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Employment, Aging and Disease in India

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Keywords

employment, NCDs, disabilities, age, assets, health policies, India

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Abstract

The literature on the associations between NCDs and disabilities, and loss of employment in India is patchy and sparse. Although insightful, these studies are long on economic losses through high out of pocket expenditure (OOP) and cutbacks in non-medical expenditure, but they are short on employment losses. Besides, most are based on not-so-recent data. The present study seeks to fill these gaps using a nation-wide panel survey, the *India Human Development Survey 2015*, that covers the period between 2005-2012. A state-of-art econometric analysis confirms that substantial employment losses are associated with non-communicable diseases such as diabetes, heart disease and high blood pressure (NCDs) and disabilities (or limitations in carrying out ADL) with appropriate controls. The economic burden of NCDs is already enormous and is set to grow rapidly. Scaling-up the prevention and control of NCDs is very low cost compared to this burden, and would provide substantial returns to health and productivity. Prevention of NCDs should be thus a major priority for India. Health and labour market policies have considerable potential for mitigating the detrimental labour market impacts of ill-health, and thus enable better lives and a more inclusive economy.

Key words: Employment, NCDs, Disabilities, Age, Assets, Health Policies, India

JEL Codes: I12, I15, I18, J21.

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1. Introduction

Old-age morbidity is a rapidly worsening curse in India. The swift descent of the elderly in India (60 years +) into non-communicable diseases (NCDs) (e.g, cardiovascular diseases, cancer, chronic respiratory diseases and diabetes) could have disastrous consequences in terms of impoverishment of families, excess mortality, lowering of investment and consequent deceleration of economic growth. Indeed, the government has to deal *simultaneously* with the rising fiscal burden of NCDs and substantial ongoing burden of infectious diseases (Bloom et al., 2014, 2014a). As a recent *Lance*t report (Ghebreyesus, 2018) points out, failure to devise a strategy and make timely investment now will jeopardise achievement of sustainable development goals (SDG) 3 and target 4 of a one-third reduction in premature mortality from NCDs by 2030.

The National Sample Survey (NSS) data for 2004 and 2014 show that the burden of NCDs has risen slowly in the aggregate population between 2004 and 2014. However, there is a marked rise among the old. It doubles among 60-69 years and 70-79 years and nearly triples among 80 years and older persons. Besides, the mean prevalence among the old more than doubled, while among ≤ 60 years it declines from 4% to 3.2%. As the population structure remains largely similar, it follows that the higher burden of NCDs displays a marked shift towards the old.

The four NCDs (cardiovascular diseases, cancer, chronic respiratory diseases and diabetes) account for 42% of all deaths in India. These diseases contribute 22% of disability-adjusted life-years in India (or DALYs – the combination of years lived with serious illness and those lost due to premature death). So the cost in terms of lives lost is horrendous. Besides, NCDs hamper growth in different ways. They reduce the supply of labour and redirect resources from productive investments to health care, and thus drain the public and private budgets, raise business costs and undermine competitiveness.

In India, the elderly population (60 years +) is growing three times faster than its population as a whole. It is projected that the percentage of elderly people will climb from 8% in 2010 to 19% in 2050. By mid-century, their number is expected to be 323 million (United Nations, 2011). Even more significant in its implications for population ageing is the dramatic rise in life expectancy at age 60 years, from about 12 years in 1950 to 18 years in 2015. This is projected to rise further to more than 21 years by 2050. Average life expectancy at age 80 years has likewise increased significantly, from about 5 years in 1950 to more than 7 years at the present time. By the middle of this century, it is projected to rise to 8.5 years (United Nations, 2015; Agarwal et al., 2016).

A total of 5,376,205 elderly individuals were disabled in India in 2011, accounting for a disability rate of 5,178 per 100,000 elderly people (5.1%). Disability rates increase as age advances, with the highest disability rate of 8409 per 100,000 among people aged >80 yrs. Disability rates are higher in males in the age group 60–69 years (4407 vs 3891 per 100,000) and 70–79 years (6258 vs 6186 per 100,000) compared with females. Beyond 80 years of age there is a female preponderance in disability rates (8570 vs 8226 per 100,000) (Velayutham et al, 2016).

Disability is part of the human condition. Almost everyone will be temporarily or permanently impaired at some point in life, and those who survive to old age will experience increasing difficulties in functioning. Disability is neither purely medical nor purely social.

Rather, it is an outcome of the interplay of these factors. NCDs such as asthma, cancer, cardiovascular disease and stroke are associated with impairments that are aggravated by stigma, discrimination over access to educational and medical services, and the job market. Higher disability rates among older people reflect an accumulation of health risks across a lifespan of disease, injury and chronic illness (WHO and World Bank, 2011). The co-occurrence of NCDs and disabilities poses a considerably higher risk of mortality relative to those people not suffering from either[1].

As both NCDs and disabilities tend to rise with age, often in tandem, the inadequacies of the present health systems, community networks and family support may magnify and render these support systems largely ineffective. If the costs in terms of productivity losses are added, the total cost burden of looking after the disabled elderly people and those suffering from NCDs may be enormously high in the near future. In addition, there are non-economic costs that include social isolation and stress that are difficult to quantify (Bloom et al. 2014).

Yet there are few systematic studies of the associations between employment, NCDs and disabilities in India. While Bloom et al. (2014) stands in a class of its own for a thorough and insightful analysis of macroeconomic growth implications of NCDs and disabilities in China and India between 2012-2030, based on an adaptation of WHO's EPIC model, it focuses on two linkages: the divergence of savings from capital investment into non-productive healthcare, and (ii) NCD mortality results in the reduction of labour supply. As there are other channels through which NCDs and disabilities impact labour supply –loss of person days of employment and lower productivity while ill-we review below selected micro-studies of household labour supply (notably, Alam and Mahal (2014), and Engelgau et al. 2012).These are long on out- of- pocket expenditure (OOP) on healthcare and short on loss of employment. In addition, there are disease-specific studies (eg, Karan et al. 2014, Mahal et al. 2014). There are a few major limitations, however. (i) Most of the micro-economic studies are based on not-so-recent data. (ii) Loss of employment is measured in number of days. (iii) The disaggregation by age is not detailed. (iv) As assets are linked to reservation wage, its omission is likely to bias the results. The present study seeks to overcome these limitations through a state-of-art econometric analysis, using a nation-wide panel survey, *India Human Development Survey 2015* which covers the period 2005-2012.

2. Scheme

Section 3 is devoted to a literature review which is unavoidably highly selective and covers different countries but includes India. The literature is long on OOP, and cutbacks in non-medical consumption expenditure and short on employment effects of NCDs and disabilities. Section 4 describes salient features of *the India Human Development Survey* 2015, a nation-wide panel survey, on which our analyses are based. Attention is also drawn to some limitations of the employment data. Cross-tabulations of employment, aging and disease are discussed in Section 5, with the caveat that comparisons of means without allowing for confounding variables cannot be taken to reveal causality at face value. Nevertheless, some insights are obtained into the interrelationships examined. Section 6 gives an exposition of the ordered probit model (OP) used for examining the categorical employment outcomes of NCDs and disabilities, with and without appropriate controls. Section 7 offers interpretation of the OP results. These are then discussed from a broader policy perspective in Section 8. Concluding observations are made on recent policy initiatives and suggestions for reforms.

[1] For a more detailed review of the evidence and projections for India, see Yadav et al. (2018) and Kulkarni et el. (2018).

3. Literature Review

The literature on effects of NCDs and disabilities on labour supply is sparse-particularly for India. Hence we draw upon a few insightful studies of various countries including India.

Drawing largely upon Bloom et al. (2014), OECD (2016), Alam and Mahal (2014), and UNDP and WHO (2016), we will first sketch the mechanisms through which NCDs and disabilities impact labour supply, followed by estimates of employment and income losses

An important channel through which NCDs affect aggregate output involves labour and productivity losses. A direct impact is a reduction in the number of working-age individuals, due to both increased mortality and reduced on-the-job productivity for the sick. If employees die or suffer from a disease that reduces their productivity, their corresponding contribution to total output is lost for the economy. Indirect productivity impacts involve reduced cognitive abilities and increased absenteeism and worker turnover. Both direct and indirect impacts lead to ripple effects, such as reduced household earnings and firms' reluctance to invest in workers' training and capacity development, which in turn further hinder economic growth.

It is not surprising that a member with an NCD will experience lower work participation. Hence work and labour force participation by other household members is of considerable interest. However, there is little research on workforce participation of non-sick household members in LMICs in the context of NCDs. Nor do we know much about the impact of health insurance on labour supply and employment in these countries.

Intra-household labour substitution, hiring external labour, and withdrawing children from school are often used to compensate for lost labour-days, and income of the household (Alam and Mahal, 2014).

NCDs force people into early retirement, and thus reduce overall labour market participation and increase the ratio of dependents to workers. The retired persons often require special medical care and specialized services, which reduce the amount of resources that can be employed in productive activities and add to the cost of firms that provide retiree health care or health insurance. The new replacement workers raise firms' hiring and training costs. Besides, the expectation of shorter post-retirement life expectancy can lead to lower savings during active life, which in turn contributes to the reduction of the stock of physical capital per worker. A related effect reduces incentives to invest in training, education, and other forms of human capital due to shorter payoff periods in the labour market (Bloom et al. 2014).

Bloom et al. (2014) applies WHO's macroeconomic model-EPIC-to data for China and India over the period 2012-30. Following the approach in Abegunde and Stanciole (2006) and Bloom et al. (2011), it focuses on two effects of health on national income: (i) NCDs cause the divergence of savings from capital investment into non-productive healthcare, and (ii) NCD mortality results in the reduction of labour supply.

Macroeconomic cost projections are given for five diseases: cardiovascular, cancers, chronic respiratory, diabetes, and mental health.

The costs associated with NCDs in China and India are substantial. For China, the cumulative cost associated with the five diseases is $ 23.03 trillion; for India, the cumulative cost is $

4.58 trillion (both estmates are in 2010 dollars) [2]. The most important NCD for each country is cardiovascular disease.

Two limitations of this analysis (noted by the authors) are: (i) the assumption that the prductivity of individuals is not affected when they develop an NCD; and (ii) EPIC does not allow for flows in and out of the labour force for reasons other than mortality.

Other studies confine themselves to microeconomic effects (at the household level). A notable one is Alam and Mahal (2014) that carries out a meta review of economic impacts of health shocks in LMICs. Effects of health shocks on labour supply cover a few African and Asian countries including India. The health shocks comprise adult death in the household, a measure of disability (eg, indicators of activities of daily living or ADLs), self-reported health and specific disease indicators.

Although a general conclusion is that adult mortality reduces labour supply, it is subject to the caveat that the studies use different outcome measures, ranging from work participation, labour force participation, work participation among specific demographic groups to the ratio of non-workers to workers in the household and varying reference periods. For example, in Tanzania, men aged 20-50 years were 66-75 % less likely to participate in wage employment in the 6 months prior to death in households that experienced an adult death due to AIDS. In Bangladesh, the death of a household member in the preceding two years lowered work participation of household members by an average of 8.6 hours in the last week (Khan, 2010). Evidence for Vietnam and Kenya suggests significant reductions in income-ranging between 25-40%-for households experiencing adult mortality (Alam and Mahal, 2014) .

Irrespective of health indicators used-ADLs, self-assessed health, BMI, any illness-adverse health outcomes are associated with reduction in labour force participation and/or work time. Evidence for urban slums in Dhaka (Bangladesh) shows that more than 20 % of adults out of 12000 interviewed take days off from work due to illness in 12 months preceding the survey (Pryer, 2005). In Vietnam, in households where an adult is bed-ridden for 2 weeks or more in the last year, annual workdays are reduced by 8 % (Wagstaff, 2005).

Larger health shocks are associated with greater income losses. While households in Indonesia are able to fully smooth income losses from minor illness (eg, fever, respiratory congestion) and 71 % of the income losses from moderate illness (inability to perform an intermediate ADL (eg, walk for 5 km, take water from a well), only 38 % of the income loss from severe illness shock (inability to perform basic ADLs such as bathe yourself, feed yourself) is smoothed (Gertler and Gruber, 2002).

Impacts of NCDs are generally negative on household members participation in the work and labour force participation. In a detailed analysis, Abegunde and Stanciole (2008) show that NCDs in Russia are associated with a 4.8% reduction in household income. Work participation among adult menbers of households containing an individual with CVD (cancer) was about 2-3% lower, relative to socio-economically and demographically similar households but without cases of CVD (cancer). Households suffering from heart disease and stroke were associated with significant reductions in labour force participation (27 % and 73%, respectively) among the elderly in Taiwan (Mete et al. 2006).

More often than not poorer households fail to protect their non-medical consumption in response to health shocks while better-off households are able to deal with them more effectively. Besides, health insurance provides partial protection to those insured.

[2] For alternative cost estimates of cardiovascular diseases, cancers, diabetes and chronic respiratory disease in LMICs between 2011-25, see UNDP and WHO (2016).

Studies of the impact of NCDs on labour supply in India are sparse and limited to specific NCDs. Two notable studies are Karan et al. (2014) and Mahal et al, (2014) which analyse the economic impact of cancer and heart disease.

The analysis of cancer is based on National Sample Survey (NSS) data for 2004 (Karan et al. 2014). Propensity scores are used to match households containing a member diagnosed with cancer (i.e. cancer-affected households) to households with similar socioeconomic and demographic characteristics (controls). The estimates are based on data from 1,645 households chosen through matching. The analysis is long on OOP but short on labour force participation. Nevertheless, the latter are of some interest. Current workforce participation rates among household members aged 15 years and above are lower by between 2.4% and 3.2% for households with cancer, relative to matched controls. Workforce participation rates are higher among adult members in cancer-affected households when the individual with cancer is excluded from consideration – by between 0.80% and 1.90% – but the results are not statistically significant. Differences in work-force participation rates among children (aged 5–14 years) between cancer affected and control households are also statistically indistinguishable from zero and vary from 0.01% to 20.30% in absolute magnitude.

More detailed results are given for heart disease affected households (Mahal et al. 2014). The NSS data for 2004 are used. Propensity scores are employed to match households containing a member diagnosed with heart disease to households with similar socioeconomic and demographic characteristics (controls). Current employment rates among household members aged 15 years and above are lower among heart-disease-affected households, relative to controls (43.6% vs. 46.4%, $P < 0.01$). Employment rates are lower for heart disease affected households than controls for both adult males and females (15 years and over) (males: 70.9% vs. 73.5%, $P < 0.01$; females: 17.7% vs. 20.4%, $P < 0.01$). Employment rates among males aged 15–59 years are not different between hear disease affected and control households (81.2% vs. 80.7%, $P = 0.62$). However, heart disease affected households have lower employment rates than controls among females 15–59 years, males 60+ years and females 60+ years by 2.5% ($P < 0.01$), 8.5% ($P < 0.01$) and 3.3% ($P < 0.01$), respectively.

As may be noted, not only the studies of the association between NDCs are limited to specific diseases but also confined to employment rates. We know nothing about changes in the duration of employment. Besides, the analyses are based on a cross-section for 2004. Finally, the relationship between employment and disabilities is not examined. Our analysis, based on a nationally representative panel survey for 2005 and 2012, IHDS, seeks to fill these gaps through a more detailed and refined econometric analysis.

4. Data

Our analysis draws upon the two rounds of the nationally representative *India Human Development Survey* (IHDS) data conducted in 2005 and 2012. The IHDS is conducted jointly by the University of Maryland and the National Council of Applied Economic Research, New Delhi. The first round (IHDS-1) is a survey of 41,554 households in 2004–05. The second round (IHDS-II) involves re-interviews with 83% of the original households as well as split households residing within the same locality, along with an additional sample of 2,134 households[3]. The total for IHDS-II is therefore 42,152 households. The sample is

[3] An additional sample of 2134 households was added to IHDS-II urban areas to reduce the impact of high attrition on the standard errors of a few key variables. The simulations estimated that the attrition would increase standard errors to unacceptable levels if 8 out of 15 households were unreachable in each urban cluster. Hence, the interviewers were asked to report to NCAER supervisor if they were unable to recontact 5 or more households in a cluster. The supervisor verified the losses and randomly assigned households to the right, the left, or at the original location (for households that migrated) using a predefined rule. A similar addition to the

spread across 33 (now 34) states and union territories, and covers rural as well as urban areas. Throughout the analysis, the computations are based on the 2005 age-distribution and other covariates.

Repeated interviewing of the same households at two points in time facilitates a richer understanding of which households are able to partake in the fruits of growth, what allows them to move forward, and the process through which they are incorporated into or left out of a growing economy.

Topics covered by the IHDS relevant in the present context include employment, major morbidity (including NCDs), limitations in ADLs, health insurance, castes, assets, social networks (eg, self-help groups), exposure to mass media, and demographic characteristics (e.g. gender, age, household size).

IHDS collected labour force participation data as part of its detailed income question. Work participation included farm, business, wages/salary. Within each income section, IHDS asked who in the household participated in this activity and what was their level of participation. The individual work variables have five categories:

0=none (did not work at this type of employment,

1= missing hours (hence merged with 0),

2=<240 hours last year,

3=part-time: ≥ 240 hours hours last year but not full year and

4. =full time last year (both at least 250 days and at least 2000 hours).

Unfortunately, the classification of participation in 2005 is much less detailed in as much as two categories are distinguished, namely, =<240 hours last year and > 240 hours.

The NCDs include cataracts, high blood pressure, heart disease, type 2 diabetes, leprosy, cancer, asthma, epilepsy, and mental disorders. The number of cases of mental disorder and cancer are very small for our analysis.

Disabilities in ADLs show the dependence of an individual on others, with need for assistance in daily life[4].

The (reported) disabilities include (1) difficulty walking; (2) difficulty using toilet facilities; (3) difficulty dressing; (4) difficulty with hearing; (5) difficulty speaking, (6) long sightedness/far sightedness; and (7) short sightedness.

The list of variables and their definitions are given in Table 1.

Table 1

List of Variables and Descriptive Statistics[a]

Label	Variable	Mean	Std. Dev.	Min	Max
Work participation (farm, business, wage/salary)		1.532	1.159	0	3
Age Group	15-30	0.401	0.490	0	1
	51-60	0.117	0.321	0	1

rural sample was not attempted because of much lower attrition rate. (Personal communication by Sonalde Desai).

[4] For a validation of self-reported health and morbidity, see Subramanian et al (2009).

	61-70	0.057	0.231	0	1
	>70	0.018	0.133	0	1
Caste	Brahmin	0.055	0.229	0	1
	High Caste	0.145	0.352	0	1
	Dalit	0.216	0.411	0	1
	Adivasi	0.079	0.269	0	1
	Others	0.137	0.344	0	1
Gender	Female	0.486	0.500	0	1
Education: Completed Years)	1-4	0.087	0.282	0	1
	5-8	0.227	0.419	0	1
	9-10	0.166	0.372	0	1
	>10	0.128	0.335	0	1
Urban residence	urban	0.293	0.455	0	1
Marital Status	Unmarried	0.176	0.381	0	1
	Widowed/Divorced	0.075	0.264	0	1
Household size	1	0.002	0.047	0	1
	>5	0.493	0.500	0	1
Radio regular Men	Regularly	0.149	0.356	0	1
Radio regular Women	Regularly	0.121	0.326	0	1
Newspaper regular Men	Regularly	0.194	0.395	0	1
Newspaper regular Women	Regularly	0.099	0.298	0	1
TV regular Men	Regularly	0.347	0.476	0	1
TV regular Women	Regularly	0.408	0.491	0	1
Minutes to workplace	1-29	0.161	0.368	0	1
	30-60	0.238	0.426	0	1
	>60	0.017	0.130	0	1
NCDs	Yes	0.067	0.251	0	1
Disabilities	Yes	0.024	0.152	0	1
Number of social groups	1	0.182	0.386	0	1
	>1	0.175	0.380	0	1
Pension	Yes	0.011	0.103	0	1
Asset Index 2005	q2	0.239	0.426	0	1
	q3	0.277	0.448	0	1
	q4	0.263	0.440	0	1
Ratio of share of top 1% to bottom 50%		0.465	0.124	0.226	0.858
Net State Domestic Product (2005)		22607	9101	7914	63877

a. Authors' computations from IHDS.

5. Cross -Tabulations of Employment, Aging and Disease

Here we compare selected averages in a broad brush treatment. These comparisons cannot be taken at face value for interpreting *causal relations* as there is no control for confounding variables. Another limitation of these comparisons is the less detailed disaggregation of duration of employment in 2005. As noted already, just two levels of participation are used: namely, =<240 hours last year and > 240 hours. This limits the usefulness of the comparisons as the proportions of those who did not work at all is not reported separately. Nevertheless, some interesting insights are revealed.

During the period 2005-12, the proportion of those who worked =<240 hours last year rises more than moderately while those who worked >240 hours declines but still accounts for the majority of those in the labour force.

The rural-urban contrast is striking. A vast majority of those in the rural labour force worked >240 hours in 2005 but it declines sharply in 2012. The majority of the urban labour force worked =<240 hours but there is a reversal in 2012 as those who worked =<240 hours become the majority[5].

Comparison of hours worked by gender is striking too. A vast majority of men (about 80 %) worked >240 hours while a bare majority of women worked =<240 hours in 2005. While the majority of men working >240 hours declines moderately, that of women working =<240 hours rises more than moderately in 2012.

By age-group in 2005, the highest proportion of those who worked =<240 hours are the oldest (> 70 years), followed by not-so-old (61-70 years) and the lowest among 31-50 years. The highest proportion of those who worked > 240 hours are among 31-50 years old and lowest among the oldest (>70 years).

In 2012, the highest proportion of those who worked =<240 hours is still among the oldest but considerably higher than in 2005, while the lowest is among the younger group (31-50 years) but moderately higher than in 2005. The highest share of those who worked > 240 hours is among the younger age group, 31-50 years, but lower than in 2005. The lowest share is among the oldest but considerably lower than in 2005.

In 2005, the highest proportion of those who worked <=240 hours is found among the wealthiest (ie, those in the fourth asset quartile), and the lowest among the least wealthy (ie, those in the first asset quartile). By contrast, those in the higher range of hours worked, display an asset gradient (ie, highest in the first quartile and a steady decline to the lowest in the fourth quartile).

In 2012, there is an asset gradient among those who worked <= 240 hours as the share rises steadily from the first quartile to the fourth quartile. But there is a steady decline in the shares of those who worked > 240 hours.

Hours worked by caste reveal an interesting pattern. The higher castes and *Others* display relatively high proportions (above 40 %) working =<240 hours in 2005. The *Adivasis* (STs) show the lowest proportion. In the higher range of hours worked, the highest share is also found among the *Adivasis* (more than three-fourths), followed by the *Dalits* (SCs), OBCs and upper castes and OBCs.

Some changes occur in 2012. While upper castes and *Others* continue to display higher proportions of those who worked =<240 hours, each accounts for a majority share. Hence the proportions are higher than in 2005. The lowest share is found among the *Adivasis*. In the higher range of hours worked, the highest share is among the *Adivasis*, followed by the *Dalits* and OBCs, and then the rest.

Another socio-economic marker is the level of education attained. In 2005, the highest share of those who worked <= 240 hours is found among above matriculation, followed by those with 9-10 years of education and lowest among the illiterates. In the higher range of hours worked, the highest share is of those with 1-4 years of education, followed closely by the illiterates and then those with middle level of education.

For 2012, a more disaggregated educational classification is given, as above matriculation is split into 11-12 years and > 12 years. The highest share of those who worked <= 240 hours is found among those with 11-12 years of education, followed by those with >12 years of

[5] More precisely, the hours worked refer to 2005 and 2012 but for convenience of exposition this is not repeated here and subsequently.

education. The lowest share is found among those with 1- 4 years of education. In the higher range of hours worked, the highest proportion is found among those with 1-4 years of education, followed by those with 5-9 years of education. The lowest share is found among those with 11-12 years of education.

Two measures of health are used: prevalence of NCDs and disabilities. In 2005, the share of those suffering from NCDs working <= 240 hours is considerably higher than that of not suffering from these diseases. However, in the higher range of hours worked, the opposite is the case: much higher share of those without any NCD. A similar pattern is observed in 2012, except that the proportion with NCD who worked <=240 hours was much higher, and considerably lower than in 2005.

A similar pattern is observed for disabilities. In 2005, the proportion of those with disabilities working <= 240 was markedly higher than those without any disability. In the higher range of hours worked, the proportion of those with disabilities was markedly lower than among those without any disability. In 2012, a similar pattern emerges, with the share of those working<= 240 hours among the disabled substantially higher than among those without any disability. In the higher range of hours worked, the opposite is found: considerably lower proportion among the disabled than that of without any disability. What is also noteworthy is that proportions among the disabled working <=240 hours and more are considerably higher and lower than the corresponding shares in 2005, respectively.

6. Model

As the cross-tabulations compare the means without any control for confounding factors, we have used a probit specification to obtain marginal associations of explanatory variables with an ordered dependent variable. In the probit model, the inverse standard normal distribution of the probability is modelled as a linear combination of the predictors. The ordered probit (OP) is a generalization of the widely used probit analysis to the case of more than two outcomes of an ordinal dependent variable (a dependent variable for which the potential values have a natural ordering, as in duration of employment: not working, <= 240 hours worked in the past year, > 240 hours worked in the past year).

Let us begin with a latent variable specification.

$y* = \boldsymbol{\beta}' \boldsymbol{x} + \varepsilon$

$y*$ is unobserved. What we do observe is y = 0 if $y* \leq 0$,

=1 if 0 <$y* \leq \mu 1$

= 2 if $\mu 1 < y* \leq \mu 2$

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=J if $\mu j - 1 \leq y*$.

The $\mu' s$ are unknown parameters to be estimated with $\boldsymbol{\beta}$. Suppose there is an employment survey to assess employment status of an individual. The respondents have their own preferences which depend on certain measurable factors such as age, gender, and wealth, and some unmeasurable factors distributed independently of the observed factors, ε. The essential

ingredient is the mapping from an underlying, naturally ordered preference scale to a discrete ordered observed outcome in terms of ordinal measures of employment status (eg, not working, <= 240 hours worked, > 240 hours worked). Given only, say, three possible answers, they choose the cell that most closely represents their preferences (Greene, 2012).

It is assumed that ε is normally distributed. The mean and variance are normalised to zero and one, respectively. With the normal distribution, the following probabilities are obtained:

Prob(y=0) =$\Phi(-\boldsymbol{\beta}'\boldsymbol{x})$,

Prob(y=1) = $\Phi(\Phi(\mu 1 - \boldsymbol{\beta}'\boldsymbol{x}) - \boldsymbol{\beta}'\boldsymbol{x}) - \Phi(-\boldsymbol{\beta}'\boldsymbol{x})$,

Prob(y=2) = $\Phi(\mu 2 - \boldsymbol{\beta}'\boldsymbol{x}) - \Phi(\mu 1 - \boldsymbol{\beta}'\boldsymbol{x})$,

.

Prob(y=J) =1- $\Phi(\mu j-1 - \boldsymbol{\beta}'\boldsymbol{x})$

In order for all probabilities to be positive, it must be the case

$0 < \mu 1 < \mu 2 \ldots \ldots . . < \mu j-1$.

The marginal effects/associations are different from the ordered probit (OP) regression coefficients. Both the sign and magnitude of marginal effects/associations vary with the ordered outcome. As Greene (2012) offers a detailed account of how the marginal effects/associations are calculated, we have refrained from an exposition here. Note that in the present context, marginal effects are *synonymous* with marginal associations.

The Wald test examines the linear restrictions $\beta 1 = \beta 2 = \cdots . \beta j-1$ or $H0$: $\beta q - \beta 1 = 0$,$q= 2, . . . , J - 1$[6].

7. Results

Let us first consider the results of the minimalist ordered probit specification in which

Table 2
Marginal Effects/Associations of NCDs and Disabilities Obtained from Ordered Probit Regression of Duration of Employment: 2012

	Did not work		Worked <=240 hours		Worked>240 hours		Worked throughout the year	
	dy/dx	S.E.	dy/dx	S.E..	dy/dx	S.E..	dy/dx	S.E..
NCD								
Yes	0.150***	(0.008)	0.00625***	(0.000)	-0.049***	(0.003)	-0.107***	(0.005)
Disability								
Yes	0.166***	(0.012)	0.00561***	(0.000)	-0.057***	(0.005)	-0.114***	(0.006)
Number of Observations	101702							

*** p<0.01, ** p<0.05, * p<0.1.

duration of employment in 2012 is explained by NCDs and disabilities in 2005.

The specification is validated by the Wald test[7]. As marginal effects/associations are of greater interest than the OP coefficients, our comments are confined to the results in Table 2.

[6] For a more detailed exposition of the diagnostics, see Greene (2012).

[7] Details will be furnished upon request.

Persons who suffered from NCDs in 2005 are more likely to not work and work <= 240 hours but less likely to work > 240 hours but not throughout the year, as also work throughout the year in 2012, relative to those who did not suffer from NCDs. A similar pattern of work duration is observed among those who suffered from disabilities in 2005. The disabled are more likely to not work and work <= 240 hours but less likely to work > 240 hours but not throughout the year, as also work throughout the year, relative to those who did not suffer from disabilities. In both cases, the probability of not working is highest in (absolute) value.

The specification with controls builds upon the minimalist specification in two ways: it overcomes the omitted variable bias as well as allows us to capture key policy elements.The results with controls for age, caste, education, urban or rural location, marital status, household size, distance to workplace, assets, pension, social networks, frequency of media exposure by gender, and state economic environment measured in terms of state per capita income and Piketty (2013) measure of income inequality (ratio of share of top 1 % in the income distribution to that of the bottom 50 %) are given in Table 3.

The overall specification is validated by the Wald test[8]. As the marginal effects/associations (used synonymously) are of greater analytical interest, these are given in Table 3. Our comments are accordingly confined to the results in this table.

The dependent variable is duration of employment: did not work (outcome 1), worked <= 240 hours in the previous year (outcome 2), worked > 240 hours but not throughout the year (outcome 3) and worked throughout the year (both at least 250 days and at least 2000 hours as outcome 4). Note that the dependent variable is for 2012 and all explanatory variables are for 2005.

Let us first consider the associations of these outcomes by age-group. The youngest (15-30 years) show higher probabilities of not working and working <= 240 hours, but lower probabilities of working > 240 hours but part of the year, and throughout the year in 2012,

Table 3

Marginal Effects/Associations Computed from Ordered Probit Regression Results on Duration of Employment: 2012

	Did not work		Worked <=240 hours		Worked>240 hours		Worked throughout the year	
Age Group (2005)	dy/dx	S.E.	dy/dx	S.E..	dy/dx	S.E..	dy/dx	S.E..
15 - 30	0.0145***	(0.0033)	0.00117***	(0.0003)	-0.00274***	(0.0006)	-0.0129***	(0.0029)
51 - 60	0.109***	(0.0049)	0.00517***	(0.0003)	-0.0280***	(0.0016)	-0.0858***	(0.0036)
61 - 70	0.199***	(0.0118)	0.00457***	(0.0004)	-0.0624***	(0.0052)	-0.141***	(0.0065)
>70	0.358***	(0.0132)	-0.00429***	(0.0011)	-0.146***	(0.0080)	-0.209***	(0.0045)
Caste								
Brahmin	0.0218***	(0.0060)	0.00111***	(0.0003)	-0.00444***	(0.0013)	-0.0185***	(0.0050)
High Caste	0.00107	(0.0039)	0.0000622	(0.0002)	-0.000203	(0.0007)	-0.00093	(0.0034)
Dalit	0.0313***	(0.0042)	0.00149***	(0.0002)	-0.00656***	(0.0009)	-0.0263***	(0.0035)
Adivasi	0.0330***	(0.0049)	0.00155***	(0.0002)	-0.00694***	(0.0011)	-0.0276***	(0.0040)
Others	0.0181***	(0.0041)	0.000942***	(0.0002)	-0.00364***	(0.0008)	-0.0154***	(0.0034)
Gender								
Female	0.258***	(0.0034)	0.0266***	(0.0008)	-0.0722***	(0.0015)	-0.212***	(0.0030)
Education (2005)								
1 - 4	0.0152***	(0.0050)	0.000674***	(0.0002)	-0.00343***	(0.0012)	-0.0125***	(0.0041)
5 - 8	0.00727*	(0.0038)	0.000341*	(0.0002)	-0.00160*	(0.0008)	-0.00602*	(0.0031)
9 - 10	-0.00431	(0.0044)	-0.000219	(0.0002)	0.000914	(0.0009)	0.00361	(0.0037)
>10	-0.0388***	(0.0053)	-0.00246***	(0.0004)	0.00731***	(0.0010)	0.0339***	(0.0048)

[8] Details will be furnished upon request.

Sector								
Urban	0.00452	(0.0031)	0.00023	(0.0002)	-0.000947	(0.0007)	-0.0038	(0.0026)
Marital Status (2005)								
Unmarried	0.0580***	(0.0041)	0.00215***	(0.0001)	-0.0130***	(0.0010)	-0.0472***	(0.0032)
Widowed/Divorced	0.01	(0.0066)	0.000525	(0.0003)	-0.00195	(0.0013)	-0.00862	(0.0056)
Household Size (2005)								
1	-0.0509**	(0.0246)	-0.00338	(0.0021)	0.00909***	(0.0035)	0.0452*	(0.0233)
>5	-0.00970***	(0.0027)	-0.000495***	(0.0001)	0.00201***	(0.0006)	0.00818***	(0.0023)
Radio regular Men								
Regularly	-0.0115*	(0.0063)	-0.000618*	(0.0004)	0.00232*	(0.0012)	0.00975*	(0.0054)
Radio regular Women								
Regularly	0.00683	(0.0067)	0.00034	(0.0003)	-0.00144	(0.0015)	-0.00573	(0.0056)
Newspaper regular Men								
Regularly	0.0118***	(0.0045)	0.000582***	(0.0002)	-0.00251**	(0.0010)	-0.00985***	(0.0038)
Newspaper regular Women								
Regularly	0.0259***	(0.0055)	0.00117***	(0.0002)	-0.00576***	(0.0013)	-0.0213***	(0.0044)
TV regular Men								
Regularly	0.00666	(0.0044)	0.00034	(0.0002)	-0.0014	(0.0009)	-0.0056	(0.0037)
TV regular Women								
Regularly	0.0025	(0.0045)	0.000128	(0.0002)	-0.00052	(0.0009)	-0.0021	(0.0038)
Minutes to workplace								
1 – 29	-0.358***	(0.0034)	-0.0699***	(0.0015)	0.0849***	(0.0030)	0.343***	(0.0042)
30 - 60	-0.360***	(0.0033)	-0.0710***	(0.0015)	0.0823***	(0.0028)	0.349***	(0.0037)
>60	-0.381***	(0.0047)	-0.0823***	(0.0027)	0.0496***	(0.0078)	0.414***	(0.0134)
NCD (2005)								
Yes	0.0390***	(0.0057)	0.00159***	(0.0002)	-0.00904***	(0.0015)	-0.0316***	(0.0045)
Disability (2005)								
Yes	0.0408***	(0.0083)	0.00159***	(0.0002)	-0.00953***	(0.0022)	-0.0329***	(0.0064)
Social Network (2005)								
1	0.00882**	(0.0041)	0.000455**	(0.0002)	-0.00182**	(0.0009)	-0.00745**	(0.0035)
>1	0.0184***	(0.0034)	0.000889***	(0.0002)	-0.00392***	(0.0007)	-0.0154***	(0.0028)
Pension (2005)								
Yes	0.0321**	(0.0133)	0.00132***	(0.0004)	-0.00734**	(0.0033)	-0.0261**	(0.0104)
Asset Quartile - 2005								
Q2	-0.00808**	(0.0038)	-0.000348**	(0.0002)	0.00177**	(0.0008)	0.00667**	(0.0032)
Q3	-0.0120***	(0.0044)	-0.000530***	(0.0002)	0.00258***	(0.0009)	0.00991***	(0.0036)
Q4	-0.0309***	(0.0046)	-0.00157***	(0.0002)	0.00628***	(0.0009)	0.0261***	(0.0039)
Ratio of share of top 1% to bottom 50%	-0.0764***	(0.0089)	-0.00393***	(0.0005)	0.0159***	(0.0019)	0.0645***	(0.0075)
Net State Domestic Product (2005)	-3.76e-07**	(0.0000)	-1.93e-08**	(0.0000)	7.81e-08**	(0.0000)	3.17e-07**	(0.0000)
Number of Observations	89,536							

*** p<0.01, ** p<0.05, * p<0.1.

relative to the omitted age-group, 31-50 years. The largest (absolute) magnitude is that of the youngest not working, followed by working <= 240 hours. The older group, 51-60 years, displays a similar pattern. The probabilities of not working and working are higher while those of working > 240 hours but part of the year, and working throughout the year are lower. The probability of not working is largest, and that of working throughout the year (in absolute value) is considerably lower than for the omitted age-group. The next group, 61-70 years, also displays a similar pattern of probabilities for the four outcomes. They display higher probabilities of not working and working <= 240 hours, and lower probabilities of working> 240 hours but part of the year, and working throughout the year, with the largest probability for not working, followed by that (in absolute value) for working throughout the year. The oldest, >71 years, display an almost similar pattern of probabilities except that the probability of working <= 240 hours is lower. The probability of not working is much larger and that of

working throughout the year is much lower, relative to the omitted age-group. The former is larger than the latter (in absolute) magnitude.

Associations by gender show that females display higher probabilities of not working, and of working <= 240 hours, and lower probabilities of working >240 hours but not throughout the year and working throughout the year, compared with males.

The marriage variable is split into three: married (the largest and hence omitted), unmarried and widowed/divorced. So relative to the married, the unmarried display higher probabilities of not working and working <=240 hours but lower probabilities of working >240 hours but not throughout the year, and throughout the year. The (absolute) value of the lower probability of working throughout the year is slightly lower than the higher probability of not working.

The omitted asset quartile is the first (or least wealthy). Relative to this, the probabilities of the next affluent group (the second asset quartile) are lower for not working and working <=240 hours, and higher probabilities of working >240 hours but not throughout the year and of working throughout the year. All probabilities (in absolute value) are, however, small in magnitude. A similar pattern emerges for the third quartile –including small probabilities (in absolute value) for each employment outcome. This is also reproduced for the wealthiest (those in the fourth quartile) with the difference that the probabilities (in absolute value) for not working and working throughout the year are not so small, with the former exceeding the latter.

Educational attainment is another asset/human capital and an important socio-economic marker. Relative to illiterates, those with 1-4 years of education display higher probabilities of not working and of working <=240 hours (the latter negligible in value), and lower probabilities of working >240 hours but not throughout the year (small absolute value) and of working throughout the year. The latter (in absolute value) is lower than the probability of not working. Those with 5-8 years of education display a similar pattern, with higher probabilities of not working and working <=240 hours (the latter small in value), and lower probabilities of working >240 hours but not throughout the year and working throughout the year. The latter (in absolute value) is slightly lower than that for not working. Those with > 10 years of education reproduce a similar pattern of probabilities except that the magnitudes differ. The (absolute value) of working throughout the year is slightly lower than that of not working.

The caste hierarchy persists as another important socio-economic marker. Relative to the OBCs, the *Brahmins* (at the top of the caste hierarchy) display higher probabilities of not working and working <=240 hours but lower probabilities of working >240 hours but not throughout the year, and working throughout the year. The (absolute value) of probability of working throughout the year is slightly lower than that of not working. The *Dalits* (or SCs who are disadvantaged socially and economically) display a similar pattern of probabilities of employment outcomes-higher for not working and working <=240 hours, but lower probabilities of working >240 hours but not throughout the year, and working throughout the year. In (absolute) value, the probability of not working exceeds that of working throughout the year. Lowest in the caste hierarchy are the *Adivasis* (or the STs who are not just most disadvantaged socially and economically but also most isolated). They reproduce the pattern of probabilities observed for the *Dalits*-higher probabilities of not working and working <= 240 hours but lower probabilities of working >240 hours but not throughout the year and working throughout the year. The latter in (absolute) value is slightly lower than the probability for not working. The residual group of *Others* is among the most well-off. Their probabilities of employment outcomes are similar but different in magnitudes-their

probabilities of not working and working <= 240 hours are higher but probabilities of working >240 hours but not throughout the year are lower, relative to the OBCs. As in the other caste groups, the (absolute) value of the probability of working throughout the year is slightly lower than that of not working.

As households with 2-5 persons are the largest category, they are the omitted category. Relative to this size, the single person households display a lower probability of not working but higher probabilities of working > 240 hours but not throughout the year, and of working throughout the year. The (absolute) value of the lower probability of not working is slightly larger than the higher probability of working throughout the year. Households of largest size, >5 persons, display lower probabilities of not working and working <= 240 hours but higher probabilities of working > 240 hours but part of the year and of working throughout the year. The (absolute) value of the lower probability of not working exceeds that of working throughout the year.

Of central interest is the finding that the persons suffering from NCDs display higher probabilities of not working and working <= 240 hours but lower probabilities of working >240 hours but not throughout the year, and of working throughout the year, relative to those who did not suffer from NCDs. The higher probability of not working exceeds the (absolute) value of the lower probability of working throughout the year.

The persons suffering from disabilities show higher probabilities of not working and working <=240 hours but lower probabilities of working >240 hours but not throughout the year, and working throughout the year, relative to those without disabilities. The higher probability of not working exceeds the (absolute) value of lower probability of working throughout the year.

Recipients of pension (eg, old age pension) display higher probabilities of not working and working <= 240 hours but lower probabilities of working >240 hours but part of the year, and throughout the year. The higher probability of not working exceeds the (absolute value) of the lower probability of working throughout the year. These results suggest that pension acts as a substitute for longer duration of employment.

Social networks influence lives of the members through dissemination of information, and financial support in contingencies and promote employment through, for example, self-help groups (eg, micro loans are given for part time activities such as selling of pottery, bangles and trading activities). The results are mixed. Relative to those who do not belong to any network, those affiliated to a single network show higher probabilities of not working and working <=240 hours but lower probabilities of working > 240 hours part of the year, and working throughout the year. The higher probability of not working exceeds in (absolute) value the lower probability of working throughout the year. Affiliation to more than a single network yields a similar pattern of probabilities. These findings suggest that social networks are associated with limited employment gains.

We have considered exposure to different forms of media by gender. Regular listening to radio by men, as opposed to never or once in a while, is associated with lower probabilities of not working and working <= 240 hours but higher probabilities of working >240 hours but part of the year, and of working throughout the year. Thus significant employment gains for men are associated with regular exposure to radio. Regular reading of newspapers by both men and women is associated with higher probabilities of not working and working <240 hours and lower probabilities of working >240 hours but part of the year, and throughout the year. These results are surprising for two reasons: one is that newspapers carry detailed information on employment opportunities for both short and long term; and, second, unless

our results are heavily influenced by better educated urban women, for most others regular reading of newspapers is a luxury that they can ill-afford given heavy burden of domestic chores.

Let us now turn to the overall state economic environment for which two indicators are used: state affluence measured in terms of state domestic product per capita (SDP), and the second is the Piketty (2013) measure of income inequality (ie, the ratio of income share of top 1 % and that of the bottom 50 %).

State affluence is associated with lower probabilities of not working and working <= 240 hours and higher probabilities of working >240 hours. However, while the higher probabilities are statistically significant, they are miniscule in magnitude. In sharp contrast, the higher the Piketty measure of income inequality, the lower are the probabilities of not working and working <=240 hours and the higher the probabilities of working >240 hours part of the year, and working throughout the year. The higher probability of working throughout the year falls slightly short of the lower probability (in absolute value) of not working. An earlier study (Kulkarni and Gaiha, 2018) demonstrated that the Piketty measure of income increases the Foster-Greer-Thorbecke class of poverty indices (FGT)[9]. In light of this finding, the previous association is consistent if and only if higher income inequality promotes longer –term employment of highly skilled in finance, real estate, and commodities in which speculative gains are dominant.

8. Discussion

We have drawn attention to patchy and sparse literature on the associations between NCDs and disabilities, and loss of employment in India. Although insightful, these studies are long on economic losses through high and unaffordable OOP and cutbacks in non-medical expenditure, and short on employment losses. These are frequently measured in terms of number of working days lost. Attention is also given to loss of labour supply through NCD-related adult deaths. However, their importance in the current policy context is limited for at least two reasons: duration of employment lost is measured in number of days and the data used are not recent. Our study seeks to overcome these limitations by using loss of employment in ranges of hours, use of a panel survey that covers the period 2005-2012, and employs a more detailed specification that covers both NCDs and disabilities, and several controls that are not included in the studies reviewed here. These include a detailed age classification, caste hierarchy, physical assets, education, living arrangements (eg, living alone), affiliation to social networks, exposure to media by gender, and state economic environment measured in terms of state affluence and Piketty measure of inequality in state income distribution.

The duration of employment, as noted earlier, is disaggregated into the following categories: 0=none (did not work at this type of employment, 1= missing hours (hence merged with 0), 2=<240 hours last year, 3=part-time ($\geq$ 240 hours hours last year but not full year and 4. =full time last year (both at least 250 days and at least 2000 hours). Unfortunately, the classification of duration in 2005 is much less detailed in as much as two categories are distinguished, namely, =<240 hours last year and > 240 hours. Two caveats are necessary. (i) Merging of individuals not working with those with missing hours inflates the not working categories. The fourth category involves a sharp spike in hours worked relative to the third. These two features of the categorical employment data may be one reason why some of the results are not so strikingly different or follow similar patterns.

[9] The FGT class of poverty indices comprise the head-count ratio, the poverty gap and a distributionally sensitive measure of poverty.

Using a minimalist specification, we are able to confirm that both individuals suffering from NCDs and disabilities are less likely to work >240 hours but part of the year, and work throughout the year, relative to their reference groups: those who do not suffer from NCDs, and those not disabled, respectively. Thus our central hypothesis is corroborated without any controls. However, due to omitted variable bias, the marginal effects of NCDs and disabilities cannot be taken at face value. In fact, these are larger in (absolute value) than those with controls. An example illustrates. As old persons are more vulnerable to NCDs and disabilities and less likely to work for long spells, the bias will depend on the correlation between old age and NCDs and disabilities, and the contribution of old age to duration of employment. Depending on their relative strengths, the bias will be upward or downward. So we give greater importance to the results with controls.

More importantly, this hypothesis is also corroborated with the controls. The persons suffering from NCDs display higher probabilities of not working and working <= 240 hours but lower probabilities of working >240 hours but not throughout the year, and of working throughout the year, relative to those who did not suffer from NCDs. The higher probability of not working exceeds the (absolute) value of the lower probability of working throughout the year. The persons suffering from disabilities show higher probabilities of not working and working <=240 hours but lower probabilities of working >240 hours but not throughout the year, and working throughout the year, relative to those without disabilities. The higher probability of not working exceeds the (absolute) value of lower probability of working throughout the year. Thus, both NCDs and disabilities dampen labour supply among those affected by them. This is broadly consistent with earlier research.

Labour supply outcomes by age-group reveal largely similar patterns. Relative to the omitted age-group, 31-50 years, the younger, 15-30 years, show lower probabilities of working for long durations (> 240 hours but part of the year and throughout the year). This may in part be a manifestation that the younger among them may be studying in schools and more likely in colleges. The oldest, > 71 years, display an almost similar pattern of probabilities except that the probability of <=240 hours is lower. The probability of not working is much larger and that of working throughout the year is much lower, relative to the omitted age-group. Evidently, these labour supply outcomes reflect largely limited physical stamina and dexterity and few employment opportunities.

The females are more likely to work for short spells relative to the males. This is not surprising for at least two reasons: much of what females do is not counted as work (eg, domestic chores), and restrictions on outside work options. The latter have weakened over time but cannot be overlooked.

The labour supply outcomes are largely similar across the caste hierarchy. Consider the Brahmins (at the top of the caste hierarchy) first, relative to the OBCs. They are more likely to work for short spells and less likely to work for longer spells. A similar pattern is observed for the *Dalits* (at the bottom of the caste hierarchy) who are also more likely to work for short spells and less likely to work for longer spells. This comment also applies to the most affluent residual group of *Others*. The probabilities of course differ in magnitude. As conjectured earlier, sharper differences in labour supply are obscured by large intervals of duration of work.

Associations between asset quartiles and labour supply reveal an interesting pattern. Relative to the least wealthy (in the first quartile), the next affluent group (in the second quartile) displays higher probabilities of working longer. This pattern is reproduced among the wealthiest (in the fourth quartiles) with the difference that the (absolute) values for not working and working throughout the year are not so small, with the former exceeding the

latter. Thus affluence is associated with working longer. Our data do not allow us to verify whether longer duration of work is also more remunerative. What does seem likely is that the more affluent are more successful in securing long –term labour contracts.

Educational attainments show a somewhat intriguing pattern. Relative to illiterates, those with 1-4 years of education are more likely to not work and work <=240 hours and less likely to work for longer durations. This pattern persists at higher levels of education too. It is not self-evident why even matriculates and above show lower probabilities of working longer as compared with the illiterates. Most of the former would be better equipped to join governmental services, manufacturing, and services but with a higher reservation wage. If, instead, a large share gets absorbed in the informal sector as a short –term strategy, the employment outcomes are not implausible.

Distance to workplace has four categories: 0, 1-29 minutes, 30-60 minutes and > 60 minutes. The first category being the largest is omitted. So relative to this, those working within 1-29 minutes display lower probabilities of not working and of working <=240 hours but higher probabilities of working >240 hours but part of the year, and working throughout the year. So the higher probability of working throughout the year is slightly lower than the (absolute) value of the lower probability of not working. The next distance interval, 30-60 minutes, yields similar probabilities for the four employment outcomes. The longest distance, > 61 minutes, also yields largely similar probabilities One striking difference, however, is the higher probability of working full time exceeds the (absolute) value of the lower probability of not working. These results are perplexing as longer distances are likely to discourage longer duration of work. One conjecture, however, is that a longer- term contract may more than offset the disadvantage of working in a distant place.

Associations between household size and employment outcomes are plausible. Relative to the omitted group of 2-5 persons, a single person household is less likely to work for short spells and more likely to work for longer durations. As survival prospects for such households depend crucially on duration of work, it is not surprising that they work longer. Besides, the largest size households,> 5 persons, are likelier to work longer spells but for reasons of income pooling in large families/joint families.

Recipients of pensions are more likely to work for short spells than non-pensioners implying pension discourage job-search for longer spells after retirement. So expansion of coverage of insurance is a mixed blessing: it offers longer-term security but at the cost of lower job search.

Affiliation to social networks is associated with limited employment gains. For example, relative to no affiliation, those affiliated to more than 1 network are likelier to work for short spells and less likely to work for longer spells. To illustrate, consider a self-help group which offers small amounts of loans (or micro-loans) to women to engage in pottery, selling of bangles, to supplement meagre household income during lean periods. In that case, as these are essentially part-time activities, the duration is likely to be short. But this is at best a partial explanation.

Media exposure by gender yields mixed results. As search costs are often high, the role of the media as a source of information on employment opportunities is potentially important. Regular listening to radio by men, as opposed to never or once in a while, is associated with higher probability of long duration of work. Thus significant employment gains for men are more likely. However, regular reading of newspapers by men and women, relative to never or once in a while, is associated with greater likelihood of working for short spells. This is indeed surprising as newspapers carry detailed information on both short-term and long-term

employment opportunities. As a distinction is not made between national newspapers in Hindi and English and local newspapers, this finding is subject to the fallacy of composition.

What is somewhat surprising at first glance is that higher income inequality measured a la Piketty (ratio of share of income of the top 1 % to that of the bottom 50 %) is also conducive to longer duration employment. If the income gains of the top 1 % accrue from real estate, stock market booms, and commodity speculation, those with requisite skills are likely to benefit for longer periods.

Some limitations of our analysis may be noted. As noted earlier, duration of employment data is not sufficiently disaggregated for more precise inferences. The large concentration among those working >240 hours but part of the year and those working throughout the year (at least 250 days and 2000 hours) could lead to (potentially) misleading or imprecise findings. A case in point is educational attainments. Another is that associations between comorbidity (eg, diabetes and heart disease) and employment are not analysed. A similar point can be made about multiple disabilities. One reason for not attempting these refinements is the sharp drop in sample size. A third limitation is that careful attention must be given to the effects on employment of the caregivers-especially women. If they are forced to withdraw from the workforce, the employment loss is likely to be considerably greater. Finally, loss of labour supply through adult deaths from, say, NCDs, could be disastrous for many families-especially because of the rise of premature deaths from NCDs (below 70 years). IHDS death data are, however, not amenable to this analysis.

9. Concluding Observations

The economic burden of NCDs is already enormous and, at current levels of action and investment, is set to grow rapidly. Scaling-up the prevention and control of NCDs is very low cost compared to this burden, and would provide substantial returns to health and productivity. Prevention of NCDs is thus a major priority for India (WHO and UNDP, 2016).

There is in fact a two-way relationship between health and employment: health problems reduce labour force participation and income, and, conversely, bad employment conditions or unemployment adversely impact physical and mental health (OECD, 2016). Our analysis focuses on the associations from NCDs and disabilities (and other covariates) in 2005 to the duration of employment in India in 2012.

Broadly, health and labour market policies have considerable potential for mitigating the detrimental labour market impacts of ill-health, and thus enable better lives and a more inclusive economy. Public health policies that prevent chronic NCDs and severe disabilities, and health care policies that aim to better manage them when they occur, can yield important benefits not only for individuals but for the economy at large. Further investment in prevention policies targeting chronic NCDs and disabilities, and associated risk factors (eg, alcohol consumption, smoking, fried food, physical inactivity) could turn the labour force into a healthier and more productive one, resulting in substantial economic benefits. A wide range of prevention policies could be used by the government to improve both the health of the population and their labour market outcomes (OECD, 2016, Bloom et al. 2014, Alam and Mahal, 2014, Patel et al. 2015).

The growing menace of NCDs in a context of rapidly increasing old population calls for bold policy initiatives. Although such initiatives are not lacking, they are either underfunded or limited in coverage and uncoordinated (Chatterjee, 2017).

A National Health Policy was announced in 2017. It proposed raising public health expenditure progressively to 2.5% of the GDP by 2025 and advocated a major chunk of resources to primary health care, followed by secondary and tertiary health care. This policy

together with the *NITI Aayog* action agenda have set targets for reduction of premature death and morbidity due to major NCDs in India. Monitoring of this progress would be aided by the ongoing production of reliable state-level estimates of disease burden and risk factors. There are two serious concerns, however. One is that scant attention is given to where the resources will come from. Another glaring omission is that little is said about the rapid rise in the share of the old in the total population and associated multi-morbidities of NCDs. In the context of declining family support and severely limited old-age income security, catastrophic consequences for destitute individuals afflicted with these conditions cannot be ruled out (Jan et al., 2018). Besides, continuing neglect and failure to anticipate these demographic and epidemiological shifts-from infectious diseases to NCDs-may result in enormously costlier policy challenges (Bloom et al.2014, Yadav et al. 2018).

In order to prevent and control major NCDs, the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS), was launched in 2010 with a focus on strengthening infrastructure, human resource development, health promotion, early diagnosis, management and referral. Although there are no immediate policy goals to ensure population-based screening, opportunistic screening of selected chronic diseases is an important strategy under NPCDCS. But this initiative suffers from underfunding and lack of infrastructure (Yadav et al. 2018).

But more important than higher financial allocation is reorganisation of the health care system and effective regulation. As argued emphatically by Patel et al. (2015), it is imperative to develop a fully integrated population- based healthcare system that brings together the public and private sectors and the allopathic and indigenous systems, and is well-coordinated at different levels of service delivery platforms-primary, secondary and tertiary. It should address acute and chronic healthcare needs, offer accessible, good quality healthcare choices, and be cashless at the point of service delivery. The primary healthcare provider should be a strengthened public care system with a clearly defined role of the private system, especially in specialised services.

Behavioural changes are no less important and perhaps also no less challenging. A few important contributions using evidence from LMIC and from India yield useful insights (WHO 2015). Lack of physical activity and unbalanced high-calorie diet promote weight gains. Obesity is a risk factor for cardiovascular and diabetes and can aggravate symptoms of CVD such as emphysema and bronchitis.

Limiting tobacco consumption is expected to benefit at the individual level but wider reduction in multi-morbidity prevalence requires taxation on unhealthy products. For example, there is evidence that tobacco taxation reduces smoking and such benefits might also lead to a reduction in certain multi-morbidity clusters (Academy of Medical Sciences, 2018). It is reassuring therefore that taxation of *beedis* and smokeless tobacco (SLT) has risen sharply in the recent Goods and Services Tax (GST).

As there is evidence of a marked rise in the prevalence of disabilities and pervasive interdependence between them and NCDs, the Rights of Persons with Disabilities Act, 2016, is laudable in its intent and procedural detail. Yet, it is largely silent on disabilities among the elderly. Primarily for this reason, it is argued that the Act's overarching goal that the "government shall ensure that the persons with disabilities enjoy the right to equality, life with dignity and respect for his or her integrity equally with others," is mere rhetoric, if not a pipe dream (GOI, 2016,4). In brief, a multi-dimensional approach comprising a strategy to overcome the physical and socio-economic barriers as well as prevention and treatment of underlying health conditions is required (Kulkarni et al. 2019).

A mega health insurance scheme, announced by Prime Minister Narendra Modi on India's Independence day (15th August, 2018), was launched nationwide on Sept 25. The scheme aims to provide up to 100 million poor families with approximately INR500 000 (US$7100) in annual health insurance coverage to pay for secondary or tertiary hospital care. It is one of the components of a flagship initiative known as *Ayushman Bharat* or "India blessed with long life", which includes developments in primary health services and health promotion.

Critics of the scheme, alarmed by the huge cost to the Government (US$1·7 billion in the first 2 years), fear doctors and hospitals responsible for delivering treatments will be left bankrupt. They point out that current Government tariffs stipulated for specialised operations and procedures—including coronary stenting—are unrealistically low. Even the proponents realise that such an ambitious scheme will take a long time to deliver the benefits. That this is a mere election rhetoric cannot be ruled out as financing details have not been announced (Kulkarni et al. 2018).

Achieving financial protection requires action in the health sector to be implemented together with programmes and regulatory initiatives in other sectors (eg, education and employment). However, given that rights to social protection are often fluid and that the delivery of relevant programmes is less than transparent (a case in point is *Ayushman Bharat*), active engagement of civil society (eg, NGOs, faith-based organisations, labour –based organisations) is needed to expose breaches in individual entitlements in these areas (Jan et al. 2018).

In conclusion, the concern for reducing employment losses associated with NCDs and disabilities-especially among the elderly-faces policy challenges and other barriers (eg, resistance from employers to hiring disabled and creating a work environment that makes it easier for them to work) that may seem insurmountable but in fact are not.

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