

THE BOY-PROBLEM IN EDUCATION AND A 10-POINT PROPOSAL TO DO SOMETHING ABOUT IT

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This article starts with an overview of how boys and young adult men fall behind in education in many countries (i.e., the “boy-problem” or “boy-crisis”), with a focus on British education. Following the overview, we review a selection of possible causes and some documented academic opposition against approaches dealing with the boy-problem. We end with a proposal for a problem-focused 10-point plan to reduce the boy-problem. Our plan is “problem-focused” instead of “gender-focused”; that is, we focus on a set of problems from which boys suffer more than girls, but there is no reason why girls suffering from the same problems (e.g. excessive gaming) would not also benefit from the plan’s implementation. We are optimistic that a solution of the boy-problem is possible, in particular because the proposed plan is affordable and straightforward, although it requires a major change in societal attitudes towards discipline and education.

INTRODUCTION

This article is about the educational gap between boys and girls and young male and female adults in education. Because formal education takes part mostly in childhood, ‘the gap’ refers primarily to the gap between boys and girls rather than a gap between men and women. The gap is therefore sometimes called the “boy-problem” (e.g. Hamilton & Jones, 2016) or the “boy crisis”. Nonetheless, the gap continues in adulthood, in particular in regard to achievement and participation in higher education.

The boy-problem goes back at least three decades. Since the 1990s there has been an increased interest in the specific problems of boys in education. This increased interest has become known as “the boy turn” (Weaver-Hightower, 2003). The interest has resulted in a range of books for the general public, such as “Raising Cain” (Thompson & Lindon, 1999), “The war against boys” (Hoff Sommers, 2000), and “21st century boys” (Palmer, 2009). Fascinatingly, the authors of these books come from very different disci-

plines. Michael Thompson is an American clinical psychologist, Christina Hoff Sommers an American philosopher and social commentator, and Sue Palmer is a former British Head Teacher who has carried out much work advising the government. The popularity of these books and the diversity of authors writing about the boy-problem suggests that there is today a good awareness of the boy-problem across society.

The interest in the gap has not only resulted in journal articles and books, but also in governmental reports and interventions. Even so, the increased interest and interventions have not led to a solution. In fact, the gap continues to grow (e.g. Stoet & Geary, 2013), as will be discussed below.

This paper is divided into three parts. In part 1, we will show that the educational underachievement of boys is profound and starts before boys go to school. In part 2, we will argue that differences in maturation and brain development play an important role, that boys have vulnerabilities in their attentional systems, and that overexposure to games and screens very likely plays a role. In part 3, we will argue that we all should care about the boy-problem, because it will affect everybody, not just boys. We will also discuss some alternative views on the boy-problem, which some argue is more a “hysteria” and not as problematic as sometimes described. Finally, in part 4, we will argue that the boy-problem can likely be dealt with by dealing with the variety of problems from which boys suffer more than girls .

PART 1: THE CURRENT SITUATION

The most obvious question that needs to be answered first is what the exact problems boys suffer from are, and at what age these problems occur. We will quickly run through examples of the types of problem we see at each stage of education (please note that we do not have space to comprehensively review all of the problems and issues).

Pre-primary

Pre-primary education has different names in different countries and is typically not compulsory. It is a great opportunity for small children to playfully develop or strengthen a variety of skills and to learn to socialise. In England, the government sets expectations of what children should learn under the age of 5, that is, before they enter

compulsory primary school (this is a comparatively early age compared to when other nations start formal education).

The requirements for this age group in England, referred to officially as the “Early Years Foundation Stage”, were introduced in 2008 and are controversial among child- and educational-practitioners (c.f., Richardson, 2013). The expectations include being able to write simple words and sentences, count to 20, do simple addition, etc. These are relatively high expectations compared to past expectations in England and compared to countries where reading and writing are formally introduced at age 6 (the majority of countries) or even age 7 (Finland and Estonia).

Many English children do not meet the expectations set out in the Early Years Foundation Stage, especially boys. For example, boys scored lower in 16 out of the 17 Early Learning Goal subject areas (technology was the only subject where they scored equally, Cotzias et al., 2013) than girls. Thus, at least in England which has a formal assessment procedure for pre-primary education, the boy-problem in education already starts before primary school when there are governmental expectations about reading, writing, and numeracy requirements.

Primary Education

Primary education is for children, roughly, for the ages from 5 (depending on country, see above) to 11 years old. Primary education is the same for all children – although there are separate schools for children with special needs. In England, boys have far more special educational needs than girls across all age groups (in 2016, 14.7% of boys compared to 8.2% of girls, Department for Education, 2016). In the USA, we see a similar gap (Oswald et al., 2003). We do not have data for all countries, and special education needs might be defined differently across cultures, but we suspect that this gender gap in the need for special education is an international phenomenon.

This larger number of boys in special need classes is not surprising if you know that at this age, boys are more likely than girls to suffer from attentional disorders, stuttering, and dyslexia (e.g. Halpern, 2012).

Secondary Education

In England, Wales, and Northern Ireland children will sit GCSE exams at age 16 and, optionally, A-level exams at age 17 or 18 (Stoet, 2015). These exam results for each school-subject are made publicly available for both genders.

In GCSE exams children should score between A* (highest) and C (lowest). For example, the 2015 dataset has 49 subject areas. Of these, only mathematics and English are compulsory subjects. In these data, we find that 8% of girls and 5.2% of boys get the highest grade, which is an A* grade, and 73% of girls get a score between A* and C compared to only 65% of boys. This is a considerable gap.

If we split the data up by subject, we find that in 46 out of 49 subject areas, more girls than boys get A* grades. There are only 3 subjects for which this is different in the UK: Mathematics and the categories “other sciences” and “other technology” (both have relatively small numbers of students).

If we look at the compulsory subject English, we see that 73% of girls get a grade between A* and C compared to only 58% of boys, again a big difference.

According to a recent research report by the Sutton Trust (2015), one of the concerning things with these exam data is that bright boys from poor backgrounds perform lower than expected based on their test-scores carried out at age 11. There is thus “something” that forms a barrier towards their success between the ages of 11 and 16.

Apart from exam data, we have many useful data from international educational surveys such as the Programme for International Student Assessment (PISA). PISA is a large and expensive international project in which around 70 countries participate and is one of the most influential educational surveys (OECD, 2003).

Every 3 years, thousands of children from each country sit a 2 hour test which measures their abilities in three domains: Text comprehension or Reading, Mathematics, and Science Literacy. The test is the same for all children, although translated into different languages to ensure it is culturally neutral.

In 70% of countries, girls outperform boys (Stoet & Geary, 2015). This lead of girls, however, was not found in the UK or the US. In both of these countries the relative advantages for girls in reading and boys in mathematics cancel each other out, while boys and girls score similarly in science literacy. The difference between UK exam data and PISA data can possibly be explained by the fact that GCSE exams cover more subjects than PISA tests, and because GCSEs are more sensitive to homework, which boys do less of.

Tertiary Education

Tertiary education follows secondary education (e.g. university education). It is well known that there is a growing gender gap in university enrolment; every year, more females than males go to university. In 2015, UK girls were 35% more likely to enter university. This gap was twice as large as the gap in 2007 according to a report by the Universities and Colleges Admissions Service (The Guardian, 2016) and the gender gap in admissions in 2015 was the highest on record (Hillman & Robinson, 2016). Women now make up more than half the students in 2/3 of university courses.

It is most likely that the large and growing participation gap in tertiary education is a cumulative effect of years of gender gaps across the educational track.

PART 2: POSSIBLE CAUSES

As is the case with most performance gaps, the ‘boy-problem’ is related to multiple factors, both biological and socio-cultural. Being able to identify and effectively counteract the most influential of these factors will increase the likelihood of managing the boy-problem more effectively.

One of the direct and indisputable causes of boy’s underperformance, in particular in secondary education, is that they do simply not spend as much time on their homework as girls (e.g. Hillman & Robinson, 2016). This raises the crucial questions of why boys are less inclined than girls to do their homework and why they are less motivated for learning and school in general.

One specific cause is video gaming. Of course, video gaming does not explain the early-stage differences which occur before the age that children play video games (e.g.

gaps in the Early Years Foundation Stage). Nevertheless, academic research shows that “pathological gaming” is almost entirely a male adolescent issue (e.g. Gentile, 2009; Gentile et al., 2011). For example, Lemmens et al. (2011) state that “In general, pathological involvement with video games seems mostly restricted to adolescent boys. In line with previous findings, the vast majority of adolescent girls showed neither signs of excessive nor pathological gaming” (p.45). Further, the authors state that these children’s lives are disrupted by the displacement of other important activities, including learning and social contacts.

Another problem is that the games encourage a sedentary lifestyle (Tremblay, 2011). We know that it is good for children to be physically active and run around between sessions of homework (Janssen & LeBlanc, 2010). Further, the games are so easily available, typically on the same computer where our children need to do their homework, that it is easy to understand why children cannot withstand the temptation.

In the time before computers, homework could be considered boring, although there were just not so many immediately available alternative tempting activities, so that even boys with weaker self-control would more likely stick to the homework.

A second factor in boys underachievement is related to their speed of cognitive and emotional development (Barbarin & Soler, 1993). This affects different stages in childhood, both early on and in adolescence.

It is well accepted that boys develop language skills more slowly than girls. For example, we know that at 1 year old, the vocabulary of girls is larger than that of boys (Bouchard, Trudeau, Sutton, Boudreault, & Deneault, 2009). Even one-year old girls raised by low-educated mothers have a larger vocabulary than boys of highly educated mothers (Zambrana et al., 2012). This is astonishing because we know that parental education is one of the best predictors of children’s success in school (Davis-Kean, 2005).

We also know that memory development of boys is different than that of girls. For example, it has been found that female adults can remember earlier childhood memories than men, and that they remember them in more details (Mullen, 1994). There are different explanations for this gender difference, but it is possible that early experiences are

processed and encoded differently by boys and girls. In this context, it is important to point out that teaching more cognitive skills than used to be case (e.g. see discussion above about Early Years Foundation Stage), such as reading and writing, in pre-primary education is controversial (Curtis, 2007). Encouragement of challenging children's abilities is not to say that children should be pushed beyond their age-matched ability level (Huitt & Hummel, 2013). Lilian Katz, an "early education" expert, said that teaching skills too early can be counterproductive: "It can be seriously damaging for children who see themselves as inept at reading too early" (Curtis, 2007).

This speed in maturation is not only an issue in early development. One important aspect of brain development is the "pruning" or removal of brain connections. This is part of normal development and leads to a more efficiently fine-tuned brain. It has now been shown that the pruning process starts earlier in girls (Lim et al., 2015), namely between the ages 10 to 12. In boys it starts between the ages 15 to 20 years old. That is a relatively big difference and can explain part of the growing gap between teenage boys and girls.

Finally, it should be mentioned that childrens' attention can be disrupted by lifestyle factors, such as lack of sleep. In this context, the high-caffeine drinks marketed at boys (Giese, 2015), and consumed more by boys (Lee, Mcenany & Weekes, 1999), may well play a role in concentration problems and sleep patterns (Calamaro, Yang, Ratcliffe, & Chasens, 2012).

OTHER CAUSES OFTEN MENTIONED

There are some other factors that are regularly mentioned, in particular the lack of male teachers and the lack of fathers. In essence, the idea is that boys need positive male role models in order to thrive (in fact, the same is often said about girls and female role models).

The challenge, though, is that the positive effect of men on boys, and in general the positive effect of same-sex role models is hard to prove (Carrington et al., 2008). Further, a study of 21 European countries found that boys do not benefit from male teachers in their reading and maths skills (Neugebauer et al., 2011). Last but not least, boys in Islamic

countries often fall behind girls (Stoet & Geary, 2013, 2015), despite often taught by male teachers.

We are not arguing that there are no positive effects of male teachers on boys. After all, if researchers do not find an effect, that does not mean it does not exist. It might just be hard to measure or the researchers have been focusing on the wrong aspects of education. It might be that a positive effect of male teachers is not simply through being a role model but by being a different kind of teacher. For example, hypothetically it might be the case that boys are more willing to accept the authority of a male than a female teacher. Further, it might be that male teachers have better ways of dealing with boys because they have been boys themselves. One example where we know that this male expertise can be helpful is by recognizing “rough and tumble play” or “rough-housing”. This is a pretend-fighting more common among young boys than girls (Dipietro, 1981).

Given the sparse evidence, at least what we are aware of, we are not sure how policies aimed at getting more male teachers into schools can be justified. We really need more research on this topic.

Some researchers have argued that the absence of fathers is also a major issue (e.g. Flouri & Buchanan, 2002; Santrock, 1975), but as argued above, there is still little evidence that this affects boys more so than girls. While the absence of fathers is a real problem for boys, it is also a real problem for girls. Although this is a societal issue that needs to be addressed to improve children’s welfare, it is probably not a major contributor to the gap between boys and girls, and hence does not fit in the list of issues that need to be addressed to reduce the educational gender gap.

PART 3: WHY WE SHOULD CARE AND WHY SOME DON’T CARE

The boy-problem or boy crisis has been in the news for quite some time. In this section, we would like to justify why society should tackle the problem. Further, we will also address alternative views on the importance of tackling the problem

We distinguish between two classes of reasons why people or institutions may care about the boy-problem, namely “idealistic-humanistic” reasons and “utilitarian” reasons.

Idealistic-humanistic reasons are based on the idea that it is simply unfair that one specific group underperforms. On the other hand, utilitarian reasons to tackle the boy-problem are partially based on the idea that education is good for the economy (e.g. OECD, 2013). Thus better educated boys will be in the interest of the common good. Furthermore, larger numbers of boys failing in school increases the likelihood of them becoming involved in delinquency (Shader, 2004). Finally, the lack of highly educated men causes a difficulty for women to find a partner with similar levels of education (Birger, 2015).

Altogether there are many reasons to care about underachieving boys. There are, however, alternative views. There are those who argue that there is not really a boy crisis and who call the concern for boys falling behind "hysteria about boys" (Mead, 2006). The argument is that both boys and girls have gained in terms of educational performance over time, but girls just more so than boys (Mead, 2006). Therefore, it is argued that boys do not really have a problem.

Another position is the one that views programmes to help boys as based on "anti-feminist", "homophobic", and "right wing" sentiments (Jóhannesson et al., 2009). For example Jóhannesson et al., 2009, write: "*The production of such global citizens is unlikely to occur when those who are the most privileged in a society are deemed to be victims, as with the way in which the boys' debate has developed and is developing in the countries considered in this article*" (p. 322). The fundamental idea behind this statement appears that because there are still more men than women in high-power positions, boys need not be helped or considered as victims.

Similarly, the National Union of Students in the UK criticized the Higher Education Policy Institute's report (Hillman & Robinson, 2016) which called the gender imbalance in university enrolment a national scandal. In response to this report, the NUS stated that the Higher Education Policy Institute had taken a complex issue and turned it into "a battle of the sexes". The underlying sentiment seems to be that as long as there are more males than females in top positions, there should be no institutional help for underachieving and underrepresented boys. We believe, however, that this view ignores the

problems of many boys. Further, this view ignores the fact that dealing with the boy-problem not only benefits boys, but is also beneficial to women and the common good.

Altogether, there is still a debate going on in society about the need to deal with the boy-problem. Arguments against dealing with the boy-problem range from a denial of the seriousness of the situation (e.g. Mead, 2006) to the idea that helping boys clashes with programmes to deal with women's issues (such as their underrepresentation at certain senior positions). We do not know how big the influence of the arguments against dealing with the boy-problem is, but given that there are so few initiatives dealing with the problem, we are concerned that these arguments are taken seriously. We believe, however, that the seriousness of the boy-problem will continue to grow so much that the large majority of stakeholders will see the need for concrete actions. We expect this to happen within the next 10 years. Part 4: A 10-point plan to stop the growing gap

In Part 2 of this paper, we have highlighted three specific classes of problems: 1) boys mature at a different rate than girls; 2) boys are more vulnerable to attention disorders than girls; 3) boys spend more time playing video games.

Even though dealing with these issues will be particularly beneficial to boys, there are certainly also girls that suffer from these problems. For example, even though fewer girls than boys have attentional problems (Sobeh & Spijkers, 2013) or a gaming addiction (Gentile, 2009; Gentile et al., 2011), there is no reason why the girls that do have problems should not also benefit from the same programmes to help boys with these issues. None of our proposed interventions target only boys; instead, it is the case that if we deal with these problems, more boys than girls will benefit, which will so reduce the gender achievement gap in education. In that sense, our proposed plan is a problem-focused and not a gender-focused approach.

Based on the three classes of identified problems, we would like to propose a 10-point plan to resolve the boy-problem. Arguably, this plan contains points that might not be politically possible to achieve. However, that is a separate problem, which we will discuss later.

1. Start primary school not before age 6
2. Start reading and writing not before the age of 6 (i.e. do not introduce it in pre-primary education)
3. A fixed school curriculum until age 16
4. More "direction" for school children in secondary education
5. Reduce caffeine intake
6. Ensure teenagers sleep sufficiently
7. Reduce video game playing
8. Reduce smart phone use
9. Reduce tablet computer use
10. No TV until age 2 and limited TV time for children over 2

Points 1-4 are about the way schooling is organized. Points 5 and 6 are about a healthy lifestyle, and points 7-10 are about 'screen time', referring to time spent with visual media. Next, we will discuss each of these three groups.

We need to change the way schooling is organized (points 1 to 4)

There is good evidence that boys develop more slowly than girls at various stages of childhood . Not only do boys develop language skills more slowly (Bornstein, et al., 2004; Eriksson, et al., 2012), they also clearly mature more slowly in the first half of their teenage years (Halpern, 2012). Both of these periods play an important role in modern education. The pre-primary period is important, especially with a tendency to start children earlier with hard cognitive tasks such as reading, writing, and numeracy problems. Before sending our children to pre-primary classes, we should at least ensure it is suitable for their ability level. Otherwise the danger of this is that when children encounter material when they are not ready for it, they suffer in different ways. It not only demotivates them, it also replaces other activities that are potentially more useful at that age (Elkind, 2001). For example, before the age of 6, children need to have sufficient opportunities to develop general executive (e.g. impulse control) and social skills (Diamond, Barnett, Thomas, & Munro, 2007; Elkind, 2001).

It should be noted that just starting later will not completely solve the boy-problem and boy's falling behind in language skills. For example, the gender gap in reading comprehension is relatively large in Finland where children start primary school at age 7

(Stoet & Geary, 2013). Further, we do not know exactly what the longer term effects of the English Early Years Foundation Stage programme are. Nevertheless, the criticism by experts of an early start with formal schooling, the demotivating factor of early failure and the lack of sufficient data on the longer-term effects of the Early Years Foundation Stages, suggests that the early start of formal education is problematic, in particular for boys.

A major problem of modern approaches to schooling in the early teenage years is related to giving children choices in selecting school subjects and more responsibility. Given that boys develop differently at this age, and are possibly more playful for a longer period, they are unable to handle the responsibility given (Halpern, 2012; Paton, 2014).

That said, not only boys may be disadvantaged by early choices and more responsibility for their own educational track record. Girls are likely to drop non-organic STEM (science, technology, engineering, mathematics) subjects based on stereotypical ideas around these subjects without any real experience of them (Blakemore & Robbins, 2012; Paton, 2014). A way to deal with this is to reduce or eliminate choices until a later age, for example age 16. Further, boys are more likely to benefit from more school discipline and external motivation (e.g. strict parenting) than girls, because boys are known to be less compliant and are more playful (Beaman, Wheldall, & Kemp, 2006).

Healthy life style: We need to focus on good sleep and control caffeine intake (points 5 and 6)

There is no doubt that a healthy life style benefits learning, and there are numerous examples of positive policies aimed at reducing alcohol (e.g. World Health Organization, 2005) and tobacco in teenagers (e.g. Montana Office of Public Instruction, 2012), as well as campaigns to encourage sports and fruit intake (Sarafino, & Smith, 2014). For example, there have been many campaigns against drug use in adolescents, and various types of substance use has declined over the past decades due to campaigns (e.g. cigarettes, Chen et al, 2012; alcohol and drugs, Tobler, et al, 2000). We will not further address these issues, because they are already addressed elsewhere. There are, however, other unhealthy behaviours that do not get much attention.

Caffeine is the one psychoactive substance which has evaded people's attention (Calamaro, Mason & Ratcliffe, 2009). Caffeine is an addictive stimulant that affects cognitive functioning and attention, and which is associated with unpleasant withdrawal symptoms (Nehlig & Boyett, 2000). Caffeine, and caffeine withdrawal symptoms, directly interfere with concentration and sleep patterns (Calamaro, Yang, Ratcliffe, & Chasens, 2012).

Studies consistently find that caffeine consumption is greater among boys than girls (Lee, Mcenany & Weekes, 1999). It is mostly consumed through soft drinks, and boys consume these more than girls (Harnack, Stang, & Story, 1999). One type of the particularly popular and high-caffeine drinks are the so-called, energy drinks, which appear to be specifically marketed to boys (Giese, 2015). There is a huge variation in caffeine content, with cans of energy drink having around three times as much caffeine as a cup of black tea.

Although for children small amounts of caffeine is generally considered innocuous (Castellanos & Rapoport, 2002), high-caffeine energy drinks are considered problematic. Caffeine has been associated with depressive symptoms in children (Benko et al., 2011) as well as with aggression and conduct disorders (Kristjansson et al., 2013), and a range of physical problems (Nowak & Jasionowski, 2015). The main risks of caffeine in relation to the boy-problem, though, are related to sleep patterns and hyperactivity. Schwartz and colleagues (2015) not only confirmed that boys consume more caffeine than girls, but also found that caffeine increases the risk of hyperactivity and inattention by 14% for each additional caffeinated drink (for all children, but hyperactivity and inattention is generally a bigger problem for boys).

A solution to this problem might be to regulate the sale of high-caffeine drinks such that these are not available to those under the age of 18. Additionally an information campaign is necessary to inform parents and teachers about the risks of caffeine on sleep and hyperactivity.

We need to reduce screen time (points 7 to 10)

Another issue with attention is that today's children are 'glued to their screens' (Anderson, Gentile, & Buckley, 2007; Rideout, Foehr & Roberts, 2010). We live in a socie-

ty where children are put in front of a screen because it keeps them nice and quiet (Bentley, Turner, & Jago, 2016). It is understandable that parents do this, because they might think that it is harmless or possibly even educational (Bentley, Turner, & Jago, 2016). This is not the case for children under two years old, though; these children do not understand what is going on the screen (Anderson & Pempek, 2005). The UK currently has no recommendations for screen time limits, and the British Broadcasting Corporation (BBC) targets children under 2 years old with the CBeebies channel.

This stands in contrast to the recommendations of the American Pediatric Association which recommends children under 2 should not watch any TV (American Academy of Pediatrics, 1999). The problem for the American Pediatric Association is that almost nobody follows the advice – American children today spend around 7 hours in front of screens (Rideout, Foehr & Roberts, 2010).

We need parents, schools, and the government to work together on these issues. There needs to be a governmentally set “safe” limit on the maximum time a week a child can watch TV and play video games. Parents will feel supported, and schools have a national guideline to work with.

CAN THIS PLAN BE IMPLEMENTED?

None of our proposed interventions are particularly expensive. Our plan focuses on starting formal education a bit later than currently is the case, focuses on delaying subject choices until children are sufficiently mature to make them, and reducing access to activities that lead to disturbed attention and distraction. We believe that these interventions will benefit boys more so than girls, because boys suffer more from these problems.

The challenge for the implementation of this plan is that it requires more effective discipline over school children. For example, most parents know how hard it will be to take away or control a teenager’s smart phone or video game (e.g. Sellgren, 2016). Therefore, we believe that there should be national guidelines on what children can do and what they cannot do. Such guidelines will enable parents and teachers to implement a more recognisable and enforceable set of rules.

We would like to point out that it is not simply "going back to the good old days in which there was more discipline". We are today faced with a unique set of temptations for children which were not available 30 years ago. In those times, parents did not need to discipline their children the way we propose, because there were no video consoles or social media to distract them (Anderson, Gentile, & Buckley, 2007, Van Dijck, 2013). The problem is that parenting and teaching has not caught up with the negative side of modern technology. In this context, it should be pointed out that it is not even clear whether the massive introduction of information technology in schools has improved children's achievement (OECD, 2015).

LIMITATIONS AND OUTLOOK

We like to conclude by pointing out that we have focused very much on the most obvious factors that distract or limit children's - in particularly boy's - ability to concentrate on their homework. Arguably, our proposal is limited in that it does not address all possible factors. It is likely that other more hidden factors play a role as well, such as gender differences in motivational factors (e.g. Dekkers et al, 2013). Further, some factors are possibly not well enough understood, such as the exact role of the father, or male teachers, on a boy's education. Given the size of the boy-problem, we recommend that policy makers take action immediately, such as the ones we recommend, that are likely to have a positive effect, but also continue to invest in further research on other factors which are currently not well enough understood to base policies on.

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