Dr. NADARAJAH SIVARAJAH MEMORIAL LECTURE 2023

Cardiovascular risk in the Northern Province of Sri Lanka: The unseen picture

By

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Professor in Public Health, Faculty of Medicine, University of Kelaniya

26th June 2023

University of Jaffna, Sri Lanka

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Vice Chancellor's Message

Late Dr. N. Sivarajah is one of the pioneers of Community Medicine at the Faculty of Medicine who contributed immensely to the development of Primary Health Care in the region. Dr. N. Sivarajah shouldered academic responsibilities of the faculty, health care services of the community and consultancy services to the WHO and UNFPA in the most difficult and unrestful period of the region with bravery and dedication. The Senate of the University of Jaffna commemorated the matchless service rendered to the university and the community by instituting this annual memorial lectures.

We are proud to have Prof. Anuradhani Kasturiratne, Professor in Public Health at the Faculty of Medicine, University of Kelaniya to deliver the Memorial Lecture 2023. Prof.Anuradhani Kasturiratne completed her secondary education at Visakha Vidyalaya in Colombo, Sri Lanka, before graduating with an MBBS degree from the Faculty of Medicine at the University of Kelaniya in 1999. With a diverse range of research interests, she has made significant contributions to the fields of snakebite, cardiovascular and metabolic diseases among South Asians, and the economic burden of chronic diseases. Driven by her passion for research and a commitment to advancing public health, she pursued further specialization in Community Medicine, obtaining an MD degree from the Postgraduate Institute of Medicine at the University of Colombo in 2008. She has been a visiting research fellow at the Wolfson Institute of Preventive Medicine at the Barts and the London School of Medicine and Dentistry, London, United Kingdom and the Lee Kon Chian School of Medicine in Singapore.

Prof.Anuradhani Kasturiratne's contributions to scientific literature are remarkable, with over 100 peer-reviewed scientific publications in indexed journals. Her research outputs have significantly advanced knowledge in the epidemiology of cardiovascular and metabolic diseases in Sri Lanka and South Asia. Additionally, her groundbreaking work on the global burden of snakebite has brought attention to this neglected public health issue. With a remarkable H-index of 34 and more than 7000 citations, Prof.Anuradhani Kasturiratne's work has gathered widespread recognition and influence within the academic community.

I extend my heartfelt appreciation to Prof. Anuradhani Kasturiratne for your willingness to share your expertise and deliver the Dr. Nadarajah Sivarajah Memorial Lecture 2023. I believe this lecture will be suitable for those who are in the public health field to strengthen their engagement and expertise.

Prof. S.Srisatkunarajah
B.Sc (Hons) Jaffna,
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Professor in Mathematics
Vice Chancellor
University of Jaffna

Cardiovascular Risk in the Northern Province of Sri Lanka: The unseen picture

Anuradhani Kasturiratne, Professor in Public Health, Faculty of Medicine, University of Kelaniya

Vice Chancellor, University of Jaffna, Dean, Faculty of Medicine, family of late Dr Nadarajah Sivarajah, distinguished guests, Ladies and Gentlemen

I am both honoured and humbled to have this opportunity to give the Dr Nadarajah Sivarajah memorial oration of the Faculty of Medicine, University of Jaffna. My colleagues from the Department of Community and Family Medicine at the University of Jaffna have always been testimony to Dr Sivarajah's vision and dedication for public health education in the Northern Province during its most challenging times. I have personally known Dr Sivarajah as a respected teacher, trainer and a senior colleague with a wealth of knowledge and experience in the field of public health both in the North and the South of Sri Lanka. He was most admired for his versatility and perseverance in keeping the Department of Community and Family Medicine and population-based health services functioning despite numerous challenges of those times. His work, as the Consultant Coordinator of the Jaffna Field Office of the World Health Organization, is legendary. I feel that it is very fitting to dedicate our work in the Northern Province to Dr Sivarajah, a visionary of the times, who focussed on the future and the potential of the Northern Province.

My talk today is based on the work conducted in Sri Lanka under the Global Health Research Unit (GHRU) for diabetes and cardiovascular disease among South Asians. This project is funded by the National Institute for Health and Care Research, United Kingdom through Imperial College London. One component of the GHRU is an island-wide population-based surveillance study that was conducted in collaboration with the national and provincial health authorities. Our work in the Northern province was coordinated and supported by colleagues from the Faculty of Medicine, University of Jaffna.

Northern Province is one of the largest provinces of Sri Lanka with a geographic extent of 8,884 km2 and accounting for 13.5% of the total land area of the country. It has a population of approximately 1,058,000 with a population density of 120/ km2, at present. In the year 1981, during the national census, the total population of the province was more than its current population, with Jaffna being the 5th most populous district in the country, with a population size comparable to that of Kalutata and Galle districts, at the time. Relatively unprotected by early measures of reconciliation and battered by conflict over a quarter of a century, Northern province undoubtedly holds the scars of the last 40 years. The population of the province dwindled due to large waves of local and international out-migration distorting its structure and composition. Perseverance of professionals like Dr Nadarajah Sivarajah, held the systems together through its darkest days. This talk is a tribute to Dr Sivarajah and numerous others who took the difficult roads alongside him over the last four decades. Many of them may be no more, but they have gifted us with hope and optimism about a future of peace and harmony.

Cardiovascular disease, which includes ischaemic heart disease and stroke, is one of the leading causes of death globally. South Asia, which

includes India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, Maldives and Afghanistan, accounts for over a quarter of the global population and bears the highest burden of cardiovascular disease as a global region. Highly influenced by British colonization, South Asians are the largest migrant group in many High-Income countries of the world including the United Kingdom and Australia having carried an increased risk of cardiovascular disease with them to those countries. Cardiovascular disease in South Asians have an earlier onset at lower risk thresholds and leads to higher mortality at a younger age compared to persons from other ancestries (Ramraj and Chellappa, 2008).

Sri Lanka having one of the relatively smaller populations in the region, has demonstrated good health and social indicators since its independence from the British. However, most of these health indicators relate to successes in maternal and child health and control of communicable diseases which are core services of public health. Due to the health transition, Sri Lanka has one of the fastest aging populations in the region and the burden of non-communicable diseases including cardiovascular disease, diabetes and cancer has been increasing for decades. Behavioural and environmental risks including sedentary lifestyle and unhealthy diets, smoking, alcohol use and stress have resulted in an unprecedented increase in non-communicable diseases led by cardiovascular disease.

Researchers from the Northern Province have done some landmark work on cardiovascular risk in the province demonstrating an interest and concern about this alarming public health problem. An anthropometry-based study conducted among nursing officers working in the Teaching Hospital (TH), Jaffna in 2013, revealed high rates of overweight and obesity. Prevalence of obesity among female nurses was higher than the national prevalence. More than 70% had central

obesity which was significantly higher compared to that of males (Sasrubi et al., 2018). Although as an occupational group, nursing officers can be considered a physically active group engaged in prolonged periods of standing, being relatively more affluent than the general population may expose them to lifestyle risks and consequent intermediate metabolic risk factors.

A recent small study conducted among in-patients in medical wards in the District General Hospital (DGH), Killinochchi revealed that lifestyle-related risk factors such as low fruit and vegetable consumption and poor physical activity levels were common. Nearly half of the sample had hypertension, but only 16% were controlled. High LDL levels were common. About 9% had renal impairment (Monoharan et al., 2022). Although this sample is a highly biased one, the lifestyle risk factors identified in this study are quite important in relation to describing the population level risks.

Among patients on ambulatory treatment for hypertension at the cardiology clinic, TH, Jaffna, high visit to visit variability of blood pressure has been observed. This variability has been associated with important co-morbidities like diabetes and chronic kidney disease (CKD). Medication adherence was identified to be a major issue among patients although not associated with variability. Among the people with chronic hypertension, more than 25% were sedentary, and more than 40% were overweight or obese (Kumanan et al., 2019).

In a population-based study among 544 adults in the Jaffna district, overall diabetes prevalence was 16.4%, ranging between 19.6% in males and 13.9% among females. Over a quarter of the persons with diabetes were previously undiagnosed. A high waist-hip ratio and a

family history of diabetes were the only significant predictors of diabetes (Amarasinghe et al., 2015).

In a large clinic-based study conducted in the Teaching Hospital (TH), Jaffna, approximately 55% of the study population were overweight or obese. Prevalence of hypertension increased with increasing BMI. This population was relatively older with a mean age over 60 years and had a high rate of diabetes complications. (Sujanitha et al, 2015). Poor compliance to antihypertensive medication has been reported in the general medical clinic attendees in TH, Jaffna. Despite having a reasonable level of knowledge about hypertension, majority were not aware that they were having hypertension (Pirasath et al., 2017).

Prevalence of Metabolic Syndrome estimated using the International Diabetes Federation Guidelines for Asians was 15.8% in a population-based study conducted among 544 Tamils in the Jaffna district. An important finding in this study was the low HDL levels found in over 75% of the sample. Significant predictors of Metabolic Syndrome in this study were older age, smoking and living in urban areas (Amarasinghe et al., 2015). The prevalence reported in this study was lower compared to the age-adjusted prevalence of 24.3% based on the same criteria, reported by Katulanda et al. (2012) in a larger population-based study of 4,485 adults living in seven provinces of Sri Lanka excluding the Northern and the Eastern provinces in 2006. Amarasinghe et al. (2015) also reported a prevalence of 24.1% in the same sample based on NCEP ATP III criteria. However, this prevalence is significantly lower than the prevalence of 46.1% reported in the population-based Ragama Health Study conducted in a semi-urban setting in the Gampaha district (Chackrewarthy et al., 2013).

Global Health Research Unit for diabetes and cardiovascular disease in South Asians (GHRU) is a multi-country collaborative study led by Imperial College London, United Kingdom with academic and research partners from Bangladesh, India - North (Delhi), India- South (Chennai), Pakistan (Lahore) and Sri Lanka. GHRU surveillance study attempted to conduct surveillance on cardiovascular risk factors in a population-based sample of 50,000 adults living across Sri Lanka. We obtained an island-wide representative sample using a multi-stage cluster sampling technique. Each cluster was a Grama Niladhari division in the catchment area of a Primary Medical Care Institution. The cluster size was approximately 500 persons and the number of clusters sampled country-wide was 100. In the Northern Province of Sri Lanka, six (06) clusters were sampled proportionate to the population size. These clusters included two (02) from the Jaffna district and one each from the other four districts of the province.

In each selected cluster, an enumerator identified from the local community supported the study teams to invite eligible adults. They were invited to participate in the screening, irrespective of their past medical/ screening history. Through household visits, information about the study was provided both verbally and in writing in Tamil. Consenting persons were registered on a digital application developed for the purpose and basic details were entered. A QR code identification was issued for each household and the geo-location of each household was recorded in the application. Appointment date and time were provided through an appointment card which contained basic information on how to prepare and attend for the screening and the details of the location where screening will be done, which was the PMCI in their own neighbourhood.

The screening was conducted by the study team comprising 12-15 trained graduate Research Assistants including medically qualified persons, who were fluent in the local language. After onsite registration, each participant received a bar coded participant identification number and went through eight (08) screening stations which included anthropometry and body fat estimation, measurement of blood pressure, phlebotomy, point of care tests for blood glucose and total cholesterol, ECG, retinal imaging, spirometry and an interviewer administered questionnaire to collect information on socio-demographic, lifestyle, medical and health related variables. After phlebotomy, each participant was provided a snack before completing the rest of the screening stations. Data entry was done digitally using the NGHRU application developed and validated for the purpose. Digital devices were interconnected through a wireless network which enabled automatic capturing of respective measurements, minimizing errors.

Our work in the Northern Province was conducted between February 2020 and February 2021, with intermittent periods of disruption due to the COVID-19 pandemic. Our study sites were: Karaveddy and Chankanai in Jaffna, Moonkilaru in Mullaitivu, Akkarayankulam in Kilinochchi, Adampan in Mannar and Maharambikulam in Vavuniya.

We included 3099 adults from the Northern Province in our surveillance study comprising of 1052 (33.9%) males. The mean age of the sample was 47.5 (SD=15.1) years. The largest percentage of the sample (22.8%) was in the age group 40-49 years. The number of participants below 40 years of age was 1001 (32.3%). There were 250 (8.1%) participants above 70 years of age. In comparison, the national sample of the study was slightly older with a mean age of 49.0 (SD=14.6) years.

The Mean BMI of the participants was 25.02 (4.81) kg/m2. This is similar to the national average of 25.04 (SD= 4.05) kg/m2 in our study. 223 (7.2%) were underweight and 547 (17.7%) was overweight while 1447 (46.7%) were obese based on the WHO cut-offs for South Asians. Mean waist circumference was 84.57 (SD=12.19) cm and the mean waist to hip ratio was 0.91 (SD=0.08). The respective national averages were 83.27 (SD=11.64) cm and 0.88 (SD=0.08).

Percentage muscle mass averaged 27.84 (SD=6.32) [National average 27.38 (6.1). Average total body fat and visceral fat percentages were 33.25(SD=11.32) and 7.73 (SD=3.56), respectively. The national average of the same were 33.83 (SD=11.04) and 7.83 (SD=3.35), respectively. This indicate that the anthropometric and body composition measurements of the adult population of the Northern Province are very similar to the national averages reported in the same study.

Mean average systolic and diastolic blood pressure was 124.8 (SD=20.5) and 76.6 (SD=11.9) mm Hg, respectively. The national averages were 125.1 (SD=20.1) and 76.7 (SD=11.8) mm Hg, respectively. 721 (23.3%) were having hypertension based on the on-site blood pressure measurements with a cut-off of 140/90 mm Hg. Percentage of persons with hypertension in the national sample was 23%. This indicates a very similar epidemiological profiles for the Northern Province and the country, overall.

Based on the point of care venous blood glucose test using a cut off of 125 mg/ dl, 560 (18.1%) participants were hyperglycemic while 33.3% were pre-diabetic. In the national sample 16.9% were hyperglycemic and 32.3% were pre-diabetic. The prevalence of hyperglycemia in the

Northern province was significantly higher compared to the rest of the country ($X2=227.45$; d.f.=2; $p<0.001$).

Prevalence of current smoking and alcohol consumption among males was 21.3% (19.3-23.4%) and 43.3% (40.9-45.6%) according to the STEPS survey, 2021. In the national sample of GHRU it was 15.7% (15.0-16.4%) and 38.3% (37.4-39.2%), respectively. In the Northern Province, prevalence of current smoking and alcohol consumption among males were 15.0% (12.9-17.4%) and 30.2% (27.5-33.1%), respectively.

Mean number of days on which fruit is consumed per week was 4.3 (4.3-4.4) in the Northern Province, as compared to 3.4 (3.4-3.5) reported in the STEPS survey, 2021 and 4.1 (4.0-4.1) in the island-wide study. Mean number of days on which vegetable is consumed was 6.7 (6.6-6.7) in the Northern Province and 6.9 (6.8-6.9) island-wide, compared to 6.5 (6.5-6.6) reported in the STEPS survey. Mean number of fruit and vegetable servings per day were 1.8 (1.7-1.8) and 2.3 (2.2-2.3), respectively in the Northern Province. The comparable values reported in the STEPS survey were 1.2 (1.2-1.3) and 3.3 (3.2-3.5), respectively. The national averages for the same in our surveillance study were 1.8 (1.8-1.8) and 3.1 (3.1-3.1), respectively. Overall, the reported number of vegetable servings are less in the Northern Province. Percentage who reported consumption of less than 5 servings of fruit and vegetables in a day was 64.6% (64.1-65.2%) island-wide in our study and 67.8% in the STEPS survey. In the Northern Province this percentage was 58.1% (58.4-61.9%).

Environmental mapping was done in the sampled Grama Niladhari divisions and a surrounding buffer zone of 500 metres to map the

existing schools, physical activity spaces, tobacco outlets, unhealthy food advertisements and food outlets which marketed fruits and vegetables. A data collection application developed in KoboToolbox was used. Maps show that tobacco outlets are widespread in all areas and in divisions with schools, a few were located close to the school despite regulations imposed by the National Authority on Tobacco and Alcohol (NATA) prohibiting tobacco sales within 100 meters of a school. Nearly all food outlets, irrespective of having fruits and vegetables also sold cigarettes. Unhealthy food advertisements were located by main roads. Physical activity spaces were generally available and have the potential for hosting community based physical activity programmes.

High disease burden of cardiovascular disease along with the associated disability and premature mortality is a global public health problem. In South Asia, this problem is intensified by complex genetic, behavioual and environmental interactions, about which little is known. Large international collaborations like the GHRU enables identifying the determinants and the patterns and encourages capacity building on understanding such interactions and addressing them. In parallel, Health promotion has a pivotal role to play in future prevention and control of cardiovascular diseases for both the Northern Province and Sri Lanka, overall. There are many opportunities and strengths for making positive changes at the population level. Public education, policy level changes including a strong regulatory framework to address modifiable behavioural and environmental risks will be crucial to determine the direction of the health trajectories and the success of our preventive programmes.

I acknowledge the National Institute for Health and Care Research (NIHR), United Kingdom and the Principal Investigator of GHRU

Professor John Chambers, Dr Manuja Kaluarachchi Soden, Study Manager, colleagues from Imperial College London and Imperial Business School, United Kingdom led by Prof Marisa Miraldo, partners from collaborating institutions in Bangladesh, India, Pakistan, Singapore and the UK, Study participants, Prof Balachandran Kumarendran, Cadre Chair and Professor of Community Medicine, Faculty of Medicine, University of Jaffna, a proud student of Dr Sivarajah and my colleague and close friend who made it possible to conduct this study in the Northern Province, Ms Sambavi Arulanandam, all members of our study teams, Dr Vindya Rajakaruna, Lecturer in Community Medicine, University of Ruhuna, Prof Rajitha Wickremasinghe, Dr Lathika Athauda and Prof Madawa Chandratilake, Faculty of Medicine, University of Kelaniya.

I am grateful to the family of late Dr Nadarajah Sivarajah, Prof Rajendra Surenthirakumaran, Dean, Faculty of Medicine and Dr PA Dinesh Coonghe, Head, Department of Community and Family Medicine for giving me the singular honour of delivering this oration.

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Professor Anuradhani Kasturiratne is a Professor in Public Health at the Faculty of Medicine, University of Kelaniya. Her research interests are snakebite, epidemiology of cardiovascular and metabolic diseases among South Asians and the economic burden of chronic diseases.

Professor Anuradhani graduated MBBS from the Faculty of Medicine, University of Kelaniya in 1999. She obtained MD and specialization in Community Medicine from the Postgraduate Institute of Medicine, University of Colombo in 2008.

She has been a visiting research fellow at the Wolfson Institute of Preventive Medicine at the Barts and the London School of Medicine and Dentistry, London, United Kingdom and the Lee Kon Chian School of Medicine in Singapore.

As the Principal Investigator or Co-Investigator of several country level and international collaborative grants, she has developed expertise in design, conduct and analysis of epidemiological studies. She has extensively worked with the health system and wider networks on health through her research.

She has been involved in field level participant recruitment, follow-up and implementation of both cohort and intervention studies in the South Asian context and published widely in peer-reviewed scientific journals. Many international publications generated from her group have contributed to advancement of knowledge in the field of epidemiology of cardiovascular and metabolic diseases in Sri Lanka and South Asia. She has also been involved in ground breaking work on the global burden of snakebite. Professor Anuradhani has published over 100 peer reviewed scientific publications in indexed journals and has a H index of 34 with more than 7000 citations.