Non-communicable diseases in South Asian immigrants: An overview

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People belonging to countries of India, Afghanistan, Bhutan, Maldives, Pakistan, Sri Lanka, Nepal and Bangladesh, who migrated to western countries, are known as South Asians (SAs). There is a pattern among the population and their health profile, even in the global scale. Non-communicable diseases (NCD) are chronic and non-transmitted diseases have longer duration and slow progression. Cardiovascular diseases, cancers, diabetes and chronic respiratory diseases are major categories of non-communicable disease responsible for 60% of global deaths (35 million). Studies on South Asians provide information on the role of environment in the causation of non-communicable diseases (NCDs) given the same genetic pool. Therefore, in this manuscript an attempt was made to review the available evidence on the status of NCDs in SAs residing abroad using content analysis from web sources and published articles.

Introduction

High blood pressure, high blood glucose, obesity, tobacco use and physical inactivity, are risk factors for Non-Communicable Diseases (NCDs) in SA. Incidence of lung, breast, uterus, ovary and testicular cancer, was found to be higher in SA living in England than their native countries. Rates of cancer in SAs of California were higher for all cancers except oral, pharyngeal, oesophageal and cervical than native Asian Indians. Higher prevalence of coronary artery disease (CAD) was found in SAs than any other ethnic group. CAD occurs early in life and follows malignant course. High triglyceride, low high density lipoprotein cholesterol, high lipoprotein (a) levels, hyperinsulinemia and central obesity are significant risk factors in SAs. Asthma was found to be increasing at a faster rate and the rate of asthma related hospitalizations was higher among SAs than general popula-

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tion. Most of the literature on SAs is based on the evidence drawn from SAs residing in United States, United Kingdom, Canada, United Arab Emirates and Singapore, these are some of the major destination countries for SA. Formulation of inclusive health policies, starting of preventive measures to reduce the burden due to NCDs and sensitization of health workers to cultural and language barriers of SAs may go a long way to reduce the disease burden of countries where SAs adapted as their home. South Asians (SAs) are the people who have ethnic roots originating from the countries of Indian subcontinent such as India, Afghanistan, Bhutan, Maldives, Pakistan, Sri Lanka, Nepal and Bangladesh. SAs constitute 1/5 of the world population and characterized by different dietary habits, culture and life style (Gupta et al., 2006; Bilen et al., 2016). It was observed that about 5-10 million people migrate annually and majority of them legally, whereas 10%-15% illegally. Socio-economic gaps, increased global connections, communication networks, faster and cheaper transportation, social networks and links with diaspora, facilitates migration. The reported reasons for migration were for studying abroad, joining family members and better employment opportunities. Migration can be temporary, permanent or circular. It may involve initial, transit, destination and return phases. It was estimated that 214 million resides in countries other than their place of birth and 57% were found to be located in high-income countries (Davies et al., 2011). Migrant people contributes high and low skill labour, rejuvenate population, improve labour market efficiency, promote entrepreneurship, spur urban renewal, and inject dynamism and diversity into destined countries and societies (Sharma et al., 2015).This manuscript attempts to present evidence on the status of Non-communicable diseases in SAs migrated to other countries for various reasons.

Non-communicable diseases (NCDs) are chronic diseases and not transmitted, have longer duration and slow progression (NCD Fact sheets). Cardiovascular diseases (coronary artery disease, hypertension, stroke, sudden cardiac deaths, arrhythmia, peripheral artery disease, congestive heart failure and congenital heart disease, deep vein thrombosis, rheumatic heart disease and pulmonary embolism), cancers, diabetes and chronic respiratory diseases are major categories of non-communicable diseases responsible for 60% of global deaths (35 million)(Davies et al., 2011; World Health Organization, 2008). High blood pressure, high blood glucose, obesity, tobacco use and physical inactivity are risk factors for NCDs (World Health Organization, 2009). SAs had been shown high risk of developing

NCDs due to higher proportion of body fat at low BMI levels, higher death and disease burden at low levels of risk factors for example glucose intolerance, genetic susceptibilities, higher prevalence of metabolic syndrome and type2 diabetes, physical inactivity, acquiring of unhealthy dietary habits in the adopted countries, increased stress levels, feelings of isolation, barriers to access to health services such as irregular legal status, unemployment, low income, poor working conditions, poor housing, low education, language and cultural barriers and lack of sensitivity in health care and social service providers (Davies et al., 2011). Most of the literature on SAs is based on evidence drawn from SAs residing in United States, United Kingdom, Canada, United Arab Emirates and Singapore.

SAs are significant population residing outside their countries of origin. Most of them follow the life stytle, social relations and endogamy with their compatriots residing in the countries of immigration or their native countries. Given the same genetic pool, studies on SAs are useful for evaluating the effect of environmental factors in the causation of diseases. Therefore, in this manuscript we reviewed the available evidence on the prevalence of non-communicable diseases in SAs.

All the data are collected from secondary sources. Using Google search engine we conducted search for the information on NCDs in SAs. We confined our search for four NCDs only such as cardiovascular diseases, cancers, type 2 diabetes, obesity and respiratory diseases. As most of the studies on NCDs in SAs are available from United States, United Kingdom, Canada, Singapore and United Arab Emirates we restricted our search to these countries. Our search for information included original articles, review articles, meta-analysis and editorials. Publications of reputed journals and contributing to significant information were included in this review article by mutual agreement between the authours for inclusion of publication in this review.

Cancer in SA immigrants:

United Kingdom:

SAs constitute 4% of population in England and have different socio-economic distributions. Incidence of lung, breast, uterus, ovary and testicular cancer was found to be higher in SAs living in England than their native countries. The cited reasons for high incidence were high prevalence of

smoking in especially Bangladeshi migrants, changes in reproductive behaviour, diet and body size, for breast cancer; lower access to diagnostic tests, for prostate cancer; and lower processed red meat intake, for colorectal cancer (Maringe et al., 2013). SAs had higher survival rates for cancers such as colorectal (58.9% vs. 53.6%), liver (15.0% vs. 9.4%) and lung (15.9% vs. 9.3%) and lower survival rates in breast and prostate cancer than non-Asians (Maringe et al., 2015). In another study, higher mortality was observed for liver, oral cavity and gall bladder cancer in the first generation of Bangladeshi, whereas, lower mortality was found in subsequent generations (Mangtani et al., 2010). Among SAs migrated to England, standardized mortality ratios for all cancers was found to be 58 from people of Indian than Bangladeshi origin in whom the mortality ratio was 85 (Zaman et al., 2007).

Incidence rate of cancer per 100000 men and women were found to be high in SAs of United Kingdom (173 and 179) followed by United States(142-152 and 164-176) and Singapore(102 and 132) and these observation were made for colorectal, prostate, thyroid, pancreas, lung, breast and non-Hodgkin lymphoma (Rastogi et al.,2008). Incidence rate of breast cancer was 29% lower and survival rate was 70% in SA than non-SA women (Farooq & Coleman, 2005). Poor survival outcomes for leukaemia and lymphoma and better survival outcomes for solid tumours was observed in SA children and young adults compared to non-SA counterparts (van Laar et al., 2012). Lower rates of prostate cancer were observed in SAs than white people (Metcalfe et al., 2008). Risk of breast cancer was found to be decreasing in SAs than native English women (McCormack et al., 2004). In a longitudinal study spanning 18 years found lower incidence of malignant neoplasms of lung, oral cavity, pharynx, oesophageal, liver, laryngeal and renal in SAs than Scottish, Irish, Northern Island men and women (Harding & Rosato, 1999). SA men had higher risk of oral cancer, whereas, SA women had higher risk of oral and pharyngeal cancer than non-SA men and women (Moles et al., 2008).

United States: Rates of cancer in SAs in California were higher for all cancers except oral, pharyngeal, oesophageal and cervical than native Asian Indians. SA population had registered higher rate of cancers of oesophagus, gall bladder, prostate, breast, ovary and uterus, as well as lymphomas, leukemias and multiple myelomas than Asia-Pacific Islanders. SAs experienced higher prevalence of cancers of the stomach, liver and bile duct,

gall bladder, cervix and multiple myelomas than non-Hispanic populations (Jain et al., 2005).

Cardiovascular diseases, obesity and type 2 diabetes in SA immigrants:

United States: Higher prevalence of coronary artery disease (CAD) was found in SAs than any other ethnic group. CAD occurs early in life and follows malignant course. High triglyceride, low high density lipoprotein cholesterol, high lipoprotein (a) levels, hyperinsulinemia and central obesity are significant risk factors in SA (Enas & Mehta, 1995). Two to four fold risk at all ages and 5-10 fold risk under 40 years, higher hospitalizations due to CAD were observed in SAs (Enas & Mehta, 1995). Severe and extensive narrowing of coronary artery was observed in SAs compared to other ethnic groups (Enas et al., 1992). Prevalence of smoking was not found to be significantly different in SAs than other ethnic groups (Jha et al., 1993). Prevalence of smoking, high serum cholesterol, high blood pressure in SAs was found to be not different from Caucasians (Enas et al., 1996). The prevalence of type 2diabetes was found to be 20% and 3-4 times higher than Caucasians. Abdominal obesity was reported as strong risk factor for CAD in SAs (Mckeigue et al.,1991).

SAs had similar but smaller LDL cholesterol (LDL-C)s whereas prevalence of low HDL cholesterol(HDL-C) and less protective HDL particle(HDL2b) was higher than other populations (Kulkarni et al.,1999; Bhalodkar et al., 2004; Superko et al., 2005). Prevalence of type 2 diabetes was higher in SAs than Blacks, Whites and Hispanics (Venkatraman et al., 2004). Higher proportional mortality ratios for CAD and higher prevalence of subclinical atherosclerosis were observed in SAs compared to other six racial groups (Palaniappan et al., 2004; Gupta et al., 2006). Increased abdominal visceral fat and insulin resistance was observed in SAs when compared to Europeans at similar BMI (Yusuf et al., 2005). Higher levels of lipoprotein(a), homocysteine, plasminogen activator inhibitor and frequent observation of microalbuminuria was observed in SAs than White populations (Gupta et al., 2006). Low adiponectin levels and higher plasma concentrations of adipose tissue metabolite leptin and non esterified fatty acids were observed in SAs than in Whites (Raji et al.,2004; Abate et al.,2004). INTERHEART study in 52 countries including SAs showed smoking, raised apolipoproteinB/apolipoprotein A1 ratio, hypertension, diabetes mellitus, abdominal

obesity and psychosocial stress were significant risk factors for myocardial infarction, whereas, daily consumption of fruits and vegetable, moderate consumption of alcohol and regular physical activity were protective factors for myocardial infarction (Yusuf et al.,2004). SA women had higher prevalence of coronary artery calcium than most other racial groups (Kanaya et al., 2014). Higher prevalence of type 2 diabetes, insulin resistance and lower beta levels were observed in SAs than other racial groups (Kanaya et al., 2014). SAs were found to be younger, had higher prevalence of diabetes, dyslipidemia and acute coronary syndromes; had smaller normalized proximal LAD luminal diameters, increased percent stenosis in proximal LAD and RCA segments and higher number of patients with multiple diseased vessel segments than Caucasians (Hasan et al.,2011). Religiosity mediated by cultural beliefs, diet and physical activity (9%) showed association with overweight/obesity in Muslims, Hindus and Sikhs (Bharmal et al., 2018). Believers of Islam showed higher mean levels of triglycerides and LDL cholesterol and lower levels of HDL cholesterol than those without religious affiliation (Hirode et al., 2019). In association study of alcohol consumption with common carotid artery intima-medial thickness measured by computed tomography showed that >7drinks/week of alcohol consumption increased 0.096mm thickness of arterial intimal-medial region (Chevli et al., 2020). A comparative study of NCD risk factors in three groups of SAs (those who prefer SA culture; United States Culture and SA and US culture) showed that in women who prefer SA culture had higher prevalence of pre-diabetes, diabetes, fasting and 2hr glucose and 2hr insulin than group favouring SA and US culture. Women who prefer US culture showed lower triglycerides, body mass index, waist circumference and higher HDL cholesterol than women favouring SA culture after adjustment for age, years in US, study site, socio-economic and life style factors. In men, no such trend was observed with reference to NCD risk factors (Al-sofiani et al., 2020).

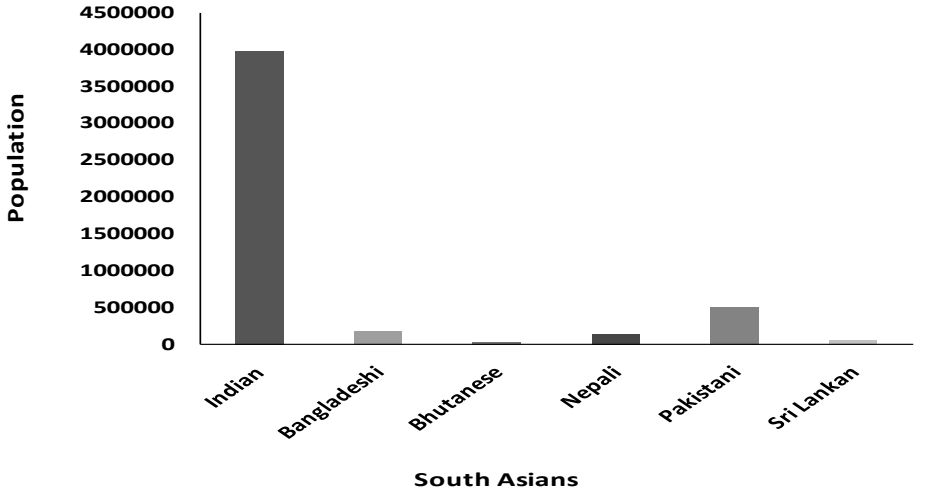
Table 1: Population Statistics of South Asians in USA in 2015

South Asians	Population
Indian	3,982,000
Bangladeshi	188,000
Bhutanese	24,000
Nepali	140,000

Pakistani	519,000
Sri Lankan	60,000

Source: Population estimates from U.S. Census Bureau, 2015 American Community Survey 1-year estimates . https://www.pewresearch.org/fact-tank/2017/09/08/key-facts-about-asian-americans/.Acess21 April 2

Figure 1 : Population distribution of South Asians in USA in 2015



United Kingdom: In SAs, the relative risk of dying in the age group of 20-29 years due to CAD was 3.13 as against 1.36 for all age groups (Enas et al., 1996). SAs were twice as likely to be admitted to hospital with heart attack and younger and more likely to die due to heart attacks in the ensuing six months than Caucasians (Wilkinson et al., 1996). Compared to Caucasians, correlation between insulin resistance syndrome and CAD was observed in SA (Dhawan, 1996). A 3 to 5 fold increase in myocardial infarction and cardiovascular death was observed in SAs when compared to other ethnic groups (Harding, 2003). Prevalence of hypertension was similar and prevalence of smoking was lower in SAs than other populations (Agyemand & Bhopal, 2002; Anand, 2000; Petersen et al., 2004). Coronary mortality fell for all migrants but remained higher for SAs men and women than Whites (Harding et al., 2008). The standardized mortality ratio for diabetes

in SAs before 30 years in men was 3.9 and in women it was 10.1 in contrast to men and women of non-SA who had the standardized mortality ratio of 2.7 and 4.0 respectively (Swerdlow et al.,2004). Poorer knowledge and understanding of diabetes, lower physical activity, cholesterol, smoking and similar levels of hypertension was observed in SAs than in Whites (Zaman et al., 2011). High proportion of younger SAs were admitted to the hospital due to CAD than Whites (Wilkinson et al.,1996). SAs had better prognosis for mortality with history of CAD and diabetes than Whites (Zaman et al., 2013). Indians had less CAD than people originated from Bangladesh and Pakistan (Bhopal, 2000). SAs had fewer retinal arteriolar and venular vessels and bifurcations compared to the White population (Hughes et al., 2013). Higher prevalence of type 2 diabetes was observed among SAs than Black or White people(English et al.,2016). Higher maternal obesity was observed in Pakistanis (32.3%) followed by Bangladeshi(24.3%) and Indian(22.8%) women residing in United Kingdom(Garcia et al.,2017). Cuisine of SAs was found to be dominated by frying and roasting and food contained higher proportion of trans fatty acids (Kakde et al., 2017).

Table 2: Population statistics of South Asians in England and Wales (2011)

South Asians	Population(thousands)
Indian	1413*
Bangladeshi	447
Pakistan	1124

Source: unity/culturalidentity/ethnicity/articles/2011censusanhttps://www.ons.gov.uk/peoplepopulationandcommalysisethnicityandreligionofthenonukbornpopulationinenglandandwales/2015-06-18#toc. * indicates UK and non-UK born.

Figure 2: Census of South Asians in England and Whales (2011)

Canada: Highest CAD mortality in SAs when compared to individuals of Chinese and European descent was reported (Sheth et al., 2019). SAs when compared to Whites were more likely to present to the hospital later and have anterior myocardial infarction (Gupta et al.,2002). Young SAs admitted for cardiac catheterization were presented with left main, multi vessel disease and distal CAD (Gupta et al., 2001). SAs were younger at the time of first hospitalization for heart failure than other non-Asian (Singh and Gupta, 2005). C reactive protein mean levels were higher in SAs than Europeans and Chinese even after adjusting for age, sex and metabolic factors (Anand et al., 2004). Higher rates of coronary angiography were reported in SAs than in general population (Jones et al., 2004). Higher prevalence of CAD was observed in SAs than in Whites. The prevalence of diabetes, hypertension, lower HDL-C and higher percentage of body fat was found to be higher in SAs than in Whites (Rana et al., 2004). SAs experienced more major cardiac events within three months after transplantation compared with Whites (Prasad et al., 2011). Standardized rate of acute

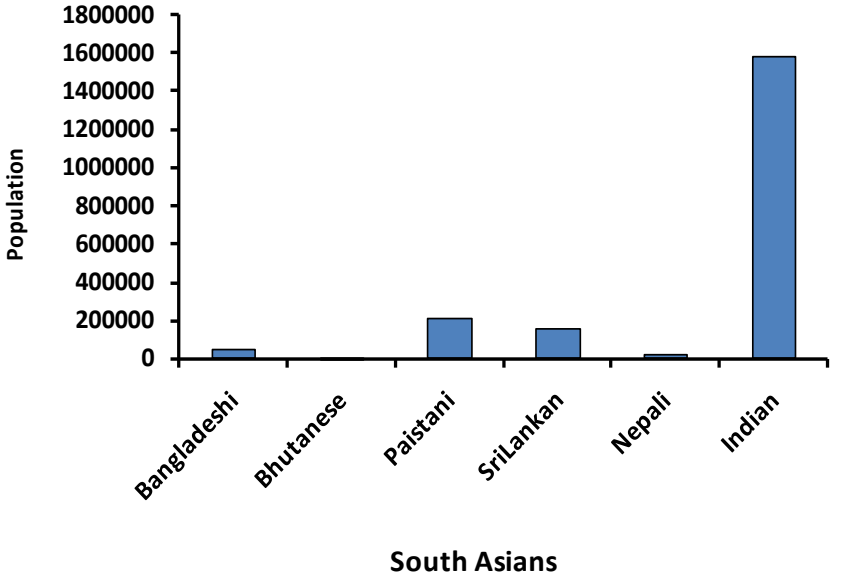
myocardial infarction hospitalization was highest in South Asians than Whites and Chinese. The same trend was also reported among South Asian women. Young men of South Asian origin had double and ten time higher incident rate of acute myocardial infarction than White and Chinese ethnic groups in British Columbia (Nijjar et al., 2010).Analysis of first generation immigrant data of South Asians in Canada revealed age,gender and income adjusted prevalence of diabetes was higher in people from Sri Lanka followed by Bangladesh, Pakistan, India and Nepal. Within each group prevalence was higher in men than women and increased with income, education, English speaking ability and refugee status (Benerjee and Shah, 2018). South Asians in Canada constitute 5.6% of Canadian population. SAs in Canada mostly populated in Ontario, Alberta and British Columbia. SAs follow faith in Hinduism, Islam, Sikhism and Christianity. Most SAs speak Punjabi (South Asian Canadians Wikipedia). Indian origin people in Singapore were dominated by Tamilians and Malayalee. They follow religious faiths of Hinduism, Islam, Christianity, Sikhism and Buddhism. English, Malay, Chinese and Tamil are mostly spoken languages by SAs in Singapore (Indian Singaporeans, Wikipedia).

Table 3: Population statistics of South Asians in Canada (2016)

South Asians	Population
Bangladeshi	45940
Bhutanese	3600
Paistani	215555
SriLankan	159880
Nepali	17140
Indian	1582215

Source:https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.

Figure 3: Census data of South Asians in Canada (2016)



Singapore: The relative risk of dying of in the age group of 30-39 years was 12.5 in SAs whereas it was 3 in Chinese men aged 60-69 years (Hughes et al., 1990). Hospital admission of younger SAs due to heart attack and dying due to heart attack was higher within six months than other ethnic groups in Singapore (Ministry of health, Singapore, 1993). A serial population survey in Singapore showed that age standardized prevalence of diabetes was stable among Chinese whereas among South Asians the diabetes showed increased trend from 1992-2010. Prevalence of obesity among Chinese women found to be stable but Chinese men and South Asians showed increased prevalence (Tan et al., 2016).

United Arab Emirates: It has been estimated that 89% of population of UAE comprised of migrants from low and middle income countries dominated by South Asian countries (2/3 of all immigrants). Prevalence of obesity, central obesity, hypertension and diabetes was found to be 44.7%, 66.7%, 30.5% and 9% respectively. Six to 10 years stay at UAE had Odds

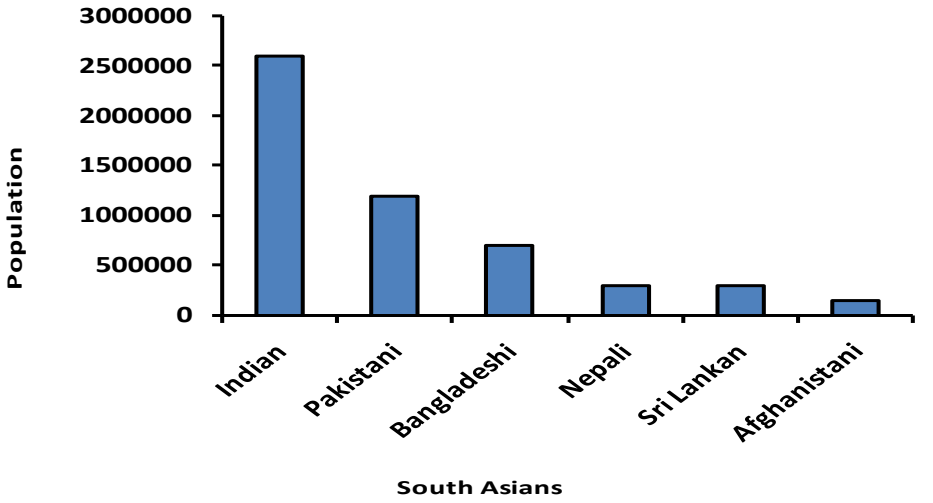
ratio of 1.6 for developing central obesity. Higher prevalence of obesity was attributed to increased fat intake, increased consumption of refined carbohydrates and soft drinks and low physical activity (Shah et al., 2015).

Table 4: Census data of South Asians in United Arab Emirates (2015)

South Asians	Population
Indian	2600000
Pakistani	1200000
Bangladeshi	700000
Nepali	300000
Sri Lankan	300000
Afghanistani	150000

Source:https://web.archive.org/web/20170321184658/http://www.bq-magazine.com/economy/socioeconomics/2015/04/uae-population-by-nationality

Figure 4: Census data of South Asians in United Arab Emirates



Most of the immigrant SAs in UAE were underpaid, unskilled or semi-skilled, live alone or share with other compatriots and characterized by suffering from depression, anxiety and stress (Shah et al. 2015). The majority of Asian immigrants to U.S. came as refugees or to study/ work/ reunite with their families. After Chinese, Asians of Indian origin is the largest Asian population (20%). Approximately 73% Asian adults are born outside of U.S. Among Asians, 92% of Bhutanese were born in countries other than U.S. About 13% of Asian origin immigrants were unauthourizedly living in U.S. Highest median annual income was observed in Indians followed by Sri Lanka, Nepali and Bangladeshi households. In poverty, Bhutanese contribute higher proportion and Indians the least. The majority of Indians had Bachelor's degree followed by Sri Lankan and Bhutanese origin SAs. Higher proportion of Nepali had house ownership among SAs. Indian followed by Bhutanese origin SAs were reported to speak English fluently. A higher percent of Bhutanese among SAs were found to be living in multigenerational families. Western U.S followed by California was inhabited by most of the Asian Americans (Lopez et al., 2017). Characteristics of Indian origin SAs are available from public resources. Indian origin SA contributes 2.5% of population in England and Wales. Leicester, Birmingham and Harrow are populated by the Indian ethnic groups. About 42.9% of Indian origin born in England; 8.3% lived in most deprived regions; 33.4% belonged to 18-34 years; 12% aged above 60 years; 3.8% were single parents; 76% were employed; 43% had annual income of £34,700; and74% were house owners(Indian ethnic fact and figures, 2019)

Respiratory diseases among South Asian immigrants: Multi ethnic study on the prevalence, severity and management of chronic obstructive pulmonary disease in London showed that South Asians and Blacks than Whites are less likely to have breathlessness; South Asians had vaccine rates for influenza and pneumococcous and lower referral rates for pulmonary rehabilitation along with Blacks than Whites (Martin et al.,2012). A comparative study on asthma consultations in England among White, South Asians and Afro-Caribbeans revealed lower consultations among White than other ethnic groups. Without regard to born in England or not, South Asians and Afro-Caribbeans experienced increased risks than Whites (Netuveli et al.,2005).

Asthma was found to be increasing at faster rate and rate of asthma related

hospitalizations was higher among SAs than general population of Ontario, Canada (Stanojevic et al.,2014; Benchimol et al.,2015). SA women who migrated to the United Kingdom aged 5 years or older reported less asthma (6.5%) than those born in the United Kingdom or who migrated before age 5 (16.0%), with an adjusted odds ratio of 0.38 (Kuehni et al.,2007). Formulation of inclusive health policies, starting of preventive measure to reduce the burden due to NCDs and sensitization of health workers to cultural and language barriers of SAs may go a long way to reduce the exchequer and disease burden of countries where SAs adapted as their home (Davies et al., 2011).

In this review, we have included four broad non-communicable diseases (cancers, cardiovascular diseases, obesity and diabetes and respiratory diseases), the subtypes of these diseases could not be included due to the lack of data on them. Even among cancers, information is available from U.S and United Kingdom only. This suggests the need to carry out more studies on NCDS from different countries where SAs are populated. Without regard to the country of immigration, SAs were characterized by unfavourable picture on NCDs than native populations. Wherever SAs immigrated, three categories of SAs emerge 1. Those who are still retaining the culture of country of origin 2. Those who adopted the culture of immigrant country 3. Those who follow the culture of countries of origin and adoption. Adoption of culture of immigrant country is seen in some of the SAs who belong to second-generation, younger and born in immigrant countries. These observations should be taken into consideration while designing the studies on SAs. It is interesting to note that countries of origin and immigration are conducting studies without integration or collaboration with each other which is not benefiting either of them. Collaborative studies on SAs between countries of origin and immigration can help to draw integrative evidence using uniform methods to develop policies and intervention for the improving the health status of SAs.

Critical Remarks and Policy Suggestions:

1. SAs should be made proficient in English speaking; this enables to bridge the gaps between patients and health care providers. Wherever needed language assistance should be provided to those who cannot speak English fluently.

2. Committees and organizations involved on health aspects of SAs should educate the community members on various health issues, generate funding for those who cannot afford the treatment and design the culturally acceptable interventions to reduce risk factor burden and prevent the development of diseases.
3. Family decisions influence the health seeking behaviour of SAs especially among women. Policy make Rs should take this aspect in to account while designing interventions in women (Bottorff et al., 2001)

4. To better strengthen the communication between patients and health care providers, studies should be conducted on beliefs and values of SAs and role of cultural and social factors influencing the definition of health problems of SAs (Bottorff et al., 2001).

5. Governments of all countries are encouraged to make health policies on migrants and legal frame work for the enforce of the same.

6. United Nations should instruct all its member countries to remove barriers and enhance the coverage of insurance to SAs in their countries irrespective of their income-levels, length of stay, immigration and legal residence status (Llano, Standford University).

7. Immigrants should be made aware and familiar on the available health services, health promotion and health screening programmes (Llano, Standford University).

8. Countries should support to countries to which their native people emigrated to implement health policies and national action plans on migrants and monitor their health periodically (World Health Organization, 2018).

9. SAs are grouped as minority though they differ in language, cultural practices, belief system and health behaviours. Efforts should made to appreciate the heterogeneity among them (Islam, 2013).

10. In the absence of quality of health data it is difficult to identify the health concerns of SAs and getting grants for promoting studies for evaluating their health status. There is need to initiate large number of studies to

collect health data of SAs (Islam, 2013).

11. Facilitation of orderly, safe, and responsible migration and mobility of people, including through implementation of planned and well-managed migration policies as given in sustainable development goal target 10.7 is the responsibility of all Unite Nation member countries which should be enforced.(Sustainable development goals knowledge platform).

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