Economic Evaluation of Mental Health Interventions for Children and Adolescents
To my sons:
Henry and Edvard
Economic Evaluation of Mental Health Interventions for Children and Adolescents: the Case of Sweden
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Abstract


The focus of this thesis is economic evaluations of programs and interventions regarding children and adolescents with mental health issues, victimization, and intellectual disabilities (ID). The first paper examines a potential link between mental health issues among adolescent and the class-size of the school class they are enrolled in. The class-size and schools’ financial resources is often at the center of policy debates. Our results suggest that there is no evidence that larger classes have negative impact on the mental health for adolescents in a Swedish context. The second paper investigate the societal willingness to pay (WTP) to reduce bullying in Swedish schools. The results suggest that the tax payers WTP is about 5 SEK and the societal is about 600 000 SEK per reduced bullying victim. This value of WTP could be used as a measure to evaluate different investments in anti-bullying programs and efforts to reduce the bullying in schools. The third paper estimates the cost-effectiveness of one recently introduced anti-bullying program, the Finnish KiVa program, one of the few evidence based programs in the world. Based on a decision-analytic model, the results indicate that the KiVa program is a cost-effective program that has a cost per reduced victim well below the WTP as estimated in the second paper as documented above. The fourth paper evaluates, from the municipality perspective, the effects of investing in a SE program compared to “business as usual” in order to increase the likelihood for gaining regular employment for the pupils with ID. The results indicate that it takes 9 years before breakeven is reached if investing in the SE program. The fifth paper conducts a decision-analytic economic evaluation of the SE program using simulations to assess the effects over the full life-course. The results suggest that from a societal perspective the program is cost-effective ten years after the investment and by then has generated a benefit of 17 000 SEK per individual.

Keywords: Children, adolescents, mental health, bullying, economic evaluation, intellectual disability, transition

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When I began this journey in 2008 as a PhD student in economics at Örebro University, I had another view of how this journey would be. But, then something called life came in between and changed the pathway of this journey. After I received my PhLic in 2010, I worked for four years before returning to Örebro University in 2015 to finalize a PhD in economics. As this journey comes to an end, some will continue and others start soon.

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Mattias Persson
# Table of Contents

1 INTRODUCTION............................................................................................................. 9  
1.1 Economic Evaluation ................................................................................................. 9  
1.2 Mental Health, Intellectual Disability and Bullying Victimization............. 11  
1.3 Purpose of the Thesis ................................................................................................. 13  

2 ECONOMIC EVALUATION METHODS.............................................................................. 15  
2.1 Estimating Effects of Interventions .............................................................................. 15  
2.2 What is needed for an Economic Evaluation............................................................... 15  
2.3 Cost-Effectiveness Analysis, Cost-Benefit Analysis and Decision Analytical Modelling.................................................................................................................. 16  
   2.3.1 Cost-Effectiveness Analysis .................................................................................... 16  
   2.3.2 Cost-Benefit Analysis ............................................................................................. 17  
   2.3.3 Decision Analytical Modelling .............................................................................. 17  

3 SUMMARY OF THESIS.................................................................................................... 19  
3.1 Paper I: Class-Size Effects on Adolescents’ Mental Health and Well-Being in Swedish schools........................................................................................................ 19  
3.2 Paper II: The Willingness to Pay to Reduce School Bullying......................... 19  
3.3 Paper III: The Cost-Effectiveness of the KiVa Antibullying Program: Results from a Decision-Analytic Model ................................................................. 20  
3.5 Paper V: A Benefit-Cost Analysis of an Individual Placement and Support program for Adolescents with Intellectual Disabilities............................. 21  

4 COMMENTS ON POLICY AND FURTHER RESEARCH.................................................. 23  
REFERENCES ...................................................................................................................... 24
List of Papers

Paper I  Class-Size Effects on Adolescents’ Mental Health and Well-Being in Swedish schools. Published

Paper II The Willingness to Pay to Reduce School Bullying. Published

Paper III The Cost-Effectiveness of the KiVa Antibullying Program: Results from a Decision-Analytic Model.


1 Introduction

1.1 Economic Evaluation

Economics is the science of how individuals, firms and the society allocate their scarce resources. Choices that lead to changes that increase welfare have typically been defined as Pareto improvements, which is defined as changes that at least makes one individual better off and no one worse off. However, in the current world there are very few examples of choices that lead to Pareto improvements, and as noted already by Nicholas Kaldor and John Hicks a more liberal definition is the potential Pareto improvement, or the Kaldor-Hicks criterion (Kaldor 1939; Hicks 1940). The Kaldor-Hicks criterion states that a change in the allocation is welfare improving if those individuals that are made better off from the change can (“hypothetically”) compensate those which are worse off. The Kaldor-Hicks criterion is still today the normative foundation for evaluation of the welfare effects of public policies, in general using the tools of applied economic evaluation methods.

Drummond et al. (2005) defines an economic evaluation as:

The comparative analysis of alternative courses of actions in terms of both their costs and consequences. (Drummond et al. 2005 p.9)

As of today, the common tools of economic evaluation methods consist of Cost Minimization (CMA), Cost Effectiveness (CEA), Cost Utility (CUA), and Cost Benefit Analysis (CBA). CMA implies comparing costs of two or more alternative actions and may be motivated if benefits are equal. CEA and CUA are methodologically identical, with the only exception that the former compares costs to some physical/natural outcome measure (e.g. prevented fatalities, reduced prevalence of disorder etc.) while the latter compares the costs to some “utility-based” outcome measure (e.g. health-related quality of life). Often the broader term of CEA is used for CUA as well. CBA is the classical tool of economic evaluations with a foundation in welfare economics, where costs of different alternative actions are compared to benefits in monetary terms (Drummond et al. 2005).

Applied economic evaluations became increasingly common for analysis of development aid projects and national infrastructure planning in the 1960-70s, mostly in the form of cost-benefit analyses. These methods have then gradually spread to other policy sectors such as environmental policy and labor market policy programs. In the field of health and social care,
especially pharmaceuticals, economic evaluation methods have a more recent history. One growing subarea within this field contains studies of prevention and interventions for children and youth related to developmental issues, where a forerunner is the Washington State Institute of Public Policy (wsipp.wa.gov) that has developed cost-benefit models that have been adapted by several states in the US and the UK (investinginchildren.eu). However, several issues within this subarea such as economic evaluation of programs for children and youth with intellectual disability, prevention of bullying in or abatement and mitigation of mental health problems have been scarcely evaluated (Romeo et al. 2005; Zechmeister et al. 2008; Romeo & Molosankwe 2010; Kilian et al. 2012; Beecham 2014).

Knapp (1997) and McDaid et al. (2010), focusing on mental health problems for children and adolescents, emphasize the complexity of conducting proper evaluations of these types of interventions as they have life-course consequences. They conclude that e.g. economic components needs to be added to existing efficacy and effectiveness studies because decision makers need to know whether spending on costly programs in early years should be given priority due to the life-course consequences.

During the 2000’s, James J. Heckman conducted a series of studies (e.g. Heckman 2000; 2008; Heckman & Masterov 2007) with findings that the return on early childhood investments are in many cases high. It is often concluded that the return decreases during the life-course of a young individual (heckmanequation.org) (Figure 1 shows an illustration) (Heckman & Masterov 2007; Heckman 2008).
1.2 Mental Health, Intellectual Disability and Bullying Victimization

In 2010, mental, neurological and substance (MNS) disorders accounted for 28.8 percent of the total global disease burden measured by years lived with disability (YLD) and with 10 percent measured as the total disability-adjusted years lost (DALY) (Whiteford et al. 2015). Since the 1990s there has been a rapid increase in the burden associated with MNS and there is an increasing policy awareness regarding larger needs to address this issue (Patel et al. 2016). The economic burden for the society of mental illness and disorder within the OECD may account for as much as 4 percent of the GDP (OECD 2014). In 2010 the World Economic Forum estimated that the cost was about $2.5 trillion and may increase to about $6.0 trillion in 2030 (Bloom et al. 2011).

The development of a mental disorder often arises during the adolescent years, but the detection and “outbreak” of the disorder may occur later in life (Patel et al. 2007; Patton et al. 2014). Mental disorders among children
and adolescents are often manifested in disorders with internalizing symptoms such as depression and anxiety, or disorders with externalizing symptoms such as behavioral problems (ADHD, conduct disorder, etc.).

Mental disorders often have a profound impact not only on the individual, but also the individual’s family and peers as well as the society in terms of direct and indirect costs (Patel et al. 2016).

The prevalence of mental disorders within the group of children and adolescents is estimated to be between 10 to 20 percent worldwide (WHO 2016a; Kieling et al. 2011). Unipolar depressive disorders together with anxiety are two of the major causes of YLD for children and adolescents (WHO 2016b). In Europe, the prevalence of e.g. general anxiety (age 14 and above) are 2 percent from reviews, and experts suggest 1.7 percent for those between 14 and 65. For major depression, the prevalence is about 7 percent in Europe 2011. And, unipolar depression disorder contributes with the highest number of DALYs for those aged 15 and above when it comes to mental disorder (Wittchen et al. 2011). The cost per individual with anxiety was €1,077 and for mood disorder, both uni- and bipolar depression, it was €3,406 in 2011 (Gustavsson et al. 2011).

It is somewhat debated whether or not there is an increasing prevalence of mental disorders over time among children and adolescents. For example, a systematic review of longitudinal studies covering children and adolescents mental health status conducted by Bor et al. (2014), suggests that there may be a rapid increase in all problems and for both genders. The burden of externalizing symptoms has been stable over time for adolescent boys, but an increasing trend for girls may be noticed. There is an increasing trend of internalizing symptoms, especially for girls over time (Bor et al. 2014). However, it is difficult to assess if this is due to a “true” increase in symptoms or if it is due to an increasing acceptance of admitting symptoms and problems considering that results typically are based on self-reported data.

Perhaps, the most vulnerable group of children and adolescents with mental disorders is the group with intellectual disability (ID). Approximately 1 percent of a population is reported to have ID (Maulik et al. 2011). Apart from the substantial problems and consequences associated with ID per se, individuals with ID typically have a high share of co-morbidity with other mental disorders. Emerson (2003), Emerson and Hatton (2007) reported that the prevalence of other (non-ID) mental disorders are between 36 and 39 percent for children and adolescents with ID, aged 5 to 15, compared to 8 percent for those without ID in Great Britain. Individuals with ID are also reported to have higher unemployment rates, worse general
As the first study, estimate individual and societal willingness to pay to reduce school bullying victimization.

Another greatly debated health and social concern among children and adolescents regard the exposure to bullying victimization, which is also substantially more common among individuals with mental disorders and intellectual disability. The number of children and adolescents reporting being victims of bullying varies a lot between countries, from e.g. Sweden with 4 percent for boys and 3.9 percent for girls to Lithuania with 28.5 percent for boys and 23.4 percent for girls (Chester et al. 2015). Mental problems may be accelerated by bullying victimization. Children and adolescents who have been victims of bullying report higher levels of depression, anxiety, suicidal intentions, loneliness and self-harm behaviors (Due et al. 2005; Wolke & Lereya 2015), compared with their peers. Recent research (Arseneault et al. 2010; Takizawa et al. 2014; Wolke et al. 2013; Wolke & Lereya 2015) indicates that bullying victimization is related to not only negative health consequences, both mental and physical, but as well social and financial outcomes. A study in the UK (Hummel et al. 2009), suggests that a victim of bullying have £50,000 less in lifetime earnings than their non-victim peers.

1.3 Purpose of the Thesis

The main purpose of this thesis is to shed light, from an economic perspective, on interventions targeting children and adolescents with mental disorders, mental health and bullying victimization. There are four sub-aims in this thesis:

1. To examine if there is a potential relationship between variation in class-size and the mental health and well-being of students. Most previous research on class-size effect has focused on educational achievements, so this adds an extra dimension to the literature on class-size and its consequences.

2. As the first study, estimate individual and societal willingness to pay to reduce school bullying victimization
3. And, to evaluate the cost-effectiveness of the KiVA antibullying program using a Markov Cohort Model over the full compulsory education (Grade 1 to 9). KiVA is a recently introduced program to prevent and reduce bullying victimization that has shown positive results in large experimental studies.

4. To evaluate a program inspired by the Supported Employment method to assist adolescents with intellectual disability to make a smoother transition from education to employment. The economic evaluation is made both with respect to the consequences for the budget of the (paying) local government as well as the societal perspective. There is some research on economic evaluations of similar programs for adolescents but none in a Swedish context, and none using a more complex model like the one used here.
2 Economic Evaluation Methods

To conduct an economic evaluation of intervention targeted at children and/or adolescents, it is necessary to estimate both the program effects as well as the monetary value of program effects and consequences.

Economic evaluations can be one of several inputs to decision making. The decision needs to assess political goals, ethical principles and legislative issues. Such considerations determine the frame within an economic analysis can be made.

2.1 Estimating Effects of Interventions

In the evaluation of interventions within e.g. economics, in the first step the researcher asks a casual question regarding the “treatment” effect of the intervention. This is viewed through the counterfactual model, where the causal effect refers to the difference in outcome between the world with and without the intervention.

The “gold standard” of such studies is the randomized controlled trial (RCT), where assignment to treatment is randomized. In many contexts it is not feasible to use such an experimental approach, and different types of observational study approaches must be used. However, given the nature of interventions and the observable data that is available, it is not possible to observe the counterfactual outcome (Maldonado & Greenland 2002; Glennerster & Takavarasha 2013). The causal effect is thus inferred from some form of quasi-experimental approach where (more or less) a number of important assumptions must be made in order to say something credible about the causal effect of mental health interventions (Glennerster & Takavarasha 2013). The most commonly applied quasi-experimental methods applied by economist are before- and after comparison, cross-section comparison, regression, matching (exact or propensity score), difference-in-difference (DiD), regression discontinuity (RD) or instrumental variable (IV) (Glennerster & Takavarasha 2013).

2.2 What is needed for an Economic Evaluation

To conduct an economic evaluation of an intervention, the analyst has to identify the consequences of the intervention and what type of outcome measurements, both outcome and cost, are needed for the specific analytical method.

A first step is to decide in which perspective the economic evaluation is to be conducted; societal, “payers” or regional etc. Related to this, the time
frame of measurement must also be decided, and e.g. a shorter time horizon versus a lifetime perspective, and what extra information this implies in the evaluation of the outcome and cost measured used (Drummond et al. 2005). For the mental health interventions and programs it would be preferable to collect data and measurements over a longer period of time, since the gains and loss of the mental disorder have long time horizons (Knapp & Lemmi 2016). Considering this, even if an intervention is evaluated based on a randomized controlled trial, the necessary follow-up period is almost never available. A second step regards the identification of costs and benefits. A mental health intervention or policy may not only affect the costs and outcomes within a specific societal entity, but may give effects on a wide range of services (Knapp & Lemmi 2016).

In a fourth step, the analyst should take into consideration the timing of the costs and benefits, i.e. if and how to adjust for discounting.¹

### 2.3 Cost-Effectiveness Analysis, Cost-Benefit Analysis and Decision Analytical Modelling

In the following section, the methods of CEA and CBA are shortly introduced together with the foundation of Decision Analytical Modelling. The latter has become more utilized within the health economic evaluations, since it could handle the uncertainty of data gathered with RCTs and trials, as well as simulate life-course costs and outcomes (Briggs, Claxton, & Sculpher 2006).

#### 2.3.1 Cost-Effectiveness Analysis

In a CEA, in the broader sense, the costs and outcomes, both natural and “utility-based”, are compared with each other. The natural outcome measures, which could be of interest within the area of mental health, are e.g. depression free days, severity of symptoms or behaviors/functioning associated with a condition. For the “utility-based” generic outcome measures, typical measures are e.g. QALYs and DALYs (or even YLL or YLD) (Luyten, Naci, & Knapp 2016). The result of a CEA is expressed as the incremental cost-effectiveness ratio (ICER) or incremental cost-utility ratio (ICUR), which describes the cost of gaining one unit of the preferred

¹ At the moment in Sweden there are two different discount rates applied within governmental entities, either the 3.5 percent for infrastructure or 3 percent discount rate for health technology and pharmaceuticals. For investments in interventions and policies for mental health, it may more appropriate to utilize the later.
outcome measure. The results from a CEA/CUA can be used to rank different interventions according the ICER, or the ICER can be compared to a specific “threshold value” or willingness to pay for the outcome measure. In the latter approach the CEA can be argued to be a form of “quasi-CBA” (Drummond et al. 2005; Luyten, Naci, & Knapp 2016).

2.3.2 Cost-Benefit Analysis
In a CBA, the costs and benefits are compared in monetary terms and have its foundation in welfarism. To assign monetary values to non-market costs or benefits, one of three different approaches is used: human capital, revealed or stated preference approaches (Drummond et al. 2005; Luyten, Naci, & Knapp 2016). If the net present value (NPV) of the benefits is larger than the costs, the intervention is said to increase social welfare based on the Kaldor-Hicks criterion. The difference in NPV, could be used in the comparison between the regular and new intervention to show how much more benefit the new intervention may generate for the society. An issue often brought up considering CBA in a health setting, is the possibility assign monetary values on health outcomes, since the general public and decision makers could consider it as unethical or difficult to do this (Weinstein & Fineberg 1980 in Drummond et al. 2005).

2.3.3 Decision Analytical Modelling
As health economic evaluation typically involve a large number of uncertainties, irrespective if conducted alongside medical trials and RCT studies, or if based on quasi-experimental approaches, Decision Analytic Modelling (DAM) approaches have been developed and are applied at an increasing rate.

DAMs have a foundation in Bayesian statistics and rely heavily on Monte Carlo Simulations. An initial decision problem and boundaries has to be set, and from this a model can be structured; in the form of a decision tree or Markov Model (Briggs, Claxton, & Sculpher 2006). To assess the uncertainty, the variability in the parameters utilized within the model is used to make the model probabilistic. The analyses are therefore often referred to a probabilistic sensitivity analysis (Briggs, Claxton, & Sculpher 2006).

An appealing feature of DAM, is the possibility to extend the time horizon of the economic evaluation further than the data gathered would allow,
i.e. facilitating life-course estimations. This gives the decision makers opportunities to make more informed decisions for interventions for which the consequences come further down the road.
3 Summary of Thesis

3.1 Paper I: Class-Size Effects on Adolescents’ Mental Health and Well-Being in Swedish schools

During economic downturns one of the common ways to reduce cost in the educational system has been to increase class-size. And on the other hand, when the economy is on the upturn the class-size may decrease with arguments that it will improve learning outcomes and school climate. Earlier research focusing on class-size and outcomes has primarily focused on learning outcomes and the there are indications for both positive, negative and inconclusive results of decreasing class-size.

This study focuses on whether class-size has an effect on the prevalence of mental health issues and wellbeing among adolescents in Swedish schools. We use cross-sectional data collected in a Swedish region during 2008, covering 2755 ninth graders from 40 schools and 159 classes. We utilize different econometric approaches to deal with potential between- and within-school endogeneity including school-fixed effects and (“fuzzy”) regression discontinuity (RD) approaches.

Our results suggest that we cannot reject our hypothesis that class-size has no effect on mental health and well-being in the school.

3.2 Paper II: The Willingness to Pay to Reduce School Bullying

During the last decades there has been an increase in introduction of new programs to reduce school bullying, but we often lack an understanding of the effectiveness and monetary benefits of such programs. In 2007, only one of the 21 most common antibullying programs used in Swedish schools could be considered to be evidence-based. To our knowledge there have not been any other research conducted focusing on the economic benefits for these kinds of programs.

In this paper, we estimate the societal willingness to pay to reduce school bullying and how this could be used to value the benefits of an antibullying program. We use a discrete choice experiment (DCE) conducted 2010, in a Swedish municipality, to elicit the willingness to pay (WTP) of reducing school bullying.

The results indicates a mean marginal WTP of €0.66-0.95 for each reduced victim of bullying and tax payer. The aggregated societal WTP value, or the value of a statistical bullying victim (VSBV), then translate to €65,446-93,431.
3.3 Paper III: The Cost-Effectiveness of the KiVa Antibullying Program: Results from a Decision-Analytic Model

Bullying cause a lot of suffering for children and adolescents. Bullying prevention programs has been advocated as effective methods for counteracting bullying in schools, but economic evaluations are lacking. This study identifies the cost-effectiveness of the Finnish intervention program KiVa in comparison to no bullying prevention program in a Swedish elementary school setting.

A cost-effectiveness analysis (CEA) was performed comparing KiVa versus no program using a Markov cohort decision model with a time horizon of nine years. A payer perspective was adopted and incremental costs were compared to incremental gains in victim-free years as well as in quality-adjusted life years (QALYs). Data on costs, probability transitions and health-related quality of life measures were retrieved from published literature. Deterministic and probabilistic sensitivity analyses were carried out in order to establish the uncertainty in the assessed cost-effectiveness.

The base-case analysis indicates that KiVa has an increased cost of €829 for a gain of 0.47 victim-free years. In terms of the cost per gained QALY the results indicated a base-case estimate of €13,823. In comparison to typical threshold values in Swedish health policy it was estimated based on the probabilistic sensitivity analysis that it was cost-effective in 100 percent of iterations.

Using a modelling approach, it was estimated that investing and implementing KiVa is cost-effective use of resources. Further research is needed to confirm the results of this study, especially regarding the treatment effects of the program in different school contexts.


In several European countries, both basic education for children and adolescents with intellectual disabilities (ID) and day-activity programs for adults are provided by local governments. Problems arise when the educational entity wants to implement a measure to increase the likelihood for transition to employment before, during and after the pupils leave school which we could regard as a social investment, since the investment during the education could be paid off from avoided future expenditure for day-
activity. The problem is that the two different entities have separate budgets and administrations, and do not have to consider any linkage of cost between them.

In this study we investigate whether, to what degree, a “business case” could be made for an implementation of a Supported Employment (SE) inspired program for pupils with ID, starting during the final year in school. For this aim we do a quasi-experimental before-after intervention impact evaluation of such a project funded by the European Social Fund in the Swedish city of Örebro (135,000 inhabitants) during 2010-2013. The intervention group consisted of 69 pupils, all pupils at the final year during this period in the Upper Secondary School for Individuals with Learning Disabilities. Under the period three individuals dropped out from the program. The control group consists of their peers at the same schools and programs, which graduated during the four-year period prior to the program and consisted of 49 pupils.

Those pupils who received support from the program had a 25.7 percent higher probability, on average, of being in employment. Considering the main question, the program would be a sound investment for the municipality as a “business case”, we find that the return on investment are 9 years, with an benefit-cost ratio of 4.154 for an period of 40 years, considering a discount rate of 3.5 percent. The return on investment time falls in under the proposed period as are set for a lot of social investment funds, 10 years.

Even though the initial investment of the SE inspired program, our economic evaluation viewing a broader picture, that an investment in one entity may give great effects for other areas and resources may get pooled together to fund such an investment since the cost should repaid after less than 10 years, and that an individual get a proper activity, an employment.

3.5 Paper V: A Benefit-Cost Analysis of an Individual Placement and Support program for Adolescents with Intellectual Disabilities

Adolescents and young adults with intellectual disabilities (ID) face many difficulties to find regular employment. During the last decades, several manual-based programs have been developed to improve labor market outcomes for individuals with ID. One of these programs is the Supported Employment (SE) method in the form of Individual Placement and Support (IPS), which has shown positive results in terms of increasing employment.
This paper evaluates a SE/IPS-based program called “Job in Sight” from an economic perspective and conducts a benefit-cost analysis of the intervention that was implemented in all Upper Secondary Schools for Individuals with Learning Disabilities (USSILD) in Swedish municipality during 2010 to 2013.

A quasi-experimental approach was conducted where outcomes in the intervention group is compared to a historical control group (pupils in the same schools between 2006 to 2009). A Markov cohort model was designed where the intervention and control cohorts are assumed to transit between four different labor market states with associated benefits and costs. Benefit and cost data was retrieved from Swedish register data and publications.

The results show that the JIS program is beneficial from a societal perspective with a positive net present value. Probabilistic sensitivity analyses were carried out to assess the uncertainty of the results and 60 to 70 percent of the iteration indicated that the JIS program is welfare increasing both during a shorter and longer time horizon.

Based on the results the JIS program shows a positive likelihood to be welfare increasing, which may be seen as appealing given the lack of evidence based interventions in the vulnerable group of individuals with intellectual disabilities.
4 Comments on Policy and Further Research

The overall focus of this thesis has been economic evaluations of interventions targeting children and adolescents. It has been conducted within a Nordic welfare state context or more specifically the case of Sweden. However, the fundamental methodologies and approaches should be applicable in other contexts. In general, this thesis indicates how economic evaluation methods can be used as an important input to decision makers regarding interventions targeting children and adolescents in the area of mental health, schooling and labor market. Given the societal perspective typically employed in this thesis, and in economic evaluations in general, the program shown to be cost-effective may not be particularly promising for a specific decision maker; while the cost of the intervention may be a burden for one governmental entity, the benefits and cost savings may fall on one or several other entities. In order to improve social welfare entities should either negotiate with each other and specific joint funding arrangements can be made, for instance such as the social investments funds that have been set up by several local and regional governments in recent years (Hultkrantz 2014; 2015; Hultkrantz & Vimefall 2016).

Some early good practices to gather evidence on the economic effects of interventions targeting children and adolescents come from the WSIPP project in the US, and the general idea has spread to e.g. the UK to fit their specific context. However, Sweden still lack systematic initiatives to gather specific evidence based interventions focused on children and adolescents, including data on cost and benefits. This thesis, give an indication that there are efficient and societal beneficial interventions, but more research for other interventions has to be conducted to create better opportunities for decision makers to find the best possible interventions.

Interventions targeting children and adolescents often have life-course consequences, and e.g. trial or observational data on all outcomes is not available for the analyst or decision-maker. This highlights the importance of modelling approaches, previously mostly used in e.g. economic evaluations of pharmaceuticals and medical technology, to merge with the CBA literature that can include financial, social and health consequences of an intervention. In our specific case, the last papers should be revisited and other benefits outcomes should be explored such as individual health effects, since we only considered the benefits associated to earnings.
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