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# DOES ONLINE PARENT TRAINING MEASURE UP TO GROUP PARENT TRAINING IN REAL-WORLD SETTINGS?

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# Does online parent training measure up to group parent training in real-world settings?
Thesis for Doctoral Degree (Ph.D.)

By

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To my family

# Popular science summary of the thesis

We already know that parent training is an effective intervention for disruptive behavior in childhood. Studies have shown that it is effective both when delivered face-to-face, as well as online. However, very few studies have compared group parent training head-to-head with online format within the same study. Such studies are necessary to evaluate the relative effectiveness of the two formats of delivery. This thesis summarizes the first trial to evaluate online parent training in comparison to group parent training when treating children with disruptive behavior in routine clinical care.

Disruptive behaviors are patterns of irritability, temper tantrums, argumentative and defiant behavior. When children more often behave defiantly or act out more than expected for their age, it often becomes a burden for them, their families and sometimes peers and other adults. Having behavior problems at an early age is a risk factor for poor social functioning, low school performance, depression, and anxiety in adulthood as well as substance use and criminality. Disruptive behavior is one of the most common causes for families to seek health care services.

It is important to help these children and their families; but, despite decades of treatment research, treatment accessibility remains low. Recommended treatment for disruptive behavior for children is parent training. Parenting programs are often extensive in terms of number of meetings and often delivered in group format. Delivering parent training as an online treatment could increase availability.

In our three connected studies we found that online-delivered parent training and group-delivered training led to similar treatment effects for disruptive behaviors in children. The effects of the treatments were similar regardless of a range of clinical and demographic variables, with few exceptions, meaning that for most children, including those with more severe disruptive behavior or comorbid ADHD, both treatment formats led to comparable results.

Parent training online is a cost-effective treatment option, online-delivery costs less than group-delivery while leading to comparable reductions in disruptive behavior. There was a small difference in increased quality of life for children whose parents completed group treatment.

In summary, online parent training leads to reduced behavior problems in children and this treatment effect was comparable to that of group treatment. More patients preferred online treatment before starting treatment while patients were more satisfied with group treatment after. Patients completed both treatments to a similar extent. The benefit of online delivery is that it has the potential to increase availability of treatment resulting in more children receiving help with their behavior problems.

# Populärvetenskaplig sammanfattning

Vi vet redan att föräldrastöd är en effektiv behandling för barn med utagerandebeteende. Studier har visat att det är effektivt både som behandling med träffar på klinik (”face-to-face-behandling”) och som behandling via digital plattform. Dock har väldigt få studier jämfört gruppbaserat föräldrastöd med online-behandling inom samma studie. Sådana studier är nödvändiga för att utvärdera de relativa effekterna av de två behandlingsformaten. Denna avhandling sammanfattar den första utvärderingen av digitalt föräldrastöd jämfört med föräldrastöd i grupp vid behandling av barn med utagerandebeteende inom reguljär vård.

Utagerandebeteende innebär mönster av irritabilitet, vredesutbrott, argumenterande och trotsigt beteende. När barn uppvisar ökad trotsighet eller utagerar utöver vad som kan förväntas för deras ålder blir det ofta en belastning för dem, deras familjer och ibland även andra jämnåriga och vuxna. Att ha beteendeproblem i ung ålder är en riskfaktor för lägre funktionsförmåga och låga skolprestationer, depression och ångest i vuxen ålder samt substansbruk och kriminalitet. Utagerandebeteendeproblem är en av de vanligaste orsakerna till att familjer söker vård inom primärvård eller psykiatri.

Det är viktigt att hjälpa dessa barn och deras familjer; trots decennier av behandlingsforskning är tillgången till behandling låg. Rekommenderad behandling för utagerandebeteende hos barn är föräldrastöd. Föräldrastödsprogram är ofta omfattande behandlingar med många möten och ges ofta i grupp. Att erbjuda ett digitalt föräldrastöd kan öka tillgängligheten.

I våra tre sammanlänkade studier fann vi att digitalt föräldrastöd och föräldrastöd i grupp ledde till liknande behandlingseffekter för utagerandebeteenden hos barn. Behandlingarnas effekter var liknande oavsett en rad demografiska och kliniska variabler, med några få undantag. För de flesta barn, inklusive de med mer allvarligt utagerandebeteende eller komorbid ADHD, ledde båda behandlingsformaten till jämförbara resultat.

Digitalt föräldrastöd är ett kostnadseffektivt behandlingsalternativ som kostar mindre än gruppbehandling samtidigt som det leder till jämförbara minskningar i utagerandebeteende. Det fanns en liten skillnad i ökad livskvalitet för barn vars föräldrar genomförde gruppbehandlingen.

Sammanfattningsvis leder digitalt föräldrastöd till minskade beteendeproblem hos barn, och denna behandlingseffekt var inte sämre än gruppbehandlingen. Fler föräldrar föredrog digital behandling innan start medan föräldrar som genomfört grupp var mer nöjda med behandlingen.  Patienter slutförde behandlingarna i liknande utsträckning. Fördelen med digital behandling är att den har potential att öka tillgängligheten till behandling, vilket kan resultera i att fler barn får hjälp med sina beteendeproblem.

# Abstract

**Background**: Disruptive behavior problems involve recurrent patterns of defiance, aggression, and hostility that interfere with normal functioning. Disruptive behaviors are commonly observed in children and adolescents and are linked to a heightened risk of academic and vocational underachievement, substance use, criminal activities, depression, and anxiety in adulthood. Parent training programs are well-established and recommended by guidelines as effective treatments. However, due to limited accessibility, there is a need for alternative approaches to deliver parent training to reach more families beyond traditional methods.

**Aim**: The thesis' overall aim was to evaluate treatment for children in primary care with disruptive behavior problems. **Study I** evaluated if a parenting program (Comet) when delivered online (iComet) would be noninferior in reducing disruptive behavior problems in children to Comet when delivered in its standard face-to-face group format (gComet). **Study II** assessed predictors and moderators of effects, engagement in and completion of treatment. **Study III** was a health economic evaluation examining cost-effectiveness and cost-utility of the treatments.

**Methods**: The three studies were based on data from a randomized noninferiority trial involving 161 children with disruptive behavior problems and their parents. Participants were patients in primary care in Stockholm who consented to participate in the trial. They were randomized to receive either gComet (n=86) or iComet (n=75). Assessments took place at baseline and after 3, 6, and 12 months. In **Study I**, the primary outcome was disruptive behavior problems measured by the Eyberg Child Behavior Inventory (ECBI). Secondary outcomes encompassed the behaviors and well-being of both children and parents, along with treatment satisfaction. Noninferiority analysis was conducted by examining one-sided 95% confidence intervals for the mean difference between gComet and iComet using multilevel modeling. In **Study II**, linear mixed effects models analyzed predictors and moderators of change in disruptive behavior and treatment engagement and completion from baseline to 3- and 12-month follow-ups. In **Study III**, the economic evaluation included a cost-effectiveness analysis and cost-utility analysis. Outcomes included recovered and reliably improved cases of disruptive behavior, quality-adjusted life-years (QALYs), costs from a healthcare perspective as well as a wider societal perspective. Statistical analysis involved logistic regression, generalized linear models, and incremental cost-effectiveness ratios (ICERs).

**Results**: **Study I** found iComet to be noninferior to gComet at all follow-ups, with small mean differences in reduction of disruptive behavior ($d$ =-0.02 to 0.13) with the upper limit of the one-sided 95% CI below the noninferiority margin of $d$ = 0.43 at 3-, 6-, and 12-month follow-ups (upper limits of 95% CIs between d= .2 and .38). The statistically significant differences in secondary outcomes were clinician-assessed ADHD

symptoms, parenting behavior at 3-month follow-up and satisfaction with treatment, all favoring gComet. There were no statistical differences at 12-month follow-up. In **Study II**, most variables did not predict nor moderate outcomes. Initial problem severity of disruptive behavior and ADHD-symptoms predicted larger decreases in disruptive behavior. Comorbid emotional problems and coercive family dynamics both predicted and moderated effects. Parents' education level also moderated effect. The three moderators were associated with higher effects in gComet. The only predictor of treatment completion and engagement was matching treatment preference, parents who were allocated to their preferred format completed treatment to a greater extent. Results in **Study III** showed that healthcare costs were lower for iComet (-$1002., 95% CI -1484, -585), and that gComet resulted in non-significantly higher rates of recovered and reliably improved cases (23 % vs 12 %, *p* = .129 and 34 % vs 30 %, *p* = .593). iComet yielded marginally fewer QALYs than gComet for children (-.013, p = .014) and borderline so for the child-parent dyads (-.016, p=0.05). There was no difference in QALYs for parents (-.002, p = .73). The cost-effectiveness results indicate that iComet leads to cost savings while being slightly less effective.

**Conclusions:** iComet was noninferior to gComet in reducing disruptive behavior. Most variables did not predict or moderate treatment effect. Coercive family dynamics, comorbid emotional problems, and parent education level did moderate the treatment effect with gComet leading to stronger effects. Treatment preference predicted treatment completion. iComet demonstrated cost savings with comparable clinical outcomes, except for slightly higher QALY gain for children in gComet. The combined results lead to the conclusion that internet-delivered parent training can be a viable alternative to group parent training in clinical care.

# List of scientific papers

I. **Engelbrektsson, J**., Salomonsson, S., Högström, J., Sorjonen, K., Sundell, K., & Forster, M. (2023). Parent Training via Internet or in Group for Disruptive Behaviors: A Randomized Clinical Noninferiority Trial. *Journal of the American Academy of Child and Adolescent Psychiatry*, *62*(9), 987–997. https://doi.org/10.1016/j.jaac.2023.01.019

II. **Engelbrektsson, J**., Salomonsson, S., Högström, J., Sorjonen, K., Sundell, K., & Forster, M. (2023). Is internet-based parent training for everyone? Predictors and moderators of outcomes in group vs. internet-based parent training for children with disruptive behavior problems. *Behaviour Research and Therapy*, *171*, 104426–104426. https://doi.org/10.1016/j.brat.2023.104426

III. **Engelbrektsson, J**., van Leuven, L. Salomonsson, S., Högström, J., Sundell, K., Forster, M., Sampaio, F. The cost-effectiveness of online versus group-based delivery of a parenting program: evidence from the Comet trial. *Manuscript*.

# Contents

# List of abbreviations

| | |
|---|---|
| ADHD | Attention deficit hyperactivity disorder |
| CD | Conduct disorder |
| CEA | Cost effectiveness |
| CHU9D | Child Health Utility |
| CI | Confidence interval |
| CPRS | Child-Parent Relationship Scale |
| CSQ | Client Satisfaction Questionnaire |
| CUA | Cost-utility analysis |
| DBD | Disruptive behavior disorder |
| DBP | Disruptive behavior problems |
| ECBI-IS | Eyberg Child Behavior Inventory – Intensity Scale |
| ECBI-PS | Eyberg Child Behavior Inventory – Problem Scale |
| ITT | Intention-to-treat |
| ODD | Oppositional defiant disorder |
| PARYC | Parenting Young Children |
| PHQ-9 | Patient Health Questionnarie |
| PP | Per-protocol |
| PSS | Perceived Stress Scale |
| QALY | Quality-adjusted life year |
| SDQ | Strength and Difficulties Questionnarie |
| WTP | Willingness to pay |

# Introduction

I have worked in primary care with children, adolescents, and parents nearly all my clinical career. Primary care involves a high patient flow and a wide spectrum of problem areas and symptom levels. The diverse patient population demands flexibility and a broad knowledge of child development, psychiatric symptoms, disorders, and treatment techniques. Delivering evidence-based treatments poses a challenge, as some patients need minimal interventions while others require comprehensive care. The constant question of "what works for whom" adds complexity to treatment planning, with uncertainty about the relevance of existing evidence for our specific patient group.

Research in primary care has not been as common as in university settings or in psychiatry. Sigrid Salomonsson and Kjersti Ejerby at Gustavsberg's primary care center envisioned an evidence-informed primary care and have worked determinedly for the past two decades to reach this goal. In 2017, Sigrid acquired the initial funding for what was to become my doctoral project. Few primary care units in Stockholm offered any manualized parent training, the recommended treatment for disruptive behavior in children, the second most prevalent problem area in youth. Clinicians were not used to treating disruptive behaviors and the programs available were not seen as a good fit in primary care as they were extensive treatments that often require training of staff not easily accessible for employees in health care.

Sigrid gathered experts in the research field, Martin Forster, Jens Högström and Knut Sundell. I was given the opportunity to be the psychologist leading this project, and together with Lotta Malm, Monica Hammarberg, Karl Simonsson, and other colleagues we contributed with the clinical perspective of the patients we treated and the context in which we worked.

Together a plan was developed with the goal to increase access to parent training in primary care. We hypothesized that an internet-delivered treatment might be suitable in terms of flexibility for patients and clinics. Research showed that internet-delivered parent training was superior to waitlist; but few studies used an active control, and none had compared it to group-delivered treatment. Study participants were often recruited through advertisement, which made us wonder if our patients would be interested in and complete internet-delivered treatment. We collaborated with seven primary care units, trained staff, and recruited patients to the trial. We decided to compare an internet-delivered treatment (iComet) to the best treatment available in Stockholm (group-delivered Comet) and we wanted to see how these treatments would compare with our actual patients to ensure that our research would be clinically relevant for primary care. This thesis summarizes the findings of the research that followed.

# 1 Literature review

Temper tantrums and noncompliance are part of normal development during childhood with a majority of children having frequent tantrums between the ages of 2 and 3 (Österman & Björkqvist, 2010). When these behaviors persist in intensity and frequency through development, age-appropriate, "normative misbehaviors" become inappropriate and a clinical concern (Wakschlag et al., 2007).

It can be challenging to raise a child that is often irritable, noncompliant, or impulsive (Smith et al., 2014; Webster-Stratton & Taylor, 2001). Parents might respond harshly to discipline misbehavior or try to appease the situation by giving in. Harsh and inconsistent parenting are risk factors for continued disruptive behavior (Webster-Stratton & Taylor, 2001). The following literature review describes disruptive behavior problems and their treatment.

## 1.1 Disruptive behavior problems

Disruptive behavior problems include a range of behaviors that interfere with normal functioning and are often characterized by patterns of defiance, aggression, and hostility. There are many terms describing these behavior patterns with overlapping definitions, such as externalizing behavior, conduct problems, anti-social, delinquent, or aggressive behavior (Magalotti et al., 2019). Disruptive behavior can be described as a continuum of symptoms ranging from none to severe or as a categorical construct i.e. diagnosis (Fergusson & Horwood, 1995; Ghosh et al., 2017). A continuous concept has important advantages in allowing for variation of severity which more accurately mirrors the population as well as being more useful in prognosis of outcome (Fergusson & Horwood, 1995; Moffitt et al., 2008) There is also evidence that symptoms of disruptive behavior problems, though they do not reach threshold for diagnosis, lead to clinically significant impairment (de la Osa et al., 2019).

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) categorizes these behavior patterns in the chapter *Disruptive, Impulse-Control and Conduct Disorders* stating that these conditions involve problems with self-control of emotions and/or behaviors as well as violating the rights of others and/or bringing the individual into significant conflict with norms or authority figures (American Psychiatric Association, 2013). Children with disruptive behaviors are highly heterogeneous (Hawes, 2014) which might be one of the reasons for the many synonyms and descriptions.

### 1.1.1 Psychiatric diagnoses

In the DSM-5-chapter *Disruptive, Impulse-Control and Conduct Disorders,* two of the most prevalent diagnoses are Oppositional defiant disorder (ODD) and Conduct disorder (CD). ODD consists of an emotional component (irritability, temper tantrums,

angry outbursts), argumentative/defiant behaviors (argues with adults/authority figures, actively defies rules, blames others) and vindictiveness (is spiteful or vindictive) (American Psychiatric Association, 2013). As there is high correlation between these components, ODD is seen as a single diagnostic construct with a highly heterogenous population (Hawes, 2014). Research has, however, found support for a multidimensional model of ODD with the emotional component (irritability, tantrums) being associated with anxiety and depression and the behavior component (defiance, argumentation) with attention-deficit/hyperactivity disorder and conduct disorder (Evans et al., 2017; Wesselhoeft et al., 2019). Conduct disorder consists of a persistent pattern of behavior that violates rules, norms or the basic rights of others (American Psychiatric Association, 2013). The DSM-5 allows for comorbidly diagnosing both ODD and CD (which was not permitted in earlier DSM editions), which recognizes the high comorbidity between ODD and CD (Magalotti et al., 2019). Both ODD and CD have high rates of comorbidity with attention deficit hyperactivity disorder (ADHD) as well (Beauchaine & McNulty, 2013; Magalotti et al., 2019) with the comorbidity between ODD and ADHD being 30-50% (Nock et al., 2007).

### 1.1.2 Prevalence

As described above, disruptive behaviors are common during childhood. Prevalence varies by age group and peaks in ages 6-11 years (Ghandour et al., 2019). Subthreshold ODD, defined as impairing behavior of oppositional defiant disorder while meeting fewer than four symptom criteria show prevalence rates ranging from 19-25% for children aged 3-9 (de la Osa et al., 2019). In worldwide prevalence rates of mental disorders in children and adolescents, any disruptive disorder was found to have a prevalence of 5.7% (CI 95% 4.0–8.1), making it the second most common group of disorders in childhood after anxiety disorders (Merikangas et al., 2009). The prevalence rates were 3.6% (CI 95% 2.8–4.7) for ODD and 2.1% (CI 1.6–2.9) for CD (Polanczyk et al., 2015). In a Norwegian study, the prevalence of behavioral disorders in 8–10-year-olds was 2.5 (95% CI: 1.9-3.1), which is lower than other prevalence studies (Heiervang et al., 2007). In a report by the Swedish Public Health Agency, 5 % of children in Sweden were estimated to have disruptive behavior problems at a clinical level requiring treatment (Folkhälsomyndigheten, 2013).

Typically, prevalence rates show that disruptive behavior problems are more prevalent in boys than in girls (Ghandour et al., 2019); however in the prevalence study of subthreshold ODD, no statistical difference between girls and boys was found (de la Osa et al., 2019).

### 1.1.3 Prognosis

Both clinical and subclinical disruptive behavior constitute a risk factor for future behavioral problems, academic and vocational maladjustment, substance use,

depression and anxiety (Fergusson et al., 2005; Smith et al., 2014; Wakschlag et al., 2015). Moderate to high ODD-symptoms, if left untreated, have been shown to persist during adolescence and into young adulthood (Leadbeater et al., 2023). Children with ODD tend to have fewer friends, experience more problems at school and have higher functional impairment in comparison to children with emotional problems or control group children (Wesselhoeft et al., 2019). The pervasiveness of these symptoms indicate that it cannot be expected that children simply grow out of these behaviors but rather that treatment is needed. Children who at a young age display disruptive behavior have a larger risk for negative outcomes during development (Fergusson et al., 2005).

Comorbidities with other mental health problems are very high for children with ODD with a lifetime prevalence of 92% for also meeting criteria for at least one other mental health diagnosis (Nock et al., 2007). In addition to the comorbidity with ADHD, children with ODD have substantial risk of secondary mood, anxiety, and substance use disorders (Nock et al., 2007).

### 1.1.4 Etiology

Considering the heterogeneity among children with disruptive behavior problems it is reasonable to assert that underlying causes are multifactorial (American Psychiatric Association, 2013; Burke et al., 2002; NICE, 2013). Neurobiological, psychological, and environmental risk factors interact in the development of disruptive behavior problems (Beauchaine & McNulty, 2013; Hinshaw, 2002; Magalotti et al., 2019).

In line with Webster-Stratton and Taylor's (2001) perspective, emphasizing modifiable factors, this risk factor overview considers demographics but primarily focuses on those risk factors that are the focal points of psychosocial treatment, namely child and parent factors. Figure 1 illustrates the explanatory model in the Swedish parenting program Comet; this illustration is used with parents to discuss the various factors that influence parent-child relationships and children's disruptive behavior.

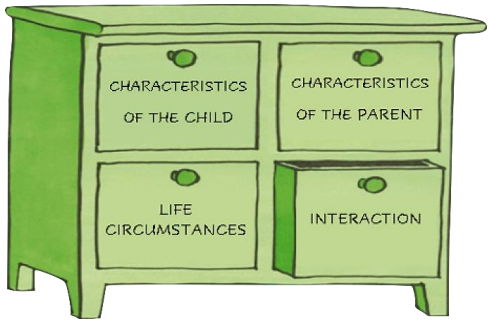


*Figure 1. Illustration from the parent material in the Comet program. Several factors influence conflicts in families and disruptive behavior in children. The dresser has one drawer open, emphasizing that the interaction between parent and child is the focus of the program. Illustration was modified and reprinted with permission from Stockholms stad.*

#### *1.1.4.1 Demographic risk factors*

Transactional models describe development of psychopathology by neurobiological vulnerabilities interacting with high-risk and protective environments to either promote or inhibit progression or deterioration (Beauchaine & McNulty, 2013). Environmental factors can include neighborhoods that are poor or have high criminality which have been associated with increased risk for delinquency in adolescence for children with high impulsivity (Lynam et al., 2000; Meier et al., 2008). For children in poor neighborhoods who were not impulsive, there was no increased risk for delinquency in comparison to non-impulsive boys in better-off neighborhoods (Lynam et al., 2000). Peer relationships, such as peer rejection and association with deviant peers, also influence development and maintenance of disruptive behavior (Burke et al., 2002).

#### *1.1.4.2 Child risk factors*

Risk factors intrinsic to the child can be divided into biological and functional risk factors (Burke et al., 2002). Moffitt (2005) summarizes research findings and states that genetic factors influence close to 50% of the variation in disruptive behavior problems, 20 % of the variation is explained by shared environmental factors and the remaining 30 % is accounted for by environmental influences not shared with family members. Environmental influences such as prenatal or early developmental exposure to toxins and physical damage to brain structures have been associated with disruptive behavior problems (Burke et al., 2002; Magalotti et al., 2019). Risk factors for disruptive behavior problems regarding the child's functioning include temperament, attachment, IQ and neuropsychological functioning (Burke et al., 2002; Moffitt & Caspi, 2001). Trait impulsivity has been suggested as the underlying vulnerability that interact with environmental risk factors, such as parenting, leading to ODD, CD and ADHD (Beauchaine & McNulty, 2013). Negative affect, a dimension of temperament, has also been linked to ODD (Frick & Brocki, 2019; Wichstrøm et al., 2018). Frick and Brocki (2019) found that parenting had a moderating effect on ODD-symptoms and that high parental support was a protective factor for children exhibiting elevated negative affect. The suggested mechanism is that the parent protects their emotionally dysregulated child from developing secondary oppositional behaviors through high parental support that regulates the child's emotion (Beauchaine et al., 2010).

#### *1.1.4.3 Parent risk factors*

There are several risk factors related to parents in the development of disruptive behavior in children. Parent behavior is an important risk factor (e.g., Furlong et al., 2013; Patterson, 2002; Webster-Stratton & Hammond, 1998) as well as negative parental emotional expressiveness and parent mental health such as depression and stress (Duncombe et al., 2012; Ghandour et al., 2019). Single parenthood, family disharmony, poor disciplinary practices, maltreatment and neglect are also known to be significantly

associated with disruptive behavior problems (Ghosh et al., 2017). Parenting behavior stands out as a key point of influence on children's behavior and coercive family interaction is of particular importance in the development and maintenance of disruptive behavior problems (Forgatch & Patterson, 2010; Smith et al., 2014).

## 1.2 Treatment overview

Treatment for disruptive behavior problems can target parents, children, both parents and children, and teachers. In their evidence-update of psychosocial treatments for disruptive behavior, Kaminski and Claussen (2017) shifted the focus from rating the evidence for different brand-named programs to summarizing evidence by generic treatment categories. Their intention was to inform policy-based decisions about the types of approaches likely to be effective on a wider population scale. Table 1 provides an overview of treatment categories and their aims. Using treatment categories instead of the brand names facilitates wider geographic coverage and increased availability in routine services because branded programs have often been implemented in specific or local areas.

Table 1. Overview of psychosocial treatments for disruptive behavior in treatment categories by Kaminski and Claussen (2017).

| | Treatment category | Treatment aim | Delivery format |
|---|---|---|---|
| 1 | Parent behavior therapy | Teach parents to be more effective behavioral reinforcers. | Individual, group, self-directed. Can include child |
| 2 | Child behavior therapy | Teach children appropriate social skills. | Individual, group. Can include parent |
| 3 | Teacher training | Teaching teachers to be more effective reinforcers of children's behavior. | Classroom |
| 4 | Parent-focused therapy | Address underlying emotional or psychological concerns within the parent, which is then assumed to translate into more positive parenting behaviors and fewer child behavior problems. | Individual, group. Can include child |
| 5 | Child-centered play therapy | To provide a close and supportive relationship for the child. By consistently providing this nurturing relationship it is assumed that the child's behavior will naturally improve. | Individual, group |
| 6 | Family problem-solving training | Engage parents, child, and siblings in problem-solving to build the family's ability to resolve issues resulting from oppositional behavior together. | |

The dominance of branded programs in the parenting field where treatments are known by their name rather than their content (e.g., Comet, Incredible Years, and Triple-P) complicates evaluation. Unlike the field of anxiety or depression (e.g., exposure therapy for anxiety or behavioral activation for depression) branded programs make it

challenging to assess active components and difficult for clinicians and families to make informed decisions about treatment as program availability varies by location (Leijten et al., 2022).

Kaminski and Claussen (2017) classified parent behavior therapy, specifically group and individual parent behavior therapy with child participation, as well-established treatments. Parent training is the recommended treatment in clinical guidelines (Furlong et al., 2013; NICE, 2013). Behavioral training has a stronger evidence-base and have shown superiority over nonbehavioral programs, both in reviews and in the few head-to-head studies (Kaminski & Claussen, 2017).

### 1.2.1 Rational of behavioral parent training

Behavioral parent training programs aim to teach parents effective strategies to reinforce positive child behavior and reduce disruptive behavior. They are typically described to be based on social learning theory (i.e., child behaviors develop, are maintained, and/or exacerbated in the context of the parent–child relationship), and operant conditioning (i.e., child behavior is increased and/or decreased depending on parents' responses to the behavior; Kaehler et al., 2016). Coercion theory, formulated by Patterson (1982), describes how parents unintentionally reinforce negative behavior in their child. Coercive cycles are described as maladaptive patters of parent–child interaction in which a child learns that increasing problem behavior is effective because the parent will eventually "give in" (Kaehler et al., 2016). Typically, coercive interaction is described as a chain of behaviors where the child shows a minor negative behavior (such as whining or not complying directly to a request), the parent responds by nagging or yelling, the child's negative behavior intensifies (the child might scream or more strongly demonstrate noncompliance) which is then followed by further intensified parental behavior (such as yelling louder or threatening). The chain is broken when the child or the parent gives in and thus negatively reinforces the other's argumentative or defiant behavior (Forgatch & Patterson, 2010; Smith et al., 2014). As the child learns this pattern of interacting within the family, these interactions are carried on outside the family as well, with peers and teachers (Smith et al., 2014).

Parents are the primary socializing agents for their children and parenting behavior affects the child's behavior; however this is a reciprocal influence and the child's behavior affects the parent's behavior as well (Beauchaine et al., 2005; Burke et al., 2008). For example, children whose parents reported reluctance of engaging in discipline because of fear of their child's behavioral response showed higher rates of disruptive behavior one year later. Children with higher levels of disruptive behavior had parents who were more reluctant to engage in discipline at follow-up one year later (Burke et al., 2008). In sum, the coercive interaction is affected by both child and parent behaviors.

### 1.2.2 Treatment components

Behavioral parent training programs often consist of multiple components, one of which is targeting the coercive interaction patterns between parent and child by changing parents' behavior (Leijten et al., 2022). Many of the behavioral parent training programs used today originate from the work of Constance Hanf and Gerald Patterson. Patterson formulated the coercion theory and was one of the originators of Parent Management Training Oregon Model, PMTO (Dishion et al., 2016; Kaehler et al., 2016; Patterson & Reid, 1975). Continual research and development building on their work in the 1960s has led to many of the well-known programs used today. The programs derived from Hanf and her students and colleagues are sometimes referred to as programs from the "Hanf-model". These include the *Incredible Years, IY* (Webster-Stratton, 1981), *Helping the Noncompliant Child, HNC* (Forehand & McMahon, 1981), *Parent Child Interaction Therapy, PCIT* (Eyberg & Robinson, 1982), *Defiant Children, DC* (Barkley, 1987), and *Community Parent Education*, *COPE* (Cunningham et al., 1995). These are similar to Comet in terms of theoretical base, techniques used, content and its sequence. Comet is similar to IY, DC and COPE in its sequencing of skills with the program starting with positive and differential attention and improvement of parent-child relationship and then followed by disciplinary behavior management skills (Kaehler et al., 2016; Kling et al., 2010).

This dual approach in teaching parents behavior management techniques as well as relationship enhancement has yielded nuanced results in recent meta-analyses. One meta-analysis found that programs with both behavioral management and relationship enhancement were associated with stronger effect in treatment settings while having weaker effects in prevention (Leijten, Melendez-Torres, et al., 2018). Building on this work and performing a network meta-analysis where the authors modeled clusters of treatment components resulted in behavior management alone having the highest probability to be most effective in treatment settings. Within behavior management, however, the component of child-directed play had a 32% prevalence, indicating that at least some relationship enhancement was included within behavioral management. Behavior management with parental self-management had the highest probability to be effective in prevention settings. Programs that had fewer components outperformed programs with more components (Leijten et al., 2022). Both meta-analyses found results to vary depending on prevention or treatment settings. By comparing different parenting programs, Leijten and colleagues (2019) showed that three techniques were associated with stronger effects when treating disruptive behaviors; namely, positive reinforcement, praise and the use of natural or logical consequences.

### 1.2.3 Effects of face-to-face behavioral parent training

Behavioral parent training programs are effective in reducing disruptive behaviors in children and the effects tend to be sustained up to at least 3-year follow up (e.g., Dretzke et al., 2009; Fossum et al., 2016; Michelson et al., 2013; Mingebach et al., 2018;

van Aar et al., 2017). Parent training has been shown to have a moderate effect on parenting skills that is sustained at follow up (Weber et al., 2019). Improved parenting practices such as reduced harsh and inconsistent parenting and improved positive incentives are associated with stronger treatment effects (Beauchaine et al., 2005; Kling et al., 2010).

### 1.2.4 Effects of internet-delivered behavioral parent training

There is a growing evidence-base for delivering parent training through technological means. Two of the earliest internet-delivered parent training programs evaluated were iComet (Enebrink et al., 2012) closely followed by Triple P Online (Sanders et al., 2012). The two studies were fairly similar in design and outcomes, both were randomized control comparisons to waitlist ("internet-use-as-usual" in Sanders et al.'s study) with samples recruited by advertisement and using the Eyberg Child Behavior Inventory (ECBI) as one of the primary outcomes. Both studies showed medium to large effects on disruptive behaviors post-intervention and at follow-up. In Enebrink et al.'s study there was on average 5 h of therapist support through messages and in Sander et al.'s 11 min telephone support (though it was described in a later article that the research team had scheduled troubleshooting checkups and reminder prompts via telephone or e-mail for inactive parents [Day & Sanders, 2018]).

During the decade that has passed since these studies a number of meta-analyses and reviews have been published (e.g., Baumel et al., 2017; Bausback & Bunge, 2021; Corralejo & Domenech Rodríguez, 2018; Florean et al., 2020; Thongseiratch et al., 2020). These show that online parenting programs are effective, mostly in comparison to waitlist, and some conclude that they have similar effects as face-to-face parenting programs (Baumel et al., 2017; Florean et al., 2020). The research on delivering parenting programs online adds to the growing body of research showing the efficacy as well as effectiveness of treatments delivered through the internet (Andersson & Titov, 2014).

### 1.2.5 Predictors and moderators of parent training

Though there is a strong evidence-base for parent training, not everyone benefits equally from treatment. A substantial proportion of children do not show any behavioral improvement after parent training (Reyno & McGrath, 2006; van Aar et al., 2019; Weeland et al., 2021). Research on predictors and moderators can increase knowledge of this differential effectiveness. Though there is a wealth of studies of predictors and moderators in parent training, relatively little is known about the factors related to poor treatment response (Dedousis-Wallace et al., 2021; Weeland et al., 2021).

A predictor is associated with response to treatment in all treatment groups, i.e., has a main effect (Kraemer et al., 2002) and can thus supply information about for whom the treatment works. A moderator introduces an interaction effect, influencing the strength

and/or direction of the relationship between intervention and outcome (Baron & Kenny, 1986; Kraemer et al., 2002). Consequently, a moderator helps identify for whom and under what conditions two or more treatments have distinct effects (Kraemer, 2016; Kraemer et al., 2002).

The most robust research finding for treatment effect of parent training is initial severity of problem behavior, which has been shown to be associated with increased treatment effect (Leijten et al., 2020; Lundahl et al., 2006; Menting et al., 2013). Child gender does not seem to have a moderating effect (Florean et al., 2020; Kaminski & Claussen, 2017). There is some inconsistency when it comes to age indicating stronger effect for younger children (Riise et al., 2021) though a large meta-analysis with this specific aim did not find any evidence to support the hypothesis that younger children have a larger effect from parenting programs (Gardner et al., 2019). Comorbid emotional problems and attention deficit hyperactivity disorder (ADHD) have often been examined as predictors or moderators; as well as, family disadvantage, for example low education or income, single-parent household, large family size, poor parental mental health, or parenting skills. Studies have found inconsistent results for most variables, i.e. some studies find e.g. age to moderate outcome while others do not, or different studies have shown the same variable to predict/moderate the outcome in different directions across studies (Dedousis-Wallace et al., 2021; Lundahl et al., 2006; McMahon et al., 2021; Reyno & McGrath, 2006).

These inconsistencies in results stem from several factors, studies have been heterogeneous in their focus, moderators, and analytic methods (McMahon et al., 2021), reviews have included few studies (Dedousis-Wallace et al., 2021) and because of the methodological limitation a variable-centered approach has in comparison to a person-centered approach (McMahon et al., 2021; van Aar et al., 2019). Much of the research on predictors and moderators have used a variable-centered approach. This approach assumes a linear relationship between a variable and its outcome, presupposing that families are homogenous. According to this perspective, intervention effects and family characteristics, excluding the moderator, are presumed to be uniform across the entire population (van Aar et al., 2019). As children with disruptive behavior and their families are heterogenous (Hawes, 2014) this diversity in individual and familial characteristics may contribute to the inconsistent findings observed in the literature.

## 1.3 Access to treatment

Despite its acknowledged effectiveness, parent training has not been disseminated into routine care to a sufficient extent (Forgatch et al., 2013; Weisenmuller & Hilton, 2021). There are several known barriers to treatment including accessibility (e.g., the cost of treatment in resources and time, parent fatigue), acceptability (e.g., stigma in seeking

treatment) and availability (e.g., the extent to which there is available treatment in routine services, Kaehler et al., 2016; Prinz et al., 2022).

### 1.3.1 Barriers to treatment

It is typically the parent who needs to seek help for a child to receive treatment for disruptive behavior problems. Parent training is contingent on parents engaging in treatment, i.e., enrolling in, attending sessions, and completing between-session homework. Chacko and colleagues' (2016) review of engagement in parent training reports bleak results with 25 % of eligible families not enrolling in treatment and an additional 26% dropping out during treatment. No matter how effective parent training programs are, their real utility depend on whether families engage in them (Johnston & Burke, 2020). Barriers reported by parents include stigma, time constraints, group dynamics, and accessibility of venues. Stigma and gender-related concerns involve fathers feeling uneasy in predominantly female groups, concerns about social status, and the apprehension of being labeled a "bad" parent (Johnston & Burke, 2020; Mytton et al., 2014). Practical barriers for parents include child-care during treatment and the frequency and timing of treatment competing with work schedule (Mytton et al., 2014). From the health care perspective reasons for not providing sufficient treatment are the high costs of service and a shortage of professionals with training in parenting programs (Enebrink et al., 2012; Rabbitt et al., 2016).

### 1.3.2 Dissemination of parent training in primary care

The role of the deliverer of parent training is important for parents (Mytton et al., 2014). Implementing parent training in primary care can reduce barriers to treatment through increasing availability, reducing stigma, and creating opportunities for screening and detection (Berkout & Gross, 2013).

Implementing parent training programs in primary care is by no means a new idea. There are several studies that have been set in primary care and whose authors have argued for the increase access to treatment through early detection and intervention (Leslie et al., 2016), the lower stigma of primary care in comparison to psychiatric or social services (Turner & Sanders, 2006) and the advantage of reaching the vast majority of children in a community (Lavigne et al., 2008; Perrin et al., 2014). Interventions have been adapted to fit the context of primary care and adaptation involved limiting the number of sessions (Kjøbli & Ogden, 2012) and treatment delivery by regular staff (Kjøbli & Ogden, 2012; Lavigne et al., 2008; Perrin et al., 2014).

### 1.3.3 Internet-delivered parent training and improving access

Internet-delivered treatments have emerged as a delivery method to increase reach and availability of treatment. Reduced therapist time, lower cost of treatment, and the potential to reach patients across large geographical distances are some of the

advantages of internet-delivered treatments (Andersson & Titov, 2014). Internet-treatment can alleviate many of the barriers to engage in treatment reported by parents such as conflicts with work schedule and other commitments, cost of transportation, and child care during treatment (Mytton et al., 2014).

Internet-delivered treatment can come in a variety of forms, e.g., video-calls, predominantly text-based treatment to content being more interactive and including video-vignettes in addition to text. The form of support can also vary and include no therapist support at all or various forms of support through telephone calls, video or meetings at the clinic or asynchronous messages (Andersson & Titov, 2014). Reviews of research indicate greater improvement from treatment with therapist support (Andersson & Titov, 2014). Online parent training with and without therapist support has been found effective and to reduce therapist time per family (Baumel et al., 2017). Studies comparing amount of support during digital treatment have shown that digital parent training with less support was rated by both parents and clinicians as less acceptable in comparison to high therapist support (Rabbitt et al., 2016) and that treatment completion and effects were higher with support (Day & Sanders, 2018). Adding therapist support increases therapist time and thereby restrains availability but may be necessary to ensure acceptability and completion of treatment as well as preserving its effects.

## 1.4 Cost-effectiveness

In addition to the burden of the individual and family, disruptive behavior problems are costly for society. Longitudinal studies show how early disruptive problem behaviors are robust risk factors for poor social function and mental health in adulthood (Fergusson et al., 2005; Kretschmer et al., 2014; Odgers et al., 2007); which are in turn associated with high future costs in terms of service utilization across multiple sectors in society such as criminal justice, health, and social welfare services (Rivenbark et al., 2018). For example, children with disruptive behaviors at age 10 were 3.5 times more costly at age 28, compared to children with no disruptive problems. For children with conduct disorder the costs were 10 times higher (Scott et al., 2001).

Cost-effectiveness analysis (CEA) and cost-utility analysis (CUA) are two types of full economic evaluation that consider both health outcomes and costs of two or more interventions (Drummond et al., 2015). A cost-effectiveness analysis utilizes a clinical measure as health outcome and can inform about the costs of that clinical outcome. Cost-effectiveness analysis is useful in direct comparison between interventions where the same outcome measure has been used; two limitations of this method are that there is no determined or widely accepted value for improvement on clinical outcomes and it is not possible to compare interventions if different outcome measures are used. Cost-utility analysis counter these limitations by utilizing generic health outcomes (e.g.,

quality-adjusted life years, QALYs) which allow for comparisons between interventions and different health outcomes as well as having benchmark willingness-to-pay (WTP) thresholds. WTP is a value judgement for what a decision-maker is willing to pay for an additional unit of improvement.

Parent training programs are likely to be a cost-effective use of societal resources (Dretzke et al., 2005; Sampaio et al., 2022). In the Cochrane review by Furlong and colleagues (2013), the cost of group-delivered parenting programs were concluded to be modest in comparison to the long-term costs of disruptive problems. In a report of parenting programs in Sweden, selective prevention programs were considered cost-effective (Folkhälsomyndigheten, 2013) adding to the body of economic evaluations showing that parenting programs as targeted prevention are cost-effective (Nystrand et al., 2019). A health economic evaluation of the Triple-P concluded that parenting programs give good value for money both as individual and group treatment, and that group treatment was most cost-effective (Sampaio et al., 2018).

The cost-effectiveness of digitally delivered parenting programs compared to traditional in-person delivery has not been established. One published study found that internet-delivered treatment produced cost-savings in comparison with staff-delivered parent training (Ingels et al., 2022). Limited public resources necessitate a concerted effort to reduce costs without compromising quality and effectiveness. Therefore, further research to investigate the cost-effectiveness of internet-delivered parent training is warranted.

## 1.5 Summary

Disruptive behavior problems are prevalent and burdensome for children, their families and for society at large. There is effective treatment, but access remains low. To increases access alternatives to traditional face-to-face treatments have been evaluated. Few studies have evaluated digitally delivered parent training in direct comparison to face-to-face treatment and none that we know of have done so in routine clinical practice. Studying treatments in routine practice increases generalizability of results which can ease implementation. Evaluating treatments that have a high chance of implementation is an important step in increasing availability of treatments in routine care.

# 2 Research aims

The overall aim of this research is to evaluate primary care treatment for children with disruptive behavior problems. Specifically, the three studies have evaluated the effectiveness and cost-effectiveness of parent training in two delivery formats, in group or via the internet. The research contributes with knowledge of treatment in clinical settings and provides implications for implementation in routine care.

## 2.1 Study I

Study I evaluated if Comet when delivered via the internet (iComet) would be noninferior in reducing disruptive behavior problems in children to Comet delivered in its original face-to-face group format (gComet). The primary outcome was reduction in disruptive behavior and secondary outcomes included parenting behaviors as well as parent and child well-being.

## 2.2 Study II

Study II assessed if there were any differences in treatment effect in subgroups of patients, i.e., if demographic, clinical or theory-based variables predicted or moderated effects, engagement in and completion of treatment.

## 2.3 Study III

Study III was a health economic evaluation of Comet in its two delivery formats and examined cost-effectiveness and cost-utility of the treatments.

# 3 The empirical studies

## 3.1 Study design

All three studies originate in a multi-center randomized noninferiority trial comparing a Swedish parent training program, Comet, delivered online to its traditional face-to-face group format. Participants were patients who sought care at the participating clinics for disruptive behavior problems. Assessments included parent-rated questionnaires and masked clinician assessments and were conducted before and after treatment (3-month follow-up) as well as at 6- and 12-month follow-ups. Participants received treatment at their clinic by clinical psychologists or family therapists employed by the clinic and trained in the interventions for the purpose of this trial. Participants were randomized to group or internet-delivered Comet. The regional ethical review board in Stockholm, Sweden provided ethical approval for the study (dnr: 2017/2511-31). Participants received verbal and written information and provided written informed consent before inclusion. The study was registered at Clinicaltrials.gov (Identifier: NCT03465384).

### 3.1.1 Participants

Recruitment of participants took place at seven primary care clinics in Stockholm. Eligible individuals were children aged 3-11 years whose primary reason for seeking care was disruptive behavior problems. Additionally, their parents needed to have internet access and sufficient proficiency in Swedish to participate in the treatment. Exclusion only occurred if intervention from social services was deemed necessary, as opposed to treatment in primary care. To ensure the study sample was as representative as possible of patients in routine care, no further inclusion or exclusion criteria were applied. Refer to Table 2 for baseline characteristics.

Table 2. Baseline characteristics of the participants per treatment condition and total sample.

| Child characteristics | *gComet* (n = 86) | *iComet* (n = 75) | Total (N = 161) |
|---|---|---|---|
| Sex, n (%) | | | |
| Female | 35 (41) | 24 (32) | 59 (37) |
| Male | 51 (59) | 51 (68) | 102 (63) |
| Age, mean (SD) | 8.1 (2.5) | 7.8 (2.3) | 8.0 (2.4) |
| Neuropsychiatric disorder, n (%) | | | |
| ADHD | 8 (9) | 9 (12) | 17 (11) |
| ASD | 2 (2) | 2 (3) | 4 (2) |
| Under assessment | 6 (7) | 5 (7) | 11 (7) |
| Symptoms of DBP, mean (SD) | | | |
| ECBI- Intensity Scale | 134.6 (25.8) | 139.2 (24.4) | 136.8 (25.2) |
| ECBI- Problem Scale | 16.3 (6.1) | 16.5 (5.6) | 16.4 (5.8) |
| SDQ- Conduct problems | 3.8 (1.6) | 4.0 (1.6) | 3.9 (1.6 |
| SDQ-Total | 14.0 (5.6) | 15.2 (5.3) | 14.6 (5.5) |
| SDQ- Emotional symptoms | 3.0 (2.4) | 3.0 (2.0) | 3.0 (2.2) |
| SDQ- Hyperactivity/inattention | 5.2 (2.7) | 6.0 (2.8) | 5.6 (2.8) |
| SDQ- Peer problems | 2.0 (2.0) | 2.2 (2.0) | 2.1 (2.0) |
| SDQ- Prosocial behavior | 6.4 (2.0) | 6.0 (1.8) | 6.2 (1.9) |
| SDQ- Impact score | 6.2 (2.8) | 6.8 (2.9) | 6.5 (2.8) |

*Note*: ADHD = Attention deficit hyperactivity disorder; ASD = Autism spectrum disorder; DBP = Disruptive behavior problems; ECBI = Eyberg Child Behavior Inventory; *gComet* = group-delivered *Comet*; *iComet* = internet-delivered *Comet*; SDQ= Strength and Difficulties Questionnaire.

## 3.2 The intervention

The Swedish parent training program Comet (a compound word for "COmmunication METhod", spelled KOMET in Swedish) is based on social learning theory and was developed by PLUS at Stockholm Stad (a department within the municipality of Stockholm tasked with developing and disseminating universal and indicated parent training programs). Comet aims to reduce child disruptive behavior through changing the way parents interact with their child and thereby leading to long-term impacts in reduced disruptive behavior. See Logic model (Figure 2) for theoretical model of the intervention.

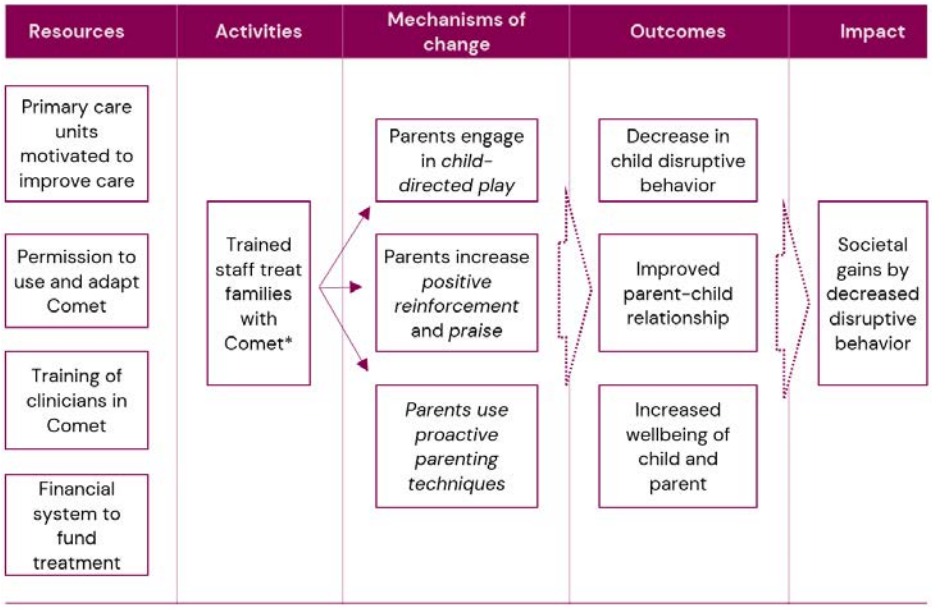


*Figure 2. Logic model of the Comet program describing the hypothesized relationship between intervention, mechanisms of change, outcomes, and impact.*
**Treatment components are presented in Figure 4.*

The Comet program is described as a pyramid (see Figure 3) consisting of a base of relationship enhancement with a focus on child-directed play, increased attention and reinforcement of prosocial behavior and decreased attention for problem behaviors. A middle part with strategies to increase co-operation between child and parent and a top consisting of strategies to manage conflicts.

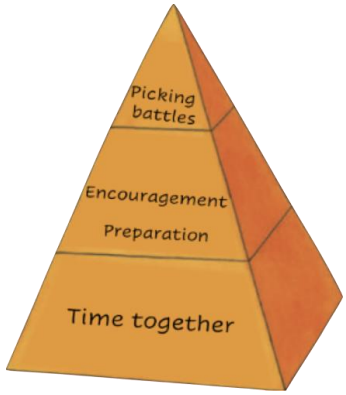


*Figure 3. The Comet pyramid, modified and reprinted with permission from Stockholms stad.*

Prior to this doctoral project, Comet had been evaluated in its original group-format in four studies; a pilot study (Hassler & Havbring, 2003), a pre-post design (Kling et al., 2006), a randomized controlled trial (Kling et al., 2010) resulting in a large effect compared to waitlist. Comet was also evaluated in a national study comparing four

parent training programs (Stattin et al., 2015) where *Comet* resulted in moderate effects on child conduct problems and parenting behaviors. These effects were sustained at the two-year follow-up (Högström et al., 2017).

The specific treatment components in Comet are displayed in Figure 4. The emphasis is on strategies that improve positive parenting skills such as preparing your child for an activity shift, reinforcing positive behaviors, and reducing negative reinforcement of undesired behaviors such as nagging or oppositional acts.

### 3.2.1 Group-delivered Comet (gComet)

Comet is traditionally delivered in group format with parents to 6-8 children in a group led by two therapists. The program consists of ten weekly two-and-a-half hour sessions and one individual meeting at week 6; thus comprising 11 sessions during as many weeks. During sessions, parents and group leaders discuss parental strategies, watch videos exemplifying parent-child interactions, role-play as well as plan and follow-up on homework assignments. Parents are given printed handouts at each session and are expected to carry out homework assignments practically daily during treatment.

### 3.2.2 Internet-delivered Comet (iComet)

iComet consists of the same treatment content as gComet, but the content of the ten group sessions has been distributed across seven modules. The parents log on to a secure platform to gain access to the treatment. The modules are opened on a weekly basis except for module 4 and 7 which take two weeks to complete. In previous studies of iComet (Enebrink et al., 2012; Ghaderi et al., 2018), therapists have mainly offered support to parents through online messages. In the present study, parents were instead offered three meetings at the clinic with their therapist. The purpose of these meetings was to encourage parents to engage with the online treatment and problem-solve when necessary. Little or no communication was made on the platform between clinician and parents. A blended treatment format, i.e., internet-delivered treatment with therapist support in live sessions at the clinic, was chosen as the reimbursement model in primary care at the time for the study would reimburse the clinic for meetings with parents but not for any other contact (e.g., phone calls or internet support through messages). Therapist guidance was therefore adapted to fit the reimbursement model.

iComet was developed by Stockholm Stad in collaboration with Karolinska Institute and has been evaluated in two prior studies. The first, in a randomized control trial comparing *iComet* to waitlist. The results showed moderate to large effects for disruptive behavior problems (Enebrink et al., 2012). The treatment effect continued to improve up to the 18-month follow-up, however there was a large attrition with 55% of the families completing follow-up (Högström et al., 2015). In the second study, iComet was the control condition to Family Check-Up, a comprehensive intervention where

parent training is one of the components. The results of the study showed large effects on disruptive behavior in both treatments with slightly larger effects for Family Check-Up, few of the differences between the treatments were statistically significant after treatment and at two-year follow-up (Ghaderi et al., 2018).

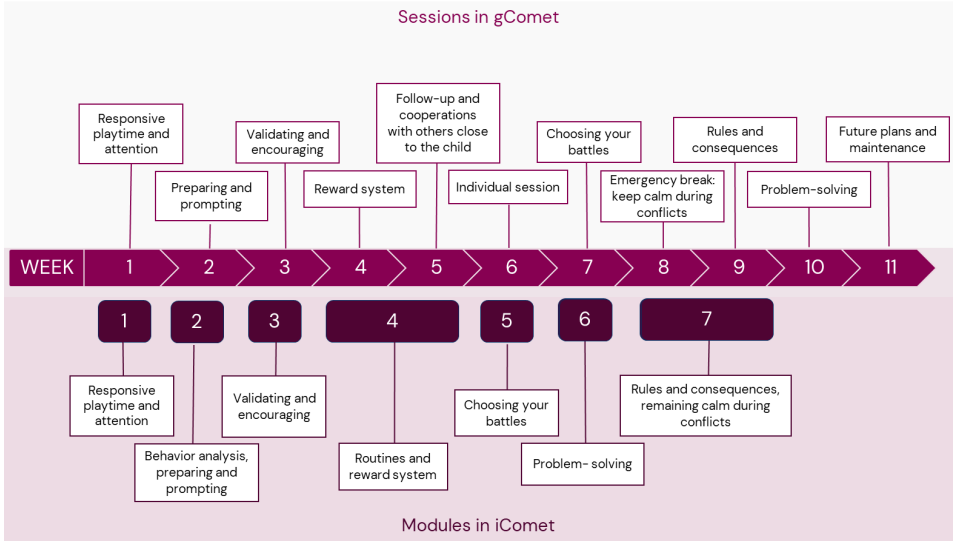


*Figure 4. Treatment content over weeks in treatment.*

## 3.3 Study I

**The non-inferiority study comparing gComet and iComet**

### 3.3.1 Methods

Study I was a randomized noninferiority trial where 161 children with disruptive behavior problems (63% boys, mean age 8.0 years) and their parents were randomized to receive either gComet (n=86) or iComet (n= 75).

#### *3.3.1.1 Outcomes*

The main outcome was the Eyberg Child Behavior Inventory (ECBI), a parent rated questionnaire measuring frequency of disruptive behavior (Intensity scale, ECBI-IS) and whether parents perceive a specific behavior as problematic (Problem scale, ECBI-PS). Secondary outcomes were parent rated questionnaires about their behavior and wellbeing as well as child-rated well-being and clinical assessment using the MINI-KID's sections about oppositional defiance disorder (ODD) and screening questions of symptoms of attention deficit hyperactivity disorder (ADHD).

#### *3.3.1.2 Statistical analysis*

To answer the research *question "Is internet-delivered parent training noninferior to group parent training in reducing disruptive behavior in children?"* we had first to define how much difference in effect that would be acceptable, i.e., the noninferiority margin. The margin was set following common practice to use half the controlled effect size found in earlier studies (Althunian et al., 2017). Halving the waitlist-controlled effect size on ECBI from the previous study of gComet (Kling et al., 2010) resulted in a noninferiority margin of *d* = .43. Please see section 3.6 for a discussion about noninferiority analysis.

Using multilevel modeling 95% CIs of the mean difference between gComet and iComet were created to determine noninferiority at the primary endpoint (3-month follow-up from baseline) as well as at the subsequent follow-ups at 6- and 12-months.

For the secondary measures, a superiority approach was applied with multilevel modeling to test for significant differences between gComet and iComet.

### 3.3.2 Results

#### *3.3.2.1 Primary outcome*

The effect of iComet was noninferior to gComet at the primary endpoint of 3-month follow-up in both intention-to-treat (ITT) and per-protocol (PP) analyses. The mean differences in between-group effect sizes were small (*d*=-0.02 to 0.13) for both ECBI subscales with the upper limit of the one-sided 95% CI below the noninferiority margin of .43 at all follow-ups. Results are illustrated in Figure 5.

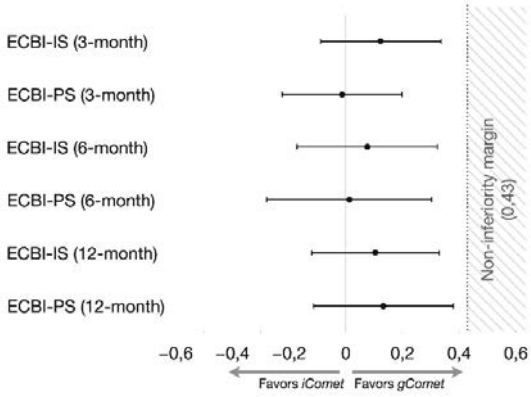


*Figure 5. The noninferiority results of disruptive behavior as measured by the two subscales of the Eyberg Child Behavior Inventory (ECBI) Intensity scale (IS) and Problem scale (PS). In the figure, the noninferiority margin is displayed as the shaded area on the right. The 95% confidence intervals are displayed with the estimated mean of the difference between the treatment formats. No difference between the treatments is indicated by 0 (zero) and results to the right indicate results favoring gComet. The upper limits of the 95% confidence intervals are below the noninferiority margin, indicating noninferior differences between the treatment formats at all follow-ups.*

#### *3.3.2.2 Secondary outcomes*

Table 3 displays an overview of the secondary outcomes. There were generally small treatment differences, three of which were statistically significant. Notably, at the 3-month follow-up, clinician-assessed ADHD symptoms showed a statistically significant reduction in gComet compared to iComet (*d* = 0.34, 95% CI [0.02, 0.66]). The PARYC-total demonstrated a significant improvement in parenting behavior for gComet at 3 months (*d* = 0.41, 95% CI [0.12, 0.69]), which was not sustained at the 12-month follow-up (*d* = 0.003, 95% CI [-0.30, 0.31]). There were no statistically significant differences in secondary outcomes at 12-month follow-up. The third statistically significant difference was parents' satisfaction with treatment (displayed in Figure 6).

Table 3. Overview of the secondary outcomes in the superiority analyses.

| Outcome | 3-month FU | 12-month FU |
|---|---|---|
| ADHD | **Number of symptoms ***<br>Symptom severity | *Not measured* |
| ODD | Number of symptoms<br>Symptom severity | *Not measured* |
| Parenting behaviors | **Positive parenting behaviors ***<br>Coercive behavior<br>Parental warmth | No difference |
| Parent well-being | Symptoms of depression<br>Symptoms of stress | No difference |
| Child behaviors | Emotional problems, hyperactivity, conduct problems, peer problems, prosocial behaviors | No difference |

*Note 1*: ADHD = attention deficit hyperactivity disorder; ODD = oppositional defiant disorder.

*Note 2*: Number of ADHD- and ODD-symptoms as assessed in MINI-KID-interviews, symptom severity rating by CSR, *Clinical Severity Rating*. Parenting behaviors measured by PARYC, *Parenting Young Children,* and CPRS, *Child-Parent Relationship Scale*. Parent well-being measures by PHQ-9, *Patient Health Questionnaire*, and PSS-10, *10-item Perceived Stress Scale*. Child behaviors measured by SDQ, *Strength and Difficulties Questionnaire*.

*Note 3:* **Variable*** indicates a significant difference between gComet and iComet.

#### *3.3.2.3 Feasibility outcomes*

In addition to clinical outcomes, results of interest in routine care involved patient preferences, treatment completion and satisfaction, please see Figure 6 for illustrations. Parents were asked before randomization which treatment they would prefer, 51% of parents reported to prefer internet-delivered treatment, 30% preferred group and 18% of parents did not have a preference. Treatment completion was high for both groups with parents completing on average 76% of the group sessions and 77% of the online modules. Parents were considered treatment completers when they attended four group sessions or completed 3 modules as this meant that they had been exposed to

the main treatment components. In gComet, 83% were classed as completers and 89% in iComet. Treatment completion did not differ between the two treatment formats; however, there was a significant difference between dropouts for parents who were randomized to their treatment of choice (2% dropout) in comparison to those who were not (22%). There was a statistically significant difference between the formats where parents were moderately more satisfied with gComet (*d* = 0.49, 95% CI [0.22, 0.75]).

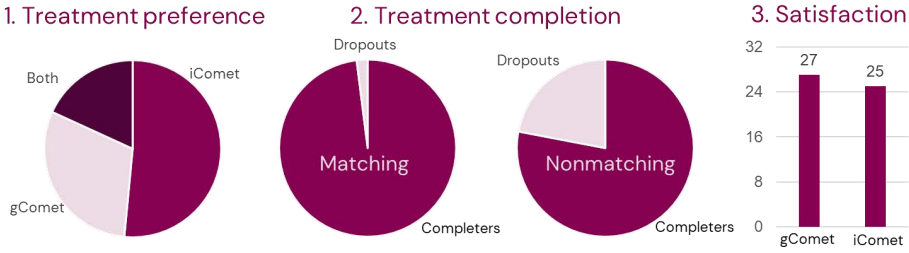


*Figure 6. Graphs displaying (1) Parent-reported treatment preference, (2) treatment completion for parents randomized to treatment that matched or did not match their preference, and (3) parents' satisfaction with treatment.*

### 3.3.3 Conclusions

The reduction of disruptive behavior after treatment was comparable between the two treatment formats, i.e., iComet was noninferior to gComet. There were some differences in secondary outcomes (parent satisfaction, ADHD-symptoms, and parenting behavior) after 3-month follow-up. At 12-month follow-up there were no differences between formats. Treatment completion in both formats was high, satisfaction was larger in group treatment while parents before treatment expressed a preference for online treatment.

In summary, the comparable therapeutic effects and high treatment completion rates for both iComet and gComet supports the contention that either format is suitable for integration into routine primary care settings.

## 3.4 Study II

**The prediction and moderation of outcomes of gComet and iComet**

### 3.4.1 Methods

In Study II, data from Study I was used to evaluate if baseline variables predicted or moderated treatment effect, completion, or engagement.

#### *3.4.1.1 Outcomes*

Treatment effect was operationalized as reduction in the frequency of disruptive behaviors and measured by the Eyberg Child behavior Inventory-Intensity Scale (ECBI-IS). Treatment completion was the number of group sessions attended or online

modules completed. Engagement was operationalized as the percentage of homework completed by the parents.

Putative predictors and/or moderators were demographic variables such as child's *age* and *gender*, parent's *education level, symptoms of depression, treatment preference*, *participation by 1-2 parents*, *siblings <13 years* and number of *adults in household*. Clinical variables were *initial severity* of parent-rated *disruptive behavior*, clinician-rated *ODD*- and *ADHD-symptoms*, and parent-rated *emotional problems*. Lastly, three theory-driven variables were studied namely *parenting behavior and self-efficacy as well as coercive family dynamics*.

#### *3.4.1.2 Statistical analysis*

In analyses using ECBI-IS as the outcome, multilevel models were applied accounting for the nesting of parent ratings within families. Predictive effects were calculated as the effects of Predictor × Time, while moderations were estimated as three-way interactions of Predictor × Time × Treatment group. Because the outcome variables completion and engagement were summarized per family predictor values were also aggregated at the level of the family. Prediction was determined by assessing the effect of the aggregated predictor value on the level of completion using simple regression analysis. Moderation was estimated as the interaction effect between the aggregated predictor value × treatment group.

### 3.4.2 Results

The majority of the examined variables showed no predictive or moderating effects on treatment engagement, completion or effect. However, some clinical variables did predict larger decreases in disruptive behavior at the 3-month follow-up namely *initial severity of disruptive behavior* and *ADHD-symptoms*. Additionally, comorbid emotional problems and *coercive family dynamics* both had a significant predictive and moderating effect on child disruptive behavior at the 3-month follow-up. Parent *education level also* moderated treatment effect at the 3-month follow-up. The only variable that predicted treatment completion and engagement was *matching preference*. At 12-month follow-up *initial severity* of disruptive behavior and *participation of 1-2 parents* predicted treatment effect. None of the other variables predicted or moderated effects at 12-month follow-up. See table 4 for overview.

Table 4. Prediction and moderation of treatment effect.

| Variable | Prediction | Moderation |
|---|---|---|
| Child age | x | x |
| Child gender | x | x |
| Level of education | x | Parents without university degree had higher effects in gComet at 3M |
| Level of depression | x | x |
| Preference match | x | x |
| Preference non-match | x | x |
| Participation by 1-2 parents | Higher proportion of participation of 2 parents predicted smaller effects at 12M | |
| Adults in household | x | x |
| Children <13 in household | x | x |
| Initial severity (ECBI-IS) | More severe disruptive behavior at baseline predicted larger effects | x |
| Initial severity (ECBI-PS) | | x |
| ODD-symptoms | x | x |
| ADHD-symptoms | More ADHD-symptoms at baseline predicted larger treatment effects at 3M | x |
| Emotional problems | More emotional problems at baseline predicted larger effects at 3M | Children with more emotional problems had a larger effect in gComet at 3M |
| Parenting behavior | x | x |
| Parental self-efficacy | x | x |
| Coercive parenting | Low coercive parenting predicted larger effects for children high in DBP at 3 M | High coercive parenting predicted larger effects in gComet for children low in DBP at 3M |

*Note*: Variable names in plum indicate significant predictor or moderator effects. x indicates no significant effect. 3M = 3-month follow-up; 12M = 12-month follow-up; ADHD = attention deficit hyperactivity disorder; DBP =disruptive behavior problems; ECBI = Eyberg Child Behavior Inventory; IS = Intensity scale, PS = problem scale; ODD = oppositional defiance disorder.

### 3.4.3 Conclusions

The majority of variables were not significant predictors or moderators of treatment effect, completion, or engagement leading to the conclusion that both treatment formats are similarly effective for most patients. More problems before treatment predicted larger effects for both formats. Three variables had a moderating effect, i.e., were associated with a stronger effect in gComet in comparison to iComet; these were parents' *education level*, *coercive family dynamics* and *comorbid emotional problems*. Parents' matching *treatment preference* was the only predictor of treatment completion and engagement.

## Study III

**The cost-effectiveness evaluation of gComet vs iComet**

### 3.4.4 Methods

The economic evaluation consisted of two analyses: 1) a cost-effectiveness analysis expressed as cost per recovered and reliably improved case of behavior problems based on the ECBI-IS; and 2) cost-utility analysis expressed as cost per QALY.

In Study I and II all participating parents contributed with data. In Study III, the sample consisted of one parent per child. If a child had two participating parents (*n*=113, 71%), the parent with the most data was selected, i.e., the parent who had answered most of the questionnaires at the 3- and 12-month follow-ups. In cases where both parents had completed all questionnaires at all time points (*n*= 23, 14%) a parent was randomly selected to contribute with their data and constitute the parent-child dyad, resulting in *n*= 160 children.

#### *3.4.4.1 Outcomes*

Health outcomes included recovered and reliably improved cases of disruptive behavior based on the ECBI, and quality-adjusted life years (QALY) for the child, parent, and child-parent dyad. Reliable change (RCI) was calculated by subtracting the baseline score from the 12-month follow-up score and dividing this by the standard error of the differences. An RCI above 1.96 was considered a reliable change at a significance level of $p < 0.05$. This equaled a decrease on the ECBI-IS by more than 24 points from baseline. Reliably improved cases thus included all children with a reduction of disruptive behavior by more than 24 points at 12-month follow. The group of recovered cases consisted of children who, in addition to being reliably improved also had a clinical change by moving from being above clinical cut-off at baseline to being below the cut off at 12-month follow-up. Costs were analyzed from the healthcare perspective and included the cost of delivery of the treatments as well as the cost of additional primary care and specialized outpatient care. A broader societal perspective was explored with the added costs for the families for attending treatment.

#### *3.4.4.2 Statistical analysis*

Between-group differences in recovered and reliably improved cases of disruptive behavior problems were analyzed using logistic regression. Cost data and QALYs were analyzed using generalized linear models (GLM). Total QALYs were analyzed while controlling for baseline utilities (CHU9D and EQ-5D). No discounting was performed as health outcomes and costs were collected within a year. To handle missing data, fifteen datasets were imputed by multiple imputation using chained equations. Incremental cost effectiveness ratios (ICER) were calculated for the cost-utility analysis (cost per

QALY). The uncertainty around the cost and outcome estimates was explored using bootstrapping with 1000 iterations and results depicted on cost-effectiveness planes.

### 3.4.5 Results

The healthcare costs were significantly lower for iComet than gComet resulting in a mean difference of -$1002 (95% CI, -$1484, -$585) per family. The number of recovered and reliably improved cases at the 12-month follow-up were non-significantly higher in gComet compared with iComet (23% recovered in gComet vs 12% in iComet, $p$ = .129; 34% reliably improved in gComet vs 30% in iComet, $p$ = .593). iComet resulted in fewer QALYs than gComet for children (-.013, $p$ = .014) and marginally so for the child-parent dyad (-.016, $p$=0.05). There was no difference in QALYs for parents (-.002, $p$ = .73).

The cost-effectiveness results from the healthcare perspective render the total cost per recovered case of $7451 for gComet and $5708 for iComet. The total cost per reliably improved case was $4967 in gComet and $2350 in iComet.

The incremental cost effectiveness ratios (ICERs) for the cost per QALY are displayed in Figure 7. The majority of estimates are in the Southwest quadrant indicating lower costs and lower effect of iComet.

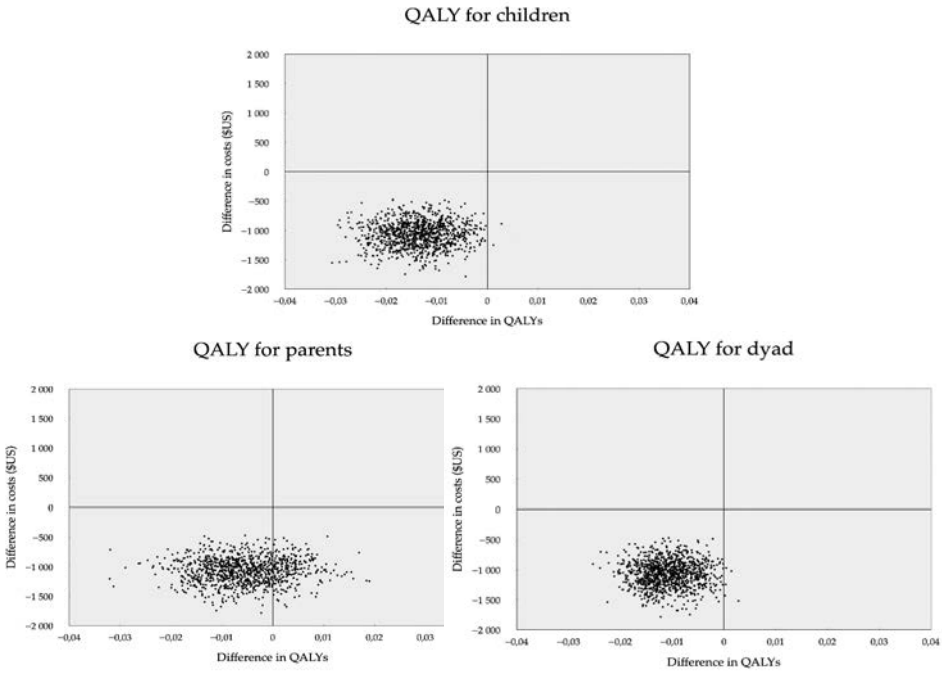


*Figure 7. Cost-effectiveness planes of incremental cost from the healthcare perspective and incremental QALYs in children, parents, and dyads. In all three planes dots, representing iterations of incremental cost and incremental QALY pairs, are in the south quadrants with most dots in the southeast quadrant indicating that iComet is less costly and yields fewer QALYs in comparison with gComet.*

### 3.4.6 Conclusions

iComet leads to cost savings while being slightly less effective. The clinical outcomes in terms of recovered and reliably improved were not statistically significantly different. There was a difference in QALYs for children where gComet yielded slightly higher QALYs than iComet.

## 3.5 Methodological considerations

This section delves into three key methodological considerations and potential limitations that shaped our results and their interpretation. These include the noninferiority design, a predominant reliance on parent-rated outcomes, and the inclusion of both mothers and fathers in our data.

### 3.5.1 Noninferiority design

Superiority trials aim to show that a new treatment is statistically superior to a control. Noninferiority trials, on the contrary, aim to show that the new treatment is not "inferior to", or unacceptable worse than, control (Schumi & Wittes, 2011).

One case for noninferiority trials is when there already exists an established treatment for a condition. If a new treatment is shown to be noninferior to the established treatment, other factors play into decisions of further dissemination (e.g., cost of implementation). For disruptive behavior problems in children, there is strong evidence for behavioral parent training. Swedish guidelines for primary care recommend group parent training when treating disruptive behavior (Kunskapsstöd för vårdgivare, 2021). The crucial research question therefore was if a new treatment (iComet) would be noninferior to the established treatment (gComet). It would be less relevant with a traditional superiority study comparing iComet to placebo or waitlist-control since that would not directly inform the researchers of the relative effectiveness to the already established treatment. Furthermore, in cases where a treatment with evidence of effects exists, it is unethical to conduct studies where patients are randomized to placebo or no treatment. The latter is another argument for conducting noninferiority studies in clinical settings.

A proposed ethical prerequisite is that the new treatment must have known advantages over existing treatments (Aberegg et al., 2018; Piaggio et al., 2012). When designing our study we had these aspects in mind, there is a sound evidence-base for treatment of disruptive behaviors and there are clear advantages of the new treatment, e.g., requiring less time for patients and therapists, more flexibility in scheduling treatment and possible cost-savings.

Two important methodological considerations in noninferiority trials are the margin and the reference treatment (Herr et al., 2018). *The margin* represents the largest difference

in efficacy tolerated between the treatments. Our choice of the 0.43-margin is one of the main methodological limitations in this doctoral work and the results of Study I must be interpreted while keeping this margin in mind. The selection of margin should be based on statistical and clinical judgement (EMA, 2006). The noninferiority margin was set by halving the combined effect size of ECBI-IS and ECBI-PS found in the previous trial of gComet compared to waitlist control (Kling et al., 2010). A margin of 0.43, though wide, was considered a clinically acceptable difference based on the advantages of iComet.

Let us consider a scenario with a smaller margin, e.g. 0.26 as suggested by Leijten in her editorial (Leijten, 2023) of the published results of Study I (Engelbrektsson et al., 2023). If the trial would have been the same but using this margin instead, the results could not have ruled out inferiority (the 95% confidence intervals from our results would have crossed the noninferiority margin at 5 out of 6 measurement points). However, this does not mean that the results would indicate inferiority of iComet. Instead, the results would have been "inconclusive", please see Figure 8 for illustration.

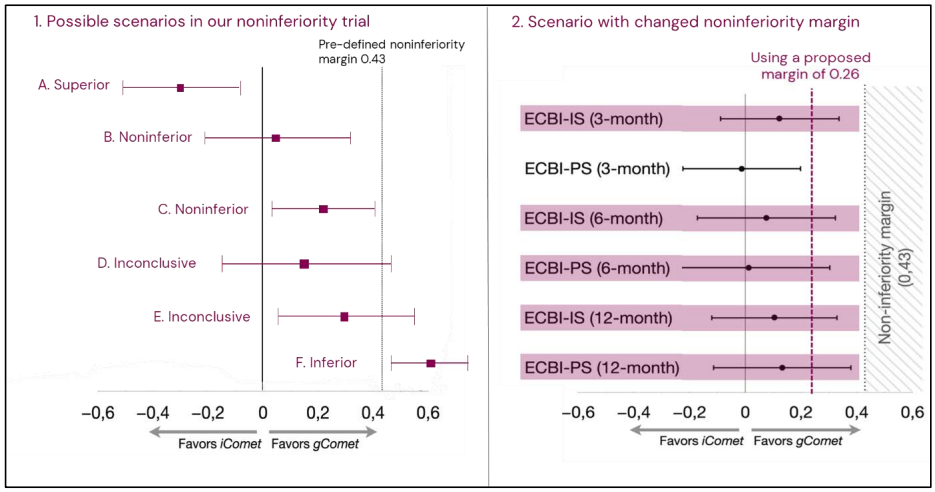


*Figure 8. Illustrating possible scenarios according to the CONSORT diagram for interpreting the results of noninferiority trials (Panel 1) and scenario with a proposed margin of 0.26 (Panel 2). The highlighted results in Panel 2 show how a lower margin changes interpretations from "noninferior" (displayed as B. in Panel 1) to "Inconclusive" (displayed as D. in Panel 1).*

Noninferiority trials have been criticized for not involving patients in decisions concerning the margin, i.e., what difference in effect would be acceptable to an affected patient (Schumi & Wittes, 2011). Considering the patient perspective and what the actual treatment options are for the patient are important for the clinical judgement of the margin. Clinical settings in publicly financed health care often offer a limited variety of treatment options and scarce resources need to cover a vast range of patients. Studies of perceived barriers to engage in parent training point to the limited accessibility of

traditionally delivered parent training (Chacko et al., 2016). Keeping this in mind and taking a closer look at what the situation in primary care was when the study started affected our choice of margin. Manualized parent training took place at only a few units in all of Stockholm meaning that few primary care patients had access to evidence-based treatment. Therefore, increasing availability of treatment was deemed an important goal and the benefit of possible increase in availability would weigh up a potential loss in efficacy.

In noninferiority studies it is important the reference treatment has well-established effect shown by previous research (D'Agostino et al., 2003). Parent training has a sound evidence-base and is recommended in guidelines (Furlong et al., 2013; Kaminski & Claussen, 2017; NICE, 2013). Comet has shown similar effectiveness to other established parenting programs (Cope, Incredible Years, in Högström et al., 2017). To ensure a "fair" comparison, the comparator treatment must be administered in a way that would maximize its effect (Schumi & Wittes, 2011). In our study gComet was administered as similarly as possible to that of the original study. The training and supervision of staff followed the same procedure, the same treatment manual and material were used, and clinicians filled out a log to rate every group session in terms of fidelity to the manual. The lower within-group results in the present study for gComet ($d$ = .5 at 3-month follow-up) in comparison to the within-group effect in Kling et al. (2010) on the ECBI-IS ($d$ = .80) was unexpected. These results might have been influenced by recruiting patients from routine care, rather than community recruitment as in the original study (Romijn et al., 2019) or the relatively large proportion of father data in the results (see section 3.6.3).

Next step would be to conduct a larger study that could use a smaller margin as we now know more of what to expect of treatment in routine primary care.

### 3.5.2 Parent-rated outcomes

Using multiple informants in assessing child disruptive behavior is considered best practice (De Los Reyes & Kazdin, 2005; Santos et al., 2020). The results in the current thesis rely heavily on parent-rated outcomes, which is a limitation to the validity of the results. In the study there were clinical assessments at baseline and blinded clinical assessments at 3-month follow-up; however, the large attrition in these assessments is a limitation to their validity.

Evaluating treatment effect on disruptive behavior through parent-rated outcomes is the most common method (Dretzke et al., 2009) and using the Eyberg Child Behavior Inventory is one of the most common measures in clinical studies (Michelson et al., 2013). Using teacher ratings as a complementary source of information is a typical, though not as frequent, way of evaluating parent training. Other common ways of assessing outcomes in parent training are observations and clinical assessments.

An advantage of parent-rated scales is that parents are often the ones who know the child best and can thereby rate the daily impact of the child's behavior (Santos et al., 2020). On the other hand, the close personal relationship hardly makes the parent an impartial judge. In studies, the parent is often not blinded to which treatment format they have completed. Teachers, on the other hand, are likely not emotionally attached to the child like a parent is and can observe the child in the structured environment of a school as well as in interaction with and in comparison to peers (Santos et al., 2020). The information that teachers supply might not highly correlate with parent ratings but can contribute with complementary information (Achenbach et al., 1987).

Achenbach et al. (1987) found the correlation in pairs of different informants (e.g., ratings by parent and teacher or parent and clinician) to be .28 and suggested that differing informants contribute with variance not supplied by the other. The difference in ratings can give information about the child's functioning across situations and interaction partners which in turn can provide information valuable when deciding on the focus of intervention and evaluation (Achenbach et al., 1987). Edwards (2005) concludes from Achenbach et al. (1987) that since the correlation of different raters from the same setting (e.g. parent-parent, teacher-teacher) is not perfect ($r$ = 0.6) , it is desirable to obtain information from both parents when possible.

The clinical assessment in the trial used standardized interview questions from the MINI-KID's sections of ADHD and ODD and included clinical severity ratings (CSR) by psychologists. Clinicians blinded to treatment allocation performed the interviews. The large attrition (66 % of children had baseline and 3-month follow-up assessments) was due to many families having difficulties in coming to the clinic for the interviews as treatments ended in conjuncture with Christmas or summer holidays. These assessments took place prior to COVID-19 and the implementation of technical solutions making it possible to have secure video meetings within health care settings.

Though it is standard practice in routine settings to rely heavily on patient ratings, this is a limitation in our study. Collecting teacher ratings would have contributed with valuable information about child disruptive behavior in school setting and the generalizability of parent training in affecting child behavior in school.

### 3.5.3 Mother and father involvement

As discussed in the previous section, data from the studies rely heavily on parent ratings, efforts were, however, made to include mothers as well as fathers in both assessment and treatment. The fact that a high proportion of data in this study comes from fathers is uncommon and may have affected the results (see Table 5 for proportion of data). Here follows a brief overview of mother and father inclusion in parent training research concluding with a reflection of current research and future directions.

Table 5. Number and proportion of mother and father ratings of the Eyberg Child Behavior Inventory (ECBI).

| | Children | Mothers | Fathers |
|---|---|---|---|
| Baseline, *n* (%) | **160** (99) | 153 (96) | 118 (74) |
| 3M FU, *n* (%) | **142** (88) | 120 (85) | 84 (59) |
| 12M FU *n* (%) | **127** (79) | 108 (85) | 66 (52) |

*Note*: Percentage of the total of children at that measurement point, e.g., at 3-month follow-up 142 children had ratings on the ECBI by at least one parent; 120 children had ratings by a mother (85% of the 142 children with a 3-month rating) and 84 had ratings by a father (59%).

Fifteen years ago, Lundahl and colleagues (2008) stated that *parent* training was historically synonymous with *mother* training and argued that fathers are important in children's emotional and social development. On the basis that there was no consensus for including fathers in parent training they conducted their meta-analysis with the two aims to evaluate 1) if including fathers added any value and 2) if fathers respond similarly as mothers to parent training. The authors found that parenting groups that included both mothers and fathers had a stronger effect after treatment than programs including only mothers. At follow-up, there was no statistical difference when including fathers in treatment. Concerning similar effects for mothers and fathers, fathers reported smaller gains from treatment in terms of child behavior immediately following treatment, but not at follow-up. Fathers also reported lower gains in parenting behaviors after treatment, which was largely sustained at follow-up. The conclusion presented in the meta-analysis was that fathers should not be excluded from parent training and encouraged to participate (Lundahl et al., 2008).

Likely, most researchers today agree that both mothers and fathers are important in parenting, but including fathers in studies is still lagging. Ten years after Lundahl et al.'s meta-analysis, the inclusion of fathers in parenting research is still not the norm (Cabrera et al., 2018). Two examples to further support this claim: a meta-analysis with 985 families in online parenting programs included studies published between 2012-2017, of the participants 93.4 % were mothers (Day et al., 2021) and Gardner et al.'s meta-analysis I included 15 studies published between 2001-2017 (11 were published after 2008) with data from primary caregivers of which 98% were mothers (Gardner et al., 2019).

Clearly, father inclusion is not on par with mothers. Concerning fathers' benefit from parent training, Lundahl et al.'s (2008) results that fathers benefit less in terms of improved parenting behaviors is corroborated by a meta-analysis of the Triple-P – Positive Parenting Program which showed that fathers' improvement after the program was significantly lower than mothers' (though approximately only 21% of participants in the intervention groups were fathers), leading to the conclusion that mothers and

fathers should not be assumed to benefit equally from parenting programs (Fletcher et al., 2011).

Taking a closer look at the results in the present trial, the effect on the child's disruptive behavior was lower for ratings by fathers than for mothers (see table 6).

Table 6. Effect sizes (Cohen's *d*) on the ECBI-IS by parent gender.

| | gComet | | iComet | |
|---|---|---|---|---|
| | 3M FU | 12M FU | 3M FU | 12M FU |
| Mothers | 0.52 | 0.75 | 0.49 | 0.46 |
| Fathers | 0.56 | 0.46 | 0.28 | 0.29 |

*Note*: ECBI-IS, Eyberg Child Behavior Inventory-Intensity Scale; 3M FU, 3-month follow-up; 12M FU, 12-month follow-up.

The phenomenon that mothers and fathers tend to differ in their ratings of their child's disruptive behavior is interesting and sparks several avenues of further investigation. This difference might be a reflection upon the situational specificity of disruptive behavior that emphasizes the relational and mutual interaction between child and parent (Achenbach et al., 1987; Santos et al., 2020). Or perhaps there are other aspects that influence the parent's rating of their child's behavior, such as parental depression, leading to a difference in ratings. In our data, mothers rated their child's disruptive behavior problems as more severe at baseline than fathers, though this was not statistically significant (ECBI-IS 138.8 vs. 134.2, $p$ = 0.135). Looking closer at depressive symptoms in mothers and fathers, there was a statistically significant difference in PHQ-9 ratings at baseline (mothers: 5.9; fathers: 4.7, $p$= .024). However, as the average was so low for both mothers and fathers (a PHQ-9 score of 5-9 indicate mild depression with scores under 5 indicating none or minimal depressive symptoms [Titov et al., 2011]) it is unlikely that the difference in scores between mothers and fathers are clinically meaningful.

An examination of differential effects between fathers' and mothers' ratings on all outcome measures revealed that mothers improved relatively more on measures of parenting behavior as measured by PARYC, see figure 9. Mothers show more development in their parenting than fathers. This is especially true regarding setting limits (measured by PARYC-SL). Mothers also perceive greater changes in their child's behavior, but there are larger baseline differences between mothers and fathers, which partly explains the greater effect for mothers. One possible explanation for the differences in parenting development could be that mothers appear to use the program more, according to estimates at 12-month follow-up where parents answered how much they continued to use parenting strategies taught in Comet (illustrated in Figure 9).

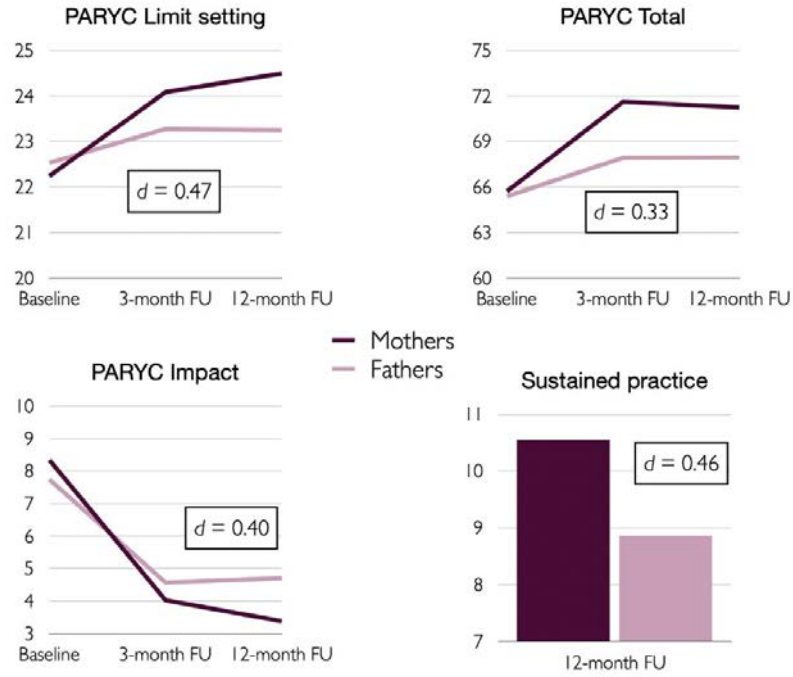


*Figure 9. Graphs over the differential effects between fathers' and mothers' ratings of parenting behavior. PARYC = Parenting Young Children.*

In sum, our results indicate that father's gain less than mothers from Comet, which aligns with Lundahl et al.'s meta-analysis (2008) as well as the meta-analysis of the Triple-P (Fletcher et al., 2011). The within-group effect sizes of our study that combine mother and father ratings of the child's behavior, are lower than anticipated, possibly due to the large proportion of fathers in the multilevel model analysis, influencing a downward shift in the results.

Results from studies involving mostly mothers might not generalize to all parents and including only mothers does not reflect reality very well. Even though fathers may experience less improvement than participating mothers in parent training, it is still important to involve fathers in clinical settings. We can assume that, for the individual child, it is better to have a father who participates and to some extent evolves in his parenthood, compared to a father who is not involved at all.

## 3.6 Ethical considerations

There are several ethical aspects to consider in the studies included in this thesis such as conducting research in clinical settings, random allocation of treatment and participants' safety and privacy. The studies have obtained ethical approvals from the regional ethical review board and the ethical authority.

In clinical research both patients, the intended research participants, as well as the clinical staff must be taken into regard. The skewed distribution of power between caregiver and patient underscores the importance of exercising special care when seeking consent for research participation. Emphasizing the voluntary nature of participation becomes crucial in this context, and it is essential to reassure the patient that their decision to dissent from participation will not impact the quality of their care. All clinicians involved in the research project were informed of this and expected to act accordingly. Patients, in this case the parents, were given written and oral information about the research project and provided written consent to participate. Staff was involved in the research project through recruiting participants and giving treatments. The additional administration by collecting consent, keeping in mind inclusion and exclusion criteria during recruitment, filling out logbooks etcetera placed an extra burden on the clinicians. Careful consideration was taken to minimize the burden on the clinicians and efforts made for continuous communication between researchers and clinicians as well as having the researchers take responsibility of data collection and thus minimize any additional work not normally caried out in routine care. The research project was anchored with the heads of the clinics and training in the treatments offered to all participating clinicians.

The research project aimed to study if iComet were noninferior to gComet. It was necessary to randomly allocate treatment thereby leading to two potential risks: one, potentially giving a less effective treatment (iComet) to half of the participants as well as two, disregarding a treatment preference when such existed. The risk of substantially reduced effectiveness was judged low due to earlier evaluations of iComet (Enebrink et al., 2012; Högström et al., 2015) as well as other internet-delivered parent training programs (Rabbitt et al., 2016; Sourander et al., 2016). Disregarding patient preferences in their choice of treatment is a true ethical dilemma that also opposes the Patient Act (SFS 2014:821) stating the patients' right to self-determination in their contact with healthcare services. Participants were informed of the randomized allocation of treatment and consented to participate in the study on those terms. Randomization was deemed a necessary methodological design to draw valid conclusions from the study.

Lastly, considering participants' safety and possible negative effects of participation. Parent training both in group and via the internet has been evaluated in previous studies and few have reported negative effects. In the present trial, participants were asked to report any adverse events during treatment and four parents did. Two parents expressed challenges in administrating the rewards system with their child. One parent had trouble with their perceived parental authority and one parent described conflicts with siblings arising from changes in parental behavior toward the child in focus in the treatment. In addition to possible negative effects of treatment, data collection and answering questionnaires also affect participants. Questionnaires take time and effort;

questions can give rise to negative emotions and be experienced as an invasion of privacy. There is a balance between researchers' wish to gain as much information as possible from the participants and what the participants can reasonably be asked for. To balance these two needs particular care was taken when choosing the questionnaires to lessen participant burden of answering many items and when possible, using well-established measurements. Questionnaires were completed via the internet and to ensure information security double authentication was required from the participants, all data was encrypted and stored on secure servers located at Karolinska Institutet. All reporting of the study findings has been on group level ensuring participants' anonymity.

## 3.7 Sustainability

During my doctoral education at Karolinska Institutet I have taken part in the frequent discussions about the United Nations' Sustainable Developmental Goals (SDGs) at the Department of Psychology. These discussions have added a perspective to research that was not as forthright at the start of this research project. Within the scope of this doctoral project, several goals have guided us. Foremost among these is Goal 3: Good Health and Well-being, which is emphasized in the overarching aim of this thesis to evaluate effective treatments for disruptive behavior problems. The focus of this doctoral work, promoting functional and positive parenting strategies that in turn reinforce children's prosocial behavior can in a wider perspective be seen as fundamental in reaching the SDGs, which is argued by Sanders and colleagues (2022). Scaling-up evidence-based parenting programs to reach effects on the population level can lead to positive behavior change in parents and children, as well as future generations, creating a healthier, more humane, just and ecologically sustainable world as displayed in Figure 10 (Sanders et al., 2022).


*Figure 10. The 9 of the 17 Sustainable Developmental Goals that Sanders et al. (2022) argue can be achieved with the help of evidence-based parenting programs.*

To confront the many challenges the world is facing, we need to work together to come up with and implement sustainable solutions. Teaching parents and children skills that increase collaboration is key, and to have scalable effects more families need to be reached by these interventions. Providing parent training in different formats at different levels of interventions is one out of many ways we can work towards meeting the challenges of today and tomorrow.

# 4 Discussion

The overall aim of this thesis was to evaluate primary care treatment for children with disruptive behavior problems. Parent training has strong empirical support for treating disruptive behavior (e.g., Kaminski & Claussen, 2017; Leijten et al., 2019) and there is growing support for internet-delivered parent training (e.g., Bausback & Bunge, 2021; Florean et al., 2020). Few studies of internet-delivered parent training have used an active control and to our knowledge none have been a direct comparison to face-to-face parent training in routine care. This thesis contributes to bridging this research gap and the three individual studies evaluated various aspects of parent training when delivered online in comparison with group-delivery. The main findings of the three studies are summarized and discussed under section 4.1. In the following sections, the results of the included studies are discussed in their wider context, focusing on the generalizability of the result, the effectiveness of the treatment, cost-effectiveness, and feasibility in routine care.

## 4.1 Does online parent training measure up to group parent training in real-world settings?

The synthesized results from the three studies contribute from slightly different angles to answering the thesis' title "Does online parent training measure up to group parent training in real-world settings?" The real-world setting was attempted by placing the study in routine clinical practice where participants were patients in routine primary care treated by therapists employed in their own clinic and performing the interventions as part of their routine work. All three studies can be summarized as answering "*yes and no, but mostly yes*" to the thesis' title; here follows a breakdown of the results.

**Study I** determined noninferiority of the effect on disruptive behaviors ("*yes*", online parent training measures up to group parent training), but there were some differences after treatment in terms on the effect on parenting behaviors and satisfaction of treatment as well as ADHD-symptoms ("*no*"); at 12-month follow-up there were no statistical difference in secondary outcomes and the noninferiority results of the primary outcome were sustained ("*mostly yes*"). There was a high rate of treatment completion in both treatment formats and parents were satisfied with both formats, though significantly more so in group, when parents were asked before randomization which format they would choose if given a choice the majority of parents answered internet treatment (also, "*mostly yes*").

**Study II** found that most demographic variables did not moderate treatment effect, engagement nor completion, leading to the conclusion that both treatment formats work well for most patients ("*yes*"); at 3-month follow-up, three variables moderated treatment effect favoring gComet, these variables were parents' education, coercive

parenting behavior and child comorbid emotional problems. For these participants the group treatment had larger effects on disruptive behavior ("*no*"). At 12-month follow-up no variable moderated treatment effect, engagement or completion indicating that at 12-month follow-up the outcomes were similar for most patients ("*mostly yes*").

**Study III** concluded that online parent training was less costly while leading to non-significant differences in clinical outcomes ("*yes*") though producing fewer QALYs for children ("*no*"); the difference in QALYs for children was small and for parents there was no significant difference in QALYs between treatments. Overall, the small and mostly non-significant differences between the treatments taken together with the cost-savings of online treatment are results favoring online treatment ("*mostly yes*").

In sum, online parent training seems to mostly measure up to group parent training in treating children with disruptive behavior in routine clinical practice.

## 4.2 Does iComet only work for Swedish middle-class families?

It is a common question if internet-delivered treatment only works for well-educated families (Sanders et al., 2012) and whether parent training in general is effective for low-income families (Kaehler et al., 2016). Overall, we can say that iComet had similar treatment effect as gComet, but how well do these results generalize to routine care in Sweden and in other contexts? As this was an effectiveness trial, we assume that the external validity is high and that the results are valid to other populations. Hypothetically these results would apply to other evidence-based parent training programs when delivered online.

The study sample consisted of a relatively large proportion of university educated parents in comparison to the general population in Sweden. On the one hand, this can mean a problem with external validity in that the results might not generalize to families where parents have lower levels of education. On the other hand, generalizability to parents seeking healthcare is probably high as healthcare consumption in Sweden has been seen to be higher in areas with higher socioeconomic status (Jablonska et al., 2021) as well as internationally in studies of parent training in primary care (Kjøbli & Ogden, 2012; Lavigne et al., 2008). Results from the moderation analysis in Study II found that after treatment (at the 3-month follow-up) parents with university education benefitted equally from group and internet-delivered treatment but parents without university degree benefitted less from internet than from group. This difference was however not sustained at 12-month follow-up.

It can be argued that many parents, regardless of education level, need help with parenting challenges and disruptive behavior in their children and that when treatment is offered in a non-stigmatized setting, parents will seek treatment (Kjøbli & Ogden, 2012). Perhaps the flexibility that internet-delivered treatment offers makes this format

particularly suitable to families with parents in the workforce and thereby are restricted in terms of time to partake in live treatment (Mytton et al., 2014). Earlier meta-analyses (Lundahl et al., 2006; Reyno & McGrath, 2006) found that families in economic disadvantage benefitted less from parent training. When families with low-income complete treatment however, research suggests that they are equally likely to benefit from parent training as higher income families (Kaehler et al., 2016). In a meta-analysis including the ten studies published after 2006 that examined socioeconomic status as predictor, socioeconomic status was not found to predict treatment outcome (Dedousis-Wallace et al., 2021).

In our study, a low proportion of parents (12%) reported being not born in Sweden. Possible reasons for the low proportion are the inclusion criteria (ability to speak and read Swedish) and the fact that healthcare consumption is lower in children with migrant parents (Gubi et al., 2022). Since parent migrant status was not included as a putative predictor or moderator in Study II, we do not know if it affected treatment effect or completion.

There is debate over the merits of homegrown parent training versus importing programs that have an evidence-base. Research indicate that parent training programs can achieve the same treatment effect in other countries and contexts than where they were developed (Gardner et al., 2016). In a Swedish evaluation of the *Incredible Years* (a North American parenting program) the effects of the intervention were large and the participating mothers reported high acceptability of the program leading the authors to conclude that parent training programs can be transferred to other contexts (Axberg & Broberg, 2012). Two meta-analyses have found no significant differences in treatment effect between the homegrown and imported parent training programs (Gardner et al., 2016; Leijten et al., 2016). Leading to the conclusion that it is likely that the parenting techniques from behavioral parent training have similar effects on child disruptive behaviors across cultures (Leijten et al., 2016). Most of the research on parent training comes from high-income Western countries; however, Burkey and colleagues (2018) found in their meta-analysis strong evidence that behavioral parent training was effective in treating child disruptive behavior in low- and middle-income countries suggesting that behavioral techniques have a universal effect.

There are many parenting programs that are delivered online and several meta-analyses concluding in their effectiveness (Baumel et al., 2016; Bausback & Bunge, 2021; Corralejo & Domenech Rodríguez, 2018; Florean et al., 2020; Thongseiratch et al., 2020). Kaehler and colleagues (2016) argue in their descriptive review of the origins of behavioral parent training and the common elements in different programs, that teaching these skills through technology should, on the basis of their common history, practice elements, and evidence base, generalize to other behavioral parent training programs as well. In other words, evidence from the Comet trial indicating that parents can learn

parenting techniques through the internet is likely to apply to parents learning similar techniques in other branded parenting programs.

In sum, the results in this thesis indicate that iComet is an effective treatment for Swedish middle-class families. Parents without university education had a higher treatment effect at 3-month follow-up in gComet, but at 12-month follow-up education level did not moderate treatment effects. There was no effect of parents' education level for treatment engagement or completion. This leads to the conclusion that it is not only well-educated parents that benefit from iComet. The generalizability of these results to contexts other than Swedish primary care rely on evidence that parent training as well as internet-delivered treatment has shown effectiveness in many other contexts.

## 4.3 What is the clinical impact of Comet in Primary care?

When discussing the effectiveness of Comet in our study it is important to be reminded of the study's noninferiority design. The premise of this design is that the standard treatment has an established effectiveness. The noninferiority design of the study stipulates that a between-group difference in effect between gComet and iComet is not expected and if it were to exist would be below the noninferiority margin. Interpreting the results of the study that iComet is noninferior to gComet includes the assumption that gComet is effective. Taking a closer look at the within-group effect sizes can provide information about the magnitude of change for participants in the two treatment formats. The effect sizes (for ECBI-IS) at 3-month follow-up was *d* = .50 for gComet and *d* = .38 for iComet with slight increases at the 12-month follow-up (*d* = .56 for gComet and *d* = .46 for iComet). These can be compared to the within-group effect sizes of other studies. The within-group effect for gComet in Kling et al.'s study (2010) was *d* = .80 and *d* = 1.23 for iComet in Enebrink et al. (2012). In a comparison of Brief Parent Training (BPT) to usual care in Primary Care in Norway, the within-group effects for BPT on the ECBI-IS was *d* = 0.68 (Kjøbli & Ogden, 2012). The study sample was similar to that in the present thesis in terms of the setting, referral of patients, age of children, and a large proportion of upper-middle class parents. The within-group effect sizes in our study were lower than these comparisons, possibly in part because of the higher proportion of father data. Kjøbli and Ogden (2012) and Enebrink et al. (2012) did not report proportion of data from fathers, in Kling's study 8% of participants in gComet were fathers. Looking at only mother-ratings in the present study, the within-group effect size for gComet was *d* = .52 at the 3-month follow-up and *d* = .75 at the 12-month follow-up, which is more similar to the effect reported by Kjøbli and Ogden (2012). Other possible factors influencing the lower within-group effect in the present trial are characteristics of the sample and the context of primary care.

Parenting programs have shown different effectiveness on disruptive behavior depending on the level at which they are given (i.e., universal, or targeted prevention and treatment). More severe disruptive behavior predicts larger treatment effects (Leijten et al., 2020; Leijten, Raaijmakers, et al., 2018; Menting et al., 2013), and as a result universal programs, with low prevalence of severe problems, have a smaller treatment effect for reducing disruptive behavior problems (Mingebach et al., 2018). In a meta-analysis of Leijten and colleagues (2019), the effect of parenting programs gradually increased per level of service from prevention (universal $d$ =-0.21, selective $d$ =-0.27, indicated $d$ =-0.55) to treatment ($d$ =-0.69). Organizationally, primary care is placed between universal services and specialized care, which is reflected in the spectrum of severity level of the included participants in the study. The intension of not specifying a clinical cut-off for disruptive behavior when including participants was precisely for this reason, to allow for the heterogeneity in the patient population and the range of symptom severity found in primary care patients. As the study sample consist of participants with subclinical as well as clinical levels of behavior problems, per definition, that would place the intervention as spanning over indicated prevention and treatment.

## 4.4 Group parent training is more expensive, is it worth it though?

Many of the results in the study favor gComet over iComet. The differences might be small and, in most cases, non-significant; but taken together gComet appears to be slightly better. Should we increase efforts to increase availability of group parent training?

The group format has its advantages as well as disadvantages. For parents, meeting other parents in similar situations and supporting each other is an important perspective (Mytton et al., 2014). On the other hand, parents also report qualms about the group setting such as fear of being labelled a "bad parent", talking in front of others, and problems with the timing and frequency of group-meetings (Mytton et al., 2014). Many parents prefer individual parent training over group parent training, particularly when the groups are large (Wymbs et al., 2016). All the barriers reported by parents to engage in group-based parent training argue for other treatment formats. In a meta-analysis of the moderators of parent training, economically disadvantaged families benefited significantly more from individual treatment format than group (Lundahl et al., 2006).

The cost of group treatment was significantly higher than the cost of iComet, meaning that within the same budget more patients can be treated by iComet than by gComet. Administrating group treatment can also be difficult in terms of sufficient patient flow to recruit groups, space to have meetings and availability of two therapists to hold the groups. These practical barriers make it difficult for smaller health care units to implement parent training in group format.

In conclusion, policymakers must weigh the pros and cons and make decisions of what treatments to implement in routine care. In a world with adequate resources in health care, the ideal would be to have both treatment options available to parents. Patient preferences and clinical assessment could then guide treatment selection. However, the reality of healthcare includes restrains on resources. For treatment in primary care, a level of care aimed at the large majority of patients, implementing a treatment option that is less costly and more flexible in terms of resource use for both parents and the clinic seems to be the better choice given the comparable effectiveness for the majority of patients. Therefore, if there is only room for one treatment format, iComet is the most suitable choice.

## 4.5 Is online parent training feasible in routine care?

The feasibility of online parent training was not specifically studied in this doctoral project, but some of the results can contribute to address this question. The high proportion of parents preferring the online format in Study I shows that this is an acceptable treatment format for patients in routine settings. The barriers to engage in treatment that parents perceive in terms of lack of time and resources such as childcare during treatment and timing of treatment sessions competing with other commitments (Mytton et al., 2014) speak in favor of more flexible delivery-formats rather than face-to-face treatment at the clinic. As internet-delivered treatment can be accessed at any time from any screen with internet-connection parents have a larger flexibility in working with a treatment at a time and place convenient to them.

The comparable proportion of treatment completers between iComet and gComet also indicate similar feasibility of the treatments. In our study, the clinicians did not have much or any prior experience in working with digital treatments meaning that they learned how to use the treatment platform and treat patients with little training (1/2-day workshop) and alongside their usual workload. Technical developments, experiences from the COVID-19 pandemic and increased demands of access to primary care has increased digital tools in routine clinical care. Patients and clinicians are likely more used to digital tools in healthcare now than when the study recruitment was conducted in pre-pandemic 2018-2019.

The reimbursement model for primary care in Region Stockholm has also changed since this study was conducted. It is now possible for the clinic to be reimbursed for treating patients digitally. This also increases feasibility of implementing online treatment into routine services.

Including therapist-support to online treatment can limit capacity of reach and availability (Day & Sanders, 2018). Being supported by a clinician through treatment was something we assumed to be important, and, in the study, parents had meetings at the clinic. In the continued implementation of iComet, therapist contact is mainly through

asynchronous messages, which is a common method of internet-delivered treatment (Andersson & Titov, 2014). It is possible that the live meetings during treatment (three sessions were offered and the average number of meetings was 2.3 per family) affected treatment effect by introducing different content or through other unknown mechanisms. We included the meetings as we assumed that patients need therapist support to be motivated to carry through an online delivered treatment. Likely, the therapist support added to the high completion rate in the study. Since the reimbursement model did not fund treatment online, we assumed that the clinical burden on the therapists would be too high for them to engage in activities of which there was no monetary incentives for the clinic, i.e., it would have been difficult for the clinician to give encouragement online since there would be no incentive to do so.

In conclusion, while the feasibility of online parent training was not a specific focus of this doctoral project, certain results contribute to the examination of this matter. Patient preferences suggests that it is an acceptable format in routine settings and the flexibility offered by internet-delivered treatment offsets identified barriers to engaging in face-to-face treatment. Despite clinicians' limited prior experience with digital treatments, the growing acceptance of digital tools in healthcare, accelerated by experiences during the COVID-19 pandemic, and changes in the reimbursement model for primary care enhance the feasibility of integrating online treatment into routine services. This shift in the healthcare landscape, with increased comfort and support for digital interventions, underscores the potential for broader implementation of online parent training in routine care.

# 5 Conclusions

From the studies included in this thesis the following can be concluded:

- Online-delivered parent training was noninferior to group-delivered parent training in reducing disruptive behavior in children. The effects were sustained at 12-month follow-up.
- Treatment effects were similar across most demographic and clinical variables, with a few expeptions favoring group treatment.
- The online-delivered treatment led to cost-savings though producing marginally fewer QALYs for children in comparison to group. There were no significant differences in other health oucomes including QALYs for parents, proportion of recovered and reliably improved children after treatment.
- The results of the three studies indicate that online-delivered parent training can be an alternative to group parent training in routine primary care.

# 6 Points of perspective

## 6.1 Take-home message for clinicians

Parent training is the recommended treatment in guidelines for disruptive behavior in children. Combined, the three studies in this thesis conclude that internet-delivered parent training can have comparable effects to group parent training for most patients in primary care. The moderation analysis in Study II shows that both group and online parent training are comparable across the scope of severity of disruptive behavior with and without comorbid ADHD. What perhaps does indicate group parent training is comorbid emotional problems and coercive family dynamics. Emotional problems can easily be assessed with the Strength and Difficulties Questionnaire (SDQ), which is common practice in routine primary care. Assessing coercive family dynamics is more challenging as there is no commonly employed free-to-use questionnaire in Swedish. The assessment can likely be made through clinical interview where the clinician should listen for indication that problematic behavior and interaction is more on the parent level than on the child, e.g., inter-parental conflict, unreasonably high demands on the child, or severe difficulties in parent's self-regulation of anger. Though these aspects were not specifically evaluated in the study, these are aspects that clinician working with iComet in clinical settings have reported as challenging.

An important take-home from this study is asking patients about their preferred treatment format. We have shown that those randomized to the treatment format that they would have chosen complete treatment to a higher degree. If we want to retain patients in treatment, their preferences should be considered (which is also in accordance with Swedish laws, The Patient Act). Both treatment formats had high completion rates, suggesting they are feasible as treatment for our patients.

## 6.2 Future research

### 6.2.1 Treatment mechanisms

The interventions in our study are based on social learning theory and the Comet program was designed to teach parents how their behavior affects their child. The treatment effect, i.e., reduction in child disruptive behavior, is hypothesized to be caused by parents' reinforcement of their child's prosocial behavior. How much parents engage in the treatment and use the parenting techniques are hypothesized to correlate with treatment effect. Meanwhile, child disruptive behavior has many causes and maintaining factors, of which parenting behavior is only one. An interesting question requiring further research is whether group-parent training and internet parent training leads to treatment effect through the same pathways. Likely, main effect comes from the behavior change in the parents through their practicing new techniques. But

possibly completing a parenting program also entails other changes than learning the treatment content. Stigma, parental self-efficacy, worry about being a bad parent and too high demands on the child are other factors that affect the well-being and behavior of the parent and consequently the well-being and behavior of the child. The treatment formats might affect these other factors to different degrees. Performing mediation analysis to uncover mechanisms of effects would be interesting and could inform treatment development to enhance effects.

### 6.2.2 Measurements

In addition to understanding treatment mechanisms, future research needs to focus on assessments that can be both informative as well as brief for both patients and clinicians. Patient assessments are necessary both for treatment planning as well as evaluation of outcome. There is a lack of validated measurements that are free-to-use and easily administered to patients. There is great potential in digital aids such as mobile applications or online platforms that can ease the burden of administration and completion of assessments. Digitally aided assessments can improve accessibility, ease of use, and the overall engagement of both patients and clinicians. Development of infrastructure that meet legal requirements and that can be integrated into the electronic medical records should be a priority.

### 6.2.3 Father inclusion and improving treatment

Parent training research is predominantly based on mothers and results from this study corroborates with research suggesting that fathers gain less from parent training (Fletcher et al., 2011; Lundahl et al., 2008). Future directions should focus on increasing father engagement in treatment, while also delving into the factors contributing to the observation that fathers may demonstrate lesser improvement.

To engage more fathers in treatment and research, information and advertisement can be framed to include fathers, e.g., contain illustrations of fathers in advertisement or information leaflets; which has been seen to raise the proportion of fathers (Dahlberg et al., 2022). A possible factor influencing results can be that measurements of parenting behavior contain behaviors more often carried out by mothers and efforts should be made into measuring parental behaviors so that they include parenting behaviors commonly carried out by mothers as well as fathers (Cabrera et al., 2018). Including more objective measurements is important to balance the differing ratings of mothers and fathers concerning both their own and their child's behavior. Lastly, more research is needed to evaluate and develop parenting programs that strengthen the effects for fathers as well as mothers.

### 6.2.4 Implementation

Despite the scientific evidence advocating for the adoption of Internet-delivered treatments in primary care and guidelines recommending its implementation, the majority of primary care organizations in Sweden continue to provide treatments only in traditional delivery format (Brantnell e t al., 2020). More research is needed to understand facilitators and barriers for implementing internet-delivered treatments in routine care. Our research has shown that parents are amenable to internet-delivered parent training, the next step is to investigate the factors that influence primary care organizations and individual clinicians in adopting internet-delivered treatment. Investigating factors such as organizational culture, resource availability, and staff attitudes can provide insights into the challenges and opportunities associated with the implementation process.

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