



DIABETES PREVENTION AND MANAGEMENT IN SOUTH ASIA: A CALL FOR ACTION

Pramod R. Regmi

Research Fellow, Faculty of Health and Social Sciences,
Bournemouth University, UK;
Visiting Research Fellow, Chitwan Medical College,
Tribhuvan University, Nepal

Corresponding Address: Faculty of Health and Social Sciences,
Bournemouth University, 19 Christchurch Road,
Bournemouth BH1 3LH, England, UK

Email: pregmi@bournemouth.ac.uk

Om Kurmi

Nuffield Department of Population Health, University of Oxford,
Richard Doll Building, Old Road Campus, OX3 7LF, UK,

Email: om.kurmi@ndph.ox.ac.uk

Nirmal Aryal

Department of Medicine, University of Otago,
Wellington, New Zealand

Email: nirmal.aryal@otago.ac.nz

Puspa Raj Pant

Centre for Child and Adolescent Health,
University of the West of England, Bristol BS8 2BN, UK

Email: Puspa.Pant@uwe.ac.uk

Amrit Banstola

Faculty of Health and Applied Sciences,
University of the West of England, Bristol, BS16 1QY, UK;
Department of Research and Training,
Public Health Perspective Nepal, Pokhara-29, Nepal
Email: amritbanstola@outlook.com

Folashade Alloh

Faculty of Health and Social Sciences,
Bournemouth University, UK
Email: falloh@bournemouth.ac.uk

Edwin van Teijlingen

Centre for Midwifery, Maternal and Perinatal Health,
Bournemouth University, UK;
Manmohan Memorial Institute of Health Sciences,
Tribhuvan University, Nepal;
Nobel College, Pokhara University, Nepal
Email: vanteijlingen@bournemouth.ac.uk

ABSTRACT

Background: Globally, the number of people living with Diabetes Mellitus (DM) has increased four-fold since 1980. South Asia houses one-fifth of the world's population living with diabetes, and it was the 8th leading cause of deaths in 2013 for South Asians.

Aim: To review and discuss the context of diabetes in South Asia, with a particular focus on, a) contributing factors and impact; b) national health policies around non-communicable diseases in the region, and c) to offer recommendations for prevention and management of diabetes.

Method: We assessed relevant publications using PubMed, Scopus and OvidSP. Similarly, the World health Organization (WHO) and relevant ministries of each South Asian country were searched for reports and policy documents.

Results: Emerging evidence supports that the prevalence of diabetes (ranging from 3.3% in Nepal up to 8.7% in India) in South Asia follows the global trend over the past decades. Urban populations in the region demonstrate a higher prevalence of diabetes, although is also a public health concern for rural areas. Changes in the pattern and types of diet, together with increasingly sedentary, lifestyles are major causes of diabetes. The overall agenda of health promotion to prevent diabetes has not yet been established in the region, and the majority of the countries in the region are inadequately prepared for the therapeutic services for diabetes.

Conclusions: The early onset of the diabetes, longevity of morbidity and early mortality may have a significant impact on people's health expenditure and health systems, as well as on the region's demographic composition. There is an urgent need to reduce the prevalence of diabetes in the region through evidence-based interventions ranging from prevention and early detection to appropriate treatment and care. We suggest that a multi-sectorial collaboration across all stakeholders is necessary to raise awareness about diabetes, its prevention, treatment and care in the region.

Keywords: Diabetes Mellitus; South Asia; Low and Middle Income Countries; Non-Communicable Diseases.

Reference to this paper should be made as follows: Regmi, P. R. *et al* (2016) 'Diabetes prevention and management in South Asia: A call for action', *Int. J. Food, Nutrition and Public Health*, Vol. 8, No. 2, pp.107–116

INTRODUCTION

Diabetes Mellitus affects a huge number of people globally with an approximate two-fold increase in the global age-standardized prevalence from 4.3% in 1980 to 9.0% in 2014 among men, and 5.0% to 7.9% among women (NCD Risk Factor Collaboration, 2016). As a consequence of the growth in population and an increasing ageing population, the number of people living with diabetes in the world has increased four-fold, from 108 million in 1980 to 432 million in 2014 (NCD Risk Factor Collaboration, 2016). Additionally, approximately 193 million people with diabetes remain undiagnosed (International Diabetes Federation, 2015), and a high proportion (83%) of the undiagnosed diabetes burden is in Low and Middle Income Countries (LMICs) (Beagley *et al.*, 2014).

Diabetes Mellitus can lead to short-term complications (e.g. hypoglycaemia, ketoacidosis) and long-term macrovascular (e.g. coronary heart disease) and microvascular complications (e.g. blindness, amputation) (Nefs *et al.*, 2012; Hippisley-Cox and Coupland, 2015; Marshall and Flyvbjerg, 2006): it accounts for more than 2 million deaths every year (Global Burden of Metabolic Risk Factors for Chronic Diseases Collaboration, 2014). The 2010 Global Burden of Diseases (GBD) study reported that diabetes-related deaths have increased by 93% over the last two decades, and the proportion of diabetes related deaths in LMICs is also very high (Lozano *et al.*, 2013). For example, in 2013, most deaths due to diabetes (81%) occurred in LMICs (Global Burden of Disease Study, 2016). In the context of South Asia, where all countries in the region are categorized as LMICs, it was already the 8th leading cause of deaths in 2013, followed by road accidents (9th) (Global Burden of Disease Study, 2016). Thus, diabetes will have a significant impact on mortality, morbidity and health system costs worldwide.

In 2015, as part of the 17 sustainable development goals (SDGs), a global target was set to reduce the increase in non-communicable diseases (NCDs), including diabetes (United Nations, 2015). The third goal of the SDG focussed on the theme 'Ensure healthy lives & promote well-being for all at all ages', with the aim to reduce premature mortality from

NCDs, including diabetes, by a third. However, a recent estimation indicates that if the rise in the prevalence of diabetes continues at post-2000 rates, the probability of achieving the target is extremely low (NCD Risk Factor Collaboration, 2016). This calls for an urgent action, including evidence-based multiple interventions, detection, prevention, treatment and care. In this paper, we discuss the context of contributing factors to, and the impact of, diabetes in South Asia. We offer suggestions to help improve health policies in the region while tackling NCDs, particularly diabetes. Finally, we also offer a few recommendations for diabetes prevention, care and treatment in the region. In this paper, South Asia refers to eight countries of the Asian continent, namely Nepal, India, Pakistan, Bangladesh, Bhutan, Sri Lanka, Afghanistan and Maldives. These countries are also known as SAARC (South Asian Association for Regional Cooperation) countries.

For this narrative review, we searched PubMed, Scopus and OvidSP (MEDLINE and EMBASE) for English-language articles published after 2000, using key words such as 'diabetes' combined with 'South Asia', or the name of each of the eight South Asian countries listed above. We did not limit our search outcomes by study types. Any paper included in this search was initially screened by publication title followed by scanning the abstracts. Similarly, we thoroughly searched websites of the World Health Organization (WHO) and the ministries of health, population, welfare, gender of the South Asian countries for national policy documents and publications around NCDs, including diabetes. Due to the narrative nature of this review, we did not appraise papers for quality or produce a flow diagram of the selected/publications.

DIABETES IN SOUTH ASIA: CONTRIBUTORS AND IMPACTS

South Asia houses a quarter of the world's population (Moran and Vedanthan, 2013), and the increase in diabetes morbidity and mortality in the region follows the global trends. For example, recent estimates by the International Diabetes Federation (IDF) reported country level diabetes prevalence in South Asia that ranges from 3.3% in Nepal up to 8.7% in India (India, 8.7%; Sri Lanka,

8.5%; Bhutan, 7.8%; Bangladesh, 7.4%; Maldives, 7.5%; Pakistan, 6.9%; Nepal, 3.3%) (International Diabetes Federation, 2015). Globally, India and Pakistan are ranked 2nd (was 2nd in 1980) and 6th (ranked in 13th in 1980) respectively in 2014 in terms of the number of people living with diabetes (NCD Risk Factor Collaboration, 2016). A recent meta-analysis estimates the prevalence of type 2 diabetes in Nepal at 8.4% (Gyawali *et al.*, 2015), over twice as many as the IDF estimates.

The GBD study estimates for South Asia (Afghanistan, Bhutan, Bangladesh, India, Nepal and Pakistan) suggest that diabetes death rates have increased by 33%, and that actual deaths have doubled between 1990 and 2013. In the year 2013, deaths due to diabetes in the above six countries was around 31% of all diabetes-related deaths reported from the LMICs (Global Burden of Disease Study, 2016). During the same period, in Sri Lanka alone, diabetes death rates increased by 250% (from 13.6 to 47.7 per 100,000), which accounts for 10% of all deaths in 2013. Diabetes is also recognized as one of the principle risk factors associated with an increase in premature heart attack and deaths among South Asians. For example, mortality data from the GBD study showed that Cardiovascular Diseases (CVD) deaths in South Asia increased by 97% (1.7 million more deaths in 2013 than 1990) (Roth *et al.*, 2015).

The escalating prevalence of diabetes in South Asia observed in the last few decades can be attributed mostly to the change in lifestyles in urban areas as a result of rapid socioeconomic changes. Diabetes prevalence in urban areas (e.g. Nepal, 8.1% (Gyawali *et al.*, 2015); India, 13.9% (Ramachandran *et al.*, 2001); Sri Lanka, 16.4% (Katulanda *et al.*, 2008); Pakistan, 22% (Hussain and Ali, 2016)), is higher than national averages. Together with the epidemiological transition, the behavioural patterns of the younger population have rapidly altered, and predilection towards lifestyle increasing rates of obesity and diabetes in the region (Aryal and Wasti, 2015). A large proportion of daily energy intake in South Asian diets comes from refined carbohydrates (e.g. white rice), and energy obtained from sugar has considerably increased in recent times. For example, in Nepal, it increased from 4g/capita/day in 1970, to 57g/capita/day in 2010 (Subedi *et al.*, 2015). There is also a high prevalence of smoking and heavy alcohol use, which are all linked to an

increased risk of diabetes (Hu, 2011).

Air pollution, an emerging public health issue in South Asia, may have also increased the risk of insulin resistance and diabetes (Pearson *et al.*, 2010). Likewise, South Asians also have a strong genetic predisposition for diabetes. A case control study, for example, found protective factors for diabetes were lower in South Asian controls than in controls from other countries (moderate or high intensity exercise, 6.1% vs. 21.6%; daily intake of fruits and vegetables, 26.5% vs. 45.2% (Joshi *et al.*, 2007)). South Asians have an increased intra-abdominal fat accumulation; this may be related with insulin resistance and consequently diabetes (Misra and Vikram, 2004).

Although diabetes is often related to lifestyle behaviours commonly associated with urbanization, physical inactivity and long sedentary periods (International Diabetes Federation, 2015), a growing body of evidence signals that diabetes is also a significant public health concern for rural areas of a region where the majority of people are farmers. For example, studies conducted in rural areas of India and Pakistan reported a prevalence of diabetes ranging from 11-17% (Amin *et al.*, 2015; Little *et al.*, 2016; Hussain and Ali, 2016). Likewise, the number of children (0-14 years old) with Type 1 diabetes in India is second to the United States (70,000 versus 84,000) (International Diabetes Federation, 2015), suggesting a wide spread of diabetes across all age groups. A higher prevalence of diabetes has also been reported among South Asians in high income countries (Zaninotto *et al.*, 2007) suggesting the possibility of genetic linkages. Moreover, studies have also found a genetic link among South Asians; this starts diabetes five to ten years earlier than other ethnic groups. For example, South Asian migrants in the UK (6.2% vs 1.7%) (Diabetes UK, 2015) and the USA (20% vs 10%) (Thomas and Ashcraft, 2013), have a higher prevalence of diabetes and experience poorer health outcomes when compared to the overall general population (Garduño-Díaz and Khokhar, 2012). This highlights the need for health intervention among this ethnic group worldwide as the economic burden of diabetes and its complications among those of South Asian descent is a global issue due to the spread of its large population across other regions.

As in many LMICs, diabetes in South Asia is a significant challenge for healthcare systems

and an obstacle to sustainable economic development. For most of South Asia the cost of diabetes accounts for 5% to 20% of total health expenditure (International Diabetes Federation, 2015). Furthermore, large inequality within countries means that the economic burden is higher for individuals with lower incomes. They are likely to spend from 25% up to 34% of their income on diabetes care (Ramachandran *et al.*, 2007), leaving little income to spend on other essentials such as proper nutrition and education. An earlier estimate reported the annual mean direct cost for each person with diabetes to be \$197 in Pakistan (Khowaja *et al.*, 2007) and \$628.30 in South India (Akari *et al.*, 2013). This substantial expenditure incurred to people with diabetes in South Asia could be reduced significantly by adopting prevention, earlier detection and a reduction in diabetes co-morbidities and complications through improved diabetes care.

SOUTH ASIAN HEALTH POLICIES ON NON-COMMUNICABLE DISEASES

Unlike other South Asian countries, the Government of Sri Lanka had prioritized prevention and control of NCDs since 1992 (Ministry of Health Care and Nutrition, 2009). In 2009, recognizing its rapidly increasing burden of NCDs, Sri Lanka developed the National Policy & Strategic Framework for Prevention and Control of Chronic NCDs, particularly related to CVDs, diabetes mellitus, chronic respiratory diseases and chronic renal disease. Other countries have started revisiting their National Health Policies (NHPs) to incorporate NCD issues. For example, although the first NHP of India was launched in 1983, only the most recent NHP 2015 recognized hypertension and diabetes as major NCDs (Ministry of Health and Family Welfare, 2002; Ministry of Health and Family Welfare, 2014).

Nepal's NHP 2014, prioritized NCDs, including diabetes, as a major national public health problem (Ministry of Health and Population, 2014). Prevention of NCDs has also been included in the Health Master Plan of Maldives (2006-2015), which focuses on prevention of CVDs, diabetes, renal diseases, COPD (Chronic Obstructive Pulmonary Disease) and selected cancers (Ministry of Health and Gender, 2014). Bhutan recognized NCDs as important diseases in its NHP (2011), aimed

at preventing and controlling NCDs through comprehensive interventions that will include risk surveillance, health promotion, and strengthening of health care services (Ministry of Health, 2011).

The implementation of the strategies/actions mentioned in NHPs for the control of NCDs has not been robust across South Asian countries. For instance, despite Bangladesh acknowledging NCDs as a priority in its NHP 2008, the World Bank reported that implementation has been slow due to a lack of finance and competing priorities (World Bank, 2011). Although Pakistan's second NHP gave special attention to NCDs, particularly cancer and diabetes (Ministry of Health, 1997), its third NHP, just four years after the second NHP, totally neglected NCDs (Ministry of Health, 2001). A recent draft of NHP had recognized NCDs as a major public health challenge for Pakistan, but still NCDs are completely neglected in the policy's objectives and actions (Ministry of Health, 2009).

In Afghanistan's current NHP (2005-2009) NCDs are not covered. This is largely because this post-conflict country is mostly focused on improving maternal and child health, reducing communicable diseases and malnutrition (Ministry of Public Health, 2005). Health services, care services and human resources in most of these countries focussed heavily on addressing the very high burden of maternal, child mortality and infectious diseases in the past. The overall agenda of health promotion has not yet been established at grassroots level, and not all countries in the region are well prepared for the therapeutic services for all NCDs, including diabetes.

DIABETES PREVENTION, TREATMENT AND CARE: A WAY FORWARD

In light of the increasing rates of diabetes in South Asia, it is important for clinical and public health communities to focus on NCDs, including diabetes. There is a need for wider implementation of cost-effective interventions in the prevention and control of diabetes, as well as a need for a united arrangement among South Asian Association for Regional Cooperation (SAARC) countries to develop common strategies, standards and guidelines to form joint action on chronic diseases (JA-CHRODIS) in line with the EU Joint Action on Chronic Diseases (European Union, n.d.). An SAARC meeting of health ministers highlighted

the urgent need for a comprehensive response to NCDs (Ministry of Health and Family Welfare, 2015). The World Health Organization's South East Asia Region (WHO SEARO) should also play a key role with its 'Regional action plan and targets for prevention and control of non-communicable diseases (2013-2020)' (World Health Organization, 2013).

Governments in the region should create and financially support designated places for physical activities (e.g. walking and cycling routes, leisure centres). Such interventions can be funded through imposing higher tax on products such as tobacco, sweetened drinks, foods high in sugar, fat and salt, and junk food. It is well documented that relatively modest changes in diet and physical activity can reduce the incidence of Type 2 diabetes by >50% for people with impaired glucose regulation (Gillies *et al.*, 2007). This is especially important as more than 80% of all Type 2 diabetes cases can be ascribed to obesity (Foody, 2007). Early identification of individuals at risk, and appropriate intervention for weight reduction, healthy dietary habits and increased physical activity, could greatly help to prevent, or at least delay, the onset of diabetes among South Asians.

It is critical for individuals to adopt a healthy lifestyle (e.g. doing regular physical activity, weight management) and eating a healthy diet (e.g. fruit and vegetables, avoiding tobacco and reducing alcohol use) from an early age to prevent diabetes later in life. The provision of affordable healthy food in schools, including healthy beverages, fresh fruit and vegetables, a supportive and safe environment for physical activity, specialized health educational curriculum, and restricting access to tobacco and alcohol products near school premises, can be effective in promoting healthy diets and physical activity (Branca *et al.*, 2007; Cecchini *et al.*, 2010; World Health Organization, 2008). Consumer-friendly nutrition labelling, together with health messages, has the potential to change food consumption patterns and can help prevent diabetes (Cecchini *et al.*, 2010; World Health Organization, 2014). Effective consumer awareness of food labelling can be achieved through sustained media and educational campaigns. However, understanding food labels also relies on consumers' general

education levels, and low literacy rates are still a serious problem in large parts of rural South Asia.

Complications of diabetes can be avoided or delayed by maintaining good glycaemic control, which is achievable through self-management and medication where necessary. People with diabetes should be provided with the knowledge and skills to manage their condition effectively on a daily basis, and should be empowered to seek out information or support as required. Diabetes education and personalized care planning support should be integrated into diabetes care services. Counselling on eating a healthy diet and regular physical activity can change behaviours related to diabetes (World Health Organization, 2010). In South Asia, community health workers, who are in close connection with the community, would be appropriate for lifestyle changes related to diabetes if trained to conduct counselling or health promotion activities (Mishra *et al.*, 2015). These interventions not only increase knowledge and skills to manage diabetes, but also motivate people to manage diabetes effectively.

Diabetes treatments that focus on lowering blood glucose levels require lifelong care and management; oral medication or insulin, or both, are needed to control blood glucose levels. Early detection by screening for diabetic retinopathy and foot ulcers, easy access to health-care services for early diagnosis using inexpensive technologies, availability of essential anti-diabetic medications at affordable price, access to insulin, are needed for treatment and management of diabetes and its complications. However, the available health workforce in the region is largely urban centred, and specialized health service provision in the region is inadequate. For example, Nepal has only one endocrinologist per 1,000,000 population, and one ophthalmologist for every 200,000 people. Moreover, appropriate referrals and consultations are not commonly practised and there is a lack of national guidelines for diabetes care (Upreti *et al.*, 2016). Cost-effective interventions for the treatment and care of diabetes, such as the WHO Package of Essential NCDs Interventions (PEN) should be implemented in the primary health care centres in the region. The WHO PEN empowers primary care physicians, as well as allied health workers, to contribute to NCD care, and has the potential to be delivered to an acceptable quality

of care, even in resource-poor settings (World Health Organization, 2010).

With a focus on evidence based prevention, treatment and care for diabetes, South Asian countries should initiate the implementation of comprehensive strategies for diabetes. A vigilant system to track progress periodically may contribute to the effective implementation. To move this forward, governments in the region should co-ordinate and bring along all other relevant stakeholders in society, such as civil society, private sector, educational institutions, media, Non-Governmental Organizations (NGOs), community organizations, donor agencies, researchers, families, and individuals where appropriate.

Accurate national data are still unavailable in most South Asian countries, making it more difficult to define needs and prioritize decisions. This highlights the need for better disease surveillance system in the region. We have a notion that the target of SDG to reduce premature mortality by one-third from non-communicable diseases will greatly depend on the concerted efforts on prevention, health services and health policies. It is thus high time for all stakeholders, especially development partners, to play a crucial role in halting the prevalence of diabetes in South Asian people with the necessary technical and financial support.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

REFERENCES

- Akari, S., Mateti, U.V. and Kunduru, B.R. (2013): Health-Care Cost of Diabetes in South India: A Cost of Illness Study. *Journal of Research in Pharmacy Practice*, 2, 3, pp.114-117.
- Amin, F., Fatima, S.S., Islam, N. and Gilani, A.H. (2015): Prevalence of Obesity and Overweight, its Clinical Markers and Associated Factors in a High Risk South-Asian Population. *BMC Obesity*, 2, p.16.
- Aryal, N. and Wasti, S.P. (2015): The Prevalence of Metabolic Syndrome in South Asia: A Systematic Review. *International Journal of Diabetes in Developing Countries*, pp.1-8.
- Beagley, J., Guariguata, L., Weil, C. and Motala, A.A. (2014): Global Estimates of Undiagnosed Diabetes in Adults. *Diabetes Research and Clinical Practice*, 103, 2, pp.150-160.
- Branca, F., Nikogosian, H. and Lobstein, T. (2007): *The Challenge of Obesity in the WHO European Region and the Strategies for Response: Summary*, Denmark, World Health Organization.
- Cecchini, M., Sassi, F., Lauer, J.A., Lee, Y.Y., Guajardo-Barron, V. and Chisholm, D. (2010): Tackling of Unhealthy Diets, Physical Inactivity, and Obesity: Health Effects and Cost-Effectiveness. *The Lancet*, 376, pp.1775-1784.
- Diabetes UK (2015): Diabetes: Fact and Stats. UK: Diabetes UK.
- European Union (2016): *Towards better prevention and management of diabetes: Joint Action on Chronic Diseases and Promoting Healthy Ageing Across The Life Cycle*, Available from http://ec.europa.eu/health/newsletter/172/newsletter_en.htm [Accessed on April 26, 2016].
- Foody, J.A.M. (2007): *Preventive Cardiology: Insights into the Prevention and Treatment of Cardiovascular Disease*, Springer Science & Business Media.
- Garduño-Díaz, S.D. and Khokhar, S. (2012): Prevalence, Risk Factors and Complications Associated with Type 2 Diabetes in Migrant South Asians. *Diabetes/Metabolism Research and Reviews*, 28, 1, pp.6-24.
- Gillies, C.L., Abrams, K.R., Lambert, P.C., Cooper, N.J., Sutton, A.J., Hsu, R.T. and Khunti, K. (2007): Pharmacological and Lifestyle Interventions to Prevent or Delay Type 2 Diabetes in People with Impaired Glucose Tolerance: Systematic Review

- and Meta-Analysis. *BMJ*, 334, p.299.
- Global Burden of Disease Study (2016): GBD Compare - Viz Hub. Washington DC: Institute Of Health Metrics and Evaluation, University Of Washington.
- Global Burden of Metabolic Risk Factors for Chronic Diseases Collaboration (2014): Cardiovascular Disease, Chronic Kidney Disease, and Diabetes Mortality Burden of Cardiometabolic Risk Factors from 1980 to 2010: A Comparative Risk Assessment. *Lancet Diabetes Endocrinol*, 2, 8, pp.634-647.
- Gyawali, B., Sharma, R., Neupane, D., Mishra, S.R., Van Teijlingen, E. and Kallestrup, P. (2015): Prevalence of Type 2 Diabetes in Nepal: A Systematic Review and Meta-Analysis from 2000 to 2014. *Global Health Action*, 8.
- Hippisley-Cox, J. and Coupland, C. (2015): Development and Validation of Risk Prediction Equations to Estimate Future Risk of Blindness and Lower Limb Amputation in Patients with Diabetes: Cohort Study. *BMJ*, 351, H5441.
- Hu, F.B. (2011): Globalization of Diabetes the Role of Diet, Lifestyle, and Genes. *Diabetes Care*, 34, pp.1249-1257.
- Hussain, A. and Ali, I. (2016): Diabetes Mellitus in Pakistan: A Major Public Health Concern. *Archives of Pharmacy Practice*, 7, 1, pp.30-32.
- International Diabetes Federation (2015): *IDF Diabetes Atlas 2015*, 7th Edition. Belgium: International Diabetes Federation.
- Joshi, P., Islam, S., Pais, P., Reddy, S., Dorairaj, P., Kazmi, K., Pandey, M. R., Haque, S., Mendis, S. and Rangarajan, S. (2007): Risk Factors for Early Myocardial Infarction in South Asians Compared with Individuals in Other Countries. *JAMA*, 297, 17, pp.286-294.
- Katulanda, P., Constantine, G., Mahesh, J., Sheriff, R., Seneviratne, R., Wijeratne, S., Wijesuriya, M., McCarthy, M., Adler, A. and Matthews, D. (2008): Prevalence and Projections of Diabetes and Pre-Diabetes in Adults in Sri Lanka—Sri Lanka Diabetes, Cardiovascular Study (SLDCS). *Diabetic Medicine*, 25, 9, pp.1062-1069.
- Khowaja, L.A., Khuwaja, A.K. and Cosgrove, P. (2007): Cost of Diabetes Care in Out-Patient Clinics of Karachi, Pakistan. *BMC Health Services Research*, 7, p.189.
- Little, M., Humphries, S., Patel, K., Dodd, W. and Dewey, C. (2016): Factors Associated with Glucose Tolerance, Pre-Diabetes, and Type 2 Diabetes in a Rural Community of South India: A Cross-Sectional Study. *Diabetology & Metabolic Syndrome*, 8, p.21.
- Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., Abraham, J., Adair, T., Aggarwal, R. and Ahn, S.Y. (2013): Global and Regional Mortality from 235 Causes of Death for 20 Age Groups in 1990 and 2010: A Systematic Analysis for the Global Burden of Disease Study 2010. *The Lancet*, 380, 9859, pp.2095-2128.
- Marshall, S.M. and Flyvbjerg, A. (2006): Clinical Review-Prevention and Early Detection of Vascular Complications of Diabetes. *BMJ-British Medical Journal-International Edition*, 333, 7566, pp.475-480.
- Ministry of Health (1997): National Health Policy 1997. Islamabad: Ministry Of Health.
- Ministry of Health (2001): National Health Policy 2001-The Way Forward. Islamabad: Ministry Of Health.
- Ministry of Health (2009): National Health Policy 2009-Final Draft. Islamabad: Ministry of Health, Government of Pakistan.
- Ministry of Health (2011): National Health Policy.
- Ministry of Health and Family Welfare (2002): National Health Policy 2002. New Delhi: Ministry of Health and Family Welfare.
- Ministry of Health and Family Welfare (2014): National Health Policy 2015 Draft. New Delhi: Ministry of Health and Family Welfare.
- Ministry of Health and Family Welfare (2015): Meeting of Health Ministers of SAARC Countries.
- Ministry of Health and Gender (2014): Maldives Health Profile 2014.
- Ministry of Health and Population (2014): National

- Health Policy 2014. Kathmandu: Ministry of Health and Population.
- Ministry of Health Care and Nutrition (2009): The National Policy for Prevention and Control of Chronic Non-Communicable Diseases. Sri Lanka: Ministry of Health Care and Nutrition.
- Ministry of Public Health (2005): National Health Policy 2005-2009 and National Health Strategy 2005-2006. Kabul: Ministry of Public Health.
- Mishra, S.R., Neupane, D., Preen, D., Kallestrup, P. and Perry, H.B. (2015): Mitigation of Non-Communicable Diseases in Developing Countries with Community Health Workers. *Globalization and Health*, 11, p43.
- Misra, A. and Vikram, N.K. (2004): Insulin Resistance Syndrome (Metabolic Syndrome) and Obesity in Asian Indians: Evidence And Implications. *Nutrition*, 20, 5, pp.482-491.
- Moran, A. and Vedanthan, R. (2013): Cardiovascular Disease Prevention in South Asia Gathering the Evidence. *Global Heart*, 8, 2, pp.139-140.
- NCD Risk Factor Collaboration (2016): Worldwide Trends in Diabetes Since 1980: A Pooled Analysis of 751 Population-Based Studies with 4 Million Participants. *The Lancet*, 387, pp.1513-1530.
- Nefs, G., Bot, M., Browne, J.L., Speight, J. and Pouwer, F. (2012): Diabetes MILES—The Netherlands: Rationale, Design and Sample Characteristics of a National Survey Examining the Psychosocial Aspects of Living with Diabetes in Dutch Adults. *BMC Public Health*, 12, p.925.
- Pearson, J.F., Bachireddy, C., Shyamprasad, S., Goldfine, A.B. and Brownstein, J.S. (2010): Association Between Fine Particulate Matter and Diabetes Prevalence in the US. *Diabetes Care*, 33, 10, pp.2196-2201.
- Ramachandran, A., Ramachandran, S., Snehalatha, C., Augustine, C., Murugesan, N., Viswanathan, V., Kapur, A. and Williams, R. (2007): Increasing Expenditure on Health Care Incurred by Diabetic Subjects in a Developing Country a Study From India. *Diabetes Care*, 30, 2, pp.252-256.
- Ramachandran, A., Snehalatha, C., Kapur, A., Vijay, V., Mohan, V., Das, A., Rao, P., Yajnik, C., Kumar, K.P. and Nair, J.D. (2001): High Prevalence of Diabetes and Impaired Glucose Tolerance in India: National Urban Diabetes Survey. *Diabetologia*, 44, 9, pp.1094-1101.
- Roth, G.A., Forouzanfar, M.H., Moran, A.E., Barber, R., Nguyen, G., Feigin, V.L., Naghavi, M., Mensah, G.A. and Murray, C.J.L. (2015): Demographic and Epidemiologic Drivers of Global Cardiovascular Mortality. *New England Journal of Medicine*, 372, pp.1333-1341.
- Subedi, Y.P., Marais, D. and Newlands, D. (2015): Where is Nepal in the Nutrition Transition? *Asia Pac J Clin Nutr*, pp.1-20.
- Thomas, A. and Ashcraft, A. (2013): Type 2 Diabetes Risk among Asian Indians in the US: A Pilot Study. *Nursing Research and Practice*.
- United Nations (2015): *Transforming Our World: The 2030 Agenda for Sustainable Development*. New York: United Nations.
- Upreti, S.R., Lohani, G.R., Magtymova, A. and Dixit, L.P. (2016): Strengthening Policy and Governance to Address the Growing Burden of Diabetes in Nepal. *WHO, South East Asia Journal of Public Health*, 5, 1, pp.40-43.
- World Bank (2011): NCDs Policy Brief - Bangladesh, Available from http://siteresources.worldbank.org/SOUTHASIAEXT/Resources/223546-1296680097256/7707137-1296680114157/NCD_BD_Policy_Feb_2011.pdf [Accessed 20 March 2016].
- World Health Organization (2008): *School Policy Framework: Implementation of the WHO Global Strategy on Diet, Physical Activity and Health*, Geneva: WHO.
- World Health Organization (2010): *Package of Essential Noncommunicable (Pen) Disease Interventions for Primary Health Care in Low-Resource Settings*, Geneva, WHO.
- World Health Organization (2013): *Regional Action Plan and Targets for Prevention and Control of Non-Communicable Diseases (2013-2020). Resolution of the WHO Regional Committee for South-East Asia*, India, WHO.

World Health Organization (2014): *Global Status Report on Noncommunicable Diseases 2014*. Geneva: World Health Organization.

Zaninotto, P., Mindell, J. and Hirani, V. (2007): Prevalence of Cardiovascular Risk Factors Among Ethnic Groups: Results from the Health Surveys for England. *Atherosclerosis*, 195, E48-E57.

BIOGRAPHICAL NOTES

Pramod Regmi is a Public Health Researcher and currently works as a Research Fellow at the Faculty of Health and Social Sciences, Bournemouth University, England. His areas of expertise are diabetes, health of ethnic minority populations, young people's sex and relationships, health promotion, ethics in population health research and qualitative research. He holds an MA degree in Demography, MSc (Public Health Research) and PhD (Public Health).

Om Kurmi is a Senior Scientist in Respiratory Epidemiology at the Clinical Trial Service Unit and Epidemiological Studies Unit (CTSU), Nuffield Department of Population Health, University of Oxford. His main research interest is environmental epidemiology of chronic diseases, particularly cardiorespiratory health in low and middle income countries. His main areas interest are cardiorespiratory health effects of air pollution (both ambient and household air pollution), occupational exposure and smoking (active and second-hand smoking).

Nirmal Aryal holds an MSc degree in Public Health from the UK, and is currently a PhD candidate at the University of Otago, New Zealand. His research interests include epidemiology of cardiovascular diseases and related risk factors. He has published research articles on cardiovascular disease risk factors and metabolic syndrome in Nepalese and the South Asian context.

Puspa Raj Pant is a researcher at the University of the West of England, Bristol. His recent work is more on injury prevention and safety promotion, where he has used a range of approaches to achieve research objectives, from mixed-methods to community mobilization. He has contributed a book chapter "The Emerging Health Problem of Non-Communicable Diseases" as a lead author.

Amrit Banstola is a health researcher from Nepal. He currently leads the Department of Research and Training at Public Health Perspective Nepal and edits its monthly newsletter. His research interests include non-communicable diseases, injury, nutrition, child health, climate change, policy analysis and health economics.

Folashade Alloh holds an MSc in Public health, and is currently a Postgraduate Researcher at Bournemouth University. Her research interests are in Type 2 diabetes among African migrants, and she is currently looking at how environment and lifestyle factors influence the development and management of the condition among the black and ethnic minority population in the UK.

Edwin van Teijlingen is Professor of Reproductive Health Research at the Centre for Midwifery, Maternal & Perinatal Health, Bournemouth University, UK. His research background is in Public Health. He has over 220 peer-reviewed publications in the field of public health, social sciences and the organization of health care systems. More than 60 of his publications focus on Nepal. He is co-editor of the edited volume *The Dynamics of Health in Nepal* (Social Science Baha/Himal Books, Nepal).