19 is recommended.

Keywords: ***COVID-19, Knowledge, IPC practices, Doctors, Nurses***

ABSTRACT ID: 43

INTEGRATING COMMUNITY EMPOWERMENT MODEL TO STRENGTHEN PANDEMIC PREPAREDNESS AND RESPONSE IN SRI LANKA: PROSPECTIVE POLICY ANALYSIS

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Abstract

INTRODUCTION AND OBJECTIVES:

During the COVID-19 pandemic Sri Lanka's pandemic preparedness, response and overall national health governance strategy has faced challenges. While curative and preventive measures remain important pillars of response and preparedness for COVID-19, dengue and other infectious diseases, there is a strong need to integrate community based sustainable efforts especially for continued adherence to public health guidance. This study aims to a) understand the challenges and opportunities in Sri Lanka of integrating a community empowerment model for pandemic preparedness, response, and resilience b) to assess contextual factors when integrating a community empowerment model.

METHODS

We used Walt and Gilson's Health Policy Triangle (HPT) to understand the integration of community empowerment within the current multi-hazard pandemic state in Sri Lanka. HPT has four key components: content, context, processes, and actors. Our analysis drew from global community empowerment best practices (e.g., Ottawa Charter) applied within the context of Sri Lanka. To complement our HPT analysis, we conducted a stakeholder analysis assessing the power differentials and interest within each stakeholder group.

RESULTS

Context: Key barriers were observed within the economic, socio-cultural, and psychological contexts. Epidemiological and demographic transition impacted across context categories. The existing free healthcare, welfare centred public systems were seen as strengths.

Content: Policies which allow the key health promotional efforts such as equity-based incentives, risk-reduced mobility, risk communication, and orienting health delivery within the COVID-19 response strengthen the community empowerment model. Policy limitations on officially integrating civil society to the pandemic response remains a weakness. Additional policy focuses include trilingual communication, empathy-based community outreach, and digital service delivery.

Processes: Decentralizing the pandemic response at national and sub-national levels, are key policy processes requiring both institutional and political focus. We need to consolidate 'whole-of-society' efforts that include multidisciplinary approaches.

Actors: Stakeholder analysis results indicated the non-alignment of power and interest among stakeholders as a key challenge.

CONCLUSIONS AND RECOMMENDATIONS

Sri Lanka needs to strengthen the community empowerment model for sustainable preparedness and response in multi-hazard scenarios involving COVID-19 and dengue. First, the normative processes can be adapted within existing legal and policy infrastructure. Second, long term policy changes need to be initiated with professional body consensus and confirmed by legislative bodies.

Keywords: ***Community Empowerment Model, Pandemic Preparedness, COVID-19, Health Policy, Policy analysis***

ABSTRACT ID: 54

COMMUNITY EMPOWERMENT THROUGH INNOVATIVE USE OF ONLINE PLATFORMS DURING THE COVID-19 PANDEMIC

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Abstract

INTRODUCTION AND OBJECTIVES

Public health security measures have been successful to some extent in curtailing the impact of COVID-19 pandemic, yet empowering communities for a sustainable public response seems challenging.

Hence, a community empowerment programme was initiated by 'Sarvodaya Shramadana Movement' together with UNICEF with the objective of strengthening knowledge, skills and positive behaviours on COVID-19 related preventative and response measures among community leaders, youth, and faith leaders through existing community networks.

METHODS

An instructor-led training method was developed in consultation with experts in the field and tailormade to deliver via online platforms since physical training was not allowed under mobility restrictions. All presentations in both Sinhala and Tamil were pre-recorded as a contingency measure to be used in case of poor connectivity.

Subsequently, a bilingual interactive series of 53 sessions via Zoom platform was conducted for a period of two months from August to September 2021. Each session coonsisted of thematic areas on introduction to COVID-19 infection, public health preventative measures and 'DReAM +V' concept, COVID-19 vaccination, and public perception, infodemic and the role of community leaders during the pandemic.

Around 100 participants, representing all districts, were involved in each session for two hours, followed by a 20-minute question-and-answer session. Sessions were moderated by subject specialists under each thematic area.

RESULTS

Altogether 6734 community leaders, youth and faith leaders were trained. Expert resource panel identified five participants from each district for 'Training of Trainers (TOT)' programmes of similar context. The participants had numerous doubts to be clarified, which often extended to scheduled time of the training.

Therefore, to engage the participants and to sustain the flow of information beyond the training, several WhatsApp groups were formed. These WhatsApp groups with a membership of more than 1700, continue to serve as a community of practice for discussion to date.

CONCLUSIONS AND RECOMMENDATIONS

Despite limitations on mobility and human to human interactions, creative and innovative programme designing, and effective use of online platforms would ensure sustainable community empowerment during the pandemic. Hence, this model of training would serve as a best practice in delivering sustainable community solutions in the time of crisis.

Keywords: ***Community Empowerment, Online Learning, Community Networks During Pandemic***

ABSTRACT ID: 65

CAN THE TEN PILLARS OF COVID-19 RESPONSE HELP FIGHT A LARGE DENGUE OUTBREAK?

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Abstract

BACKGROUND

The COVID-19 Strategic Preparedness and Response Plan (SPRP2021), introduced by the World Health Organization (WHO) in February 2020 details the public health measures that countries need to prepare for and respond to COVID-19. Ten pillars identified in the SPRP are: 1:Coordination, planning, financing, and monitoring; 2:Risk communication, community engagement and infodemic management; 3:Surveillance, epidemiological investigation, contact tracing, and adjustment of public health and social measures; 4:Points of entry, international travel and transport, and mass gatherings; 5:Laboratories and diagnostics; 6:Infection prevention and control, and protection of the health workforce; 7:Case management, clinical operations, and therapeutics; 8:Operational support and logistics, and supply chains; 9:Maintaining essential health services and systems; and 10:Vaccination. The objective of this paper is to examine the usefulness of these ten Pillars to manage large scale Dengue outbreaks.

METHODS

Ten Pillars of COVID-19 Response were examined through a scenario-based discussion among five subject matter experts from the National Dengue Control Unit and the Disaster Preparedness and Response Division of the Ministry of health for their usefulness in relation to a scenario of a large Dengue outbreak in which 200% increase of number of Dengue cases from the baseline in 20 out of 25 health districts in Sri Lanka.

RESULTS

The subject matter experts in the debrief of the scenario-based case discussion agreed that the ten Pillars of COVID-19 Response could be effectively used in responding to a large Dengue outbreak. However, during the scenario-based discussion, it was found that prior to their use, they need to be contextualized based on the epidemiological, clinical, and socio-economic similarities and differences between COVID-19 and Dengue. It was suggested to modify the Pillar 3 to accommodate source reduction strategies as well.

Modifications were suggested for the Pillar 4 on ports of entry could be modified to prevent introducing dengue infections to non-dengue endemic areas. Further, it was suggested to modify Pillar 10 for the introduction vaccine and innovations in vector control for integrated vector management.

CONCLUSIONS AND RECOMMENDATIONS

Ten Pillars of COVID-19 could be used for effective country level preparedness and response to other large scale local or global outbreaks such as Dengue. They could be used for enhancing preparedness and response in emergencies as well.

It is also recommended that the relevant units within the Ministries of Health, WHO and other stakeholders should familiarize with the use existing tools such as the ten pillars during the preparedness phase, rather than reinventing and introducing yet another new tool in the middle of a large-scale Dengue outbreak

Keywords: ***Ten Pillars, SPRP, COVID-19, Dengue***

ABSTRACT ID: 79

IDENTIFYING THE MOST SUITABLE EVACUATION STRATEGY FOR A TSUNAMI HAZARD DURING A PANDEMIC OUTBREAK – AN EVACUATION SCENARIO ANALYSIS FOR SRI LANKA

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Abstract

The COVID-19 pandemic outbreak is a devastating incident that has currently recorded more than 375 million infected cases and more than 5 million deaths by the end of 2021. During this period many of the daily activities in cities got disrupted and was adapted into the health and safety precautions to maintain the continuity of business as usual. However, disciplines such as disaster management were unable to adapt to such haste changes as there is no sufficient information to develop adaptation guidelines in line with pandemic management. Especially, as there is no sufficient knowledge about the behaviours of contagious disease among the community during a natural disaster evacuation, the lately introduced guidelines such as tsunami evacuation during the pandemic are identified to be vague and not clear. Therefore, understanding the behaviours of a contagious disease during different disaster evacuation contexts is identified as a significant need in the disaster management discipline. Since the empirical evidence is limited in these aspects, one of the best approaches for identifying the mentioned relationship can be considered as simulated scenario evaluation. Therefore, this research aims to evaluate six different simulated scenarios for identifying the relationship between the transmission of a contagious disease and the evacuation routes for natural disasters considering tsunami hazard and the COVID-19 pandemic. The scenarios are identified using expert opinions and road network centrality is used as the basis for identifying the relationships. Road network centrality is a well-used analytical tool in transportation and emergency evacuation. Further, centrality has been successfully utilized in pandemic modelling and transmission monitoring in the recent past. Accordingly, this research attempts to utilise the centrality concept for modelling and monitoring the effect of pandemics during an emergency evacuation situation. The six scenarios identified in this research will be able to explore the mentioned research gap and provide an essential solution for planning an alternative evacuation strategy for tsunami hazards during a pandemic outbreak. The outcome of this research will enable the formulation of an alternative evacuation strategy for tsunami hazard-based a clustered approach for evacuating communities affected by a pandemic outbreak.

Keywords: ***COVID-19, Emergency Evacuation, Rapid Onset Hazards, Scenario Evaluation, Connectivity Analysis***

ABSTRACT ID: 80

A HARMONIZED VISION FOR CRISIS MANAGEMENT AND DISASTER-RESILIENT SOCIETIES THROUGH HUMAN FACTORS, AND SOCIAL, SOCIETAL, AND ORGANISATIONAL ASPECTS: "CORE" APPROACH

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Abstract

The complexity in assessing disaster risks make the role of disaster risk reduction more challenging as disaster preparedness and response becomes complex on multiple dimensions. components of such complexity rely on the wide diversity of levels of vulnerability, risk awareness, safety culture, social and science trust among interested populations either at regional or at European scale. Risk characteristics are driven by more complex and interdependent urban systems and urban-rural inter-linkages. Population vulnerability is compounded by other risks such as climate change, terrorism, pandemics, and cyber-attacks. One of the lessons learned by the recent COVID 19 crisis is that risk is systemic, and crises are cascading. Disasters produce more and more disasters in other areas as well, threatening and jeopardizing human lives. Therefore, there is indeed a need to strengthen disaster resilience at the level of municipalities, Member States and EU agencies, which must consider the diversity of European society, and the variability of human factors. This can only be achieved through a transdisciplinary collaboration involving the environmental science and social science communities. Within this context, the CORE project funded by the Horizon 2020 program will investigate such differences at EU countries level and at transversal social groups level, to develop a harmonized vision of crisis management awareness and overcoming, through a transdisciplinary collaboration involving the environmental science and social science communities. The scope of the research is to define a comprehensive methodological approach to review and evaluate the diversity in risk perception because of education and scientific knowledge, geography, and place of living (within and outside Europe), within social groups, attitudes, institutional trust, and social trust, including a variety of personal and cultural variables. In this way, human factors, social, societal, and organisational aspects can be supported by the scientific results obtained in research on environmental and anthropogenic risks.

Keywords: ***CORE, Disaster Risk Management, Risk Perception, Natural and Man-made Risks, Cascade Events, Vulnerable Groups, Safety Culture Indicators, Youth Education, Social Media Misinformation***

ABSTRACT ID: 82

STRENGTHS OF COMMUNITY-BASED DISASTER RISK REDUCTION APPROACHES FOR PANDEMIC PREPAREDNESS AND RESPONSE: LESSONS FROM COVID-19 PANDEMIC

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Abstract

INTRODUCTION AND OBJECTIVES

Hazards and their impacts may vary according to the spatial and social context. Moreover, social, economic, environmental issues faced by communities are also deemed to be different from one society to another. The level of effectiveness and the efficiency of any disaster risk reduction (DRR) activities are determined by the grassroot level social and cultural factors as the last mile is one of the most significant focal points of DRR. Further, the intensity of risk and vulnerability of the affected community is underpinned by a larger number of social factors in a community. Applying an 'umbrella' or a 'blanket' approach for DRR, therefore, is least effective as DRR activities are most often affected by an array of community determinants such as the level of disaster knowledge, cultural beliefs, attitudes, disaster experience of people, and the willingness of a community. The objective of this paper is to examine the strengths of the community-based approaches in pandemic preparedness and response in the context of multi-hazards, as an entry point for effective DRR at the community level.

METHOD

Data was collected through an extensive literature review and analysed using the thematic method.

RESULTS

Findings indicate that low and middle-income countries have documented many community initiatives during the COVID-19 pandemic than high-income countries. Community approaches are particularly important to reach marginalized populations and to support equity-informed response. Prevention and control are the fundamental interventions in which communities have been considerably engaged. Effective interpersonal communication and use of social media, case detection and surveillance, population movement monitoring, community contact tracing, quarantine monitoring, community quarantine system, quarantine support and isolation and community trust-building are identified as potential community-based interventions which have been evident during the COVID-19 pandemic.

CONCLUSION AND RECOMMENDATIONS

The ability to build trust among the people, effectiveness in grassroot communication and ability to avoid misinformation or rumours, sustainability of community-led initiatives, and less burden on institutional architectures and regulatory mechanisms are several strengths of the community-based approaches as explored.

Keywords: ***COVID-19 Pandemic, Community-based Approach, Pandemic Preparedness, Response***

ABSTRACT ID: 85

EMERGENCY RESPONSE AND DISASTER PREPAREDNESS FOR THE MULTI-HAZARDS IN SRI LANKA: FLOOD RESPONSE ACTIVITIES DURING COVID-19 PANDEMIC

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Abstract

Sri Lanka experiences a large scale of multi-hazards due to heavy monsoon rains and long-run droughts during health hazards such as Covid-19, dengue, and malaria. Several districts were badly hit by floods during the peak of the third wave of the Covid-19 outbreak in Sri Lanka. In this context, regulatory institutions have more eyes on multi-hazard preparedness in the country. The objective of this paper is to discuss the challenges of emergency response activities during the flood in the western province during the Covid-19 pandemic. This research used the secondary data obtained from several official sources and reports to analyse the scenario. Quantitative data were analysed using the statistical analysis method and thematic analysis method was used to analyse qualitative data. Flood related and pandemic related data was collected based on the western province in Sri Lanka more focused on the district level. Results revealed that, in the western province, there were around 57048 affected families which came to 231,201 individuals during the flooding. And also 73 safe centres have been maintained for the affected communities in the area and 513 families have been temporarily detained in those centres. This flooding was more severe because flooding has occurred during a high Covid-19 outbreak in the country. Ironically, the highest number of infected people were also recorded from the western province. Many rescue and immediate response activities have been carried out following health guidelines and under severe escalations of covid-19 emergency response activities. Therefore, as people were struggling to cope with the flood situation there was a need to provide essential household items to meet their emergency needs. Due to the lockdown of the country (travel restrictions), it was challenging to conduct flood related response activities as planned. Most of the field locations are under quarantine regulations. The study concludes that lack of awareness on combined hazards, lack of infrastructure facilities, and people's perceptions are reasons for that low level of emergency disaster response reported during the period. Moreover, it is important that make proper emergency response plans for highlighting multi-hazards scenarios in the country.

Keywords: ***Disasters, Multi Hazards, Preparedness, Response***

ABSTRACT ID: 87

IDENTIFICATION OF THE KEY THEMATIC AREAS FOR HEALTH PREPAREDNESS IN DISASTER RISK REDUCTION

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Abstract

INTRODUCTION AND OBJECTIVES

Pandemics are not frequent, yet when they do occur, they can have a devastating impact on human wellbeing. Causing more than 5 million deaths worldwide, COVID-19 is already recognised as one of the worst pandemics in human history, with far reaching health impacts, but also disrupting sustainable development, and economic and social growth all over the world. Global policies, like the Health Emergency and Disaster Risk Management (HEDRM) Framework, along with country level practices, have been introduced by decision makers to address such threats. However, international and national institutions are now looking to develop better preparedness and coping strategies to face future pandemic threats. There is also increasing recognition that pandemic preparedness should be integrated with wider disaster risk reduction efforts. In order to support such efforts, this study set out to identify the key thematic areas of health preparedness which can be integrated with disaster risk reduction for improved pandemic preparedness.

METHODS

A desk review was carried out across academic research, institutional reports, and policies. Emerald, SCOPUS, Science Direct, and Springer databases were used to search for academic studies, while the World Health Organization and United Nations websites were used to identify and source relevant institutional and policy reports. These included the HEDRM Framework, 2030 Agenda for Sustainable Development, and the Sendai Framework for Disaster Risk Reduction. The key words used for the search include health preparedness, pandemic preparedness, disaster risk reduction, disaster resilience, and COVID-19.

RESULTS

Analysis revealed twenty-two key concepts related to disaster risk reduction and health preparedness. They were further classified into four key themes: bio-security risk management; socio-ecological vulnerability; strategic management; and preparedness planning.

RECOMMENDATIONS AND CONCLUSIONS

These key concepts and themes will inform the next phase of the research, which seeks to develop improved health preparedness strategies as part of wider disaster risk

reduction efforts. Further research will involve fieldwork in Padang Province, Indonesia, to understand how these key concepts and themes relate to current arrangements for pandemic preparedness.

Keywords: ***Disaster Risk Reduction, Health, Preparedness, Pandemic***

ABSTRACT ID: 91

UNDERSTANDING DISASTER RISK GOVERNANCE ISSUES IN MULTI-HAZARD CONTEXT: THE CASE OF SRI LANKA

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Abstract

INTRODUCTION AND OBJECTIVES

Several national and international agencies have identified Sri Lanka as a high hazard country. Over time, Sri Lanka has faced different hazards, including multi-hazards. COVID-19 is the recent multi-hazard reported in Sri Lanka with other natural and man-made induced hazards. Accordingly, Sri Lanka introduced several disaster management mechanisms long ago to minimise the impacts of hazards. After the 2004 Indian Ocean tsunami incident, the Sri Lankan disaster management system received significant attention, becoming more systematic.

Nevertheless, there are still gaps in the Sri Lankan disaster management system specifically relating to disaster risk governance (DRG), which is the case for many countries worldwide. Weak DRG has generated catastrophic impacts worldwide during the COVID-19 outbreak. Leading global frameworks have recognised DRG as a key priority for strengthening future disaster resilience within this context. Hence, the study was conducted to explore the challenges related to DRG within the disaster preparedness system in Sri Lanka.

METHOD

The study was conducted in the Sri Lankan disaster preparedness system due to the high and frequent hazard profile. The study conducted 14 expert interviews as semi-structured interviews with the key informants relating to the disaster preparedness system. The data were thematically analysed to identify the DRG-related challenges under key categories.

RESULTS

The study found more than 40 issues related to DRG within the disaster preparedness system and presented under five thematic areas following the Risk Governance Framework. Accordingly, the challenges are presented under pre-assessment, appraisal, characterisation and evaluation, management and cross-cutting themes.

CONCLUSIONS AND RECOMMENDATIONS

The study recommends decentralisation of power, collaborations between agencies, strengthening disaster preparedness plans, raising awareness and disaster management education, conducting disaster-related research, allocating more resources, strengthening monitoring mechanisms and introducing legislative changes addressing the challenges.

These evidence-based recommendations will strengthen the DRG within the disaster preparedness system towards a resilient country.

Keywords: ***Disaster Risk Governance, Sri Lanka, Disaster Preparedness System, Hazards***

Symposium Theme 6

Early warning and risk communication strategies on multi-hazard scenarios for concurrent and cascading hazards

ABSTRACT ID: 11

ASSOCIATION OF ABO RH GROUP WITH DENGUE INFCETION

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Abstract

INTRODUCTION AND OBJECTIVE

Currently there is no specific treatment or vaccine for dengue. One of the genetic factors influencing the severity is ABO blood group. The aim of the study to find an association between ABO Rh blood groups and dengue infection.

METHOD

It was a case control study conducted in Teaching hospital, Peradeniya, Sri Lanka in year 2021. Serologically confirmed dengue patients were recruited to this study. Control group was apparently healthy volunteers. Ethical approval was obtained from PGIS, University of Peradeniya, Sri Lanka. EDTA blood sample was collected and ABO, Rh blood grouping were determined by tube method. Platelet count and HCT were determined by using Mindray 6800 automated analyzer.

RESULTS

Among 220 participants 109 were dengue patients and 111 were apparently healthy control. Among dengue patients, 72.5% were males. Blood group B (48.6%) and Rh positive (97.2%) blood group were found higher in frequency. Among control, 59.5% were females. Blood group O (38.7%) and Rh positive (91.9%) blood group were found in higher in frequency. Significant difference was obtained platelet count ($p=0.000$) and HCT ($p=0.0163$) between case ($98.23\pm42.5x10^3/\mu l$ and $38.98\pm5.11\%$) and control ($316\pm44.4x10^3/\mu l$ and $40.42\pm3.51\%$) but not in age. Significantly lower ($p<0.05$) platelet count was obtained in group A, B and O dengue patients than control. No significant difference was obtained in HCT in any blood groups among case and control.

Chi-square test results showed that there was an association between the ABO blood groups and dengue infection. Blood group A was significantly negative associated ($p<0.0001$, OR: 0.186) and decreased risk of dengue infection. Blood group B was significantly associated with dengue infection ($p=0.001$, OR: 2.56) and had a higher risk.

No significant association was obtained between dengue infection and group AB ($p=0.084$), group O ($p=0.282$) and Rh group ($p=0.080$).

CONCLUSIONS AND RECOMMENDATIONS

Blood group B was associated with an increased risk and blood group A having less chances of dengue infection. To confirm the association between the ABO blood grouping and severity of dengue the study needs to be done in larger sample size.

Keywords: ***Association, Blood Group, Dengue Infection***

ABSTRACT ID: 23

RISK COMMUNICATION AND SOCIAL MOBILIZATION TO COUNTER DENGUE OUTBREAK IN MAWITTARA GN DIVISION- PILIYANDALA MOH AREA

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Abstract

INTRODUCTION AND OBJECTIVES

During the early days of January 2022, about 15 dengue cases were reported in two weeks. Subsequently, healthcare workers visited this area and found many breeding places inside and outside household premises.

The main objective of this project is to communicate the risk to affected people and get maximum participation of community groups to control dengue transmission in the Mawittara GN division.

METHOD

A team consisting of Medical Officer of Health, Additional Medical Officers of Health, supervisory grade public health officer and area public health inspector had a productive discussion, and they planned to conduct a special outbreak mitigation programme with the collaboration of government and non-government organizations in the area. As the initial step, a meeting was arranged with government officers, politicians and non-governmental organizations and with their ideas, a strategic plan was designed to control the outbreak. Then, an entomological assistant performed a pre-survey in this GN area to get an idea about breeding places. Public awareness programmes in the area were done using a public advertisement system in late evenings, weekends and public holidays. Banners were displayed in the GN area to inform people about the programme. A one-day special programme was conducted with health workers, community workers, volunteers, government officers, and religious leaders. A container collecting programme was also held in collaboration with Kesbewa urban council. Public announcements were made to empower people, and teams consisted of a special team for roof gutter inspection. Leaflet distribution was done, and important messages were communicated to the community.

RESULTS

According to the post-survey, the number of discarded items was reduced. According to the pre-test of the entomological survey, the premise index was 17%, the container index was 21.5%, and the Breatu index was 23. After the programme, they changed to 4%,11.8% and 4 respectively. Furthermore, the Mawittara GN division has reported no dengue cases for the last two weeks.

CONCLUSIONS AND RECOMMENDATIONS

Risk communication and social mobilization is powerful method in controlling dengue transmission. Moreover, community participation is very effective in controlling communicable diseases. Therefore, this strategy is useful for controlling dengue outbreaks in high-risk areas.

Keywords: ***Risk Communication, Community Mobilization, Outbreak Management***

ABSTRACT ID: 57

MOBILE AND WEB-BASED GIS APPLICATION TO MONITOR DENGUE SURVEILLANCE, OUTBREAK PREDICTION, DETECTION, AND RESPONSE FOR DENGUE

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Abstract

INTRODUCTION

During the recent past, morbidity and mortality related to dengue fever and associated complications has been the most important epidemiological concern for infectious disease related public health policy makers of Sri Lanka. The routine notifications for dengue fever are being done on clinical suspicion, where considerable delays are inevitable on case investigations. The provincial department of health services (PDHS), Western province introduced new notification and response strategy using mobile and web-based GIS to improve the timeliness and sensitivity of notifications and control spread dengue disease on positive NS1 Dengue antigen test. This was achieved through implementing laboratory based real-time mobile and web-based GIS facilitated antigen surveillance system for notification and rapid preventive response for confirmed dengue cases within the Western Province.

METHODS

An online notification platform was established from April 2016, for Colombo District and was expanded to cover the entire province. The data were fed by public system as well as from the main laboratories of private sector. The notification process was initiated at the laboratories by creating a new notification whenever a Dengue antigen test result was detected as positive. Notifications were forwarded to the relevant Medical Officer of Health (MOH) area by the centralized unit (PDHS Office) for MOH to update action implemented to complete the response process. A dashboard visualizes the status of each notification and facilitates statistical evaluation. Case mapping and tracing can be readily performed using mobile and web-based GIS.

RESULTS

Salient features of the novel system are instant notification of antigen positive patients, the rapidity of notification(real-time) and response, user-friendliness, access to multiple stakeholders simultaneously without data duplication, early involvement of the field staff,

the ability to trace the cases using checklists and a GIS from a dashboard. During the period of 2019 – 2020, using this system, 4792 new antigen positive dengue cases have been reported by the laboratories, and 90% of these were within the first 3 days of testing. Of these, 2855 cases have been sent to PDHS and/or MOH, while feedback from MOH has been received for 1661 cases.

CONCLUSION / RECOMMENDATION

This can be implemented with improvements at national level to produce a better early warning and response system for Dengue surveillance in Sri Lanka and augment the existing surveillance under the directives of the ministry of health.

Keywords: ***Early Warning and Response System, NS1 Surveillance, Real-Time Surveillance, Dengue Notifications, GIS Mapping***

ABSTRACT ID: 63

DEVELOPMENT OF A DENGUE SITUATION REPORT FOR TIMELY RISK COMMUNICATION

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Abstract

INTRODUCTION AND OBJECTIVE

Timely notification of patients is important for the prevention and control of dengue. Currently, in Sri Lanka, dengue patients are notified through two systems: a paper-based system and an electronic system.

Decision-making on control activities and resource allocation based on raw data is challenging.

A weekly situation report on dengue is generated by the National Dengue Control Unit (NDCU) summarizing the burden imparted upon the preventive and curative health sectors.

The objective of generating a situation report is to ensure effective and timely communication with relevant authorities in the preventive and curative health sectors for better decision-making.

METHODOLOGY

In public health sector, number of dengue patients at the district and all Medical Officer of Health (MOH) areas are focused on, data for which is received via the electronic dengue surveillance platform; 'DenSys', which receives notifications from both government and private hospitals. The number of dengue patients treated at 69 sentinel hospitals across the country is received through the daily 'Midnight total of dengue patients' reports.

All collected data are cleaned and analyzed to study the percentage reduction or increase in weekly district-wise dengue patients compared to the week before and increase or decrease of weekly average midnight total of dengue patients compared to the week before.

Analyzed data are then compiled to categorize MOH areas according to risk-based criteria. All analyzed data are illustrated in graphs and colour coded tables for better comprehension.

RESULTS

The report is disseminated to public health and curative sector administrators for necessary actions. Each MOH is notified of its current status, which would empower them to decide on necessary preventative health measures in line with their risk status.

At the central level, special dengue prevention and control programmes are planned according to the risk criterion, hence resources could be targeted to the most essential areas. Based on the report, reginal health authorities have also been able to tailor made control programmes to specific localities, thus preserving the services of skilled workers for the most needed eventualities.

CONCLUSION AND RECOMMENDATIONS

The applicability of ground-level data for action could be enhanced by analyzing them to visualize their change over time. Timely communication of such data would augment the capacity of regional health authorities to identify their risk status and initiate a timely response.

Keywords: ***Situation Report, Risk Communication, Outbreak Preparedness***

ABSTRACT ID: 72

D-MOSS: USING SPACE TECHNOLOGY TO PREVENT DENGUE FEVER OUTBREAKS

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Abstract

Dengue is the fastest-growing mosquito-borne viral infection in the world today. It is present in over 150 countries, and it has been estimated that annually dengue affects 390 million people and has a global cost of almost US$9 billion per year.

The Dengue MOdel forecasting Satellite-based System (D-MOSS) is the first fully integrated dengue fever forecasting system incorporating Earth Observation (EO) data and seasonal climate forecasts to issue warnings on a routine basis. The system is being piloted in Vietnam from June 2019 and in Malaysia and Sri Lanka from August 2020.

D-MOSS integrates data derived from a variety of different sources: live and historical satellite data, weather forecasts, on-the-ground observations, climate and meteorological data and other geo-located information related to dengue outbreaks. D-MOSS also includes a surface water availability component as this can be a key factor affecting mosquito breeding habits. Once the data is collected it is fed into statistical models of disease incidence, which produce the forecasts of dengue outbreaks. These forecasts are made available on a simple, regularly updated user interface, which shows the likelihood and location of an outbreak up to six months in advance.

This allows preventative measures to be taken. Authorities on the ground can strategically plan interventions in advance, moving resources to where they are most effective.

The interface has been designed to be user-friendly, after a series of consultations with end users. The system's architecture is based on open and non-proprietary software, where possible, and on flexible deployment into platforms including cloud-based virtual storage and application processing.

Early results from Vietnam and Malaysia indicate that D-MOSS is able to change their reactive approach to dengue prevention to a more proactive one. The system is shown to be reliable, cost-effective, and can be easily replicated elsewhere, at a range of different scales. A D-MOSS system is currently being piloted in Sri Lanka, and advanced discussions are also taking place with other countries in Asia.

The D-MOSS project is funded by the UK Space Agency's International Partnership Programme.

Keywords: ***Dengue, Early Warning, Forecasting, Satellite Data***

ABSTRACT ID: 73

A STUDY INTO THE KEY ACTORS IN LOCAL DISSEMINATION OF TSUNAMI EARLY WARNING, AND THEIR ROLES AND RESPONSIBILITIES

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Abstract

INTRODUCTION AND BACKGROUND

After the destructive 2004 Indian Ocean Tsunami, there was international attention on establishing a tsunami early warning system in the region. Despite these efforts, disseminating warnings to the local communities at risk, the so called 'last mile', remains a challenge. This is especially the case for near-field tsunami threats, as demonstrated by the 2018 Palu and Sulawesi tsunami events.

This study is part of a wider research project that is undertaking a detailed investigation into the dissemination of tsunami early warnings to local communities at risk. A key research question of the project is who are the key actors involved in tsunami early warning at the local level and what are their roles and responsibilities?

METHOD

In addressing this question, a desk-based study was carried out, comprising a systematic and narrative review. A systematic review protocol was developed and thirty-six research articles were selected and supplemented by a narrative review of grey literature, including eighteen policy and guidance manuals. NVIVO20 was used to carry out thematic analysis for data extraction.

RESULTS

The systematic review identified seven key local actors: local governing bodies, local community, NGOs, police and armed forces, schools, hospitals, and hotels. Notably, some actors often associated with early warning in policy and guidelines, such as critical infrastructure, are not discussed in the published research studies. Also, very few studies describe the legal mandates where roles and responsibilities of local actors are specified.

The key actors have varied roles and responsibilities across countries, and in some instances, within the same country. For example, the role of local governing bodies is not only for warning dissemination to the community, but can also involve a much wider role before, during and after a disaster. The varied nature of governing bodies in the studies reflects the specific governance structures of each country under investigation, including the extent to which decision-making is (de)centralised. The different levels and terminology associated

with local government also makes it difficult to draw comparison across countries or compare the findings.

CONCLUSIONS AND RECOMMENDATIONS

This is an area of research that is growing in interest with more work being published. However, the lack of common methodological approaches across studies, as well as the lack of detail in the presentation of research methods, makes direct comparisons across studies more difficult. There is a need for a stronger conceptual basis to underpin future work, and enable comparison and learning.

The findings from this desk study will inform further fieldwork in Indonesia, and contribute to the development of a detailed conceptual framework and improved guidance for localising tsunami early warning.

Keywords: ***Early Warning, Tsunami, Dissemination, Local, Roles and Responsibilities***

ABSTRACT ID: 83

FUNDAMENTALS OF PANDEMIC AND EPIDEMIC RESPONSE: A REVIEW OF STAGES AND KEY ELEMENTS OF PANDEMIC WARNING AND RESPONSE SYSTEM

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Abstract

INTRODUCTION AND OBJECTIVES

Overwhelmingly infected cases of the SARS-CoV-02 virus reported globally since the first outbreak, have plunged many governments to transform their public health emergency systems to be more effective and resilient. Recently emerged 'Omicorn' strain and IHU variants signal that the edge of the Covid-19 pandemic is not as close as scientists are expecting. Moreover, the virus strain reported very recently from Cyprus called 'deltacorn' is suspected to be a result of unexpected laboratory contamination which highlights an unforeseen global risk in the near future. Therefore, early detection and early actions are really necessary with a comprehensive preparedness mechanism to mitigate public health challenges associated with infectious diseases around the world. Risk and vulnerability in the public health system increases in any country as many outbreaks are transboundary. Therefore, comprehensive preparedness and response strategies should be established to face alarming threats of epidemics and pandemics with more focus on strengthening the detection and response interface at both global and domestic levels. The objective of this research paper is to analyse the core elements of epidemic and pandemic response systems and develop a detailed framework by interconnecting identified elements in line with the detection-preparedness-response interface.

METHOD

The study is a complete desk review, based on the published research in electronic databases and the systematic literature review method used for literature mining and analysing. The research article extracting was carried out using PubMed, Scopus, and ScienceDirect at three independent instances by administering Boolean search operator which was formulated based on the syntax generated by the key strings.

RESULTS

An extensive framework focusing on epidemic and pandemic preparedness and response is prepared based on the key elements identified through the literature survey. Findings suggest that primary epidemiological surveillance and the detection of infectious diseases including zoonotic pathogens are the keys to the warning and dissemination process in any pandemic and epidemic context. Both zoonotic and climate surveillance are significant as many pathogens emerge either independently or frequently with the changes

of the environmental conditions, especially during the rainy and drought seasons. Two early warning points have been suggested in the analysis framework as primary alert and secondary alert where dissemination is needed with detecting viruses and starting outbreaks. The effectiveness of the primary diagnosis, screening, risk and vulnerability assessment, and prediction are, however, determined by the efficacy of the detection and dissemination process, especially in the local transmission stage. Further, preparedness and response strategies which are followed by the preventive strategies and pharmaceutical and non-pharmaceutical countermeasures play a key role in the amplification phase of the outbreak. Measures for elimination are set to the reducing stage of the virus outbreak and lessons learnt from the event circulate to the beginning of the process for new normal or better policy transformation for the anticipated future outbreaks.

Keywords: ***Epidemic, Pandemic, Public Health Emergencies, SARS-CoV-02, Preparedness, Response***

ABSTRACT ID: 100

MULTI-HAZARD EARLY WARNING SYSTEM FOR COVID -19 PANDEMIC: CASE OF SRI LANKA

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Abstract

INTRODUCTION

A critical aspect of disaster risk reduction is the efficient functioning of multi-hazard early warning systems that are owned by States, which also require a high degree of international and multilateral cooperation. However, progress in early warning is uneven across Asia, with some high-risk, low-capacity countries falling behind. There is also uneven progress by hazard type and sub-region.

Sri Lanka's, MHEW is designed for communicate from Upstream to downstream in Sri Lanka. It is essential to ensure capacity of the EW system. There is a need to identify the gaps associated with the dissemination and community reception of the cascade disasters within the backdrop of the pandemic situation.

METHODS

Analyze and evaluate the present capacity of MHEW system and to further evaluate the ability to fulfill the early warning demand by the communities and the responders in the event of pandemic situation in Sri Lanka. Data and information collected and analyzed through a case study of response of the 117 call center and EOC took place in 2020.

RESULTS

There have been only one monsoon flood occurred in 2020, to coincide with the COVID pandemic in Sri Lanka. All warnings and associated information was disseminated with specific covid pandemic related guidelines. However, some aspects of the community early warning system could not be operated due to probabilities of contamination from the virus. Also observed that DMC wasn't engaged actively with the dissemination of the warning of the pandemic, as warnings, guidelines, information and advices directly disseminate by Health Ministry and the covid -19 special taskforce appointed in Sri Lanka.

CONCLUSION

Official EW messages could not be transmitted up to grass root levels, due to lack of employers and many of the department and institution branches were closed. Mobile phones and social media were increasingly used by all communities for gathering of information purposes. The early warning dissemination associated with the COVID pandemic amidst other natural hazards was very challenging. DMC needs to undertake the early warning dissemination as per the DM Act Sri Lanka. Therefore, there need to

be much better cooperation between the DMC and the Health authorities on how early warning need to be in light of compound hazards.

Keywords: ***Early Warning, Cascade Disasters, Pandemic***

Symposium Theme 7

Built environment resilience and innovation in addressing biological hazards and multi-hazard scenarios

ABSTRACT ID: 09

CONSTRUCTION OF A POND AT THE PILIYANDALA MOH OFFICE PREMISES TO BREED GUPPI FISH FOR DISTRIBUTION AS A BIOLOGICAL METHOD OF MOSQUITO CONTROL

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Abstract

INTRODUCTION AND OBJECTIVES

Entomological survey of 2020-2021 revealed that guppy fish can be grown as a biological control method in most of the mosquito breeding places in the area. Guppy is a well-known larvivorous fish which would help in controlling mosquito breeding.

The Green Productivity Circle of our office aimed to provide guppies to those in need by launching this project in the outdoor premises of the office.

METHOD

The team finalised the location to design a pond, making sure it was visible to visitors. Thereafter, they gave the pond a creative touch by designing it in the shape of a fish. Initial construction was completed in about a week, followed by a two-week stagnation process. About 150 guppies were donated to the project by a local pet fish exporter and he agreed to supply fish for the project each month. Measures were taken to protect the fish from environmental hazards and to make the project sustainable. A net with an iron frame was designed to protect the fish from birds. Moreover, the pool was cleaned weekly by a team of disease control assistants.

RESULTS

Field mosquito control assistants released these guppies breed within the pond to more than 18 drains and other water bodies suitable for breeding identified in the field. This project had an indirect impact in decreasing the total number of cases in the Piliyandala MOH area by 76.7%, reducing the average number of cases per year from 282 to 65.

CONCLUSIONS AND RECOMMENDATIONS

Guppies were distributed among the public in high risk Grama Niladari Divisions and they were able to contribute in reducing dengue cases with minimum effort. This method could be replicate elsewhere in the island as a sustainable, cost effective and environmentally friendly mosquito control method

Keywords: ***Dengue, Green Productivity, Empower***

ABSTRACT ID: 10

APPLYING 3R CONCEPT FOR WASTE MANAGEMENT TO REDUCE POTENTIAL MOSQUITO BREEDING PLACES IN PILIYANDALA MOH AREA IN A PRODUCTIVE MANNER

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Abstract

INTRODUCTION AND OBJECTIVES

According to the 2020-21 entomological survey conducted in the area, nearly half of the mosquito breeding places included tires, plastic bottles and other discarded receptacles. This project aims to reuse the above disposable materials using the 3R (Reduce, Reuse, Recycle) concept and demonstrate how they can be used in a productive manner.

METHOD

Finding the necessary material (discarded items) and usage of these items were decided through brainstorm discussions with the staff at Medical Officers of Health (MOH) Office Piliyandala. The location to collected items was decided as Karadiyana garbage yard as it was close by to the MOH office and they segregate discarded items. The selected items were tires, plastic bottles and other items that can be used to grow plants. Tires were converted into huge figures of elephants and kept on the ground to both cultivate plants and for environmental beauty. Plastic bottles were put up in walls to grow plants, minimizing the space needed. Discarded tiles, gutters and pots were modified as vases to grow plants. Appropriate flower plants and vegetable plants were obtained from a local plant seller. This project also included to collect PET bottles in the MOH office premises to limit the waste items generated in the environment which relate to the concept of "Reduce". These methods of productive usage of discarded items were communicated to the general public through mosquito control assistants attached to the MOH office.

RESULTS

Through this project, we were also able to show how discarded items can be utilized productively and the general community was made aware on this.

After 2020, the total number of cases in the Piliyandala MOH area has decreased by 76.7%, reducing the average number of cases per year from 282 to 65 which can be attributed to this strategy of source reduction.

CONCLUSIONS AND RECOMMENDATIONS

This project facilitates the main strategy of dengue control through source reduction of mosquito breeding sites. Evidence generated through this project could be an example for other Medical Officer of Health areas with challenges in waste management.

Keywords: ***3R Concept, Disposable, Waste***

ABSTRACT ID: 24

MULTI-HAZARD PREPAREDNESS AND RESILIENT CITIES; A SYSTEMATIC REVIEW OF EXISTING URBAN PLANNING STRATEGIES IN TSUNAMI PRONE AREAS

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Abstract

Coastal cities are home to an increasing proportion of the world's population. They are also more exposed to a range of natural hazards that increase disaster risk, including tsunamis, cyclones, flooding and coastal erosion. Many of these hazards can occur as independent events, but they can also pose a multi-hazard threat. In contrast to a single-hazard event, the occurrence of multiple hazards in coastal areas poses a range of additional challenges due to the differing characteristics and processes, and wide range of potential scenarios. The COVID-19 pandemic has also revealed the potential for natural hazards to combine with other hazards, such as biological. In order to address such threats, sustainable urban planning is an important strategy for reducing disaster risk. Therefore, this study aims to identify and better understand the kind of urban planning strategies that can be applied to reduce multi-hazard risk in tsunami-prone areas. A systematic review and a meta-analysis is carried out using the peer-reviewed journals and articles in scientific databases related to the research field with the following key words: Urban Planning, Tsunami and Multi Hazards. After applying inclusion and exclusion criteria, 56 sources were selected for the review. The result suggests that the most of the studies focus on single hazard threats, rather than addressing the complexity, for example, coupled or cascading events in coastal regions. Tsunamis and floods were the most frequently discussed event under urban planning in coastal regions whereas coastal storms, landslides, health disasters were less represented. The results reveal that many of the existing studies focus on evacuation planning strategies, while community participation and spatial planning are also frequently addresses. However, there has been a lack of studies on environmental, health and demographic perspectives in urban planning and how these could contribute to risk reduction efforts. The findings of the systematic review will be used to guide global and national actors in order to better understand how urban design may address systemic risks and multi-hazard events in tsunami-prone regions. The paper presents suggestions for future urban planning research and provides a generic framework for structuring urban planning and working toward sustainable urban planning in coastal cities.

Keywords: ***Multi-hazard, Coastal Cities, Systematic Review***

ABSTRACT ID: 25

INCLUSION OF HEALTH IN ENVIRONMENTAL IMPACT ASSESSMENT LEGISLATION: A REVIEW OF DEVELOPED AND DEVELOPING REGIONS

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Abstract

The Environmental Impact Assessment (EIA) process originated in the United States in the late 1960s and early 1970s, and is now the most developed, recognised and institutionalised form of impact assessment. EIAs are often based on explicit legal regulations, and inclusive and informed decision making on project proposals. Despite their increasing use, the negative health and environmental impacts of development projects have generated growing public concern across the world. It is therefore timely to revisit current EIA legislation and consider how effectively it addresses the human health impacts of projects. This study compares health in EIA legislation within eight developed and developing countries: Brazil, Canada, Germany, India, Sri Lanka, Sweden, United Kingdom, and USA. A desk study was carried out on country specific EIA legislation, with a special focus on national level studies of EIAs, legal texts and guidelines that underpin the design and methodology of EIAs, as well as an overview of how health is addressed in EIA assessments in the target countries. This study only included full-length articles for analysis and documents written in languages other than English were excluded. Content analysis of EIA legislation and the treatment of human health show that a majority of the eight countries have, in their EIA legislation, some reference to impacts on humans or on human health (or related concepts). Most of the health issues within EIA legislation and guidelines are related to air, water, soil and noise pollution, and their biophysical effects. These are areas for which quantitative assessment methods are available and threshold levels have been set. Further, the definition of human health in legislation and guidelines varies and tends to be quite unspecific and vague. Findings also reveal that wider health determinants and physicochemical health impacts were often ignored in the EIA legislation in developing countries. Further, in most countries, the potential impact on public health and the most vulnerable groups have been missed in the legislation process. The findings suggest the need for a clearer reference to human health within EIA legislation and guidance, including consideration of the whole range of health determinants, as well as positive and negative health impacts. These results highlight the critical value of increasing capacity, both within and outside of government, to fully recognise the health impacts of road development through EIA practices. Policymakers should establish a proper health impact assessment for all road construction projects to tackle the broader public health issue under the EIA process.

Keywords: ***EIA, Public Health, Desk Study, Developing Countries, Developed Countries***

ABSTRACT ID: 30

COVID-19 CONTROL MEASURES IMPACT ON LAND SURFACE TEMPERATURE IN DEHIWALA MOUNT LAVINIA SUBURB IN 2020 - A CASE STUDY

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Abstract

COVID-19, a severe acute respiratory syndrome has had multifaceted effects on human lives, society, and economic activities all over the world since its initial outbreak in late December 2019. The health emergency has led to rigorous worldwide containment measures for minimizing the spread of the virus in terms of social distancing, limitation of industrial production, human activities and transportations which have also had some positive impact on the atmospheric environment with less human engagement. Dehiwala-Mount Lavinia Divisional Secretariat Division (DSD) is the largest suburban area in Sri Lanka and holds the second highest population in the country. The present study aims to investigate its environmental status during COVID-19 pandemic travel restrictions and highlight the importance of the risk of Urban Heat Island (UHI) and its interactions with global climate change.

Land surface temperature (LST) and Normalized Difference Vegetation Index (NDVI) during the lockdown period (April, 2020) and the normal working period (April, 2019) in Dehiwala-Mount Lavinia DSD. The Landsat 8 satellite images were used for the research study, and the processing was accomplished in the ArcMap 10.5 using Mono window Algorithm.

Results exhibited that, the LST is reduced and NDVI is increased during the lockdown phase than the normal working periods which highlights the reduction of transportation related pollution and anthropogenic activities which are the major influencers behind lowering of the LST. It also indicates negative correlation between the LST-NDVI. Further investigation indicated that some of the high temperature zones are permanent, and that the Aththidiya wetland has greatly reduced the surface temperature of the eastern portion of the Dehiwala-Mount Lavinia division.

Therefore, it is a timely requirement to set up suitable strategies for the mitigation and the adaptation to UHI and other related causes and it is recommended to establish a permanent national network for monitoring the development of the UHI and implementing mitigatory measures through policymaking.

Keywords: ***LST, NDVI, UHI, Dehiwala-Mount Lavinia, COVID-19***

ABSTRACT ID: 46

CREATING CITIES SUSTAINABLE AND RESILIENT TO DISASTERS AND THE PANDEMIC: THE CASE OF THE NIGER DELTA REGION OF NIGERIA

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Abstract

This study centres on the importance of creating cities that are sustainable and resilient to disasters and pandemics in the Niger Delta region of Nigeria. Natural and man-made hazards have continued to ravage various countries of the world at an unprecedented rate. Statistics shows that about 335 natural disasters were recorded all over the world in 2017 and it killed about 9,697, affected over 95.6 million people and generated a loss of US $335 billion. In Nigeria, the 2020 statistics demonstrates that about 169,000 persons were displaced by disasters. Regarding the pandemic, it was noted that in the middle of December 2020, a second wave of the pandemic broke out with about 9% as daily growth of new cases, compared to 2% at the height of the first wave. This is worrisome especially because there has not been an effective solution to completely get rid of the Covid 19 pandemic; and like other hazards, it can significantly affect the vulnerable groups and make even the less vulnerable more vulnerable. Strikingly, the occurrences of these disasters and pandemics in cities have highlighted the increased vulnerability of the urban centres. This makes it critical for countries to create sustainable and resilient infrastructural facilities that can help reduce the impacts of these urban disasters. Unfortunately, literature reveals that most developing countries such as Nigeria lack the sustainable and resilient infrastructural facilities to withstand disaster risks. Notwithstanding this lack, it has continued to urbanise rapidly with projection showing that from 2014 to 2050, its urban population will have an additional increase of 212 million people. This increase without sustainable and resilient infrastructure heightens the vulnerability of the teeming population and escalates losses.

Accordingly, the researcher conducted ten (10) expert interviews and two (2) focus group discussions with each group made up of four (4) participants to understand why it is important to create cities that are sustainable and resilient to disasters in the Niger Delta region of Nigeria. The informants were carefully selected experts from the field of urban planning, disaster management and the department of sustainable development. The researcher adopted thematic analysis with the use of NVivo to organise the data according to emerging themes from the field in a way that it will provide the structures with which to answer the research question. The result shows that the creation of sustainable and resilient cities in the region is important because it serves as both disaster risk reduction strategy and climate change adaption measures. Also, it helps to reduce urban vulnerability and make the cities capable of bouncing back better after any disaster and the impending dangers of the pandemic. Accordingly, it is recommended that the governing authorities, urban

planners, and other relevant stakeholders should take an urgent action to create cities that are sustainable and resilient to disasters.

Keywords: Disaster, Resilience, Sustainability, Cities, Niger Delta Region

ABSTRACT ID: 64

GUIDELINES FOR BIODYNAMIC URBAN DESIGN TO SUSTAIN IN A MULTIHAZARD AND PANDEMIC ENVIRONMENT IN THE SRI LANKAN CONTEXT

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Abstract

INTRODUCTION AND OBJECTIVES

Covid – 19, one of the most detrimental health hazards of the decade was an eye-opener for the authorities and the policymakers on the neglected prevailing threat from the biological hazards including Dengue. It has alarmed the nations to reconceive their plans for sustainable communities and economies. Even though the sustainable urban design has evolved through the past decades to a significant extent, biological hazards have been barely addressed in the local guidelines. Therefore, the focal objective of this study is reviewing the globally implemented novel elements of multi-hazard resilience in urban planning which address the pandemic scenarios and bring out essential features of a salutogenic and biodynamic city and buildings as conceptual guidelines.

METHODS

A systematic review of global and local literature was carried out using the keywords, biodynamic, urban design, pandemic, biological hazards, and sustainable infrastructure using google scholar database considering the studies carried out from 2000 – 2021. The articles written in the English language were considered for the study.

RESULTS

The review enabled identifying the main indicators of biodynamic urban design to combat Dengue, Covid 19, and similar biological hazards. Then it allowed the aforementioned guidelines to be developed considering the ergonomics, biophilic architecture, space, and materiality of infrastructure. Also, the required amendments and modifications to other hazard preparedness and response plans were suggested.

CONCLUSIONS AND RECOMMENDATIONS

After proceeding through a series of expert committee interviews these guidelines can be incorporated in the Green SL Rating tool for Sustainable Cities or similar incentive framework or rating system.

Keywords: ***Pandemic, Biodynamic Design, Infrastructure, Sustainable***

ABSTRACT ID: 76

INCORPORATING MOSQUITO PREVENTION APPROACHES INTO THE GREEN BUILDING RATING TOOLS IN SRI LANKA

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Abstract

Climate change has become a significant challenge that the world is facing now. Considering the severity of the impacts of climate change, nations have tended to initiate actions to control climate change by following sustainable development. Buildings are one of the key factors of climate change as it is responsible for 38% of global carbon emissions and 50% of global material usage. Hence, incorporating green concepts into the buildings has become essential. The trend of Green Buildings has been established in Sri Lanka also. Green building rating tools such as GREEN$^{SL®}$, LEED, BREEAM guide the community to enhance the buildings with respect to Sustainable Site, Water Efficiency, Energy and Atmosphere, Materials and Resources etc. But some of the green concepts like green roofs and green walls can create a healthy environment for mosquitoes providing breeding places due to the presence of water and water gathering places. As a city belonging to the same climate zone as Sri Lanka, Dhaka city in Bangladesh has suspected green roofs as a possible mosquito breeding location. Even though some countries like China have done detailed investigations regarding mosquito breeding in green components of buildings, there is a lack of studies in Sri Lanka related to this study area. As an initial step, this study aims to investigate and discuss the possibility of mosquito breeding in green components of a building under the tropical climate, possible locations for mosquito breeding in green components of a building, and prevention strategies by combining the views of experts in both green building and mosquito prevention subject areas. Furthermore, this study suggests a section to Green Building rating tools that practices in Sri Lanka summarizing the mosquito prevention strategies in the green components of a building.

Keywords: ***Green Buildings, Mosquito Prevention, Green Building Rating Tools, Sri Lankan Context***

ABSTRACT ID: 77

INTERRELATIONSHIP OF BIOLOGICAL HAZARDS AND INFRASTRUCTURE SYSTEM IN SRI LANKA

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Abstract

The COVID-19 outbreak and its rippling effects have caused devastating impacts on Sri Lankan infrastructure sectors. Among many, the healthcare sector is the prominent sector that battles the impacts of these biohazards despite limitations in the available infrastructure. This has led us to rethink the effect of a sudden outbreak of biohazards on various infrastructure sectors in Sri Lanka, which is an unspoken area in the extant literature. Thus, this study aims to identify the interrelationships between biological hazards and the infrastructure system in Sri Lanka.

This study involved an initial literature synthesis in identifying the extent to which the existing research gap has been addressed in the extant literature. Google, Google Scholar and ScienceDirect databases were used to search for relevant literature materials while securing maximum coverage. Moreover, advanced search tools were used to search literature materials. The findings suggest that the transportation sector has become vulnerable to airborne biological hazards due to existing policies, practices, design, and operation. Agriculture, water supply, and irrigation sectors are extremely vulnerable to waterborne biohazards. Water resources in Sri Lanka are mostly poorly managed, depleted and degraded due to various anthropogenic activities, and many water bodies are polluted. Over the years, water contamination incidents have been recorded in the Rathupaswala, Jaffna, and Kelaniya areas, causing massive social uproars. Moreover, the spread of chemical contaminants through irrigation methods causes devastating impacts on people. The interconnectedness of infrastructure sectors may ultimately endanger the food security of the country.

Globally, hazard management planning and response strategies have yet to consider the non-linear transition of biohazards. Consequently, the community has become prone to long-term crises, raising the community's vulnerability to multi-hazard cascading risks, which produce complex secondary events and interactions. Although the Disaster Management Act. No. 13 of 2005 of Sri Lanka has recognised biohazards such as epidemics as a hazard type, the existing pandemic and epidemic preparedness plans have not provided due attention to the role played by the other infrastructure sectors, except for the healthcare sector. Thus, this study highlights the criticality and timeliness of addressing the interrelationship between various infrastructure sectors and biological hazards.

Keywords: ***Biological Hazards, Infrastructure, Interdependencies***

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CHALLENGES OF URBAN AGGLOMERATIONS IN HEALTH PREPAREDNESS DURING PANDEMIC

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Abstract

INTRODUCTION AND OBJECTIVES

Urban agglomerations are becoming a vital geographic unit for nations to sustain economic growth and development. However, due to their complex and interconnected nature, they are also especially exposed to climate change impacts, and natural and biological hazards.

COVID-19 has rapidly developed into an unprecedented health, economic and geo-political crisis. It has also created temporary "manufacturing deserts", whereby a city, region or whole country's output drops so substantially, they become a no-go zone to source anything apart from essential items such as food stuffs and pharmaceuticals. It is vital that regions that are highly interconnected from an economic perspective, a key characteristic of 'agglomerations', can address how to minimise supply chain disruption in the event of a pandemic, and adjust rapidly to a changing risk landscape.

This is the first phase of a larger study. In this paper, four central research questions are addressed: How has the pandemic impacted urban agglomerations? What measures have been taken to mitigate the challenges faced by urban agglomerations during the pandemic? How prepared were urban agglomerations to minimise the impact of the pandemic? What are the regulations and policies adopted to minimize the impact of the pandemic in urban agglomerations?

METHODS

A desk study was carried out using academic literature, institutional reports, and statistical data. SCOPUS, Science Direct, and Emerald were searched using a combination of the following keywords: pandemic preparedness, health preparedness, COVID-19, urban agglomerations, and urbanisation.

RESULTS

A review of previous studies reveals that population density is a major reason for the rapid spread of COVID-19 and other epidemic and pandemic threats. Other contributory factors include extreme heat, confined spaces, mass transit, reinhabitation, the impact of air pollution, and informal settlements. Defensive measures have helped to limit some of the short-term impacts of the virus, but also resulted in a shift of priorities, alterations in work processes and venues, physical distancing, self-isolation, and quarantine measures,

as well as temporary lockdowns of entire communities. These tend to disproportionately affect disadvantaged groups, including people in poverty and migrants, who most often live in overcrowded and under-resourced settings, and depend on daily labour for subsistence. In order to reduce risk, a number of strategies have been adopted, including polycentric urbanisation, heat adaptation strategies, ecology-based construction, and public open spaces.

CONCLUSION AND RECOMMENDATION

The impact of COVID-19 has exposed the limitations of existing measures. The results of this review are informing further research to understand how to increase pandemic preparedness in urban agglomerations.

Keywords: ***Urban, Agglomeration, Pandemic, Preparedness***

ABSTRACT ID: 89

DENGUE OUTBREAKS INSIDE CONSTRUCTION SITES: A FRAMEWORK TO ELIMINATE MOSQUITO BREEDING PLACES INSIDE A CONSTRUCTION SITE

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Abstract

INTRODUCTION AND OBJECTIVES

Owing to hazardous working conditions, the construction industry is considered one of the most dangerous industries in the world. With the complexity of construction projects, the risk in construction activities has increased significantly. In addition to hazardous working conditions, biological outbreaks such as dengue have emerged as a severe challenge in the construction industry. Mostly in tropical countries, construction site-associated dengue outbreaks pose severe health issues and socio-economic impacts as well. Lack of monitoring can be identified as a major reason for dengue outbreaks started in construction sites. Therefore, this study has attempted to develop a framework to monitor vector control activities inside construction sites in Sri Lanka, a country where major construction site-associated dengue outbreaks have been reported.

METHODOLOGY

Currently, the Construction Industry Development Authority in Sri Lanka devised and published a monthly reporting framework that is supported by a weekly assessment for vector controlling inside construction sites. The present study aims at developing the vector controlling framework taking the said monthly reporting system as the baseline. A comprehensive literature review which included scholarly articled, reports and plans published on vector control in construction sites was conducted initially. After identifying gaps and new areas to be included, the existing framework is amended to cover the holistic view of vector control. The improved framework is to be validated through a panel of experts which consisted of professionals from the construction field, public health sector, and academia, followed by case studies in construction sites.

RESULTS

The checklist will make provisions to inspect potential mosquito breeding places and actions taken to mitigate the impacts under the areas namely, elimination, substitution, engineering controls, and administrative controls. In relation to the proposed checklist and assessment framework, monitoring activities have to be carried out weekly. And monthly report is to be prepared based on the results of the weekly assessment. The results of the

monthly report can be incorporated in eliminating potential mosquito breeding places and planning mosquito prevention methods ahead.

CONCLUSIONS AND RECOMMENDATIONS

The monthly reporting system will consist of progress in areas namely, risk assessment, administrative support, legal aspects, education and labour training, emergency response, and review and evaluation. Based on the monthly report, construction authorities are able to take actions to enhance the preparedness for dengue outbreaks inside construction sites.

Keywords: ***Dengue Outbreaks, Construction Sites, Vector Control, Monthly Monitoring***

ABSTRACT ID: 90

VECTOR CONTROLLING IN CONSTRUCTION SITES: A SYSTEMATIC LITERATURE REVIEW ON EXISTING STRATEGIES

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Abstract

INTRODUCTION AND OBJECTIVES

Impacts of the COVID-19 demonstrated that lack of health and safety protocols in construction sites can severely affect the resilience of the industry. By its nature, the construction industry is considered one of the most dangerous industries due to its hazardous working environment. Even before COVID-19, biological hazards have impacted the health and safety level of the industry, in addition to the challenges of occupational hazards. Specially vector-borne diseases have become more frequent in construction sites since the availability of potential mosquito breeding places is high. Therefore, mitigating the risk of mosquito-borne diseases has to be considered one of the priorities in construction health and safety. In such a context, this paper aims at identifying existing strategies for mitigating the impacts of vector-borne disease outbreaks inside construction sites.

METHODOLOGY

A systematic literature review was conducted using publications done on vector controlling in construction sites. Three databases were searched using the string: ((“Mosquito” OR “Vector”) AND “Control”) AND “Construction sites”. Peer-reviewed journal articles, conference proceedings, and book chapters published only in English between 2010 and 2022 were included in the review. Based on inclusion and exclusion criteria, 10 full-text articles were used in this review.

RESULTS

According to the analysis, existing strategies in vector control can be categorized into four areas namely, breeding place elimination, larvae and pupae control, adult mosquito control, and personal protective equipment (PPE). Starting from the breeding place elimination, the effectiveness of strategies reduces to the use of PPE. In relation to the elimination of breeding places, there are measures to stop water collection and remove stagnant water where it is not practical to stop water collection. Both chemical and biological methods can be used in Larvae and Pupae control while fogging and mosquito traps can be used in controlling adult mosquitoes. Last but not least, insect repellent sprays and costumes are available to use as PPE.

CONCLUSIONS AND RECOMMENDATIONS

The most recommended measure is controlling mosquitos at their breeding places. Because the mosquito outbreaks starting from construction sites are not limited to the site premises but spread to the adjacent communities as well. Therefore, it is highly recommended to prevent a possible outbreak at its start.

Keywords: ***Vector Control, Mosquitos, Construction Sites, Larvae Control***

ABSTRACT ID: 92

UNIVERSITY ENTERPRISE COLLABORATION DURING A PANDEMIC OUTBREAK

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Abstract

INTRODUCTION / OBJECTIVES

University-enterprise collaborations (UEC) play a major role in many fields, including disaster management. Provision of necessary resources, data, and more opportunities for associated stakeholders are some benefits of UEC to universities. Similarly, UECs benefit the industry by providing expert knowledge, human resources and innovative business solutions. This importance was further highlighted during the COVID-19 pandemic, during which UECs have ramped up the race to fight the disease by contributing to vaccine development and conducting trials. Even though Asia is one of the highest affected regions from hazards, the level of UECs for disaster resilience is not even and are not well thought of across the countries in the region. In this context, a study was initiated by several higher education institutions in Asia as part of the SECRA project (Strengthening University-Enterprise Collaborations for Resilience Communities in Asia) with financial support from the European Commission to support UECs for strengthening disaster resilience in the region. A detailed literature review was conducted to develop a relational framework to guide future university-enterprise collaboration for a resilient society.

METHOD

The literature review was conducted using peer-reviewed academic papers based on their relevance and the period. The data was thematically analysed to highlight the importance of UECs for disaster resilience, specifically during the pandemic. In addition, data were analysed to identify the factors affecting UECs, identify existing collaborative frameworks, and emphasise the importance of a relational framework for strengthening UECs.

RESULTS

The literature review revealed the importance of UECs and emphasised their significance within the COVID-19 context. The study presents a Triple-Helix-Model, demonstrating governments, universities and enterprises as key stakeholders of UECs. Besides, the study identifies communities and technical agencies as additional stakeholders. Twenty-four challenges were identified from the literature review and categorised under four thematic areas of structural, material, relational and cultural. Similarly, 16 enablers were identified and categorised under the above thematic areas.

CONCLUSIONS AND RECOMMENDATIONS

The role of UEC was emphasised in the study, specifically within a pandemic context. Furthermore, the importance of a relational framework over existing frameworks was highlighted for strengthening UECs. Several strategies were identified for addressing the identified challenges based on the literature review. Accordingly, the strategies were presented under the layers of micro, meso and macro-levels, which could be considered the study's value-addition. Accordingly, the study provides an innovative relational framework consisting of three layers and additional stakeholders for strengthening UECs for building resilient communities.

Keywords: ***University-enterprise Collaborations, Relational Framework, Disaster Resilience, Pandemic, Asia***

ABSTRACT ID: 99

DIGITAL HEALTH FOR DISASTER RESILIENCE IN CITIES

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Abstract

INTRODUCTION AND OBJECTIVES

The role of cities, as a unit in the urban ecosystem, in supporting and enhancing the health and wellbeing of people has attracted growing attention over recent years. The harsh reality cities are left with, despite the global developments, demanded nothing but a sense of shared vision in reconceptualising and restoring cities. While the 'hazard-by-hazard risk reduction' approach is no longer functional, the need for cities to be resilient is now more critical than ever. The health and wellbeing of a community is a reflection of a resilient urban system and so many discussions have been emerged to improve urban resilience through enhancing the healthcare setting. Harnessing the potential of digital health and related technology innovation is one such step. This research aims to review the current literature on digital health technology solutions that contributes to building, enhancing and sustaining resilience within cities and how the broad multidisciplinary concepts of resilience and digital healthcare converge.

METHOD

To achieve the aim of this study, a systematic literature review is conducted following the PRISMA (Preferred reporting items for systematic reviews and meta-analyses) approach. The review includes peer-reviewed scientific research from Science Direct, Emerald Insight and Scopus.

RESULTS

While there is an interest in investigating the importance of health resilience by means of resilience in community health and resilience in healthcare systems, and a proliferating interest in how digital health has broadly revolutionised the healthcare landscape, there is a lack of research on how the existing, new and emerging digital health technology solutions become useful in disaster resilience. This research identified 7 key digital health technology solutions, Telemedicine/Telehealth, Electronic Health/Medical Records, Mobile Health (Mhealth), Wireless Health Devices (Wearables), Wireless Health Sensors Imaging, Software Innovation (Including Virtual Reality), Public Health Surveillance using "Big Data" and Artificial Intelligence (AI) algorithms, and discuss how they are utilised in low-resource, vulnerable and, and often remote settings.

CONCLUSIONS AND RECOMMENDATIONS

To ensure the inclusive application of these digital solutions, comprehensive reform for cities with coherence policy implementation and strong inter-and intra-city partnerships and learning is vital. Therefore, further studies are recommended to be conducted to develop a collaborative framework to advise on appropriate digital health technology solutions where gaps in health resilience are found in different city contexts. It is also recommended to take necessary steps to operationalise appropriate digital health technology solutions in underdeveloped contexts for the betterment of those communities.

Keywords: ***Cities, Digital Health, Disaster Resilience, Technology Solutions***

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