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Onset of Non-Communicable Diseases in India, 2004-14

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Background

Non-communicable diseases (NCDs) are the leading cause of premature mortality, morbidity, hospitalization and disability globally and nationally (WHO, 2018; Forouzanfar et al., 2016; Cao et al., 2018; Mahal et al., 2010). An estimated 41 million of 57 million deaths were due to NCDs in 2016, nearly 32 million in low and middle income countries and 9 million in high income countries. India, with an estimated 9.6 million NCDs deaths in 2016, accounts for one-fourth of all NCD deaths worldwide (WHO, 2018). The proportion of deaths due to NCDs in the country has increased from 37.9 percent in 1990 to 61.8 percent by 2016, and the burden of disease measured in terms of Quality Adjusted Life Years (QALY) had increased for all NCDs (Dandona et al., 2017). Increase in NCDs is associated with early onset, prolonged duration of treatment, and exerts a high economic burden on households and the nation (Miszkurka et al., 2012). NCDs affect all ages, but it is disproportionately higher among the working and older population (Mini & Thankappan, 2017). Estimates of onset of diseases are key inputs for public health programmes, health planning and health budgeting. Effective intervention to prevent the early onset of disease is possible with public health measures.

The definition of age at the onset of disease is not consistent in literature. It has been defined using the first symptom of illness, time of first hospitalization or first symptom in connection with first hospitalization (Kjeldsen et al., 2006). In Health and Retirement Study (HRS), the age at onset was derived from a question age at diagnosis of the specific disease by a trained health professional (Capistrant et al., 2014). The distribution and median age by disease are indicative of the progression of disease in a population. Though a number of studies estimated the morbidity, hospitalization, OOPE and CHS, no attempt has been made to estimate the onset of NCDs over time in India. In this context, this research brief presents the estimates of onset of NCDs in India.

Data and Methods

We have used the unit data of Schedule 25.0 from the 60th and 71st rounds of the National Sample Survey (NSS), henceforth referred to as 60 (25.0) and 71 (25.0), conducted in 2004 and 2014 respectively. Particulars were collected by spell of ailment of household members along with cost of treatment and other characteristics during a 15 day (both outpatient and inpatient) and a 365 day (inpatients) reference period. We have used data collected in a reference period of 15 days. A total of 38,091 cases of 32,394 individuals were covered in 2004 and 37,282 cases of 31,219 individuals were covered in 2014. In 2004, the NSS provided the morbidities in 5 major categories and 42 individual ailments, and in 2014 it provided for 15 major categories and 61 individual ailments. Besides, both the rounds of survey had information on the total duration of ailments in days and current age.

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We have reclassified the disease by considering the sample size, similarity of disease, the classification adopted in earlier studies and similarity for two rounds of survey. After a detailed check, we have provided the estimates for eleven NCDs and injuries/accident. We have used the descriptive statistics, Cox proportional hazards model and Kaplan-Meier survival estimates in the analyses. The onset of diseases was defined as the difference of current age and duration of diseases. The median age of onset, the 25th and 75th percentile along with mean and 95 percent confidence interval of each disease was presented. The Kaplan-Meier survival function was used to estimate the probability of a specific morbidity not occurring until a certain age. It used current age as time, occurrence of each disease as a binary variable and age of the person of the onset of each disease as the final event (failure) of the analyses. The Cox proportional hazards model was used to estimate the timing of onset of each specific NCD.

Results

Changing Median Age of Non-Communicable Diseases

Table 1 presents the median age of onset of eleven NCDs and injury/accident for 2004 and 2014. The median age of onset of all eleven NCDs has declined during the last decade. The median age of cancer has declined by 3 years and about half of the cancer patients were below 46 years in 2014. Similarly, the median age of heart disease has declined from 58 years to 54 years and that of diabetes from 58 years to 52 years. During this period, the median age of onset for injury/accident has increased from 32 to 44 years. The largest decline in median age was for eye disease followed by asthma. The onset of NCDs and injury/accident at 25 percentile, 50 percentile (median), 75 percentile along with mean and 95 percent confidence interval (CI) is also presented in table 1. The overall median age of onset of NCDs has declined from 57 years in 2004 to 50 years by 2014. About one-fourth of the NCDs occurred before age 40. The 25th percentile for diabetes was 52 years in 2004 and declined to 45 years by 2014. In 2014, about one fourth of mental disease was under 16 years and that of neurological disease was 27 years, lower than other NCDs. The median age of most of the NCDs has shown a declining trend over time, suggesting that the NCDs are affecting the younger population. Specifically, the median age of diabetes has declined from 58 years in 2004 to 52 years in 2014 and that of high blood pressure has declined from 59 to 55 years, heart disease from 58 to 54 years, eye disease from 63 to 50 years and bone disease from 60 to 55 years during this period. In 2004, among all NCDs, the median age of onset of injury/accident (32 years) was the earliest followed by blood disease (33 years) in 2004. On the other hand, in 2014, the onset of blood disease (31 years) was earliest followed by mental disease (33 years). In 2014 about one-fourth of the mental diseases occurred under 17 years, while it was 25 years for injuries/accident suggesting that these diseases were largely affecting young population.

Table. 1: Onset of Selected Non-Communicable Diseases (NCDs) in India, 2004-14

Sr. No.	Type of NCDs	Onset of NCDs (years), 2004					Onset of NCDs (years), 2014				
		P25	Median	P75	Mean	95% CI	P25	Median	P75	Mean	95% CI
1	Diabetes	52	58	66	57	57-58	45	52	60	52	52-52
2	High Blood Pressure	52	59	67	57	57-58	46	55	62	55	54-55
3	Heart Disease	47	58	67	55	54-55	44	54	64	52	51-53
4	Asthma	46	59	68	53	52-54	36	51	64	47	46-48
5	Genitourinary	27	34	54	38	37-39	25	36	50	37	36-39
6	Cancer	35	49	61	47	45-49	36	46	59	46	44-48
7	Neurological	26	43	63	43	42-44	27	39	59	38	37-39
8	Mental Disease	23	34	51	37	35-39	16	33	47	32	30-34
9	Blood Disease	20	33	58	33	30-37	22	31	54	34	32-36
10	Eye Disease	53	63	70	57	56-58	32	50	65	45	43-47
11	Bone Disease	49	60	68	56	55-57	44	55	63	53	52-53
12	Injury/Accident	19	32	55	34	33-35	25	44	55	42	41-43
	NCD (Any)	41	57	67	52	51-52	39	50	61	48	48-49

Kaplan-Meier (K-M) Estimates of Selected NCDs and Injury/Accident in India, 2014

Figure 1 presents the K-M estimates of NCDs- diabetes, heart disease, high blood pressure, cancer, neurological, mental diseases and injuries/accidents. These NCDs are presented based on their contribution to DALY and for dispositional clarity. The K-M curves show the probability that the onset of the disease has occurred at a certain age and that the pattern of the onset of these diseases is different. Among all the seven NCDs, the probability of mental disease occurs consistently at a younger age followed by injuries/accident, neurological disorder, cancer, heart disease, high blood pressure and diabetes. For example, the probability of onset of mental disease by age 40 was 0.6, while that for diabetes and hypertension was less than 0.2. The probability of onset of cancer was at a younger age than diabetes, hypertension and heart disease. All these diseases have a higher chance of occurrence by age 60.

Figure 1: Kaplan- Meier Survival Estimates of seven NCDs in India, 2014

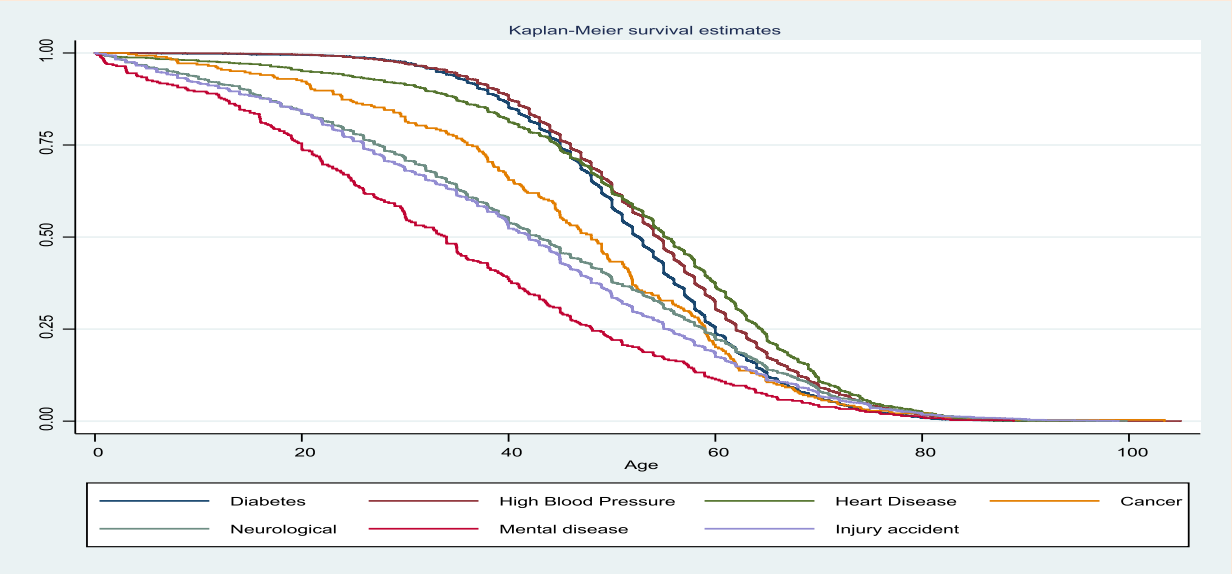

Table 2: Onset (in years) and Hazard Ratio of Diabetes in India, 2014

Background Characteristics	Diabetes			
	Median age of Onset (in years)	Incidence rate	Hazard Ratio	95% CI
Region				
Northern Region	52	0.0192		
Eastern Region	52	0.0191	1.06	0.93-1.20
Northeast	56	0.0178	0.62	0.46-0.84
Western Central	54	0.0185	1.27	1.13-1.42
Southern Region	52	0.0192	2.11	1.91-2.34
Residence				
Rural	52	0.0190		
Urban	52	0.0191	1.60	1.49-1.73
Education				
No Education	55	0.0180		
Up to Primary	52	0.0190	1.17	1.07-1.28
Middle/Secondary	50	0.0199	1.46	1.33-1.61
Higher Secondary & Above	52	0.0195	1.60	1.43-1.79
Religion				
Hindu	53	0.0191		
Muslim	51	0.0196	1.17	1.06-1.28
Others	54	0.0185	1.04	0.94-1.16
Social Group				
ST	50	0.0197		
SC	52	0.0192	1.39	1.13-1.71
OBC	52	0.0192	1.36	1.12-1.66
Others	53	0.0188	1.33	1.09-1.62
Sex				
Male	53	0.0189		
Female	51	0.0193	0.96	0.90-1.03
MPCE Tertile				
First	54	0.0188		
Second	53	0.0190	1.22	1.11-1.34
Third	52	0.0192	1.48	1.34-1.63
Employment				
Labourer	50	0.0197		
Self employed	53	0.0191	1.30	1.17-1.44
Regular Wage/Salary	51	0.0195	1.30	1.16-1.45
Others	57	0.0177	1.23	1.08-1.40

Onset of Diabetes

We estimated the median age, incidence rate, hazard ratio and 95 percent confidence interval for each of the NCDs by socio-demographic characteristics using Cox proportional- hazards model. We present diabetes as an illustration (table 2). The hazard function addresses the failure rate at time 't' among those individuals who are without specific disease. The median age at the onset of diabetes was 55 years for those who had no education, 50 years for those with middle/secondary education, 52 years among those who had education up to primary level and 52 years for those with higher secondary education and above. The median age of diabetes among males was 53 years, while it was 52 years among females.

Hazard Ratio

The adjusted hazard ratio (AHR) of diabetes was higher in the southern region (AHR=2.11; 95% CI: 1.91-2.34) and western region (AHR=1.27; 95% CI: 1.13-1.42) compared to that in the northern region. Among other independent variables, educational attainment showed a statistically strong association with the onset of diabetes. The estimated hazard for the education variable showed an increasing pattern. The hazard of the onset of diabetes among those who had higher secondary education and above was 1.60 times higher compared to those with no education.

Conclusion

The finding suggests that the younger population in India is increasingly vulnerable to NCDS. The median age had declined for all the NCDs and increased for injuries/accident. About one-fourth of the NCD cases took place before age 40, and the pattern is similar for each of the NCDs. The mental disease occurs at a younger age followed by injuries/accident, neurological disorder, cancer, heart disease, high blood pressure and diabetes. The factors affecting age at onset of each of the NCDs are diverse - genetic, physiological, environmental and behavioral. A comprehensive strategy that strengthens information, education and communication on the adverse effects of NCDs, early diagnosis, preventive and curative care can help reduce the burden of NCDs in India.

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