Global Measures of Health Risks and Disease Burden in Adolescents

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INTRODUCTION

Adolescents are commonly viewed as healthy in comparison with other age groups (Sawyer and others 2012). Adolescence is an age at which many positive attributes of health peak, and these positive attributes predict health in later life. Physical fitness peaks about age 20 years; it remains high until the early 30s, when it declines steadily to old age (Rockwood, Song, and Mitnitski 2011). Those with the highest fitness levels in their 20s are more likely to stay physically healthy throughout life, using less health service as they age (Rockwood, Song, and Mitnitski 2011). Adolescent cardiorespiratory fitness, muscular strength, and body composition are also predictive of lower all-cause mortality and cardiovascular disease in later life (Ruiz and others 2009). Adolescence is similarly central in skeletal health. Bone mineral density, a primary determinant of later-life osteoporosis and its complications, peaks in the late teens to early 20s (Baxter-Jones and others 2011). In the two years of peak skeletal growth, adolescents accumulate more than 25 percent of adult bone mass; patterns of physical activity and adolescent nutrition are important modifiable influences (Julián-Almárcegui and others 2015; Whiting and others 2004).

Increasingly, adolescence is recognized as a time of changing trajectories and health across the life course (Patton and Viner 2007; Sawyer and others 2012). This is evident in mortality shifts showing a rise in deaths that are largely preventable: deaths from intentional and nonintentional injuries; deaths due to human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), tuberculosis, and other infectious diseases; and deaths due to maternal causes (Patton and others 2009). Patterns of nonfatal disease burden also shift across these years. The prevalence of mental disorders rises sharply across adolescence (Gore and others 2011). Many risk processes leading to chronic noncommunicable diseases (NCDs) in later life, including tobacco use, alcohol and illicit substance use, unsafe sex, obesity, and lack of physical activity, typically emerge in these years (Gore and others 2011). Definitions of age groupings and age-specific terminology used in this volume can be found in chapter 1 (Bundy and others 2017).

HEALTH INFORMATION SYSTEMS AND ADOLESCENCE

Sound information is essential for selecting priorities in health and social policy and monitoring the effects of subsequent actions (AbouZahr, Adjei, and Kanchanachitra 2007). Global and national health information systems have paid little attention to the

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adolescent age group, in part because of the prevailing view of young people as healthy. Very few attempts to systematically measure their health have been made. Initiatives in adolescent health metrics have more commonly arisen from interest in particular aspects of health, such as sexual and reproductive health or adolescent-onset risks for NCDs in later life. The Millennium Development Goals (MDGs), for example, proposed indicators on the development of young people in low- and middle-income countries (LMICs) but with a health focus predominantly on sexual and reproductive health (Beaglehole and Bonita 2008).

Broad conceptual frameworks for reporting adolescent health have been used in only a small number of high-income countries (HICs) that undertake regular reports on the health status of young people (AIHW 2003; Kolbe and others 1997; Office of the Minister for Children and Youth Affairs 2008; Ministry of Social Development 2008). In these countries reporting has moved from a focus on age-disaggregation of routinely collected health and demographic statistics to reporting behavioral and risk factor data collected directly from young people (UNICEF 2007).

Current Data Surveys and Databases for Adolescent Health

Planning responses to adolescent health requires data that are timely, developmentally relevant, age- and gender-disaggregated, and defined to a local level. Ideally, these data would allow comparisons over time and tracking of inequalities within and between countries. In reality existing global data systems for adolescents are uncoordinated, inconsistent in coverage and timing, inadequately disaggregated, and missing large groups of adolescents, and they fail to deal with the spectrum of health problems and their determinants. This situation matters because LMICs are, to a large extent, dependent on global surveys, such as Demographic and Health Surveys (DHS), for data for health policy and programming.

Map 5.1 and annex table 5A outline the available surveys and databases that provide data on adolescent health problems, health risks, and social determinants of health. Adolescent health and well-being is currently assessed in a patchwork of surveys that include school- and household-based surveys.

Health Behaviour in School-Aged Children (HBSC) is the oldest of the school-based surveys. It is supported by an academic network and has, over the past three decades, collected data on younger adolescents in schools in many HICs and middle-income countries, with intermittent, ad hoc support from some national governments. The Global Youth Tobacco Survey and the Global School-Based Student Health Survey (GSHS) were both established in the past two decades, primarily to gain greater information on NCD risks that emerge in adolescence. They are both administered by the World Health Organization (WHO), with support from the U.S. Centers for Disease Control and Prevention, and focus on younger adolescents ages 13–15 years in schools in LMICs. Although broadly focused on risks for NCDs, the GSHS also covers other aspects of adolescent health.

The DHS are the most well established of the global household surveys. It is supported by the U.S. Agency for International Development and operates in LMICs. It has provided some health information for ages 15–25 years over the past three decades, predominantly around sexual and reproductive health. It has more recently been complemented by the Multiple Indicator Cluster Surveys (MICS), administered by the United Nations Children's Fund. MICS use methodologies similar to those of DHS, with a predominant focus on the sexual and reproductive health of married women and girls.

HEALTH INDICATORS AND COVERAGE FOR ADOLESCENTS

Health indicators are summary measures chosen to describe particular aspects of health, health risk, or health system performance. They are generally developed in the context of a specific policy initiative and conceptual framework. Indicators are commonly defined within the context of specific disease-related initiatives, a process that has led to rapid inflation in numbers of indicators, presenting a major challenge for global health information systems (Murray 2007). Many indicators remain poorly measured, leading to calls to define smaller numbers of core health indicators focused on mortality, morbidity, service coverage, and risk factors (Bchir and others 2006).

The MDGs brought a focus to indicators for HIV/AIDS and maternal health in adolescents. There have been a number of subsequent calls to expand indicators and data collection systems beyond this focus on sexual and reproductive health to take into account rapid transitions in adolescent health in many countries (Boerma and Stansfield 2007). More comprehensive approaches would consider relevant social determinants of health, as well as the contribution of adolescent-onset risk factors to future disease burden (Walker, Bryce, and Black 2007).

Growing evidence suggests the importance of sound information to promote effective responses to the

Map 5.1 Global Coverage of Adolescent Health by International Data Collections, 2000–12

GSHS/HBSC

DHS only

GSHS/HBSC and DHS

MDB only
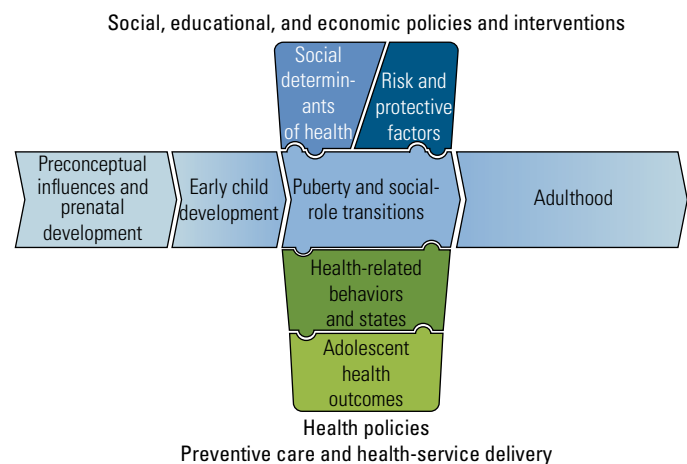
GSHS/HBSC and MDB

No data
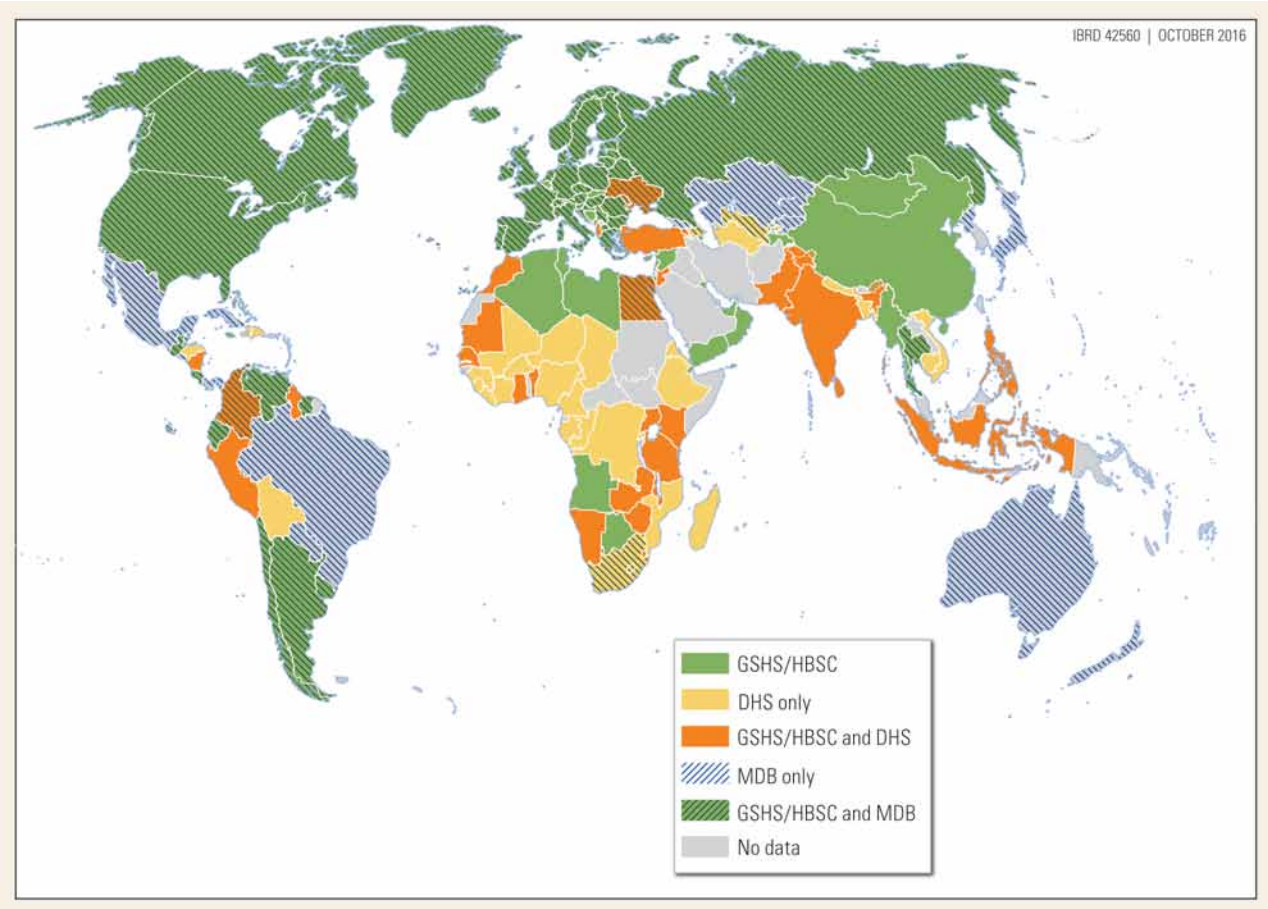
Source: Reprinted from *The Lancet* 379 (9826): Patton, G. C., C. Coffey, C. Cappa, D. Currie, L. Riley, and others, "Health of the World's Adolescents: A Synthesis of Internationally Comparable Data," 1665–75, © 2012, with permission from Elsevier.
Note: DHS = Demographic and Health Surveys; GSHS = Global School-Based Student Health Survey; HBSC = Health Behaviour in School-Aged Children; MDB = World Health Organization Global Mortality Database.

health problems of young people, including prevention of traffic injury (Shope and others 2001); reducing adolescent alcohol abuse (Wagenaar 2003); responding to underweight and malnutrition; and promoting the social, neighborhood, and school engagement background for healthy development (Hawkins and others 2009; Patton and others 2006). Despite this growing recognition of the importance of good information for adolescent health, there is as yet no current internationally agreed-upon set of indicators. The *2012 Lancet Adolescent Health Series* conceptual framework was adopted for the purpose of defining indicators relevant to adolescent health (figure 5.1). It incorporates elements from earlier national reports, including measures of health and well-being (AIHW 2007), social role transitions (Department for Children, Schools, and Families 2010), risk and protective factors (Bronfenbrenner 1979), and health service system

Figure 5.1 Conceptual Framework on Adolescent Health

Social, educational, and economic policies and interventions

Social determinants of health

Risk and protective factors

Preconceptual influences and prenatal development

Early child development

Puberty and social-role transitions

Adulthood

Health-related behaviors and states

Adolescent health outcomes

Health policies

Preventive care and health-service delivery

Source: Reprinted from *The Lancet* 379 (9826): Sawyer, S. M., R. A. Afifi, L. H. Bearinger, S. J. Blakemore, B. Dick, and others, "Adolescence: A Foundation for Future Health," 1630–40, © 2012, with permission from Elsevier.

responses (Rosen and Levine 2010). The series selected indicators across five areas:

- Health outcomes reflecting major causes of death and incident disability in ages 10–24 years
- Health-related behaviors and states that carry risks for current or later-life disease and typically emerge in adolescence and young adulthood
- Risk and protective factors derived from the immediate social contexts affecting emerging health risks
- Markers of social role transitions that are associated with altered patterns of health risk
- Health service policy interventions provided to adolescents that have the potential to influence current or later health status.

The indicators drew on the four categories of data outlined in annex 5A including the global mortality database, international household surveys, international school-based surveys, and other United Nations (UN) sources. The indicators included the most recent data available, collected since 2000, even if the data were not available for the entire age spectrum or were available only at a subnational level. Regional subgroups were defined according to the 2010 Global Burden of Disease study (Murray and others 2012).

The Lancet series used indicator definitions with the best comparable data to optimize global coverage. Where available, the series used well-accepted and consistent definitions, although definitions varied considerably for many indicators. In these instances, the series examined currently available data sources (annex 5A) to derive definitions that allowed comparisons to be made across a maximum possible number of countries.

Global Coverage of Adolescent Health

Given the widespread perception of adolescence as a healthy life phase, it is not surprising that this picture of young people's health is patchy, with a range of data gaps. Global coverage of the 25 indicators selected for the 2012 *Lancet* series on adolescent health are outlined in annex 5B. Comparable data coverage was higher for indicators that have been the focus of the MDGs. However, only a few indicators had global coverage greater than 50 percent; coverage was very low for some indicators, particularly around mental health, substance use, and health service delivery. Accurate population data on the major causes of nonfatal health-related disability in this age group, even for HIV/AIDS, is telling for its absence. This lack of good health information reflects a number of gaps that can be classified into four categories.

Indicators Needing Better Measures

Much work needs to be done on indicator development and measurement. Sexual and reproductive health in adolescents has had the greatest policy and programmatic attention, leading to a greater degree of consensus on definitions of indicators and, in turn, the production of data. In other areas, there are difficulties in defining and measuring indicators. The lack of investment in, and agreement around, mental health indicators is one striking gap that is relevant for an age group in which the peak onset for mental disorders occurs (Gore and others 2011). This void reflects a lack of clarity about the definition of an indicator and a lack of agreement about which standardized and practical measures might be used widely in health surveys. Potentially useful measures exist, however, in that the K-6 (Kessler-6), PHQ-2 (Patient Health Questionnaire), and PHQ-9 seem brief enough to be useful in the major surveys (Green and others 2010; Richardson and others 2010).

Indicators of health service delivery to young people were poorly measured other than an MDG-related focus on HIV/AIDS. In some instances, such as human papillomavirus (HPV) vaccination, this gap is likely to reflect the comparatively recent introduction and as yet absence of wide-scale implementation (Goldie and others 2008). In other instances, such as health care responses to major mental disorders, it reflects both lack of agreement about the indicator and measurement problems. In delineating indicators of intervention coverage, there is scant evidence about the effectiveness of interventions such as youth-friendly primary health care and longer-term outcomes of treatment for mental disorders (Tylee and others 2007). Such evidence is needed to define indicators of health service coverage and quality. Current international surveys, such as those conducted by the Commonwealth Fund, provide data on unmet health care needs but focus on a small number of HICs and lack scope for disaggregation by age group. Given that the delivery of high-quality interventions is likely to be the main way in which health systems may effect change in adolescent health, this gap is concerning.

One area that few national or international reports have addressed well is measurement of risk and protective factors related to the social contexts of child and adolescent development. In addition to being important determinants of adolescent health, these factors are commonly the areas for which good evidence around prevention exists (Catalano and others 2012). Positive family, school, and community connections are measured in school health surveys, but much more work needs to be done to clarify cross-culturally valid indicators in these areas (McNeely and Barber 2010).

Indicators Needing Agreed-Upon Definitions

Sometimes which indicator and definition is most valid, and whether a single indicator is sufficient, is unclear, for example, maternal mortality rate and ratio. Both the choice and definition of indicators in earlier national and international reports have varied greatly, in part reflecting the available data. Many HICs have used the HBSC; this practice has led not only to comparable measures but also to the adoption of similar definitions (UNICEF 2007). Even so, in areas such as tobacco and substance use, and physical activity, measurement is not a major problem; however, these areas do have substantial differences in the definitions used that limit comparisons between countries and over time.

International comparability can be optimized where similar methods of sampling and measurement are used across surveys (Pirkis and others 2003). Such harmonization of data collection is evident in the major household surveys (MICS, DHS, Reproductive Health Surveys, AIDS Indicator Surveys), but it is not yet optimal for the major international school-based surveys, even though some comparisons are possible. The GSHS complements the more established HBSC in providing new data on adolescents in LMICs. Despite the difficulties inherent in international comparisons, there appear to be sufficient similarities between these two international surveys to suggest that aggregated analyses might be feasible in the future (Pirkis and others 2003). This comparability could be strengthened even further with alignment of sampling and measurement strategies.

Indicators Needing Extended or Different Data Collection

Some of the difficulties in capturing a complete picture of young people's health lie in the limits of international data collection. Mortality indicators are one example. Although arguably a poorer guide to health status of adolescents than for other age groups with higher death rates, these estimates depend on good national registers of death. Those countries with the highest mortality rates, and therefore where mortality is a more important indicator, tend to be those without national registers.

The capacity to measure and respond to the health risk behaviors that emerge in adolescence and young adulthood will be central in prevention efforts for NCDs (Strong and others 2008; WHO 2000). Investment has increased since the 2000 World Health Assembly call for surveillance to track the major risks for chronic NCDs (WHO 2000). Yet many adolescent estimates in LMICs are based on only one data point, with little certainty about whether and when serial measurements

of indicators will be feasible. Recently introduced surveys, such as the GSHS, are also limited to younger adolescents in school rather than being population based. School-based surveys provide no information on those outside of school, almost certainly a higher-risk population for many health problems (Bovet and others 2006). Additionally, because retention rates drop with progression through secondary school, the predominant focus of school surveys has been early adolescence, arguably too young an age group in which to track important risk processes related to alcohol abuse and illicit drug use that tend to emerge at a later age (Patrick and Schulenberg 2011).

To what extent the measurement of young people's health best takes place in adolescent school-based surveys or augmentation of existing household surveys that include older age groups is an important question. School-based surveys are efficient where a high proportion of adolescents are in school; for those countries and regions where school retention rates are low or absenteeism high, however, it is unlikely to be a sufficient strategy without data collection on the higher-risk groups outside of school. This situation will be particularly true for girls in countries with lower enrollment rates because girls are less likely to be in school than boys. Furthermore, because of lower school retention in later secondary school, school-based surveys, even in HICs, are likely to provide a better measure of the health of younger rather than older adolescents. Yet it is in older adolescence that many health risk behaviors, such as tobacco, alcohol, and other substance use; obesity; and physical activity, and health states become established. The younger adolescent age group with the greatest coverage is arguably too young for the extent of these problems to be adequately assessed.

Although some programs do capture risk behaviors and states in older groups (for example, the European School Survey Project on Alcohol and Other Drugs, the WHO's STEPwise approach to Surveillance), the range of country coverage globally is limited and depends on high retention rates in upper secondary schools. For this reason, the extension of household surveys with a broader range of measures is likely to be important. These surveys collect fewer data from men and remain largely restricted to sexual and reproductive health, even though the MICS have taken recent steps to extend to other areas of health. There are challenges beyond survey design, respondent burden, and cost. Questions may also arise about whether an adolescent or a parent is the better informant, who can provide consent, and whether confidentiality can be maintained.

Strategies relevant to socially marginalized young people, including those out of school, out of home, and

in juvenile detention, are needed. These young people are unlikely to be included in current data collections and health profiles, and their access to health services is often very poor. Strategies for health surveillance are needed in these groups, such as focused institutional surveys or respondent-driven sampling, methods that have been used to track HIV prevalence and risk behaviors at a local level (Chopra and others 2009).

Digital technologies potentially offer an alternative path, either in the context of existing surveys or development of new surveys. In countries with conspicuous acute adolescent health problems—such as intentional and nonintentional injuries, HIV/AIDS, and mental disorders—it may be possible to use these technologies to tap into data from existing facilities where young people are seeking care. Web-based sampling and assessment methods, the use of mobile phones and hand-held devices for data collection, and new data-sharing strategies also have great potential to increase the range and use of data (Lang 2011). So, too, digital technologies offer scope for collection of data on health service encounters, the weakest aspect in current adolescent health data systems (Simmons, Fajans, and Ghiron 2007). Combined with the use of logic models, these technologies might also generate data that are useful at local levels to guide practice responses and secure support for data collection by decision makers.

Indicators for which Data Are Not Fully Utilized
No clear inclusive forum exists for the collection and collation of global data on young people's health. As a result, countries such as Australia, Brazil, and New Zealand, despite having sophisticated survey and health information systems, do not have data that are easily internationally comparable (AIHW 2007). A simple solution of incorporating at least some elements of the HBSC into national surveys in these countries, as well as adopting an agreed-upon international core set of indicators, would do much to ensure international comparability.

However, more systematic approaches will be needed. A range of UN agencies and other groups contribute elements to current surveillance, but they do so without any clear coordinating mechanism (Murray and Lopez 2010). In more targeted areas of global health, the development of mechanisms for the coordination of strategic information has underpinned many advances. In HIV/AIDS, malaria control, vaccine-preventable diseases, and diarrheal diseases monitoring and evaluation groups have been organized and may extend across UN agencies (Stein and others 2007). The Child Health Epidemiology Reference Group (CHERG) was established in 2001 in response to the need for

better information on infant and child mortality in pursuit of MDG 4. CHERG subsequently extended its work to examine the relationship between infant and maternal mortality; CHERG has produced reports that have shaped global policy responses and information systems around early childhood mortality and disease. A coordinating entity for the measurement of young people's health might have a work plan that includes conducting research that would lead to better measures of important and neglected indicators, refining indicator definitions with optimal validity, determining the best methods of capturing data in this adolescent age group, and ensuring the full use of available data. Ultimately, this effort could lead to harmonization across the different data sources, establishment of a consensus set of global indicators, development of a global index of adolescent health, and better use of data in policy formation.

Outside of HICs, with a few notable exceptions, relatively few countries have compiled status reports on the health and development of young people. The absence of data on intervention coverage suggests that even in the development of policy within the health sector, the data currently collected may receive little attention and have little capacity to drive health program delivery at a country level. Without such bottom-up data collection capacity that can specify local priorities and document health intervention coverage, securing either political or donor engagement may be difficult (Boerma and AbouZahr 2005).

GLOBAL PATTERNS OF ADOLESCENT DISEASE AND HEALTH RISK

The 2012 *Lancet* series illustrated wide international variations in almost all areas of young people's health. These differences existed both between and within regions, such as those defined by the WHO. The poorest regional health profiles were generally for young people in Sub-Saharan Africa, where mortality, rates of HIV/AIDS infection, and role transitions such as early childbirth linked to health risk were high. There were striking regional differences that included death rates from violence in Latin American countries and wide variations in rates of suicide and traffic injury deaths. With regard to risks for later NCDs, the available data suggest that HICs had some of the poorest profiles relating to patterns of alcohol abuse, mental disorders, and overweight.

Adolescent Health Outcomes
HIV seroprevalence based on household surveys was available from 29 countries representing 29 percent of

the global population. Data were predominantly from Sub-Saharan Africa and to a lesser extent from central and southern Asia. We have not included estimates from sentinel surveillance sites or women attending antenatal clinics because these generally overestimate prevalence (Wilson and others 2010). In areas where HIV/AIDS is endemic, rates are substantially higher in females ages 15–24 years than in males. Swaziland had the highest estimated rates of HIV/AIDS infection. Countries with higher rates of HIV/AIDS that have not had country-wide surveys include Angola, Botswana, Eritrea, The Gambia, Guinea-Bissau, Namibia, Nigeria, South Africa, Somalia, and Sudan. Countries outside of Africa without seroprevalence data include Pakistan, Papua New Guinea, the Russian Federation, Thailand, and Ukraine.

Axis 1 psychiatric disorder in the past 12 months in those ages 18–24 years was only available from 23 countries representing 37 percent of the global population. In a number of countries with smaller sample sizes (less than 4,000 for all age groups, for example, Belgium, France, Germany, and Lebanon) or with subregional samples (for example, Japan), confidence intervals around the estimates for those ages 18–24 years were greater than 5 percent. No comparable data are available for those younger than age 18 years. Rates of disorder tended to be higher in females than males in most countries. There was a threefold difference in rates across countries, with low rates in Bulgaria, India, Italy, and the Netherlands, and high rates in Brazil, France, New Zealand, Spain, and the United States. Erskine and others (2016) estimated the coverage of prevalence data for mental disorder in children ages 5–17 years. The overall global coverage was very poor; 124 out of 187 countries have no data at all on the prevalence of mental disorders. The mean global coverage for mental disorders in this age group was 6.7 percent (Erskine and others 2016).

Health Risk Behaviors and States

Coverage for health risk behaviors ranged between 40 and 85 countries. In general, there was good to excellent coverage of health risk behaviors and states in North America, the European Region, and southern Latin America.

Tobacco Use

Tobacco use in the past 30 days was available in 62 countries representing 45 percent of the global population of young people. Rates of tobacco use were high in a number of Western European countries, Chile, Jamaica, Namibia, Tonga, and in males in Indonesia. In the European Region, North America, Latin America, and many Sub-Saharan African countries, rates of tobacco

use appeared similar in males and females. In most Asian regions and the Caribbean, rates were higher in males.

Binge Drinking

Data on binge drinking in the past month were available for 51 countries and 17 percent of the global population. Definitions are not strictly comparable between the GSHS and HBSC. The former defines binge drinking as the consumption of at least five units of alcohol on any day in the past month; the latter defines it as getting drunk at least once in the past month. Rates are substantially higher for age 15 years than for age 13 years. In general, estimates for binge drinking from HICs were substantially higher than derived from LMICs, with the exception of some Latin American countries. Austria, Ireland, and the United States had the highest rates, with close to one-third of 15-year-olds reporting binge drinking in the past month.

Illicit Substance Use

Data on illicit substance use in the past 30 days were available in 41 countries representing 12 percent of the global population. The best data available were for the European Region and North America. There were substantial variations in the rates of use; the highest were in Canada, France, Spain, the Netherlands, and the United States.

Underweight

Underweight in those ages 13–15 years could be defined in 72 countries representing 48 percent of the global population. The greatest availability of body mass index (BMI) data was in the European Region. Limited data were available for Sub-Saharan Africa and Central Asia, regions where the prevalence of underweight might be expected to be highest. Rates of underweight were generally less than 10 percent in the European regions and North America. In regions with higher rates of underweight, males tended to fall into this category more than females. South-East Asia had high rates of underweight with Indonesia, Myanmar, and Sri Lanka particularly high. Limited data exist for other regions; Djibouti, Fiji, and the Republic of Yemen stood out for their high rates, particularly in males.

Overweight

Overweight in those ages 13–15 years was available for a similar range of countries as underweight. In HICs, rates of overweight were substantially higher in males than females. Canada, Greece, Italy, Malta, and the United States stand out for their high rates, particularly in young males where more than one-third were overweight. LMICs demonstrated substantial variation in rates of overweight; the lowest rates were in Malawi,

Mongolia, Myanmar, Pakistan, and Sri Lanka. It is striking that many LMICs had substantial rates of overweight; between one-fifth and one-third of young males are overweight in Latin American countries, Oceania, China, Thailand, and Mauritania. Tonga had the highest rates of overweight, with approximately 60 percent of those ages 13–15 years fulfilling the criteria.

Physical Activity

Physical activity data were available for 86 countries representing more than 50 percent of the global population. Boys were generally more likely than girls to fulfill the recommended level of activity. HICs displayed some tendency to have higher rates of reported activity than LMICs. In most HICs, a majority of those ages 13 and 15 years meet the guidelines of at least 60 minutes of moderate physical activity on most days of the week; the rates were lower in older females. Among HBSC countries, Bulgaria, Croatia, France, Greece, Israel, Italy, Malta, Romania, and Russia stand out for their low rates

of physical activity. The rates of physical activity are lower in LMICs, particularly for females, in the Middle East and North Africa, many Sub-Saharan African countries, Pakistan, and the Philippines.

Sexual and Reproductive Health

Indicators of sexual and reproductive health were generally more available. Map 5.2 provides an illustration of information on sexual health risks available from household surveys. The surveys do not collect data on those younger than age 15 years.

- *Sexual activity by age 15 years* was relatively well populated if the data sources extended to school-based surveys. Theoretically, data were available for 117 countries and almost 50 percent of the global population. Generally, more information was available for females than males. The household survey data derive from retrospective reports in samples ages 15–24 years, while available school-based survey

Map 5.2 Sexual Health Risks in Adolescents in Countries with Available Household Data
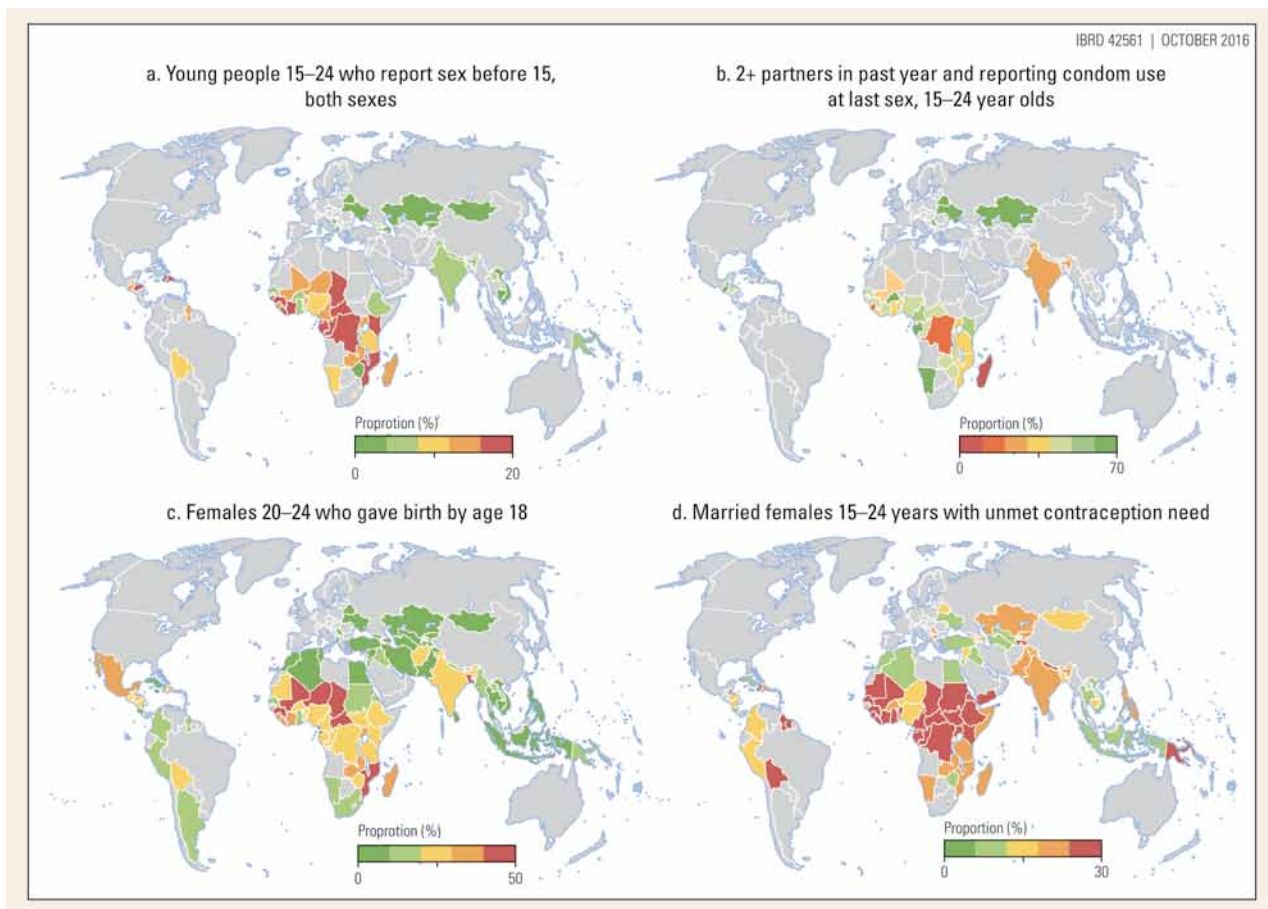
Source: Reprinted from *The Lancet* 387 (10036): Patton, G. C., S. M. Sawyer, J. S. Santelli, D. A. Ross, R. Alifi, and others, "Our Future: A Lancet Commission on Adolescent Health and Wellbeing," 2423–78, © 2016, with permission from Elsevier.

data cover having had sex by the time of report. Rates from retrospective reports appeared to be lower than those from concurrent reports in countries where both sets of data are available. European countries surveyed through HBSC showed an almost fourfold variation in rates for males and females and up to an eightfold variation between countries. Coverage was poorest in the Middle East and North Africa, and coverage was limited in HICs in East Asia and Pacific. Bulgaria, the Central African Republic, Denmark, Iceland, Mauritania, Mozambique, the United States, and Zambia appeared to have higher rates of early sexual activity in females.

- **Female marriage before age 18 years** had good data coverage for much of Sub-Saharan Africa, and mixed coverage in Asia, the Middle East, and Latin America and the Caribbean. Similar data may be available in HICs (Stein and others 2007), but they are not collated according to this definition to allow international comparability. Rates of early marriage were high in Southern Asia; Bangladesh reported the highest rate globally, with two-thirds of women marrying before age 18 years. Very high rates of early marriage were reported for most of Sub-Saharan Africa. Rates in Eastern Europe and Latin America were generally in the intermediate range but with striking variations among countries.

- **Child birth by age 18 years** had relatively good coverage with data available for 57 percent of the world's young women in 96 countries across a wide range of incomes. Rates of early childbirth closely mirrored rates of early marriage, with high rates in Southern Asia, Sub-Saharan Africa, and countries in Latin America and the Caribbean. Namibia, South Africa, and Swaziland stand out for their relatively high early birth rates and lower rates of early marriage.

## ALTERNATIVES TO HARMONIZATION IN DATA COLLECTION

The current low rates of coverage do not allow an adequate picture to be developed of health and health risks in adolescents in most countries. Recent attempts have been made to model the use of existing sources of information to provide a more comprehensive picture of global health and health risks (Murray and others 2012). Multiple definitions from different data sources are modeled in Murray and others (2012) using ordinary least-squares regression to generate estimates of frequency within particular categories. Maps 5.3–5.8 illustrate global patterns of three health risks that emerge prominently during the adolescent years and the changes over the past two decades.

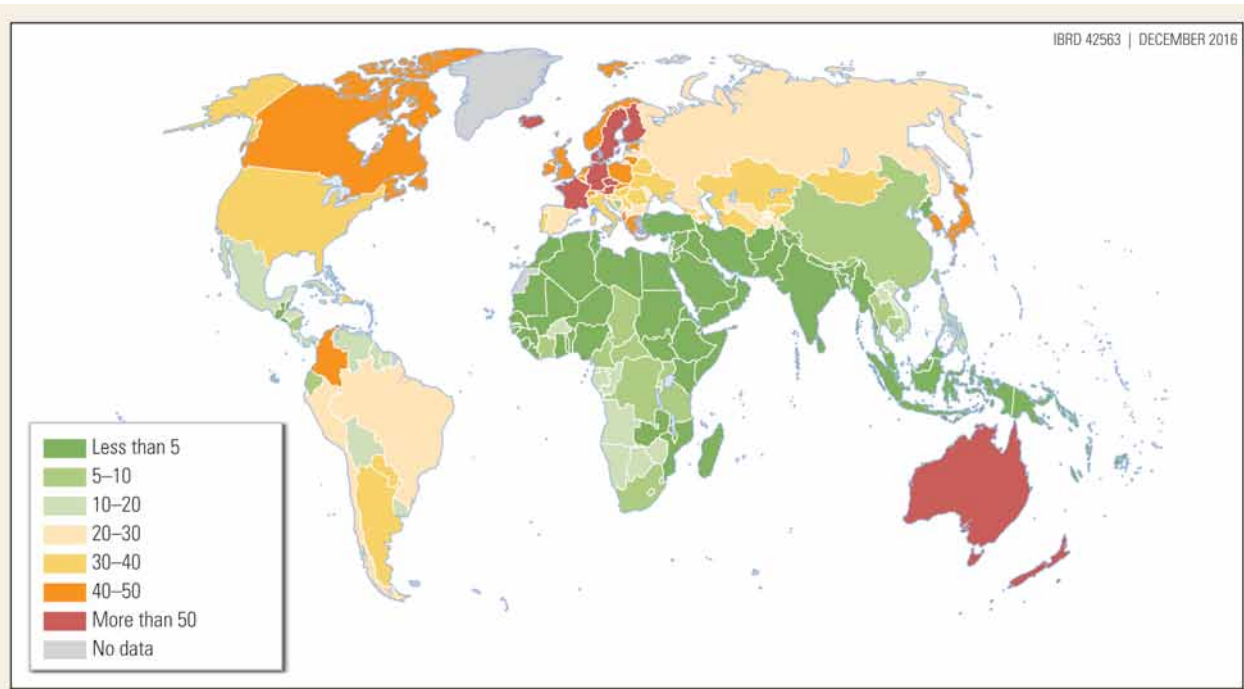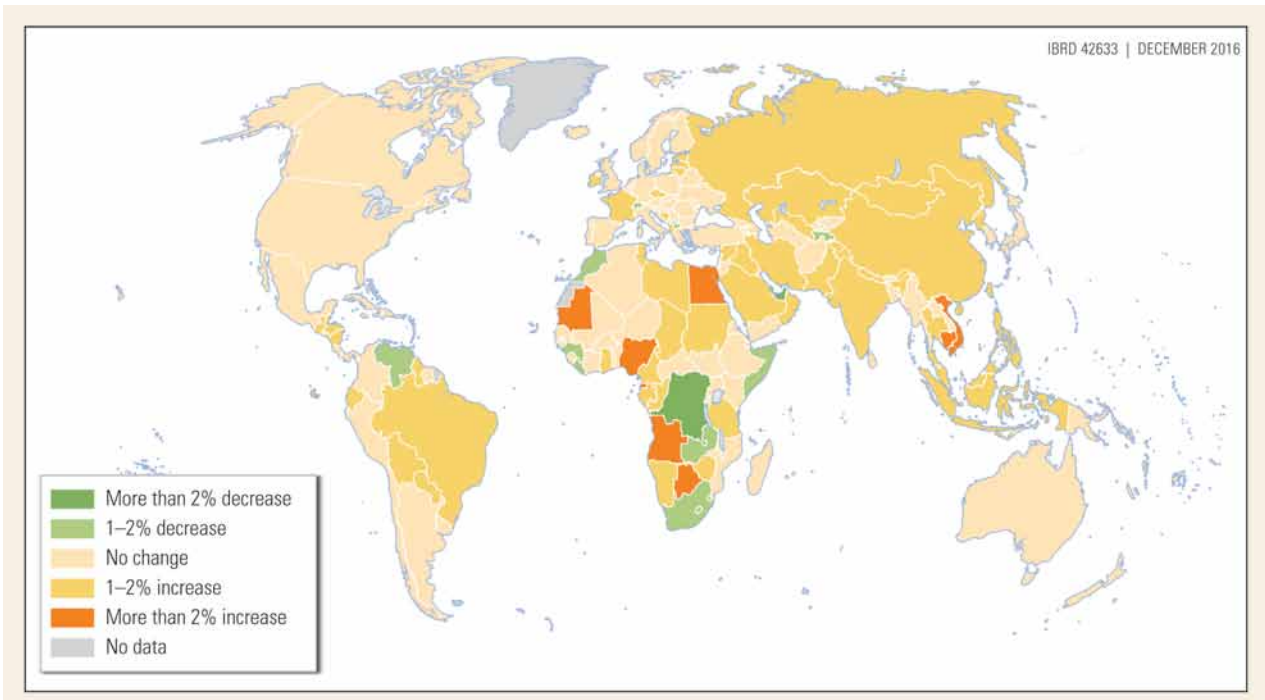**Map 5.3** Prevalence of Daily Smoking in Ages 10–24 Years, 2012
Percent
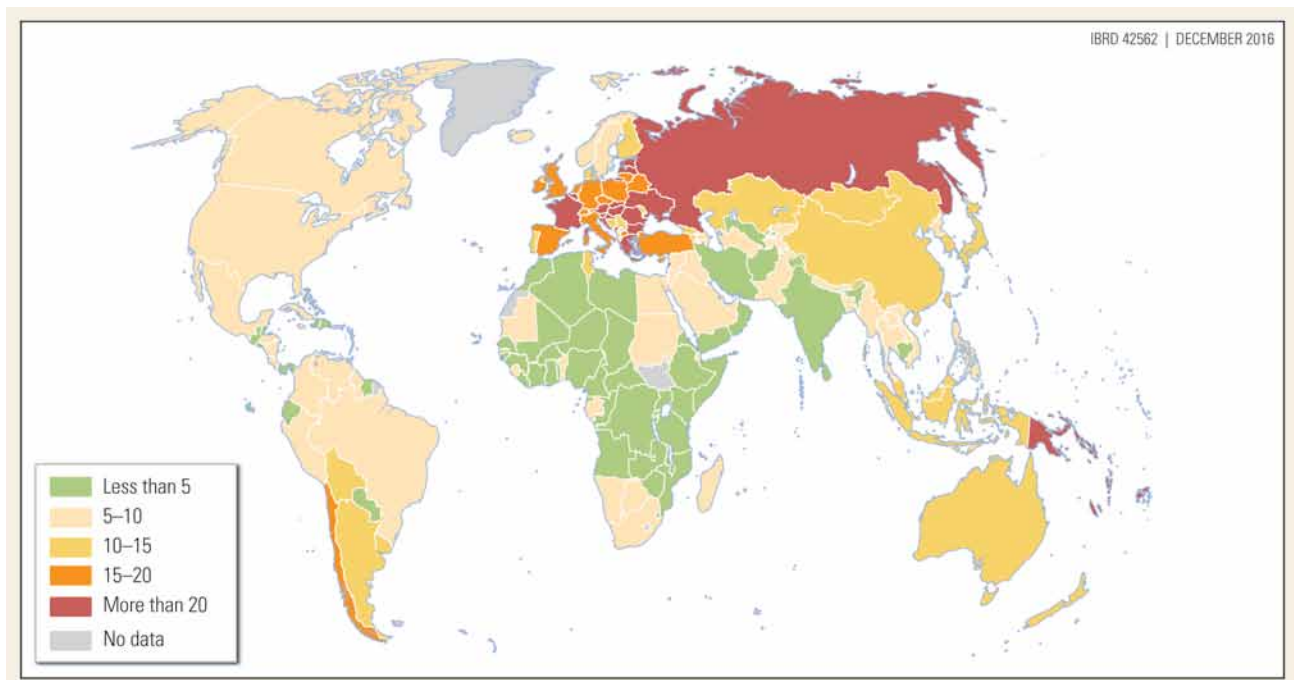
Source: Reprinted from *The Lancet* 387 (10036): Patton, G. C., S. M. Sawyer, J. S. Santelli, D. A. Ross, R. Alifi, and others, "Our Future: A Lancet Commission on Adolescent Health and Wellbeing," 2423–78, © 2016, with permission from Elsevier.

Map 5.4 Annual Change in Daily Smoking in Ages 10–24 Years, 1990–2012
Percent
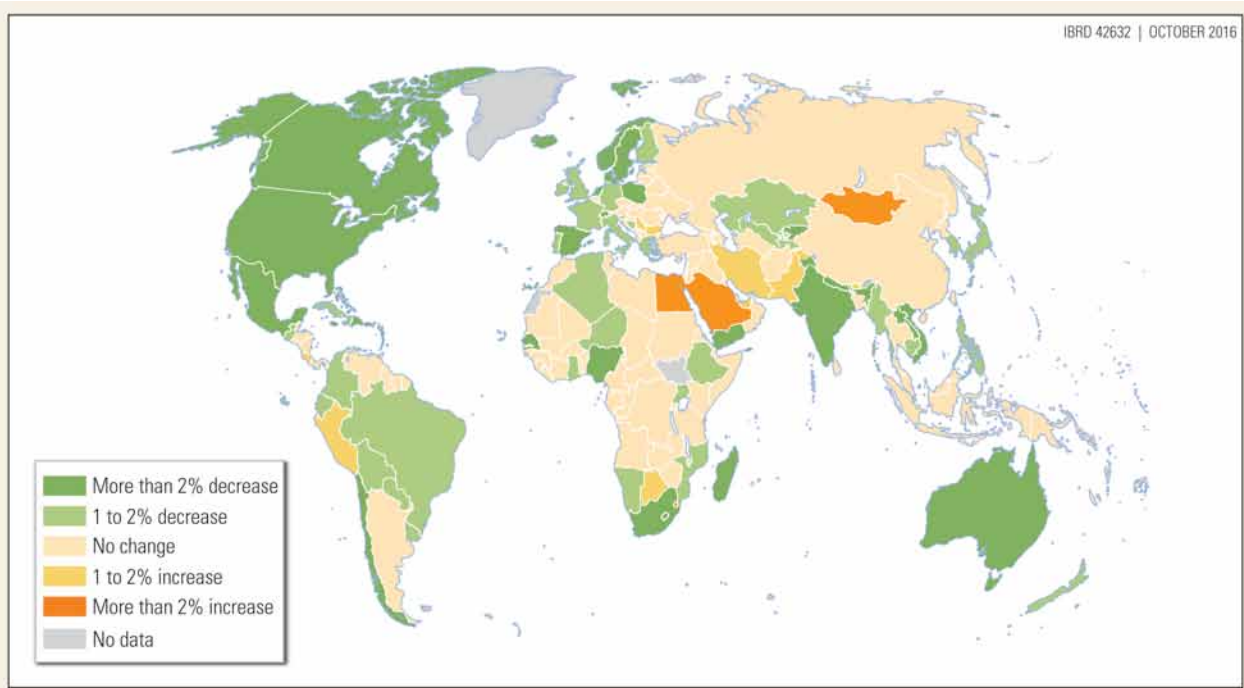
Map 5.5 Ages 15–24 Years Reporting Binge Drinking in the Past 12 Months, Both Genders, 2013
Percent

Map 5.6 Annual Change in Ages 15–24 Years Reporting Binge Drinking in the Past 12 Months, Both Genders, 1990–2013
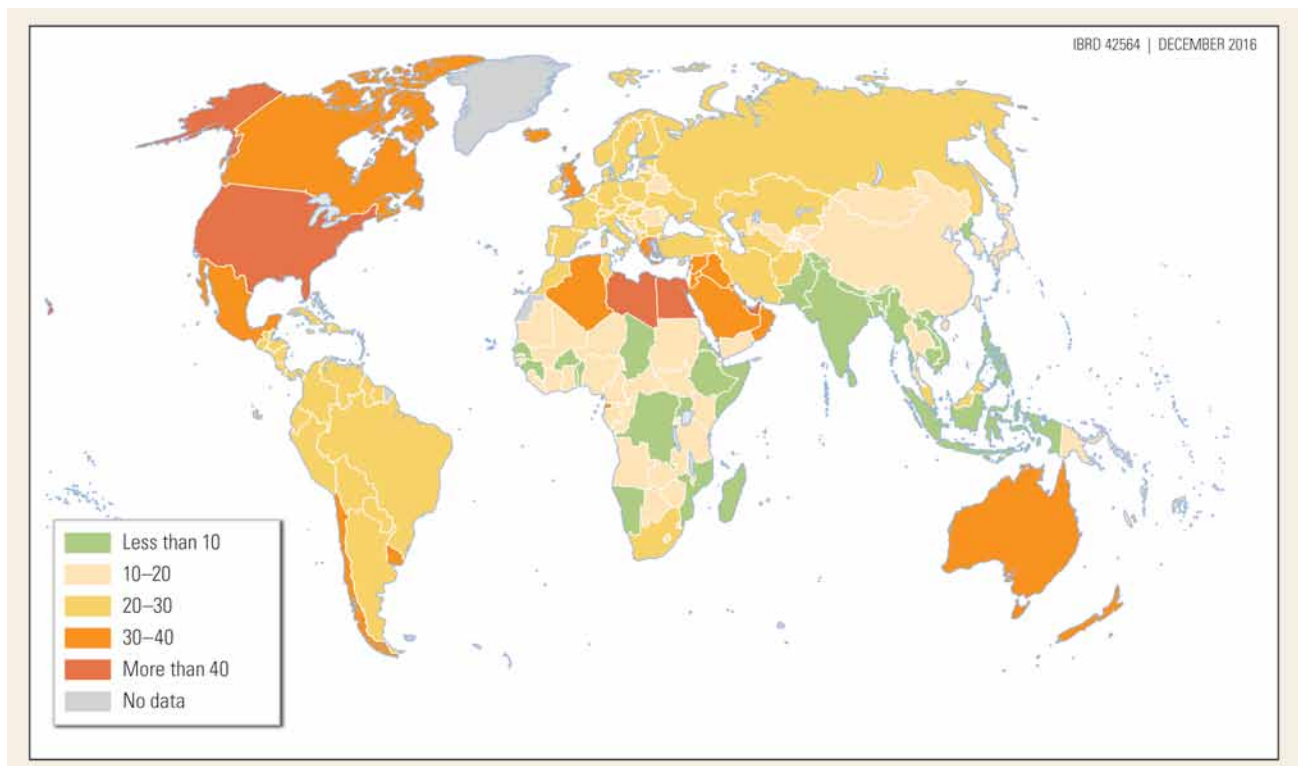*Percent*

Source: Reprinted from *The Lancet* 387 (10036): Patton, G. C., S. M. Sawyer, J. S. Santelli, D. A. Ross, R. Alifi, and others, "Our Future: A Lancet Commission on Adolescent Health and Wellbeing," 2423–78, © 2016, with permission from Elsevier.

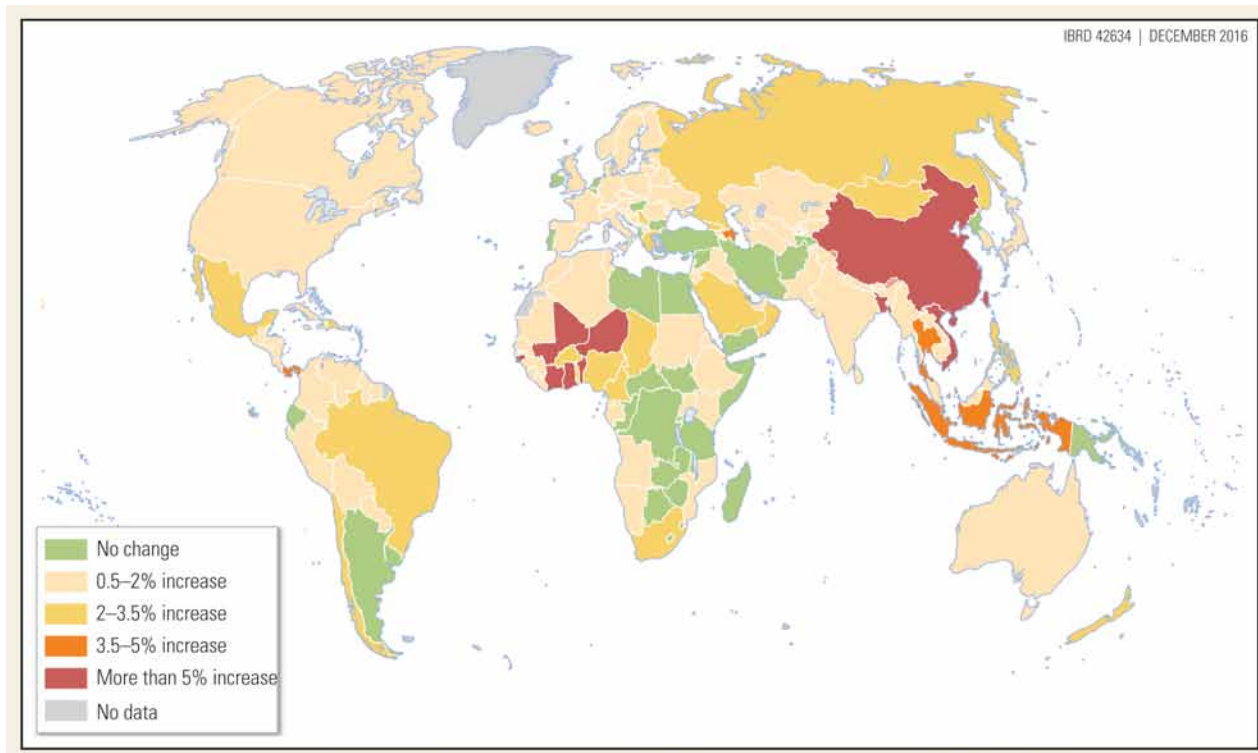**Map 5.7** Prevalence of Overweight and Obesity in Ages 10–24 Years, 2013

Source: Reprinted from *The Lancet* 387 (10036): Patton, G. C., S. M. Sawyer, J. S. Santelli, D. A. Ross, R. Alifi, and others, "Our Future: A Lancet Commission on Adolescent Health and Wellbeing," 2423–78, © 2016, with permission from Elsevier.

Map 5.8 Annual Change in Overweight and Obesity in Ages 10–24 Years, 1990–2013
Percent

Source: Reprinted from *The Lancet* 387 (10036): Patton, G. C., S. M. Sawyer, J. S. Santelli, D. A. Ross, R. Alifi, and others, "Our Future: A Lancet Commission on Adolescent Health and Wellbeing," 2423–78, © 2016, with permission from Elsevier.

The prevalence of smoking was defined as tobacco smoking at least once per day. Smoking prevalence data were available for 186 countries for ages 10–14, 15–19, and 20–24 years, and for males and females.

Tobacco use is a major risk factor for NCDs later in life and overwhelmingly has its onset in adolescence. Maternal smoking during pregnancy is also a well-established risk factor for poor fetal growth as well as for later-life illness in offspring (Bruin, Gerstein, and Holloway 2010). Overall, tobacco use has declined since 1990, but progress has been mixed. Rates of daily smoking remain greater than 15 percent in ages 10–24 years across most European countries. In Russia, one in four people ages 10–24 years smokes daily. Across all groups of countries, daily smoking is more common in males than females. A number of countries in Sub-Saharan Africa, Eastern Europe, and the Middle East have seen increases. Many nonsignatories to the Framework Convention on Tobacco Control have not seen any decline in adolescent and young adult tobacco use.

Alcohol use disorders typically begin during the young adult years. As with nicotine addiction, younger age of drinking is a particular risk factor (Bonomo, Patton, and Bowes 2006; Viner and Taylor 2007). Alcohol consumption in adulthood is linked to eight different cancers, hypertension, hemorrhagic stroke, atrial fibrillation, and various forms of liver disease and pancreatitis (Parry, Patra, and Rehm 2011). Greater use of alcohol in pregnancy has prominent intergenerational harms in the form of fetal alcohol syndrome (Riley and McGee 2005).

Binge drinking was defined as consuming 48 grams of alcohol in a single occasion for females and 60 grams for males in the past year, per Global Burden of Disease definitions. Alcohol prevalence data were available for 188 countries for a combined 15–24 age group, and for males, females, and both genders combined. The modeled estimates were for a 15–24 year age band that assumed constant prevalence across all ages in this group. Data were available for 1990, 1995, 2000, 2005, 2010, and 2013.

Binge drinking was considerably more prevalent in males than in females in every country grouping. Little progress has been made in reducing adolescent and young adult binge drinking since 1990. An increasing

trend for binge drinking is clear; both males and females in LMICs are likely to overtake HICs in binge drinking in the coming years.

Overweight and obesity increase markedly across adolescence and young adulthood with very high persistence, particularly for obesity (Patton and others 2011). The risks in later life include premature mortality, chronic disability, type 2 diabetes, ischemic heart disease, hypertension, and cerebrovascular disease (Reilly and Kelly 2011). Preconception maternal obesity increases risks for miscarriage, gestational diabetes, operative delivery, preeclampsia, infant perinatal mortality, and macrosomia (Yu, Teoh, and Robinson 2006).

For those ages 19–24 years, overweight was defined as BMI ≥ 25 to < 30 kilograms per square meter (kg/m^2) and obesity as BMI ≥ 30 kg/m^2. For those ages 10–18 years, classification was based on percentiles using the International Obesity Task Force definition. Overweight and obesity prevalence data were available for 188 countries for age groups 10–14, 15–19, and 20–24 years, and for males, females, and both sexes combined. Data were available for all years from 1990 to 2013.

Adolescent overweight and obesity have increased in prevalence across almost all countries since 1990, as shown in map 5.8. Notable exceptions are Argentina, Bulgaria, the Islamic Republic of Iran, Turkey, and countries in central Sub-Saharan Africa. The annual increase has been about 10 percent in China and Vietnam; there have also been marked increases in other countries across South-East Asia, as well as in Sub-Saharan Africa. If their recent increases in obesity continue, middle-income countries will soon outstrip HICs in rates of overweight and obesity.

CONCLUSIONS

Current knowledge of adolescent health reflects many of the broader gaps in global health information systems. Adolescents are further disadvantaged on a number of counts.

- Younger adolescents are poorly covered, especially in LMICs, with no coverage for those out of school in any survey.
- Fewer data are available on males and unmarried young women.
- Beyond sexual and reproductive health, most aspects of adolescent health and health risks are not included in household surveys.

- The capacity to understand health trends has been limited by funding constraints resulting in lack of investment in repeat surveys in many countries.

Moving forward will require responses in multiple areas, including the following:

- *Improving the harmonization of assessments across surveys based on standardized indicators and measures.* Where harmonization is not possible, studies are needed to understand how different survey approaches might be complementary.
- *Extending the coverage of current surveys to new and emerging problems and health risks, including mental disorders and emotional well-being, substance use, and injury risks.* Doing so is likely to require the development of new indicators and measures.
- *Extending existing surveys to provide adequate coverage of younger adolescents, as well as developing systems for assessing structural and social determinants of health.*

Digital technologies will offer great opportunities for more affordable and more effective data collection systems, training, and support of in-country expertise in data analysis.

ANNEXES

The annexes to this chapter are as follows. They are available at http://www.dcp-3.org/CAHD.

- Annex 5A. Characteristics of Important International Data Sources Used in Adolescent Health Indicators
- Annex 5B. Availability of Information from International Data Collections to Populate Indicators of Adolescent Health, 2000–12

NOTE

World Bank Income Classifications as of July 2014 are as follows, based on estimates of gross national income (GNI) per capita for 2013:

- Low-income countries (LICs) = US$1,045 or less
- Middle-income countries (MICs) are subdivided:
  a) lower-middle-income = US$1,046 to US$4,125
  b) upper-middle-income (UMICs) = US$4,126 to US$12,745
- High-income countries (HICs) = US$12,746 or more.

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