

Does Increasing Longevity Lead Increasing Disability? Evidence from Indian States

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Abstract

Recent studies uncovered continuous increase in life expectancy (LE) at birth in India and its states. Does increasing longevity lead to increasing disability? How is LE associated with proportions of life in good or bad health?

The paper aims to answer these questions by relating the disability data available in the 2011 census with the corresponding mortality data in the Sample Registration System. In doing so, the paper examines the differential pattern of disability among older adults defined as aged 60 and above and the association between LE and healthy life expectancy (HLE) at birth and at age 60 in India and its states.

Two measures are used to quantify disability in Indian states. First, disability rates were calculated by age, sex, residence and states; secondly, healthy life expectancy (HLE) and disabled life expectancy (DLE) were calculated by the method proposed by Sullivan (1971) and proportion of life spent in poor health.

Findings reveal that almost all types of disability increase with increasing age. There exists greater prevalence of disability in rural areas, among elderly populations and the oldest-old women in India. The disability prevalence rate is systematically more among Indian men than Indian women until age 79. Among the oldest age group (80+), Indian women are more disabled than men. On average, both males and females are expected to live about two years in an unhealthy condition. In general, there exists positive association between LE and HLE.

The findings recommend that policy and intervention on disability should be pro-rural, pro-gender and pro-elderly to reduce the disparity in disability among the Indian population. Further, modification of census disability definition as per the International Classification of Functioning, Disability and Health model of the World Health Organization is urgently needed for accurate measurement of the disabled population in India.

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I. Introduction

India's consistent achievement in gaining life expectancy (LE) in the past several decades made it the home of more than 103 million people aged 60 years and above in 2011. As a consequence of its rapidly ageing population, the central theme of health research in India is no longer confined to longevity but has expanded to understanding the burden of disability, particularly among the old-aged population. Does survival advantage translate to poorer health among older adults (60+) in India?

Answering these questions is of an enormous importance for future health care needs and policy implications. The existing body of literature addressing ageing and disability issues are not inclusive. While one group of studies focuses exclusively on the measurement and prevalence of disabilities in India (Mitra and Sambamoorthi 2006; Jeffery and Singal 2008; Mishra and Gupta 2006; Mehrotra 2006; Bakshi 2010), other studies focus on the problem of ageing issues in India (Chatterji et al. 2008; Thomas et al. 2014). We, however, found a limited number of studies that link ageing and disability by applying population-level disability data.

Nevertheless, addressing this question is not straightforward even in the context of developed countries, where the literature revolving around this issue is ample. While several researchers argue that people are living longer healthy lives (Fries 1983), some others believe that ill health and disability has increased with increasing longevity (Kramer 1980; Gruenberg 1977). Crimmins et al. (1989) claim that the association between longer lives and longer healthy lives depends on the definition of "health"; for instance, if the definition of "health" includes an ability to participate fully in the normal activities of everyday life, then the population under consideration might not live longer healthy lives. However, the conclusion would be altered if the definition were limited only to ill health, or to days spent in bed.

Unlike China or many other developed countries, India has the advantage of having heterogeneous sub-populations with diverse demographic indicators. It is well documented that most of the southern states in India are in the advanced stages of demographic transition with low mortality and more old-aged populations, whereas the central and eastern states still have relatively high mortality and young populations. This demographic diversity across Indian sub-populations gives an opportunity to test the linkage between different levels of survivorship and disability even after applying cross-sectional data.

The purpose of this paper is twofold. First, we examine the differential patterns of disability condition among the older population in India. Secondly, using 80 sub-populations of India, we test whether increasing longevity measured by life expectancy (LE) at birth and age 60 leads to increasing disability measured by proportion of life in poor health.

II. Data and Methods

Disability data were used from the C-20 table of the most recent 2011 Census provided by the Office of the Registrar General and Census Commissioner India. The question canvassed in Census 2011 is “Is this person mentally or physically disabled?” If the answer to this question is “yes”, a list of eight different types of disability is provided, viz. disability 1) in seeing, 2) in hearing, 3) in speech, 4) in movement, 5) mental retardation, 6) mental illness, 7) any other and 8) multiple disabilities. A detailed definition of each of the disabilities mentioned above can be found on the website of the Office of the Registrar General and Census Commissioner, India. Data were organized into 5- and 10-year age groups—0 to 4, 5 to 9, 10 to 19, 20 to 29,... and the 90+—by sex and residence (rural-urban) at the state- and district-level. Since disability information is not available in the line of conventional life table age groups, we assumed that percentage disability in each five-year age group is the same as the percent disability for corresponding ten-year age group, i.e., if the disability rate for the 60-69 age group is 4.41, we assume that the percent disability for each five-year age group, viz. 60-64 and 65-69, is 4.41. For the age group 0-4, we assume that the disability rate is uniformly distributed in each age. Although disability information was collected in the 1981, 1991 and 2001 Census, we could not use those due to definitional changes in disability from one census to another. To calculate the disability rate, the corresponding population data are obtained from the same census.

Age-specific death rates (ASDR) for the years 2010, 2011 and 2012 were obtained from statistical reports of the Sample Registration System (SRS). Instead of using one single-year ASDR, we used an average of ASDRs for 2010, 2011 and 2012 to eliminate possible sampling fluctuation. In short, the SRS, a dual registration system in India that covers six million of the population, has been providing the most reliable estimates of vital rates at national and sub-national (state categorized by rural-urban) since the 1970s. Several previous studies evaluated the quality of mortality information provided by the SRS (Saikia et al. 2011; Bhat 2002).

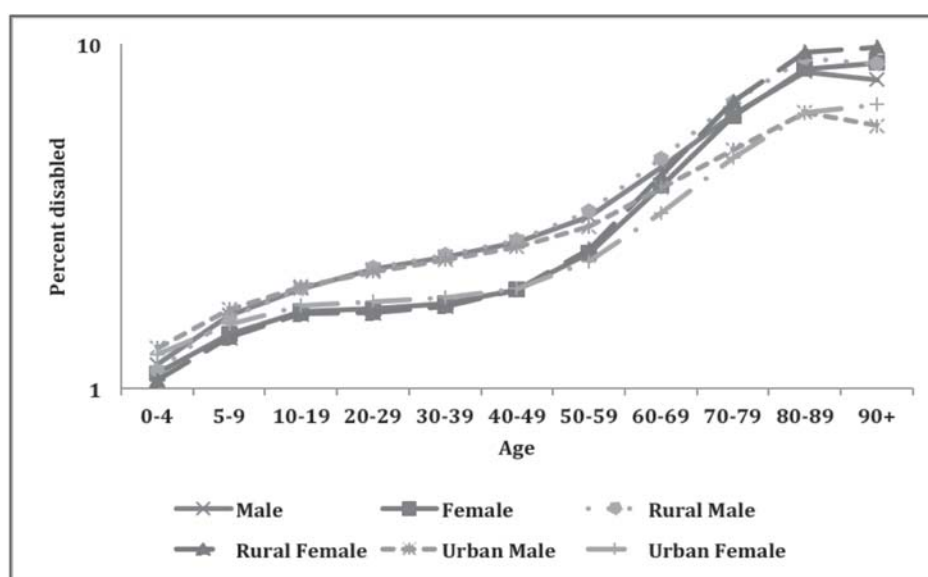
The most recent reports of the SRS provide ASDRs for 20 states of India by sex and rural-urban category. Life tables were produced for eighty population subgroups (20x2x2) using Chiang’s method (Preston et al. 2001).

Further, HLE and disabled life expectancy (DLE) were calculated using the Sullivan Method (Sullivan 1971), which provides estimates of HLE and DLE with few data requirements, such as age-specific prevalence of disability and age-specific mortality rate from a life table. It combines the disability prevalence observed for a given population with life tables depicting that population’s mortality experience. The number of years lived within each age group in the life table is distributed across states of disability according to age-specific disability rates (Cambois et al. 2001).

III. Results

The absolute number of disabled population in India is 26,810,557, comprising about 2.21 percent of the total population. Figure 1 depicts the age-sex pattern of the disability prevalence rate. It can be seen that for both sexes, the prevalence of disability slowly increases with age, but escalates after age 50. Compared to men, women experienced a lower rate of disability in India except for the oldest-old age groups (80 and above).

Figure 1: Disability prevalence rate by age, sex and place of residence, India, 2011



Note: Y-axis is expressed in logarithmic scale

There exists a stark difference in the disability prevalence rate between men and women in the 10-59 age group, indicating that men are subject to a higher prevalence of disability before becoming older adults. The gender gap in disability prevalence vanishes between ages 60 and 89; afterwards, women report marginally higher disability than men. Among all age groups and all residents, the pervasiveness of disability is the highest among rural women belonging to the oldest-old age group. Interestingly, the rural-urban differential in disability prevalence is not visible until age 60. Afterwards, rural Indians experience a higher prevalence of disability than urban Indians, suggesting an irregular divide of the disability burden by rural-urban residence.

Figure 2: Prevalence rate of disability by sex in 20 states of India among 60+ aged populations, 2011

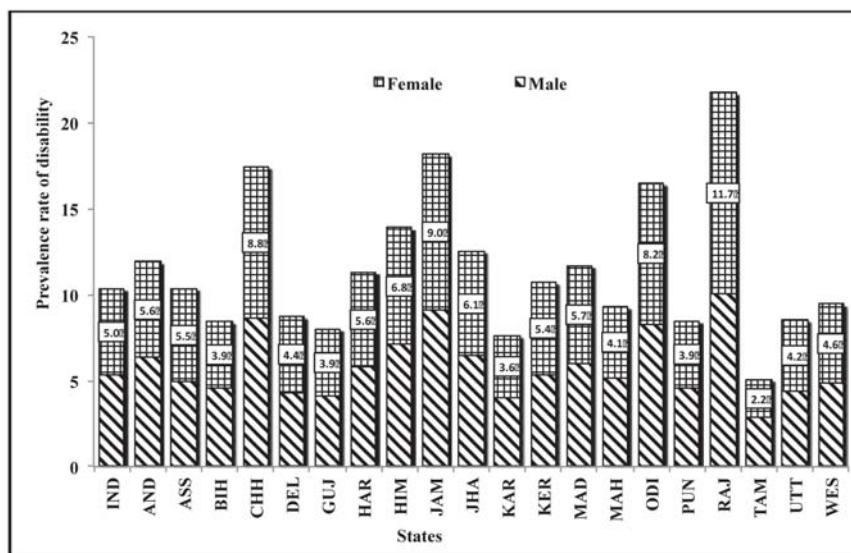


Figure 2 depicts the differential rate of disability prevalence by gender among people aged 60 and above in 20 states of India. It suggests substantial variation in disability prevalence rate across these states. Among males in the age group of 60 years and above, the disability prevalence rate in Rajasthan is more than three times than that of Tamil Nadu (2.8 percent in Tamil Nadu against 10.1 percent in Rajasthan). Likewise, women in Rajasthan experienced more than five times the disability rate experienced by women of Tamil Nadu (11.7 percent in Rajasthan against 2.2 percent in Tamil Nadu). In the majority of states (17 out of 20 states), disability prevalence is higher for men than women in 2011.

Figure 3: Life expectancy and healthy life expectancy at birth and at age 60 by sex and residence, India 2011

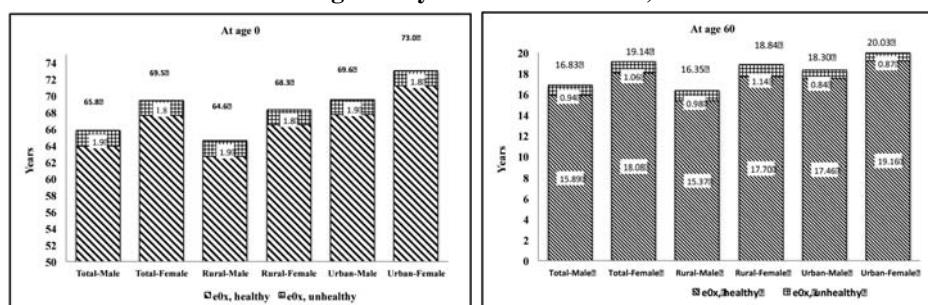


Figure 3 exhibits rural-urban differential in LE, HLE and DLE at birth and age 60 for India in 2011, respectively. In general, Indian women are expected to survive longer than Indian men irrespective of their place of residence. While life expectancy at birth

varies considerably by place of residence for both sexes, DLE at birth remains constant for both sexes, i.e., 1.9 years for males and 1.8 years for females, among all types of residents. Thus, Indian men are expected to live a slightly longer disabled life than Indian women at birth. However, this picture is altered when we examine this difference at age 60. All women experience longer DLE at age 60 than men irrespective of their residence (rural-urban). Likewise, the rural-urban difference is more pronounced in DLE at age 60.

Table 1: Life expectancy and disabled life expectancy at age 0 for Indian States, 2011

States	Rural				Urban				Total			
	Male		Female		Male		Female		Male		Female	
	LEB	DLE	LEB	DLE	LEB	DLE	LEB	HLE	LEB	DLE	LEB	DLE
Andhra Pradesh	63.5	2.2	68.9	2.1	69.2	2.3	74.1	2.2	65.1	2.2	70.3	2.2
Assam	61.0	1.3	64.0	1.5	68.3	1.3	72.2	1.4	61.9	1.3	65.0	1.5
Bihar	67.3	2.0	68.0	1.6	69.9	2.1	71.4	1.8	67.5	2.0	68.3	1.6
Chhattisgarh	62.4	2.1	65.9	2.4	66.2	2.0	70.2	2.0	63.0	2.2	66.5	2.3
Delhi	69.3	1.6	72.6	1.6	72.1	1.6	74.8	1.6	71.7	1.5	74.4	1.5
Gujarat	64.4	1.4	69.6	1.4	69.4	1.7	73.5	1.8	66.2	1.5	71.0	1.6
Haryana	64.6	1.9	69.8	1.9	68.8	2.0	71.9	2.0	65.9	2.0	70.5	2.0
Himachal Pradesh	68.4	2.2	73.9	2.3	76.1	2.0	79.6	2.2	69.0	2.2	74.3	2.3
Jammu & Kashmir	70.0	3.4	71.3	3.1	73.7	2.7	77.2	2.8	70.7	3.2	72.4	3.0
Jharkhand	64.6	2.2	65.2	1.9	69.5	2.0	72.6	1.9	65.4	2.1	66.4	1.9
Karnataka	64.5	1.7	69.9	1.6	70.1	1.9	73.5	1.7	66.3	1.7	71.1	1.6
Kerala	71.2	2.1	77.8	2.2	72.3	2.0	77.4	1.9	71.5	2.0	77.7	2.1
Madhya Pradesh	61.0	1.7	64.6	1.7	67.0	1.9	70.6	1.7	62.2	1.8	65.7	1.7
Maharashtra	68.0	2.4	72.4	2.0	71.8	2.2	74.7	1.9	69.5	2.3	73.3	2.0
Odisha	63.3	2.5	65.8	2.5	68.2	2.2	70.3	2.1	63.9	2.5	66.3	2.4
Punjab	67.3	2.1	72.4	1.8	70.8	1.9	74.8	1.7	68.6	2.0	73.4	1.8
Rajasthan	64.4	2.6	69.2	3.4	68.0	2.0	71.8	2.1	65.1	2.4	69.7	3.1
Tamil Nadu	66.9	1.3	71.6	1.2	69.8	1.3	73.8	1.1	68.1	1.3	72.5	1.2
Uttar Pradesh	61.6	1.5	65.2	1.5	66.6	1.9	69.0	1.7	62.5	1.7	65.9	1.6
West Bengal	67.8	2.0	70.8	1.9	70.5	1.9	73.6	1.8	68.5	1.9	71.5	1.8
India	64.6	1.9	68.3	1.8	69.6	1.9	73.0	1.8	65.8	1.9	69.5	1.9

Table 1 presents life expectancy and DLE birth for 20 Indian states in 2011. In all Indian states, women live longer than men irrespective of their place of residence. Both LE and DLE at birth vary substantially from one state to another. The maximum regional gap in LE at birth is among rural women and is about 13.8 years (77.8 years in Kerala and 64.0 years in Assam). The highest female DLE at birth, in rural Rajasthan (3.4 years), is more than three times the lowest female DLE at birth, in urban Tamil Nadu (1.1 years). Although urban residents enjoy systematically higher LE at birth than rural residents, there is no distinct pattern in the rural-urban differential in DLE at birth. Also, Indian women do not always have longer DLE than Indian men at birth. Remarkably, the differential in LE and DLE at birth is not identical with the differential in LE and DLE at age 60 in Indian states. Rural people's systematic disadvantage both in LE and DLE is uncovered at age 60 (Table 2). At age 60, all Indian women expect to live longer than men, and a majority of them experience longer DLE than men.

Table 2: Life expectancy and disabled life expectancy at age 60 for Indian States, 2011

States	Rural				Urban				Total			
	Male		Female		Male		Female		Male		Female	
	LE	DLE	LE	DLE	LE	DLE	LE	DLE	LE	DLE	LE	DLE
Andhra Pradesh	16.2	1.2	18.9	1.3	17.7	1.0	21.5	1.0	16.6	1.1	19.5	1.2
Assam	14.7	0.7	17.4	1.1	18.4	0.7	19.7	0.8	15.2	0.8	17.8	1.1
Bihar	17.1	0.8	17.7	0.8	18.8	0.9	18.8	0.7	17.3	0.9	17.8	0.8
Chhattisgarh	13.7	1.2	17.6	1.8	16.8	1.2	19.0	1.4	14.1	1.2	17.7	1.7
Delhi	17.4	1.0	18.9	1.2	20.1	1.0	21.1	1.2	19.7	0.9	20.7	1.1
Gujarat	17.3	0.7	20.4	0.9	17.6	0.7	21.0	0.9	17.4	0.8	20.6	0.9
Haryana	17.1	1.1	20.3	1.3	18.6	1.1	20.1	1.2	17.6	1.1	20.3	1.3
Himachal Pradesh	18.2	1.4	21.7	1.7	22.8	1.2	26.0	1.5	18.4	1.4	21.9	1.7
Jammu & Kashmir	19.2	2.1	20.2	2.2	21.1	1.6	23.5	1.8	19.6	1.9	20.8	2.0
Jharkhand	15.8	1.2	16.5	1.2	17.8	0.9	19.8	1.0	16.2	1.1	17.0	1.1
Karnataka	16.1	0.7	18.9	0.8	18.7	0.7	19.8	0.6	16.9	0.7	19.2	0.8
Kerala	17.7	1.1	21.6	1.3	17.9	1.0	20.8	1.2	17.7	1.0	21.4	1.3
Madhya Pradesh	14.6	0.9	17.6	1.1	17.8	0.9	18.8	0.9	15.2	0.9	17.8	1.1
Maharashtra	17.3	1.0	19.2	0.9	18.9	0.9	20.0	0.8	17.9	1.0	19.5	0.9
Odisha	17.0	1.6	17.9	1.6	17.7	1.1	18.1	1.2	17.0	1.5	17.9	1.5
Punjab	18.6	0.9	21.0	0.9	19.7	0.8	20.7	0.8	19.0	1.0	20.9	0.9
Rajasthan	16.6	2.0	21.0	3.2	17.2	1.2	19.8	1.5	16.7	1.8	20.7	2.8
Tamil Nadu	16.7	0.5	18.9	0.5	18.0	0.5	19.4	0.4	17.2	0.5	19.1	0.5
Uttar Pradesh	15.2	0.7	18.4	0.8	18.0	0.9	19.1	0.8	15.6	0.7	18.6	0.9
West Bengal	16.6	0.9	18.2	1.0	18.2	0.8	20.0	0.8	17.1	0.8	18.7	0.9
India	16.4	1.0	18.8	1.1	18.3	0.8	20.0	0.8	16.8	0.9	19.1	1.0

Figure 4: Relationship between life expectancy and healthy life expectancy at birth in Indian states

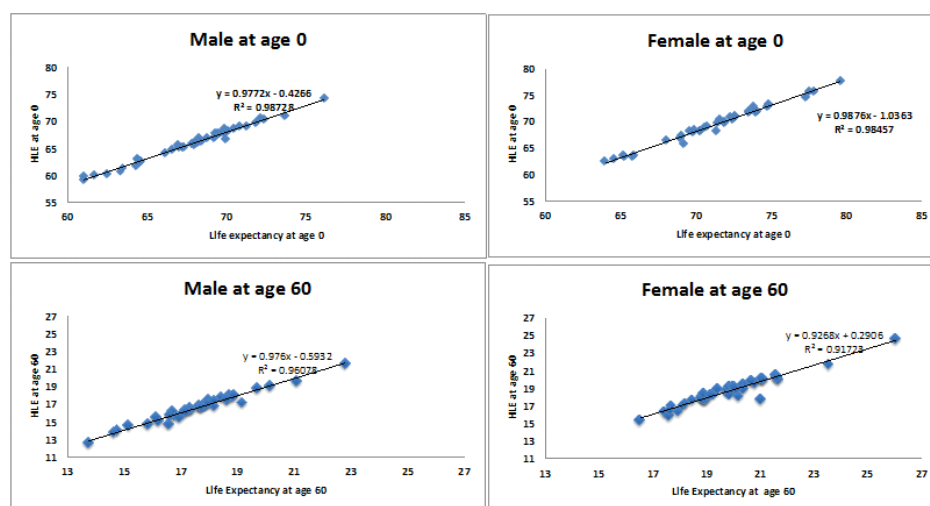


Figure 5: Life expectancy (at age 0 and at age 60) and % of life in poor health in Indian states

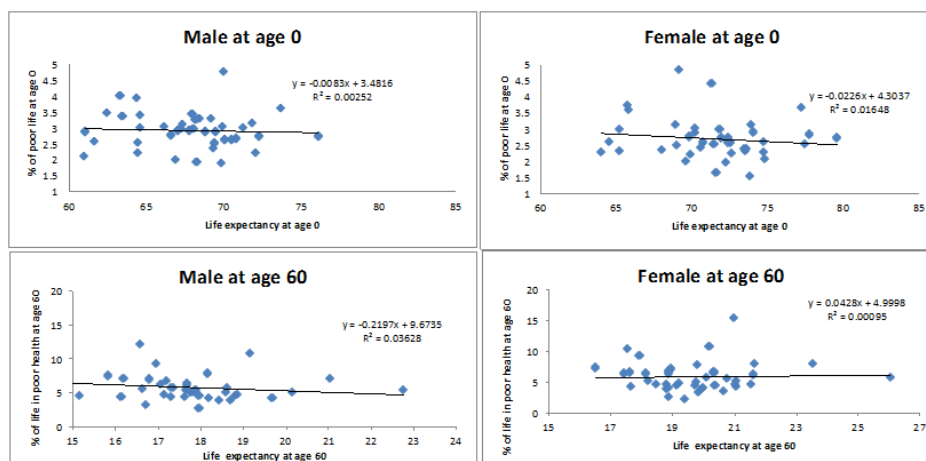


Figure 4 describes the relationship between life expectancy and healthy life expectancy at ages 0 and 60 in 80 Indian sub-populations (20 states subdivided by male-female and rural-urban), respectively. A large mortality difference among Indian states in both ages is clearly visible in these figures. We also observe a strong and positive linear relationship between LE and HLE at different ages, which indicates that increase in life expectancy leads to an increase in healthy life expectancy.

Figure 5 presents the relationship between life expectancy and percentage of life in poor health at ages 0 and 60 in same 80 Indian sub-populations respectively. Contrary to the above findings, as life expectancy at birth increases, the percent of total life in poor health has not shrunk but remained constant. Thus, although the increase in LE indicates an increase in HLE, it may not lead to an increase in the percentage of a life spent in better health.

IV. Discussion and Conclusion

Understanding the burden of disability among the older populations is extremely important in the context of a rapidly diversifying and ageing population like India. This paper aimed to investigate the differential pattern of disability among people aged 60 and above, as well as its linkage with life expectancy in Indian states. This is an important addition to the current disability literature in India, since there is very little empirical evidence on this issue.

The results of the first objective reveal a great deal of disparity in disability prevalence by age, gender, type and state of residence among the Indian population. The disability prevalence escalates after age 50, and is the highest among oldest-old women (aged 80 and above). The stark gender difference in disability prevalence in the age group 10-

50 suggests that men might be more exposed to accident-related disability than women at young adult ages.

Compared to urban Indians, rural Indians suffer a higher rate of disability beyond age 60. Similarly, regional differences in life expectancy DLE are remarkable for both men and women. The most of these findings are consistent with previous findings (O'Keefe 2005).

The present study confirms that there exists greater prevalence of disability in rural areas, among elderly populations and especially among older women in India. These findings suggest that policy and intervention on disability should be pro-rural, pro-gender and pro-elderly to reduce health inequality among the Indian population.

Secondly, we tested whether increasing longevity measured by LE at birth and age 60 leads to increasing disability measured by proportion of life in poor health. Our results reveal that increasing longevity is not strongly associated with the proportion of life spent in poor health. However, this result depends heavily on the definition of "disability" in the census or surveys.

Accurate measurement of disability is extremely necessary for improving the overall life and well-being of disabled people. This can prove to be an important tool for appropriate policies and interventions at both societal and individual levels. As of now, the definition of "disability" in the Indian census is a narrow measurement of disability, since it does not include information on activity limitations and participation restrictions. This prevents the comparison of Indian disability indicators with those of the rest of countries in the world. We strongly recommend the modification of the definition of disability in the Census as per the International Classification of Functioning, Disability and Health (ICF) model of the World Health Organization to capture physical impairments, activity and functional limitations.

The present study has a few important limitations. The very first limitation arises due to the definition of "disability" as conceived in the Census of India, which does not strictly follow any of the conceptual models of disability defined by previous studies (Altman 2001; WHO 2001; WHO 2011). There exist three different approaches of understanding disability, viz., the medical model, the social model and the ICF model (Bickenbach et al. 1999; Altman 2001). While the medical model understands "disability" as intrinsic to the body or mind, and neglects limitations in daily life activities, the social model considers "disability" a result of society's failure to address the needs of persons with impairment (Mitra and Sambamoorthi 2006; Oliver 2013). The ICF model of disability of the WHO provides a coherent conceptualization of "disability" since it combines disability due to impairment, activity limitations and participation restrictions (WHO 2001; Mitra and Sambamoorthi 2006; Leonardia et al. 2006). Most of the literature addressing disability in developing countries is based essentially on the ICF model. For instance, the Global Burden of Disease study defines disability as "shorter long-term health loss, other than death, such as chronic respiratory disease, diabetes,

cardiovascular diseases, and mental or behavioural disorders” (Murray et al. 2012). Unlike these studies, the Indian census has completely overlooked disability in daily activities/participation and defined disability as in the medical model. Consequently, no evidence was found of the positive relationship between longevity and disability in India. Therefore, one may expect a different direction in this relationship if the census definition of disability moves beyond the narrow definition of medical disability.

Secondly, while establishing linkages between longevity and disability, we depended primarily on only one cross-sectional census on Indian sub-populations with different levels of LE. Time series analysis of LE, HLE and DLE could not be done due to the lack of a uniform definition of disability from one census to another.

The third important limitation in the current analysis is inherent in the assumption of constant mortality in both healthy and disabled populations in Sullivan’s model. Thus, if disabled persons are subject to mortality selection, DLE based on Indian census data will be severely underestimated.

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