A contemporary picture of the burden of death and disability in Indian adolescents – data from the Global Burden of Disease Study

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Word count:

Abstract 228, manuscript (excluding references) 2954

Short title: Burden of death and disability in Indian adolescents

Abstract

Background

Adolescents (10-19 years old) comprise a fifth of the Indian population (253.2 million), yet there is very little published information about the burden of disease and injury for this age-group. This paper aims to provide a contemporary picture of the leading causes of death and disability for Indian adolescent girls and boys for 2013 and changes in deaths and disability between 1990 and 2013.

Methods

Data from the Global Burden of Disease (GBD) study for India, for the years 1990 and 2013 were accessed. Data were categorised into two age groups: 10 to 14 years (younger adolescents) and 15 to 19 years (older adolescents) and analysed separately for girls and boys.

Results

The study shows that for both younger and older adolescent boys and for older adolescent girls non-communicable diseases (NCDs) and injuries are responsible for a greater number of deaths and DALYs than communicable diseases. Communicable diseases are still important causes of death and disability for young adolescents. Among older adolescents there is an increasing burden of death and disability due to self-harm, road traffic injuries, fire and heat related injuries, and mental disorders such as depressive disorders.

Conclusion

While strategies to reduce the burden of communicable diseases among adolescents must continue to be an important focus, innovative, evidence based strategies aimed at reducing the growing burden of NCDs and injuries must be elevated as a priority.

Background

Adolescents (10-19 years old) comprise a fifth of the Indian population (253.2 million)(1), yet there is little information about their burden of disease. Adolescence, perceived as a healthy age, has largely been neglected by the global health community, when compared to younger children(2). Adolescents undergo rapid developments in this of life which has major health consequences over the life-time. Health and behaviour related conditions that originate in adolescence have an impact on adult health with important socio-economic consequences (3). For instance, tobacco use, consumption of unhealthy diets, and harmful use of alcohol, are initiated in adolescence, and leading to the premature onset of several non-communicable diseases (NCDs) such as heart disease, and chronic lung disease(4). In the Indian context, as NCDs and injuries form the major burden of disease and disability (5, 6), it is important to understand the disease burden in adolescents.

In India, the most recent cause of death statistics publicly available are from 2013, although they only provide data on the 20% of the population who have a medically certified cause of death(6). Large studies such as The Million Deaths Study(7), either group adolescents with children (5-14 years) or young adults (15-24 years) or focus on one or two of the main health issues affecting adolescents, such as reproductive health(8). The Registrar General of India's Sample Registration System (SRS) groups various age-groups into broad categories combining early adolescence with childhood (5-14 years) and late adolescence with young and middle-aged adults (15-49 years), hence it is difficult to estimate the causes of death amongst the adolescent population(6, 9). Surveys like the National Health and Family Surveys (NHFS) 1, 2, 3 and 4 have extensively surveyed young adults, but the focus has primarily been on child health and reproductive health(8). Smaller surveys have shown that injuries, especially self-harm and road traffic crashes, are major causes of death and disability among this age-group(10, 11).

Two recent publications from the Global Burden of Disease study focused on adolescent health. The first paper provided data on the levels and trends of burden of disease amongst children and adolescents between 1990 and 2013 in 188 countries, but does not disaggregate the data for adolescents by younger and older adolescents(12). The second paper provides data separately for younger and older adolescents, but does not provide country specific details (13).

This paper aims to provide a comprehensive and contemporary picture of the causes of death and disability for younger and older adolescents in India, focusing particularly on the levels and changes with respect to the burden of NCDs and injuries.

Methods

Data from the Global Burden of Disease (GBD) study for India for the years 1990 and 2013 (14-16) were used for this analysis. The GBD study is a comprehensive epidemiological study which measures levels and trends of disease and injuries, risk factors and causes of death worldwide(17). For India, the cause specific mortality is sourced from the vital registration system including the Medically Certified Causes of Death system (MCCD) and the Sample Registration System (SRS) (6, 18). Cause specific disability and other data for India are sourced from the Demographic Health Survey (national health surveys), SRS, census and household and facility surveys conducted in different parts of the country (19). This paper collated data available through the GBD study and did not gather any primary data.

Data were categorised into five-year age groups from 10 to 14 (younger adolescence) and 15 to 19 years (older adolescence). We examined data on the causes of death and disability adjusted life years (DALYs) for 2013, separately for girls and boys, and compared these data with that from 1990. DALYs are calculated as the sum of the Years of Life Lost (YLL) due to premature mortality in the population and the Years Lost due to Disability (YLD) for people

living with a health condition or its consequence. DALYs are a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability.

The main causes of death and disability were identified, firstly, in three broad categories (GBD Level one): communicable diseases (CDs), which includes maternal, neonatal and nutritional diseases; NCDs; and injuries. They were then identified more specifically in terms of the top ten leading causes of death and DALYs, corresponding to GBD Level three(20).

Findings

Disease burden in 2013

In 2013, an estimated 275000 Indian adolescents died, of whom 35% were in the 10-14 year age groups and 65% in the 15-19 year age group(15). The mortality rate for adolescents was 114 (95%CI 102-129) per 100,000. The mortality rates for younger adolescent boys and girls were 80 (95%CI 71-91) and 77 (95%CI 64-91) per 100,000 respectively and the mortality rates for older adolescent boys and girls were 146 (95% CI 114-181) and 153 (95% CI 21-182) respectively.

Of the total DALYs sustained by adolescents 42% were among younger adolescents and 58% were among older adolescents. Of all the DALYs sustained by girls (49% of the total adolescents DALYs), 41% were younger and 59% were older girls. Of the DALYs sustained by boys, 43% were younger boys and 57% were older adolescents.

Younger adolescents (Age 10-14 years)

The main causes of death in this age group were CD (girls 54%, boys 47%), followed by injuries (girls 23%, boys 28%) and NCDs (girls, 23%,boys 26%) (Figure 1). The leading causes of death for girls were intestinal infections (11%, 95%CI 6-19%), followed by diarrhoeal disease (9%, 95%CI 4-15%) and lower respiratory infections (6%, 95%CI 4-10%) (Figure 2a). For boys, they were intestinal infections (13%, 95%CI 5 - 22%), diarrhoeal disease (7%, 95%CI 3-12%) and drowning (6%, 95%CI 4-12%) (Figure 2b).

The main causes of disability in this age group were NCDs (girls 45%, boys 45%), followed by CDs (girls 43%, boys 41%) and injuries (girls 12%, boys 14%). For younger girls, iron deficiency anaemia was the leading cause of disability (10%, 95%CI 8-12%), followed by intestinal infections (5%, 95%CI 3-9%) and migraine (5%, 95%CI 3-8%) (Figure 2c). For younger boys, the leading causes were iron deficiency anaemia (11%, 95%CI 9-13%), intestinal infections (6%, 95%CI 3-11%) and skin diseases (5%, 95%CI 3-9%) (Figure 2d).

Older adolescents (Age 15-19 years)

In 2013, 42% of deaths among older adolescent girls resulted from CDs, closely followed by injuries (38%) and NCDs (20%). Self-harm was the leading cause of death (16.8%, 95%CI 10.2-24.6%), followed by fire and heat related deaths (9%, 95%CI 6-15%) and tuberculosis (6%, 95%CI 3-9%) (Figure 3a). Injuries were the leading cause of death among older boys (43%), followed by CDs (31%) and NCDs (26%). Road injuries, self-harm and intestinal infections were responsible for 12% (8-16%), 10% (6-16%) and 6% (3-12%) of all deaths in older boys (Figure 3b).

In this age group, NCDs CDs and injuries were responsible for 44%, 34% and 23% of DALYs among girls, respectively. NCDs, injuries and CDs were responsible for 49%, 27% and 25%

of DALYs among boys, respectively. Self-harm (10%, 95%CI 6-15%), fire and heat (6%, 95%CI 3-9%) and depressive disorders (5%, 95%CI 3-7%) were the leading causes of disability for older girls (Figure 3c). Road injuries (8%, 95%CI 5-10%), self-harm (6%, 95%CI 3-10%) and skin diseases (6%, 95%CI 3-9%) were the leading causes of disability for older boys (Figure 3d).

Changes in disease burden over the past two decades

Younger adolescents (Age 10-14 years)

From 1990 to 2013, among girls, deaths due to injuries increased from 21% to 23% while deaths due to CDs decreased from 6 to 54% and NCDs remained stable at 23%. Among boys, deaths due to injuries and NCDs increased from 26% to 27%, and 24% to 25%, respectively, while deaths due to CDs decreased from 50% to 47% (Figure 1).

For girls, self–harm increased by 87%, and intestinal infections increased by 49%. (Figure 4). Among boys, deaths as a consequence of self-harm increased by 105%, deaths due to leishmaniasis increased by 37%, whereas deaths from tuberculosis decreased by 36%.

Among girls, DALYs from CDs and injuries decreased from 49% to 43% and 14% to 12%, respectively, while DALYs due to NCDs increased from 37% to 45%. Among boys, DALYs due to communicable and injuries decreased from 46% to 40% and 16% to 14%, respectively, while DALYs due to NCDs increased from 38% to 45% (Figure 1). Iron deficiency anaemia was the leading cause of DALYs for girls and boys in 1990 and 2013(Figure 5).

The biggest changes in the leading causes of DALYs for girls were the increases in the ranking of NCDs (from three to five of the top ten causes), a 75% increase in skin diseases, 64%

increase in migraine, 59% increase in anxiety disorders, and 55% increase in depression. For boys, the biggest changes were the increases in the ranking of NCDs (now responsible for four compared with two of the leading causes of DALYs), a 46% decrease in lower respiratory infections, 43% increases in migraine,, 41% increase in conduct disorders and 37% increase in depression.

Older adolescents (Age 15-19 years)

Among girls, deaths due to injuries and NCDs increased from 34% to 38%, and 18% to 20%, respectively. Deaths due to CDs decreased from 48% to 42%. Among boys, deaths due to injuries and NCDs increased from 38% to 42% and 25% to 26%, respectively, while deaths due to CDs decreased from 38% to 31%.

The most significant changes in the leading causes of death over the two decades, for older adolescent girls, were the increases in deaths due to injuries and specifically those due to self-harm (up by 92%), and road injuries (up by 65%). Road injuries were the leading cause of death for older boys in 1990 and 2013, although the proportion of deaths attributable to road injuries increased by 13% over the years. For boys, the biggest changes were the increases in deaths from interpersonal violence (increased by 52%) and self-harm (increased by 49%). Deaths due to tuberculosis and diarrhoea reduced by 50% and 45%, respectively. For boys and girls, ischaemic heart disease was ranked in the 10 leading causes of death.

Among girls, DALYs due to NCDs increased from 34% to 44%, while those due to CDs and injuries decreased from 42% to 34% and 24% to 23%, respectively. Among boys, DALYs due to NCDs increased from 41% to 48% and those due to injuries from 26% to 27%. DALYs due

to CD decreased from 33% to 25%. Road injuries were the leading cause of disability among older adolescent boys in 1990 and 2013.

Discussion

This study, based on GBD data provides a comprehensive description of the burden of death and disability and the transition over two decades, disaggregated by age and sex, for Indian adolescents. This paper shows that for adolescent boys and for older adolescent girls, NCDs and injuries are now responsible for a greater number of deaths and DALYs than CDs. While CDs are important causes of death and disability, particularly for young adolescents, the current burden of death and disability from injuries and especially self-harm is concerning.

The limitations of this paper are that the findings are based on secondary data, some of which are based on estimates. The GBD data from India is based on extrapolation of Indian studies including national registries. The quality of data obtained in the national registries are questionable, especially due to under-reporting of self-harm related to deaths. However, one of the advantages of using the GBD data is that irrespective of the shortcomings of the primary data, consistent methods were applied to analyse information for each condition to produce results using standardised metrics(21). It would have been ideal to analyse high quality primary data for this age group, however, there are no publically available data for the burden of diseases and disability for adolescents in India(22).

Our findings which show the increasing importance of self-harm, depression and anxiety disorders is consistent with other Indian studies (23). Self-harm and suicide (23) which are the largest contributors to mortality rates in this age-group are one of the highest in India and this contributes to the high mortality rates when compared to other developing countries. Some of

the reasons for the increase in self-harm are increased interpersonal stressors, academic pressures, early marriage, related adjustment issues(24, 25), and unidentified mental disorders(26). Depression, anxiety and conduct disorders begin during adolescence (27, 28) and a high proportion of these go undiagnosed, with serious consequences throughout life. A study in India showed that suicide was responsible for 25% of all deaths in boys and between 50% and 75% of all deaths in girls aged 10-19 years (10). Results from The Million Death Study have also shown a high rate of self-harm amongst adolescents and young adults and underscores the importance of under-reporting of self-harm in existing registries (26).

Our findings suggesting that road traffic injury is a leading cause of death among adolescents supports prior research from India (11). Globally, road injury is the leading cause of death and the second leading cause of disability among adolescents, with boys affected three times more compared to girls(4). A review of road injuries in South Asia found that adolescents and children comprise 13% of all road injury related deaths (29). The Million Death Study reported about 75% of all road injury related deaths were pedestrians and other vulnerable road users(30).

Our findings that ischaemic heart disease is in the top 10 causes of death for adolescents is surprising and disturbing, but not inconsistent with studies from India which have shown that cardiovascular risk-factors such as obesity(31), diabetes and hypertension(32) are increasing amongst adolescents(33) and that adolescents lack knowledge about CVD risk factors(34). Results from NFHS–3 indicate that in the late adolescent age-group 29% boys and 4% girls had used tobacco (35). Given the large adolescent population in India, such high rates have public health implications and the government strategies should specifically target adolescents.

Implications for policy and practice

Previously, GBD data have shown that mortality rate for adolescents in India (115/100,000) is higher than the global rate (81/100,000) and other developing countries (89 per 100,000). (12). The reasons for this increased rate could be the triple impact of CDs and NCDs and injuries.

This paper highlights the differences in death and disability amongst younger and older girls and boys and shows that there are clear differences in health conditions amongst the different age-groups and sexes. Hence, age and sex disaggregated data on death and disability is vital for understanding the priority health conditions and developing effective health systems to manage them (40). In the absence of complete civil registration and vital statistics, it would be very useful if the routinely collected data, such as those collected by the SRS, are made available disaggregated data by age and sex at regular intervals.

Since Indian adolescents face the burden of CDs, NCDs and injuries, the national health policy should incorporate all these conditions, and also focus on adolescents. Rashtriya Kishor Swasthya Karyakram (RKSK)(36), an adolescent health program by the Government of India, aims to address the health problems faced by adolescents and young adults using a holistic model. This model of care focuses on community-based health promotion along with the strengthening of preventive, diagnostic and curative health services using referral linkages. The main objectives of RKSK are to improve nutrition, sexual and reproductive health, enhance mental health, prevent injuries and substance abuse, and address risk-factors for NCDs(37). However, the rationale behind choosing interventions or details of the interventions are unclear. A key area that needs strengthening is development of roadmaps to roll out appropriate evidence-based interventions that can be monitored, and that involves collaboration with key stakeholders (30). For instance, strategies to prevent suicide include tackling underlying mental

health problems and stressors and using evidence-based approaches such as reducing access to firearms, pesticides(38) and certain medicines(39, 40). Similarly, strategies proven useful to prevent road traffic injuries such as lower speed limits in school zones, use of child restraints, helmets, seatbelts, graduated driver licensing systems, lower limits for blood alcohol along with adequate trauma care and rehabilitation services need to be incorporated within the health system and transport infrastructure. The National Road Safety Policy, established to prevent deaths and injuries due to road traffic crashes will only be effective if the laws are enforced successfully.

The government has supported stricter laws around tobacco advertisement and under-age alcohol consumption, however, the execution of such laws is often lax. Recently the government of Kerala introduced a 'fat tax' to make 'junk foods' more expensive(41). Such laws while in the right direction, may need further enhancements given that the vast majority of roadside eateries, selling Indian snacks do not have formal food labelling systems. Legal systems should be backed by health promotion interventions that involves households and communities to prepare and serve healthier food.

The results of this study attest to the significant gains in infection control and maternal health. While intestinal infections, diarrhoeal disease and respiratory infections are still predominant among younger adolescents, the proportionate cause of death attributable to these diseases has decreased. It is vital that the government continue their efforts to improve sanitation, immunisation programs and the judicious use of antibiotics to reduce the burden of CDs. The Swachh Bharat Abhiyan(42) or the Clean Indian Mission aimed to improve sanitary conditions should have positive consequences on infection control if implemented successfully.

Conclusion

The burden of disease and injury among Indian adolescents has changed dramatically over the past 20 years, such that deaths and DALYs from NCDs and injuries now comprise a much higher proportion of deaths and DALYs from two decades ago. While strategies to reduce CDs and maternal conditions must continue to be implemented, strategies aimed at reducing the burden of NCDs and injuries must be a priority.

Key messages:

1. Communicable diseases are important causes of death and disability for young adolescents.
2. Non-communicable diseases are becoming an important cause of death and disability for adolescents in India.
3. Among older adolescents there is an increasing burden of death and disability due injuries (self-harm, road traffic injuries) and mental disorders (depressive disorders).
4. Accurate and reliable data for burden of disease for Indian adolescents is not available.

Ethics approvals

An ethics committee approval was not required for this paper as it involved secondary analysis of publicly available data.

Role of funding agency

This study was not funded by any agency.

Acknowledgement

PKM is a Wellcome Trust/Department of Biotechnology Intermediate Career Fellow. RJ is funded by a Future Leader Fellowship funded by the Australian National Heart Foundation (APP100484).

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