



Online programs as tools to improve parenting: A meta-analytic review[☆]



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ABSTRACT

Background: A number of parenting programs, aimed at improving parenting competencies, have recently been adapted or designed with the use of online technologies. Although web-based services have been claimed to hold promise for parent support, a meta-analytic review of online parenting interventions is lacking.

Method: A systematic review was undertaken of studies ($n = 19$), published between 2000 and 2010, that describe parenting programs of which the primary components were delivered online. Seven programs were adaptations of traditional, mostly evidence-based, parenting interventions, using the unique opportunities of internet technology. Twelve studies (with in total 54 outcomes, N_{tot} parents = 1615 and N_{tot} children = 740) were included in a meta-analysis.

Results: The meta-analysis showed a statistically significant medium effect across parents outcomes ($ES = 0.67$; $se = 0.25$) and child outcomes ($ES = 0.42$; $se = 0.15$).

Conclusions: The results of this review show that web-based parenting programs with new technologies offer opportunities for sharing social support, consulting professionals and training parental competencies. The meta-analytic results show that guided and self-guided online interventions can make a significant positive contribution for parents and children. The relation with other meta-analyses in the domains of parent education and web-based interventions is discussed.

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1. Introduction

Several authors have suggested that the Internet has great potential for delivering parenting interventions in an accessible way (Daneback & Plantin, 2008; Funderburk, Ware, Altshuler, & Chaffin, 2009; Scharer, 2005). The use of the Internet has increased rapidly since it became widely available in 1995. Parenting professionals, involving multiple disciplines, such as pediatrics, counseling and nursing, have begun to exploit the opportunities afforded by online technology and the Internet now offers a rapidly increasing number of resources for parents. The potential of online resources for parents is widely acknowledged (e.g., Long, 2004; Rothbaum, Martland, & Beswick Janssen, 2008). A recent review shows that the first studies on this subject were published in 1998 and the evaluated internet services since then reflected an emphasis on parents of preschool children, mostly concerning health topics (Nieuwboer, Fukkink, & Hermanns, 2013).

The Internet offers unique opportunities to design empowerment-oriented resources for learning, modeling and support (Amichai-Hamburger, 2008). Whereas traditional parenting intervention programs are often targeted at specific minorities with certain risk factors (e.g., Shonkoff & Meisels, 2000), the Internet is the information and

support resource of choice for large groups of parents. Visitor numbers to parenting websites run as high as hundreds of thousands per month (Brent, 2009; O'Connor & Madge, 2004; Sarkadi & Bremberg, 2005). The wish to upscale parenting programs and the phenomenon of mass media parenting interventions are not new (Laurendeau, Gagnon, Desjardins, Perreault, & Kishchuk, 1991; Sanders & Montgomery, 2000; Schoenwald & Hoagwood, 2001; Self-Brown & Whitaker, 2008; Turner & Sanders, 2006). However, in comparison to traditional media like hardcopy newsletters and television broadcasts, the Internet enables new, highly interactive opportunities for communication between parents and professionals (Amichai-Hamburger, 2008; D'Alessandro & Dosa, 2001). Typically, information pages, e-mail consultations and digital training modules represent types of online communication, in which professionals may disseminate current knowledge and offer tailored advice, whereas peer support is provided through group forums and discussion boards.

Web-based parenting programs may embrace a public health approach with the aim to support everyday parenting and inform and assist with frequently occurring parenting questions, stimulating a responsive and positive attitude towards children (e.g., Eshel, Daelmans, de Mello, & Martines, 2006; Sanders, Bor, & Morawska, 2007; Sanders & Kirby, 2012). However, parents may also seek professional help in difficult circumstances, like social isolation, divorce, illness, or child disabilities (Anastopoulos, Guevremont, Shelton, & DuPaul, 1992; Gurdin, Huber, & Cochran, 2005; Schwartz et al., 2003). Furthermore, parenting can be a challenging task in certain stages of child development,

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e.g., transition to parenthood, infancy, adolescence (Belsky & Rovine, 1984; Glascoe & Dworkin, 1995).

The current fast-speed, broad-band Internet offers new interactive, multi-media experiences, which are currently used in different resources to increase parental competencies focusing on knowledge, attitudinal or behavioral aspects of parenting. Available programs include instructional and modeling animations and video to disseminate knowledge (see Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009). One of the attractive features of the Internet is the opportunity to receive and give social support anonymously. Discussion boards and group forums are web-based technologies which enable such interactions between peers, contributing to emotional well-being, confidence, and self-efficacy (e.g., Bellafiore, Colón, & Rosenberg, 2004; Braithwaite, Waldron, & Finn, 1999; McKenna, 2008). Finally, web-based training can be used as a technology that can structure step-by-step learning, tailored to individual progress (LaMendola & Krysik, 2008). Internet interventions can be designed to be self-guided or they may be guided, for instance by a start-off face-to-face session or email coaching. However, one of the motivations for internet interventions is to help a large number of individuals with a low amount of professional involvement (Ritterband et al., 2009). To summarize, the Internet offers different possibilities for parents with different needs. Large numbers of parents use the Internet to find information, support and concrete advice, supplementing and enhancing traditional forms of parenting services.

Meta-analytic reviews have reported positive effects of traditional (i.e., not web-based) parental support at parent and child level (see, for example, Fukkink, 2008; Kaminski, Valle, Filene, & Boyle, 2008; Lundahl, Risser, & Lovejoy, 2006; MacLeod & Nelson, 2000). Less is known about the effects of online programs for parents and a systematic review is currently lacking. In fact, several authors have described online parenting support as a service “in its infancy” and little is known of the effects of technology-driven services for parents and their families (D'Alessandro, D'Alessandro, & Colbert, 2000; Madge & O'Connor, 2006; Mallen, Vogel, Rochlen, & Day, 2005; Ritterband & Palermo, 2009; Self-Brown & Whitaker, 2008). Experimental evaluations of online resources for parents are relatively scarce (Plantin & Daneback, 2009; Weiss et al., 2004; Zubrick et al., 2005). However, interesting studies have recently been published which evaluated the effects of online resources on parenting competencies, including knowledge, attitudinal and behavioral aspects. In this line of study, also some traditional evidence-based programs (e.g., the Play and Learning Strategies Program, PALS, and the Positive Parenting Program, Triple P), were adapted for online dissemination, and have been evaluated. Also transfer effects of web-based parental support on the development of children have recently been investigated. In this review study, we aim to synthesize the experimental outcomes in the relatively new domain of web-based parenting resources for parental competencies and children's development.

2. Method

2.1. Selection of studies

To find empirical studies on web-based parenting services we conducted a search in the databases of the Social Science Citation Index, PsycINFO, and PubMed. The extensive search strategy included blocks of various key words related to parenthood (parent*, mother*, father*, child*, famil* or pediater*), parental support (counsel*, coach*, support*, empower*, advice or train*), and the specific online context (internet*, online, mail, chat, computer*, website*).

There were three inclusion criteria for this review. First, the primary components of the studied resource were delivered online; second, the primary target group of these resources exists of parents who had children aged between –9 months (pregnancy) and 21 years (adulthood). Finally, studied resources were aimed at improving parenting competencies. One original research report, which was pre-published online

in 2009, was included. Editorials, commentaries, reviews, and conference papers were excluded.

After screening for duplicates and screening the studies with our eligibility criteria, 19 research articles published between 1998 and 2010 comprised the final set of studies. Seven studies described the development or application of online programs. Twelve out of 19 studies were experimental and were included in the meta-analysis.

2.2. Coding

We developed a coding scheme to describe resource and user characteristics of the web-based resources and to assess the methodological characteristics of their evaluations. Two independent coders (i.e., the first and the second author) coded each study.

With respect to resource features we coded types of online communication (i.e., information pages, e-mail consultation, group forum); facilitation of professional or peer support. Further, parent and child demographics and risk factors were coded on the basis of early intervention theory (see Shonkoff & Meisels, 2000), i.e., on the parent level: pregnancy, first time parenthood, single parenthood, low income; on the child level: physical handicaps, mental health problems, illness. Finally, we coded the following methodological aspects of the research design: type of research (experimental, descriptive); research period; sample size; allocation and randomization; use of incentives; types of tests and experimental results.

Inter-coder reliability was evaluated by determining Cohen's kappa (κ) in the case of nominal variables and by the intra-class correlation (ICC, two-way random, absolute agreement) for continuous variables, using .70 as the cut-off score for inclusion. Reliability proved satisfactory to excellent for the majority of the coded variables, with κ ranging from .77 to 1, and ICC ranging from .81 to 1. In the case of divergent codes, final codes were established by discussion.

2.3. Analysis

Twelve of the studies in this review were included in the meta-analysis. Of these, two studies had a one-group pretest–posttest design, while ten studies were randomized controlled trials. Most of the studies identified in the search included multiple outcomes reflecting several aspects of parenting. This procedure yielded a database containing 35 effect sizes at the parent level, reported in 11 studies ($N_{tot} = 1615$). At the child level, the database was smaller, with 19 effect sizes, reported in 4 studies ($N_{tot} = 740$).

Effect sizes were derived directly from reported means and standard deviations. Hedges' g , which corrects for bias resulting from small samples, was used as the effect size estimate (Hedges & Olkin, 1985). For inherently negative variables, effect sizes were recoded by changing the sign. The large scale approximation formula of Becker (1988; see also Morris, 2000) has been used to estimate the variance for effect sizes from within-designs. Correlation values for the pretest and posttest were not reported and conservative estimates of .5 were therefore used to estimate the variance of the effect sizes of these designs.

Effect sizes were subsequently integrated into an overall effect size according to a random effects model, using a multilevel approach. This model acknowledges the hierarchical nature of the data, with effect sizes (i.e., the lowest level) nested under treatments (i.e., the highest level). The multi-level approach also allows the explanation of heterogeneous outcomes through moderator analysis (e.g., analyzing an association between effect size and type of design or type of outcome measure). The specification and testing of models were conducted with MLwiN, using restricted maximum-likelihood estimation (Bryk & Raudenbusch, 2002; Hox, 2002).

Using a medium effect size of 0.50 from the meta-analysis as a cut-off score, studies with positive outcomes are discussed in a brief narrative review. Following the descriptive framework of Proudfoot et al.

(2011), we focus on type of support, interactivity and guidance, and theory of change as important internet intervention characteristics.

3. Results

3.1. Characteristics of online parenting interventions

All studied online parenting interventions were designed and guided by parenting professionals. Information pages were a common feature in all resources. Table 1 provides an overview of these findings and an identification code (ID) for each study, to which we refer in this section. In six programs (31.6%), email consultation was offered. One third of the programs offered peer support in the form of group chat or group forum.

Training modules, consisting of multiple sessions or lessons, were found in sixteen of the programs as the most prominent component. The evaluation studies showed creative usage of web-based technologies, such as an animated character on a hand-held device that guides mothers through a problem solving strategy (1), videos, pictures and animations demonstrating positive parenting behaviors (2; 4), multimedia training modules (7; 10), and interactive homework sessions (16; 18).

Four online parenting interventions specified parental characteristics to identify a certain target group. Three programs served pregnant/first time parents (ID Study = 8, 9, 10). One study explicitly focused on parents with low income and infants at risk of poor social-emotional development (2). Eight programs specified child characteristics by describing (mental) health issues (7; 11) or behavior problems (17), including children with cancer (1), ADHD (5) and disabilities (6; 18; 19). One intervention addressed drug abuse in young adolescent girls (16). Seven resources were online adaptations of traditional parenting programs.

These online programs show unique possibilities of technology-assisted intervention, like automated prompts to use parenting skills (ID Study = 1); logging or recording of home experiences (1; 2; 8); instruction by animated characters (1); remote coaching (1; 2; 8; 15); progress monitoring (2; 3; 8); video vignettes (2; 6; 8; 15; 17); online interaction with peers (2; 8; 17) and hyperlinks (6; 12). Typically, all interventions could be accessed from home.

This overview shows examples of online parenting programs, which have the potential to be directed at a large population, offering peer and professional support and making use of new technologies. They may be designed for specific target groups or topics, or for general parenting support and public health. Online interventions are particularly suitable for providing information and step-by-step training of skills. Finally,

Table 1
Characteristics of online interventions for parents.

ID	First author	Name of intervention ^a	Professional and peer support					Parent and child characteristics		
			Prof.	Info	Training	Email	Gr. forum	Char. parent	Age child	Topic
1	Askins et al. (2009)	Problem-solving skills training ^a	Pr	+	8 sessions	-	-	-	All	Cancer
2	Baggett et al. (2010)	Infant net ^a	Pr + P	+	10 sessions	-	+	Low income	<12	-
3	Bert, Farris, and Borkowski (2008)	Adventures in Parenting ^a	Pr	+	12 sessions	-	-	-	<12	-
4	Buzhardt and Heitzman-Powell (2006)	Training modules	Pr	+	2 modules	-	-	-	All	-
5	Carpenter, Frankel, Marina, Duan, and Smalley (2004)	Parent-Adolescent Conflict Training PACT	Pr	+	2 modules	-	-	-	>12	ADHD
6	Cook, Rule, and Mariger (2003)	Strategies for Preschool Interv. in Everyday Settings ^a	Pr	+	lessons	-	-	-	<12	Disabilities
7	Deitz, Cook, Billings, and Hendrickson (2009)	Youth Mental Health, A Parent's Guide	Pr	+	4 modules	-	-	-	Oth	Mental health
8	Feil et al. (2008)	Infant Net (Playing and Learning Strategies, PALS) ^a	Pr + P	+	10 sessions	-	+	Pregnant, First time, Single, Low income	<12	-
9	Hudson, Campbell-Grossman, Fleck, Elek, and Shipman (2003)	New Fathers Network	Pr + P	+	-	+	+	First time	<12	-
10	Kuo, Chen, Lin, Lee, and Hsu (2009)	Internet newborn-care education program	Pr + P	+	six weeks access	+	+	Pregnant, First time	Oth	-
11	Mackert, Kahlor, Tyler, and Gustafson (2009)	Child Care Center Web Site	Pr	+	-	-	-	-	All	Obesity
12	Mertensmeyer and Fine (2000)	Parentlink ^a	Pr	+	-	+	-	-	All	-
13	Na and Chia (2008)	Kidz Grow Online	Pr	+	3 months access	-	-	-	<12	-
14	Salonen, Kaunonen, Astedt-Kurki, Jarvenpaa, and Tarkka (2008)	Vauvankaa	Pr + P	+	-	+	+	-	<12	-
15	Sanders, Calam, Durand, Liversidge, and Carmont (2008)	Triple P ^a	Pr	+	10 weeks access	+	-	-	<12	-
16	Schinke, Fang, and Cole (2009)	Daughter-mother substance abuse program	Pr	+	9 sessions	-	-	-	Oth	-
17	Taylor et al. (2008)	Incredible Years Adapted ^a	Pr + P	+	10 sessions	+	+	-	<12	Behavior problems
18	Wade, Carey, and Wolfe (2006)	Family Problem-solving Group (FPS)	Pr	+	14 sessions	-	-	-	Oth	Brain Injury
19	Wade, Oberjohn, Burkhardt, and Greenberg (2009)	I-InTERACT	Pr	+	10–15 sessions	-	-	-	<12	Brain Injury
Total		n.a.	Pr 68.4% P 0% Pr + P 31.6%	100%	n.a.	31.6%	31.6%	n.a.	All = 21% <12 = 52.6% >12 = 5.3% Oth = 21%	n.a.

Note. Prof. Pr/P = professional/peer; Info = information pages; Email = email consultation; Gr. forum = group forum/discussion board.

An “+” indicates that the criterion has been met.

^a Adaptation of a traditional parenting program.

all reports expressed optimism about the feasibility, acceptance, and effectiveness of the online service, often based on positive satisfaction reports.

3.2. Characteristics of the research design

Table 2 provides an overview of the research designs. Sample size varied from 19 to 482 ($M = 138$; $sd = 153$). Five studies (3; 4; 7; 10; 13) evaluated effects in the cognitive domain, focusing on an increase of knowledge related to parenting. Seven studies (1; 2; 7; 9; 10; 13; 15) measured different attitude outcomes, like postpartum depression (2), father's self-efficacy and parenting satisfaction (9), maternal confidence (10), perceived quality of time spent with children (13), parental anger and quality of the parent–child relationship (15), mostly measured with standardized and validated tests. Five studies evaluated the enhancement of parenting skills by external observation or by self-reported parental behavior, like mother–infant interactions (2); parent–adolescent communication (7); dysfunctional discipline styles in parents (15); mother–daughter communication on drugs (16) and parenting skills (19).

Of the 35 parent measures, 42.9% assessed attitudinal outcomes (e.g., self-confidence as a parent, quality of the relationship with child, and depression) while 34.3% measured behavior (e.g., problem solving and communication related to parenting, positive parenting) and 22.9% evaluated knowledge outcomes (e.g., knowledge of newborn care, child development or legal issues). Of the 19 child measures, 84.2% focused on behavior (e.g., use of alcohol, adherence to family rules, social competence) and 15.8% measured attitudinal outcomes (e.g., the intention to stop taking drugs or body esteem).

In two studies aspects of the parent–child interaction were observed and coded, in order to acquire reliable outcomes in respect to social-emotional development (2) and parenting skills (19), whereas in the other studies self-report measures were used. In all experimental studies but one (3) the program for evaluation was developed by or in close cooperation with the researchers. In two studies attrition rates were strikingly uneven, showing a third/two third difference in

trial and control group (13, 16). Dropout rate was mostly predictable and reasonable, although there are two exceptions with a high failure to follow intent to treat of 49% (13) and 61.6% (15).

3.3. Experimental effects

3.3.1. Parent outcomes

The aggregated effect size (i.e., fixed effect in Table 3) for parent outcomes is 0.67 ($se = 0.25$), corresponding to a statistically significant, medium effect. The outcomes are heterogeneous (see random effect in Table 3). After statistically correcting for the design of some studies without a control group the overall effect size was smaller, i.e. 0.38 ($se = 0.40$), a small-to-medium effect. An exploratory analysis did not show significant differences between cognitive, attitudinal and behavioral outcome measures ($ES = 0.71, 0.65$ and 0.67 , respectively). The effect sizes were also not related to the other coded methodological characteristics or to sample size.

3.3.2. Child outcomes

The aggregated and statistically significant (fixed) effect at child level is 0.42 ($se = 0.15$), close to a medium effect. The large majority of child outcomes were behavioral measures ($n = 16$), whereas only three measures pertained to attitudinal outcomes ($n = 3$). The variation in outcomes from different studies was not statistically significant (see Table 3).

3.4. Qualitative analysis of effective interventions

With 75% of the studies conducted from 2008 onwards, parallel to developments in technology, the number of internet intervention research studies in this domain is rapidly growing. All interventions in this sample were developed by the researchers in order to assess the feasibility and effectiveness of a web-based parenting program.

Eight programs with relatively positive outcomes ($ES > 0.50$) can be characterized as psycho-educational services, aiming to handle or prevent social–emotional problems in young children (Study ID = 2),

Table 2
Characteristics of the research design.

ID	Study	Mechanism of change	Theory of change	Design	Control condition	Parent outcomes	Child outcomes	N
1	Askins et al. (2009)	individual problem-solving sessions and interaction with therapist	cognitive behavioral theory	RCT	traditional training	attitude		123
2	Baggett et al. (2010 2009)	evidence based intervention, with elements of instruction, coaching, reflection, exercise	early intervention theory, promoting sensitive and responsive parenting behavior	RCT	resources program	behavior attitude	behavior	38
3	Bert, Farris, and Borkowski (2008)	mental model of parenting	parent training theory	RCT	traditional program	knowledge (3x)		106
7	Deitz, Cook, Bilings, and Hendrickson (2009)	multimedia rich, attractive and interactive	social cognitive theory	RCT	waiting list	knowledge behavior (4x) attitude (2x)		96
9	Hudson, Campbell-Grossman, Fleck, Elek, and Shipman (2003)	social (peer) support	transition theory and social support theory	RCT	no intervention	attitude (2x)		34
10	Kuo, Chen, Lin, Lee, and Hsu (2009)	provision of learner-centered education and social support	self-efficacy theory	RCT	no intervention	knowledge attitude		118
13	Na and Chia (2008)	interaction between parents and established information about child development	advantages of online learning, developmental knowledge base	RCT	waiting list	attitude (4x) knowledge (3x)		418
15	Sanders, Calam, Durand, Liversidge, and Carmont (2008)	structured self-help and helpline	advantages of mass media	RCT	traditional program	behavior (2x) attitude (4x)	behavior	174
16	Schinke, Fang, and Cole (2009)	interactive activities in mother–daughter dyads	family interaction theory	RCT	no intervention	behavior (3x)	behavior (10x) attitude (3x)	482
18	Wade, Carey, and Wolfe (2006)	family involved self-guided problem-solving	cognitive-behavioral theory	RCT	resources program		behavior (4x)	40
19	Wade, Oberjohn, Burkhardt, and Greenberg (2009)	self-guided web sessions, including modeling content, exercises and coaching	parent–child interaction theory	PP	n.a.	behavior (2x)		9

Note. Design = PP: pretest–posttest within group; RCT = randomized controlled trial; x = number of outcome measures > 1; N = total sum of participants.

*INCEP = Internet newborn-care education programme.

** Triple P = Positive Parenting Programme.

*** I-INTERACT = Internet-based Interacting Together Everyday, Recovery After Childhood TBI.

Table 3
Experimental effects of web-based resources for parents and children.

	Parents	Children
Fixed effect	0.67 (0.25)*	0.42 (0.15)*
ES (se)		
Random effect	0.69 (0.29)*	0.09 (0.07)

Note. An asterisk indicates statistically significant effects ($p < .05$).

mental health problems in youth (7), or adolescent substance use (16). Two programs helped new fathers and mothers with the transition in becoming a parent and taking care of a newborn baby (9; 10). One program focused on helping a specific group of parents to cope with children with traumatic brain injury (18; 19). Finally, one study evaluated an online training for foster parents (4). Thus, topics and target populations of the web-based programs for parents were diverse. The three programs with a broad public health orientation for everyday parenting (3; 13; 15) resulted only in small effects. Based on this sample, programs which helped parents in addressing a specific issue seemed to be more successful than general programs for common parenting support.

Most web-based programs have been developed on the basis of social learning theory (Bandura, 1986) and positive outcomes were expected, regarding either parental self-efficacy and skills through modeling (e.g., using animated characters or video demonstrations) or child behavior and attitude through responsive and positive family interaction (e.g., using interactive assignments or exercises). The study by Baggett et al. (2010) aimed to evaluate an online adaptation of an evidence-based intervention, Play and Learning Strategies program (PALS), and showed medium outcomes. Parent-Child Interaction Therapy, which has been shown to be effective in face-to-face settings, was used to develop the web-based intervention I-INterACT, of which Wade, Oberjohn, Burkhardt, and Greenberg (2009) reported large positive outcomes in their study. In another study, Wade, Carey, and Wolfe (2006) evaluated an online version of Family problem-solving therapy, with medium outcomes. Two other parenting programs which have been established as effective interventions by previous studies in regular settings, i.e. Problem Solving Skills Training (Askins et al., 2009) and Triple P (Sanders, Calam, Durand, Liversidge, & Carmont, 2008) showed only modest outcomes in the adapted web-based version. Apparently, finding mixed outcomes in this set of studies, face-to-face, evidence-based programs do not automatically lead to positive outcomes after adaptation for online dissemination.

Three of the websites also offered peer support by providing a discussion or bulletin board.

Apart from the oldest study (Study ID 9), published in 2003, all programs offered three or more types of multimedia channels, like video, animated characters, tests, and interactive exercises. In most studies, both synchronous and asynchronous types of communication were offered. However, these online characteristics were not related to outcomes.

The intensity of the services was diverse, with five interventions offering intensive sessions in a short period of time (e.g., weekly sessions) and three programs offering free access to a website for a period of time (e.g., two or three months). Also, most programs with sessions required an interval progress assessment with correct answers before proceeding to the next session. Higher levels of knowledge may be achieved using an online program with several intensive sessions and an interval progress assessment before proceeding to the next session. Four programs were fully self-guided, one program offered email consultation on demand, and three programs were intensively guided by a therapist or coach, reviewing each online session with parents through a video-conference or telephone call. Three web-based interventions started with a single face-to-face session. The programs which were fully self-guided showed higher outcomes with regard to parental knowledge, whereas the guided programs produced higher outcomes with regard to parental attitude and behavior. The programs with higher attitudinal outcomes more often provided a combination of professional and peer

support; behavioral change in parents was achieved by remote coaching with an earpiece. The studies show that different online and offline techniques and resources are successfully being used to inspire change in parental competencies.

4. Discussion

The studies in this review evaluated web-based interventions for parents and families, including web-based adaptations of existing traditional interventions. The evaluated programs aimed to enhance parental competencies, offering support and training by using online technologies in different settings. Our meta-analysis provides evidence for the effectiveness of the Internet in supporting parents in their parenting role. Although the number of experimental studies is relatively low, including some small sample studies, these results are promising. In spite of the fact that family communication is a very complex set of knowledge, attitudes and behaviors, our study shows that participation in a short web-based intervention may lead to beneficial changes in both parents and children. Our findings do attest to the claim that online interventions may not only increase knowledge or improve attitudinal aspects, but may also enhance parenting skills. Interestingly, the studies from our review also show some positive effects at child level, although the effect is slightly smaller.

The web-based parenting programs, which have become available relatively recently, add to the diversity of parenting support and education practice. Parental education was traditionally disseminated through books, electronic media like the radio and television or other multimedia products (e.g., dvd or videotapes). The current fast-speed Internet now offers new and additional opportunities to empower a large group of parents in societies where the Internet is available and this study shows some inspiring examples and an increase of supportive programs using multiple multimedia channels. Most of the programs in this analysis were aimed at a specific group of parents and (mental) health topic, supporting parents in challenging circumstances, and more research is needed to evaluate websites with a public health approach.

The outcomes from our meta-analysis of online resources for parents are consistent with other, related meta-analytic results. Favorable results of medium effect size have also been reported for traditional forms of parent training in different domains, including attitudinal outcomes (Barlow, Coren, & Stewart-Brown, 2002; MacLeod & Nelson, 2000; Pinquart & Teubert, 2010), parental knowledge (Kaminski et al., 2008) and parental behavior (Fukkink, 2008; Lundahl et al., 2006). Interestingly, our analysis shows that positive evaluations of face-to-face, evidence-based programs do not guarantee positive outcomes in a web-based adaptation.

The general finding of our meta-analysis is also in line with results of recent reviews of other related web-based interventions. Recent meta-analyses have shown that web-based interventions can help people with different health and life issues, varying from sexual health promotion to alcohol abuse, weight gain, debt, depression and chronic illness (Bailey et al., 2010; Cugelman, Thelwall, & Dawes, 2011; Maon, Edirippulige, Ware, & Batch, 2012; Riper et al., 2009; Sorbi & Riper, 2009; Wantland, Portillo, Holzemer, Slaughter, & McGhee, 2004). Our findings confirm that not only knowledge can be enhanced, but also attitudinal and behavioral aspects of parenting can be influenced by online programs. The Internet is, therefore, not only a source of information, but can also be an instrument for support and training. A preliminary conclusion on the basis of this small sample is that knowledge can be improved by self-guided web-based training programs, while changes in attitude and behavior may be incited through internet interventions, intensively guided by therapists or coaches.

4.1. Limitations

The number of studies in this new domain is relatively small, and further research is needed to establish a firm knowledge base. The small database from our review did not allow a moderator analysis

of the variation in effect sizes. An exploratory analysis did not show significant relationships with the coded methodological characteristics of the studies, but the statistical power of this analysis is limited.

Given the small sample, the quality of study design was not taken into account in our meta-analysis, and instead, every study's effect sizes were accorded equal weight. However, it should be noted that there are some distinct characteristics or flaws in most of these studies, which may be avoided in future research. In all but one of these studies the evaluated program was developed by the researchers, which may enter a biased judgment in analysis. Furthermore, some studies showed a high failure to follow intent to treat, and most studies were based on a small sample size. Furthermore, attrition rates were rather uneven in a number of studies. The most common used measures relied on self-report by parents, which may be a source of bias. Our analysis shows some useful examples of observation scales to detect changes in child or parent behavior, which indicates that studies in this field do not need to be limited to self-report measures only. With the availability of webcam technology, tapes of parent-child interaction can be easily obtained. The analysis of observed interactions could strengthen the quality of study design and lead to better insight in the effectiveness of interventions. These methodological issues limit the results of this meta-analysis and future evaluation design should take these issues into account.

A different limitation pertains to the individual experimental studies. The reviewed studies focused exclusively on a particular web-based intervention and it is, therefore, not always clear whether parents used this resource as a "stand-alone" intervention or complemented the web-based tool with other services. Finally, the findings of our review are related to interventions that were evaluated in scientific studies, and the outcomes of this review cannot be generalized to the many resources for parents that can be found on the Internet.

Acknowledging the limitations of our study, this meta-analysis shows the first promising results in the new and developing field of online parenting support.

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