

Chapter 8

Life stage: Adolescence

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Key statistics

- There are now as many young people in the second decade of life (10–19 years) in the UK as children in the first (0–9 years); adolescents from 10 to 19 years make up 12% of the population.¹
- The gap between puberty and adult social and financial independence has widened from around six years in the 1950s to 15 years or longer for most young people today.²
- All-cause mortality among adolescents (10–19 years) is now higher than for other periods of childhood except the newborn period. Injuries are the main cause of adolescent mortality.³
- Morbidity due to disability and long-term conditions is higher among adolescents than children and long-term conditions rise from early adolescence.⁴
- Five of the 'top 10' risk factors for the total burden of disease in adults are initiated or shaped in adolescence.⁵
- Some 75% of lifetime mental health disorders have their onset before 18 years of age, with the peak onset of most conditions being from 8 to 15 years. Approximately 10% of adolescents suffer from a mental health problem at any one time.⁶
- Health service use is higher in adolescence than in childhood after age 3 years. It rises during adolescence, yet there are few dedicated services for young people.⁷
 - Long-term condition outcomes are poorer in adolescents than in adults.
 - Some 70% of childhood type 1 diabetes occurs in adolescence, yet adolescents have poorer diabetes control and more emergency hospital admissions than children or adults.⁸
- Adolescents have seen the least improvement in cancer survival compared with children and adults.⁹
- Age-appropriate services for adolescents have been shown to increase the quality of care.¹⁰

Why does adolescence matter?

Young people aged 10–19 years, defined by the World Health Organization (WHO) as adolescents, have experienced the least improvement in health status of any age group in the British population over the last 50 years.

Adolescents have been assumed to be low users of health services and adolescence understood as the healthiest period of life. These assumptions have not been true since the 1960s, yet their persistence makes young people nearly invisible in a health service that focuses on the middle-aged and elderly and on young children.

Six key issues underpin the case for a greater focus on adolescents in our health services and across government. These are population changes, the shift of disease burden out of childhood into adolescence, the widespread initiation of health and self-management behaviours in adolescence, the rise of long-term conditions and injuries during adolescence, shifts in health service use, and **the huge potential for change brought about by dramatic brain and psychosocial development in adolescence.**

Shifts in population towards adolescence

There are now the same numbers of young people in Britain in the second decade of life, 10–19 years of age, as there are children in the first decade. Each group made up 12% of the UK population in 2012.

Worldwide there are now 1.2 billion young people aged 10–19 years, the largest youth cohort in history, who form 20% of the global population.¹¹ Adolescence is rapidly becoming a major priority for governments and health systems across the world. **The World Bank has identified youth as a key driver of economic productivity, providing a potential ‘demographic dividend’.**¹² In its 2011 report on the state of the world’s children, *Adolescence: An age of opportunity*, UNICEF identified adolescence as a key time of opportunity for preserving life-long health.¹³ Britain today has more adolescents than at any time in its history, with its own ‘youth bulge’ of the children of migrants over the past four decades. **This population of young people has unparalleled potential to influence the future of Britain over the next 50 years.**

Rapid development presents opportunities

Adolescence is often seen as a risky and turbulent period of life, with young people ‘at risk’ from a range of new health problems. However, it is important to recognise the beneficial potential of changes during adolescence, understanding that young people can become positive levers for change in society.

Adolescence is a key period of rapid and extensive psychological and biological growth, second only to early childhood in the rate and breadth of developmental change. Changes in the brain and all organ systems during puberty and adolescence interact with social development to set up



Toilet roll puppets – making something fun and beautiful out of rubbish

Source: Kids Company

a range of new behaviours that can be both positive and potentially negative. Brain and body development also set up a number of transitions that are important for an individual to function as a productive adult.²

Biological, psychological and social development

Puberty is one of the central biological dramas of human life, a period of major bodily change that has dramatic effects on the psychological and social aspects of young people’s lives. **During puberty, the body achieves its maximum potential in terms of fitness, physical strength and reproductive capacity.** Puberty for most British young people starts around 10–13 years of age, and is largely over by 14–16 years.

Human puberty is unique, in that we are the only animals that have major brain development at the same time as puberty. One of the great discoveries of neuroscience in the past 20 years has been the recognition that **there is a surge of brain development during early adolescence, and that brain development continues into the early 20s if not beyond. Waves of ‘synaptic pruning’ travel across the brain between 10–12 and 20 years of age, cutting away unused connections between brain cells to increase cognitive capacity and speed.** Particular areas that develop rapidly are those dealing with social relationships, with taking risks and with controlling feelings and emotions. While it is still too early to translate neuroscience into policy interventions, **we are beginning to understand why adolescents are particularly vulnerable to peer**

influences and why there appears to be a 'window of vulnerability' to risky behaviours around ages 14 to 17 years, particularly in the presence of peers.¹⁴

Rapid brain development and the acquisition of new cognitive abilities, such as complex abstract thinking, drive a series of changes in young people's lives in terms of identity and relationships with families, peers and schools. This dynamic interaction between body changes, changing identity and changing social groups during adolescence gives rise to both great potential and significant risk in young people's lives.

Transitions

This rapid development drives transitions in nearly all parts of young people's lives, not just within health. The World Bank identified the key adolescent transitions as being from dependent child to autonomous adult, from primary to secondary and later education, from education into the workforce, transition into responsible and productive citizenship and transitions in health from dependent recipients of children's healthcare to adults responsible for their own healthcare.¹² Successful negotiation of these transitions is necessary for young people to become economically productive members of society and to have the best chances for good health and wellbeing across the life course.

Widening gap between puberty and adulthood

Adolescence has increased in prominence as a life period because the timing of puberty is increasingly out of kilter with young people's social development in the modern world.²

The average age of starting puberty fell dramatically in the early 20th century, but timings have been largely stable in the UK and most developed countries since the 1960s. Yet over the last 40 years we have seen a major divergence between the timing of puberty and the achievement of 'adult' social and financial independence. In the 1960s, for most young women, marriage and childbirth followed within five to six years of the start of their periods. Today, the average gap between puberty and moving out of the family home (mean age 25 years) is around 12 years, with the gap between puberty and having children (mean age around 29 years) around 16 years.

This widening gap between physical and sexual maturity (i.e. at the end of puberty) and attaining adult social and financial independence has been postulated to explain growing mental health, behavioural and substance use issues among adolescents and young adults.²

Shifts in burden of disease: childhood to adolescence

Conventionally, adolescence has been seen as the healthiest time of life – a time when nature prepares us to take on the adult roles of work, reproduction and family life. However, this is no longer true.

In all high-income countries globally, mortality among adolescents is now greater than in 1–9 year olds, a reversal of traditional mortality patterns dominant for millennia.³ This shift has been driven by the 'health' transition from infectious diseases to injuries and non-communicable diseases. The health transition has particularly benefitted younger children, but left adolescents vulnerable to the largely preventable morbidity and mortality related to injuries, mental health and non-communicable diseases such as asthma, cancer, diabetes and obesity.^{3,15}

Among children and adolescents, burden of disease has largely coalesced into two poles, namely infants (<1 year) and adolescents, and middle childhood has replaced adolescence as the healthiest period of life.

Initiation of health behaviours and disease during adolescence

The shift of burden into adolescence relates to the development of new health-related behaviours and to new problems appearing during adolescence.

Health behaviours

Adolescence is the most significant period in the life course for the initiation of a wide range of health behaviours that are associated with the largest health burdens in adult life. Smoking in the UK leaps up from a population prevalence of 1% at age 11 years to around 20% at 15 years. In fact, nearly 90% of lifetime smoking is initiated between the ages of 10 and 20 years in the UK. Similarly, approximately 80% of lifetime alcohol or cannabis use is initiated <20 years, with the proportions initiating other illicit drugs in adolescence closer to 50%. Once initiated, these behaviours track strongly into adult life, highlighting the importance of intervention in adolescence to prevent health burden.¹⁶

Initiation is far more common than sustained substance use, and five of the 10 key risk factors for adult disease burden identified in the WHO Global Burden of Disease Study (tobacco, physical activity, overweight, unsafe sex and alcohol use) are problems that are usually initiated or heavily shaped (e.g. physical activity) in adolescence. Adolescent health and development are therefore key to the prevention of adult non-communicable diseases.^{17,18}

Health risk behaviours and mental and physical health problems co-occur in adolescence to a greater degree than in adulthood: **common factors such as deprivation, poor parental connection, low self-esteem and poor mental health are responsible for a range of exploratory behaviours.**¹⁹ As outlined in the following table taken from the US Institute of Medicine, interventions addressing common risk factors have the potential to prevent multiple problems.

Table 8.1 Table from the Institute of Medicine (IOM) report On the Science of Adolescent Risk Taking 2011

Risk factors	Substance abuse	Delinquency	Teen pregnancy	School dropout	Violence	Depression and anxiety
Community						
Availability of drugs	✓				✓	
Availability of firearms		✓			✓	
Community laws and norms favourable towards drug use, firearms, and crime	✓	✓			✓	
Media portrayals of violence					✓	
Transitions and mobility	✓	✓		✓		✓
Low neighbourhood attachment and community disorganisation	✓	✓			✓	
Extreme economic deprivation	✓	✓	✓	✓	✓	
Family						
Family history of the problem behaviour	✓	✓	✓	✓	✓	✓
Family management problems	✓	✓	✓	✓	✓	
Family conflict	✓	✓	✓	✓	✓	✓
Favourable parental attitudes and involvement in the problem behaviour	✓	✓			✓	
School						
Academic failure beginning in late elementary school	✓	✓	✓	✓	✓	✓
Lack of commitment to school	✓	✓	✓	✓	✓	
Individual/Peer						
Early and persistent antisocial behaviour	✓	✓	✓	✓	✓	✓
Alienation and rebelliousness	✓	✓		✓		
Friends who engage in the problem behaviour	✓	✓	✓	✓	✓	
Favourable attitude toward the problem behaviour	✓	✓	✓	✓		
Early initiation of the problem behaviour	✓	✓	✓	✓	✓	
Constitutional factors	✓	✓			✓	✓

Source: Hawkins and Monahan presentation (data from Brooke-Weiss et al, 2008).

Self-management behaviours for long-standing conditions

Long-term self-management behaviours for diabetes, asthma, epilepsy and other chronic conditions are also largely initiated in adolescence. It is in early and mid-adolescence that individuals take over the management of their chronic conditions from their parents, and **there is strong evidence that the self-management behaviours initiated in adolescence remain with them throughout life.**²⁰ Adolescence therefore provides an important window of opportunity to influence the trajectories of non-communicable diseases throughout later life.

Adolescent development precipitates an avalanche of new-onset diseases

Rapid changes in the brain and across all organ systems in adolescence result in a host of new mental and physical health disorders appearing at this time. **Approximately 75% of lifetime mental health disorders (excluding dementia) have their onset before 24 years of age, with the peak onset of most conditions from 8 to 15 years.**²¹

Type 1 diabetes and many other auto-immune conditions have their peak incidence in early adolescence, and adolescence sees the development of new types of rheumatological conditions, epilepsy and respiratory conditions.² Indeed, some 'paediatric' diseases such as type 1 diabetes are predominantly diseases of adolescence: the National Paediatric Diabetes Audit showed that 70% of the childhood diabetes population is aged 12–19 and that

the great majority of emergency hospital admissions for diabetes are in this age group.⁸

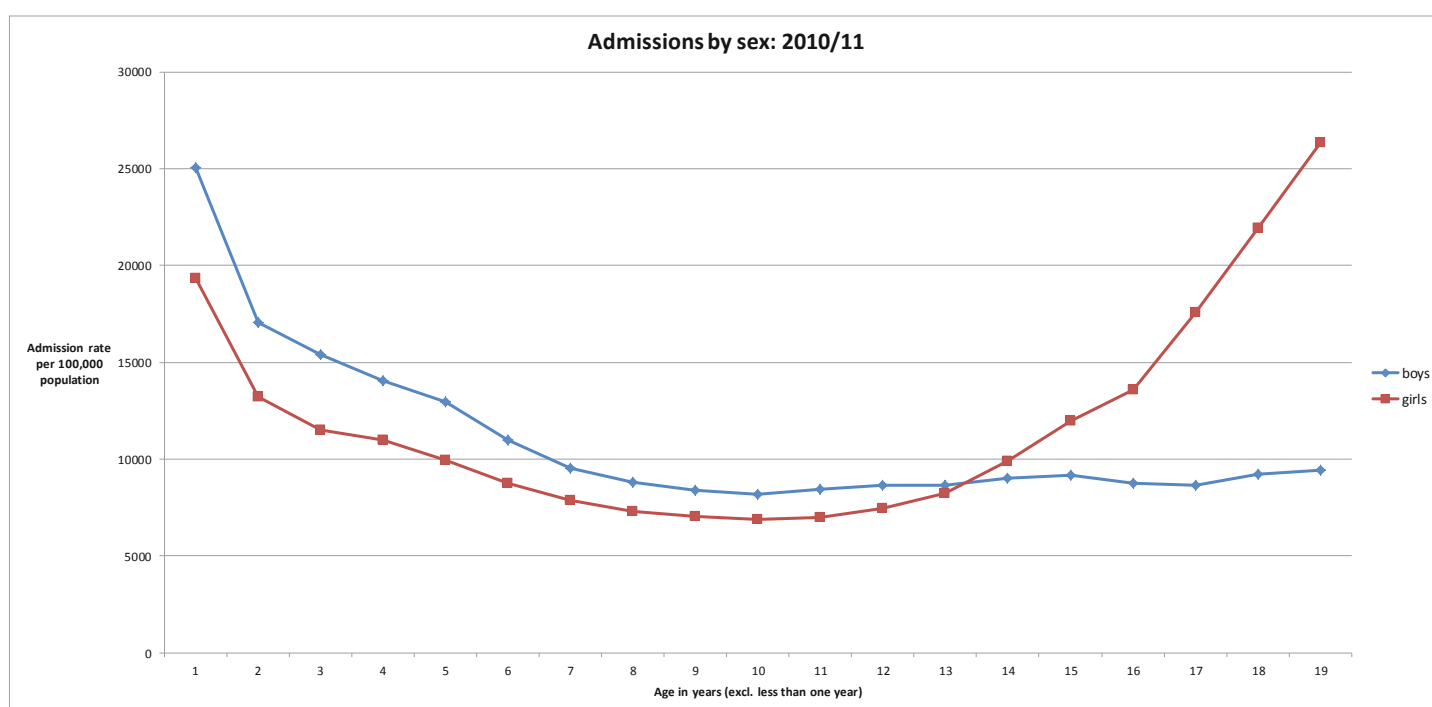
Cancer in adolescence has a distinct biology and behaviour to that in either children or adults, and cancer survival in adolescents has failed to match the dramatic improvements seen in child or adult cancer over the past 20 years.⁹ This may in part reflect poor participation in research by young people, as there is good evidence that the poor progress in adolescent cancer is related to very low participation in clinical trials compared with the participation rates of children or adults.^{22,23}

Behaviourally related conditions such as sexually transmitted infections and HIV begin to appear in early adolescence and escalate rapidly: 16–24 year olds have the highest incidence and prevalence of the majority of sexually transmitted infections in both sexes in the UK.²⁴ Globally, 45% of new HIV infections occur in 15–24 year olds.²⁵

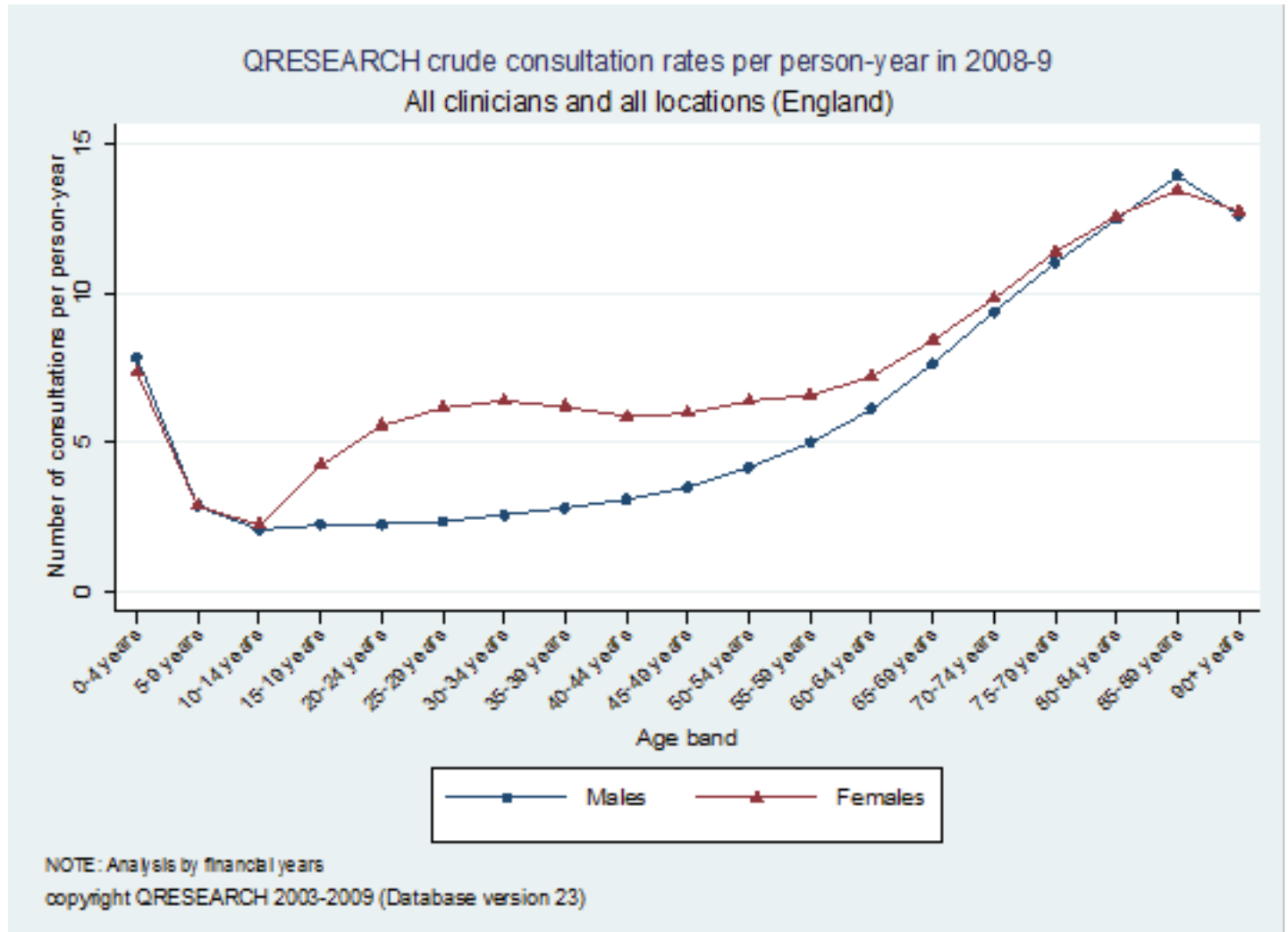
Long-term condition outcomes are poorer in adolescence than in childhood

Outcomes for many long-term conditions are poorer in adolescents than in children or adults. For example, markers of diabetes control such as the HbA1c level are worse in adolescence than in childhood or adulthood in type 1 diabetes.⁸ **Given poorer outcomes for diabetes in Britain than in other European countries, this places British adolescents at the bottom of the outcome leagues.**⁸ Similarly, asthma and epilepsy control are poorer in adolescents than in children. As noted above,

Figure 8.1 Hospital admission rate by age for <20 year olds in 2010/11



Source: Child and Maternal Health Intelligence Network, Public Health England

Figure 8.2 Primary care consultation rates by age Source: NHS Information Centre²⁶

adolescents have seen the least improvement in cancer survival compared with children and adults.

These poorer outcomes in adolescence reflect both biological factors and psychosocial issues related to regimen adherence and self-management.

Increasing health service use in adolescence compared with childhood

The myth that adolescents are low users of health services dissipates with even a cursory glance at health service use in the UK. **Data from Hospital Episode Statistics (HES) show that inpatient, outpatient and Accident and Emergency department use are higher in adolescence than in childhood after 3 years of age.** Inpatient length of stay is higher in adolescence than in childhood after infancy. **Primary care use is higher in adolescence than in mid-childhood, with most young people seeing their GP more than yearly.**²⁶

Schools and peers emerge as new social determinants of adolescent health

Policy actions relating to the social determinants of health by the WHO and in the UK have focused on interventions

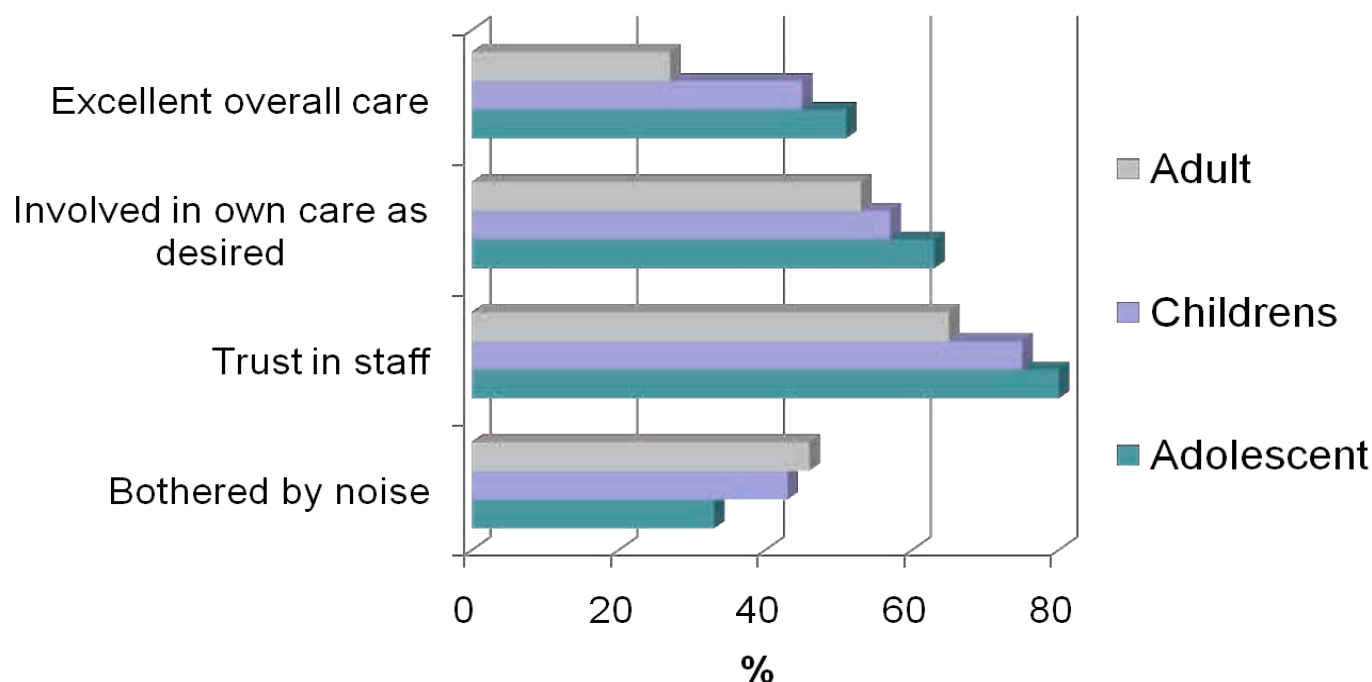
with young children as a strategic way of improving health across the life course. Yet the **major transitions and developmental changes occurring during adolescence make the teenage years a time of immense potential for preventive interventions and building resilience in young people.**

While parenting and family factors, so crucial in early childhood, remain key protective determinants in adolescence, new social determinants arise in adolescence that influence the transition from childhood into adult life.

Peers begin to exert influences that can be both pro-social and anti-social and begin to attenuate the influence of family on young people.

Schools begin to exert new influences, with connection with school (sense of belonging) becoming a key protective factor in addition to attainments. Further, health in adolescence is strongly predictive of educational outcomes including attainments and employment. Promotion of health by schools should be an essential part of their 'core business' of increasing attainments and enhancing later life chances.

Figure 8.3 Adolescent inpatient wards improve quality of care



Source: National Young Patient Survey, England, 2004¹⁰

Neighbourhood environment begins to exert strong effects not seen in earlier childhood, particularly in later adolescence as young people begin to explore life outside the family. Young people also have their own experiences of unequal chances related to gender, ethnicity, education, employment and socio-economic status – determinants that impacted upon child health only through their parents.²⁷

In addition, **it is likely that latent determinants such as puberty and brain development recapitulate the biological embedding of social determinants seen in very early life.**

Adolescence as a second opportunity for intervention

Adolescence is a second opportunity for intervention after very early childhood. A rational early intervention approach targets critical periods of rapid development, i.e. adolescence as well as very early childhood.²⁷

Given that health and health behaviours track strongly from adolescence into adult life, the way that health is promoted and protected during adolescence is key to the health of the whole population and the economic development of the nation.

New approaches to adolescent health are required

so that young people stop being the neglected minority in adult public health areas, for example the tobacco, alcohol, and sexual health strategies. Given evidence that health risk behaviours co-occur in adolescence and that common factors underlie all such health behaviours in adolescence, horizontal approaches focusing on these common factors have great potential to prevent multiple problems.

Age-appropriate services across all areas of the health service

Despite the large proportion of young people in the population, their higher mortality and morbidity rates than most of childhood, and their poorer long-term condition outcomes than in childhood, **there are few specific age-appropriate services for young people in the UK. Services are organised around professional groupings (child health versus adult health professionals) and on historical grounds.**

Adolescence needs to be thought of as a discrete period within the life course in which preventive services and clinical services need to be targeted and age-appropriate.

There is currently sufficient adolescent usage of inpatient healthcare (12–19 years) to form an 18-bed ward in most district general hospitals serving a population of around 250,000, with greater activity than this in regional and teaching hospitals.²⁸

There is evidence that age-appropriate adolescent services improve outcomes by improving attendance and retention of young people in clinical services.¹⁰

There are few data on the health economic consequences of developing adolescent age-appropriate services and this is a key research need.

Transition

The focus of child health services on the under-5s, and the focus of adult health on the elderly, have meant that young people with ongoing needs for healthcare have often faced barriers to accessing quality care.²⁹ Concepts of transition (i.e. the purposeful planning of moving from child to adult health

systems) have been around for many decades, yet many young people still face poor transitions.

There is good evidence that poorly planned transition may be linked with increased risk of non-adherence to treatment and loss to follow-up for young people.³⁰ Outcomes can be disastrous, for example in solid organ transplants, and problems with transition have been identified as among the major causes of graft loss.³¹ However, there is also good evidence that well-planned transition can improve outcomes, for example dramatically reducing graft loss after renal transplantation and improving disease control in diabetes.³²

Effective and timely transition planning should be a routine part of all long-term condition management for children and young people. It may also be useful to provide young adult services together with adolescent services, as AYA (adolescent and young adult) services, such as are now commissioned in all cancer services in England. This appears to be improving patient-related outcomes for young people, although it is too early to examine the effects on disease outcomes.

Conclusion

Young people must no longer be the 'forgotten tribe' of the health service. In the modern world, adolescence is a time of increasing health burden and a time of great potential for preventing the accelerating burden of non-communicable diseases in later life. The provision of age-appropriate care and effective transition from child health to adult health systems improve outcomes for young people, but caring for young people is everyone's business.

What we still need to find out

There is still a great deal we need to find out about the best way to help young people live healthy and satisfying lives. This includes:

- **The relative impacts and benefits of intervening in adolescence compared with in early life.** There has been considerable work done on the economic case for intervention in early life, yet very little is known about the benefits of intervening in adolescence.
- **How puberty, nutrition, deprivation and stress during adolescence affect brain development, and how these affect health throughout life.** There is promising research on such questions in early childhood, examining how poverty 'gets under the skin', but the same questions need to be examined in adolescence.
- **How health services are best provided for young people, and how this might be done without further fragmenting healthcare.** Current health services have poor aim and reach for young people, yet there is a risk that developing specific age-appropriate services may further fragment healthcare.
- **How to increase the participation of young people in research.** While there has been a marked increase in the participation of children and young people in research in the last 10 years, particularly relating to medicines, it is

believed that poor progress on some adolescent outcomes (e.g. cancer) relates directly to low levels of participation in clinical trials.

- **How to best preserve young people's wellbeing and emotional health given rapid social change.**
- **How to best engage schools in the business of preserving and promoting young people's health.** There is clear evidence that health and educational attainments affect each other, yet the evidence base for improving health through schools is poor.

Key messages for policy

- Caring for young people is everyone's business.
- A rational early intervention approach targets critical periods of rapid development; therefore it should target adolescence as well as very early childhood. Public health and intervention strategies must have twin foci on early childhood and on adolescence.
- A discrete adolescent public health strategy is needed. This must be horizontal across substance use, sexual health, mental health and long-term conditions rather than young people being the neglected minority within each adult public health silo.
- Common intervention strategies should be used to prevent or reduce substance use, improve sexual health, reduce injuries and improve mental health, focusing on common risk factors across behaviours/problems.
- Schools are a central factor for young people's health during adolescence. Promotion of health by schools helps schools achieve their 'core business' of increasing educational attainment and enhancing later life chances. A refocusing of school health services is needed.
- Outcomes for almost all long-term conditions are poorer among adolescents than children. Given poorer outcomes in Britain than in other European countries, this places British adolescents at the bottom of the outcome leagues. Successful strands from the adult long-term conditions strategy should be deployed specifically for adolescents.
- Age-appropriate facilities for adolescents should be provided across a range of outpatient and inpatient physical and mental health services, as there is evidence that they improve outcomes.
- High-quality transition from child-centred to adult-centred care should be a standard part of any long-term condition pathway.
- Improved participation of young people in clinical trials may help to improve survival from cancer and other long-term conditions in adolescence.

References

- Hagell A, Coleman J, Brooks F (2013) Key data on adolescence 2013. London: Association for Young People's Health.
- Patton GC, Viner R. Pubertal transitions in health. *Lancet* 2007; 369(9567): 1130–9.
- Viner RM, Coffey C, Mathers C, et al. 50-year mortality trends in children and young people: a study of 50 low-income, middle-income, and high-income countries. *Lancet* 2011; 377(9772): 1162–74.
- World Health Organization (2008) The global burden of disease: 2004 update. Geneva: WHO.
- Kessler RC, Berglund P, Demler O, Jin R, Merikangas, KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry* 2005; 62: 593–602.
- Meltzer H, Gatward R, Goodman R, Ford T (2000) Mental health of children and adolescents in Great Britain. London: HMSO.
- Public Health England, Child and Maternal Health Intelligence Network, HES Data.
- National Paediatric Diabetes Audit Report 2010-11. London: Royal College of Paediatrics and Child Health & HQIP (Healthcare Quality Improvement Partnership) UK, 2012.
- Bleyer A, Viny A, Barr R. Cancer in 15- to 29-year-olds by primary site. *The oncologist* 2006; 11(6): 590–601.
- Viner RM. Do adolescent inpatient wards make a difference? Findings from a national young patient survey. *Pediatrics* 2007; 120(4): 749–55.
- Patton GC, Coffey C, Cappa C, et al. Health of the world's adolescents: a synthesis of internationally comparable data. *Lancet* 2012; 379(9826): 1665–75.
- World Bank (2007) World development report: Development and the next generation. Washington DC: World Bank.
- UNICEF (2007) State of the World's Children 2011: Adolescence, An Age of Opportunity. New York: UNICEF.
- Steinberg L. A behavioral scientist looks at the science of adolescent brain development. *Brain Cogn* 2010; 72(1): 160–4.
- Resnick MD, Catalano RF, Sawyer SM, Viner R, Patton GC. Seizing the opportunities of adolescent health. *Lancet* 2012; 379(9826): 1564–7.
- Degenhardt L, Chiu WT, Sampson N, et al. Toward a global view of alcohol, tobacco, cannabis, and cocaine use: findings from the WHO World Mental Health Surveys. *PLoS Med* 2008; 5(7): e141.
- World Health Organization (2009) Global health risks: Mortality and burden of disease attributable to selected major risks. Geneva: WHO.
- Gore FM, Bloem PJ, Patton GC, et al. Global burden of disease in young people aged 10-24 years: a systematic analysis. *Lancet* 2011; 377(9783): 2093–102.
- (2011) The science of adolescent risk-taking. Washington DC: Institute of Medicine and National Research Council.
- Sawyer SM, Drew S, Yeo MS, Britto MT. Adolescents with a chronic condition: challenges living, challenges treating. *Lancet* 2007; 369(9571): 1481–9.
- Williams R, Gillies P. Do we need objective measures to validate self-reported smoking? *Public Health* 1984; 98(114): 294–8.
- Bleyer WA, Tejada H, Murphy SB, et al. National cancer clinical trials: children have equal access; adolescents do not. *J Adolesc Health* 1997; 21(6): 366–73.
- Fern LA, Whelan JS. Recruitment of adolescents and young adults to cancer clinical trials – international comparisons, barriers, and implications. *Seminars in oncology* 2010; 37(2): e1-8.
- England PH. Sexually transmitted infections and chlamydia screening in England, 2012. *Health Protection Report* 2013; 7(23).
- World Health Organization (2011) Global HIV/AIDS Response: Epidemic update and health sector progress towards Universal Access. Geneva: WHO.
- Hippisley-Cox J, Vinogradova Y. Trends in consultation rates in General Practice 1995/1996 to 2008/2009: Analysis of the QResearch® database: NHS Information Centre for Health and Social Care, 2009.
- Viner RM, Ozer EM, Denny S, et al. Adolescent Health 2 Adolescence and the social determinants of health. *Lancet* 2012; 379(9826): 1641–52.
- Viner RM. National survey of use of hospital beds by adolescents aged 12 to 19 in the United Kingdom. *BMJ* 2001; 322(7292): 957–8.
- McDonagh JE, Viner RM. Lost in transition? Between paediatric and adult services. *BMJ* 2006; 332(7539): 435–6.
- Crowley R, Wolfe I, Lock K, McKee M. Improving the transition between paediatric and adult healthcare: a systematic review. *Arch Dis Child* 2011; 96(6): 548–53.
- Rianthavorn P, Ettenger RB, Malekzadeh M, Marik JL, Struber M. Noncompliance with immunosuppressive medications in pediatric and adolescent patients receiving solid-organ transplants. *Transplantation* 2004; 77(5): 778–82.
- Harden PN, Walsh G, Bandler N, et al. Bridging the gap: an integrated paediatric to adult clinical service for young adults with kidney failure. *BMJ* 2012; 344: e3718.