

## Future Directions in the Use of Telemental Health to Improve the Accessibility and Quality of Children’s Mental Health Services

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### Abstract

**Objectives:** This concluding commentary offers a brief overview of progress to date in providing telemental health services to children, and then offers a critical vision for future research needed to provide the rigorous empirical foundation for telemental health to be considered a well-established format for the delivery of children’s mental health services.

**Methods:** We review how recent years have witnessed advances in the science and practice of children’s telemental health, and the articles in this special series collectively offered a critical step forward in the establishment of a guiding literature to provide informed direction for child providers incorporating remote technologies to extend their practices.

**Results:** Researchers must be cautious not to develop a “horse race” mentality and a misguided search for a decisive “winner” regarding the ultimate effectiveness of child telemental health versus traditional clinic-based treatments. Instead, research efforts are needed to examine key mediators and moderators of telemental health treatment response. The question should not be simply *whether* telemental health strategies are supported, but rather *when, under what circumstances, and for whom* telemental health formats may be most indicated. Barriers to the continued evolution of children’s telemental health are discussed, and we consider issues of telemental health reimbursement and matters of cross-state professional jurisdiction.

**Conclusions:** Continued efforts are needed in order to fully actualize the potential of children’s telemental health to optimize the quality and transform the accessibility of mental health services for all children, regardless of income or geography.

RECENT YEARS HAVE WITNESSED truly transformative advances in the sophistication and broad accessibility of remote communication technologies, and these advances have set the stage for the blossoming field of child telemental health, with the power to meaningfully improve the reach of services to traditionally underserved youth. Since 1973, when the term *telepsychiatry* was first applied to describe live consultation services using “interactive television” to link experts at Massachusetts General Hospital to a remote medical site (Dwyer 1973), there has been a steady increase in the number of scholarly and empirical articles devoted to the use of remote technologies to extend mental health services. According to Web of Science, there were 145 scientific publications between 2000 and 2014 that addressed child “telemental health” (and/or child “behavioral telehealth,” child “telepsychology,” or child “telepsychiatry”) (see Fig. 1). Roughly 56% of these publications on child telemental health were printed in the past 5 years, suggesting a very strong recent uptick in interest in the topic. Although this recent increase in telemental health scholarship devoted specifically to child services is somewhat lower than the co-occurring recent increase in telemental health scholarship addressing adult

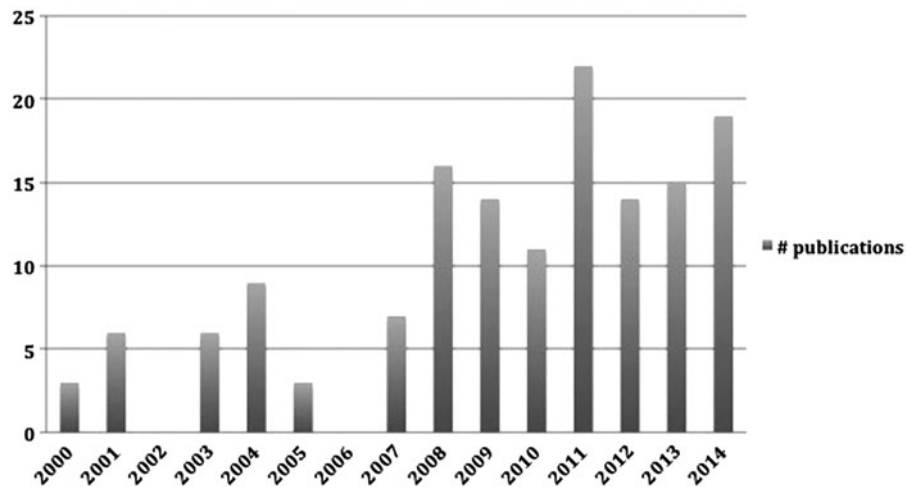
services (see Comer, et al., 2015), it is clear that rapidly developing and affordable information and communication technologies, broadening Internet availability, and increasing capacities for mobile broadcasting are truly beginning to transform the accessibility and scope of children’s mental healthcare.

Across this period of considerable growth in the field of child telemental health, it is notable that researchers and practitioners have not always agreed about the merits and promise of incorporating remote technologies into children’s treatment. When researchers first began making concerted efforts to consider how remote technologies could be used to expand children’s mental healthcare, there were strong concerns and hesitations voiced in practitioner communities that such efforts were misguided and detached from the realities of clinical practice: That activities that involved computer technologies and remote services would fail to address key components of the therapeutic alliance and were a slippery slope toward automated (and presumably less effective) care. As increasingly sophisticated remote technologies quickly transformed how we learn, share, and communicate, and as personal computing devices and mobile applications became

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**FIG. 1.** Number of scholarly publications between 2000 and 2014 on child telemental healthcare, child behavioral telehealthcare, child telepsychology, and/or child telepsychiatry.

progressively more user-friendly, affordable, and ubiquitous, child mental health practitioners quickly incorporated more remote communications into their practices, to the point that some researchers now caution that child telemental health clinical practices may be evolving at a more rapid pace than the guiding clinical trials needed to inform evidence-based care and best practices.

Given the daunting number of children affected by mental illness and related problems (Merikangas et al. 2010), as well as the considerable geographic barriers that interfere with the broad accessibility of quality care for large proportions of underserved youth (Merikangas et al. 2011; Comer and Barlow 2014; Myers and Comer, 2015), the uptick in use of technology to expand children's services has been highly welcome and holds enormous promise. As child telemental health services continue to evolve and adoption rates continue to climb, a new set of ethical, legal, procedural, and risk management issues must be carefully considered, and as a field we must be cautious against technology-based services advancing more rapidly than the guiding empirical literature and the development of relevant regulatory standards. The articles in this special series collectively offer a critical step forward in the establishment of a guiding literature to provide informed direction for child providers incorporating remote technologies to extend their practices.

As we move forward, systematic research and further controlled evaluations are needed to provide a most rigorous empirical foundation for child telemental health (Comer et al. 2014a; Jones 2014). Early work on child telemental health entailed single case studies or small case series, followed by detailed descriptions of large hospital-based telemental health practices, open trials, and then waitlist controlled trials (see Myers et al. 2007, 2008, 2010, 2011). These efforts provided strong documentation of utilization, proof of concept support, and early evidence of the general feasibility and acceptability of child telemental health. The current wave of research evaluating the incorporation of technology into children's services is using randomized trial designs to compare child telemental health to increasingly rigorous and revealing comparison conditions, including minimal support, treatment as usual, and standard clinic-based care (e.g., Comer et al. 2014a; Jones et al. 2015; Myers et al. 2015; see also Crum and Comer, 2015).

Importantly, researchers must be cautious to not get pulled into a "horse race" mentality and a misguided search for a decisive "winner" regarding the ultimate effectiveness of child telemental health versus traditional clinic-based treatments. If, in a randomized trial, 75% of children responded to a well-supported clinic-based format of an established treatment protocol, whereas only 50% of children responded to a telemental health format of the same protocol, and this difference reached statistical significance, would those results mean that the telemental health format had failed in this trial? We would argue that, given that the standard clinic-based format with a 75% treatment response may not be accessible for the vast majority of children in need, it is possible that a telemental health format (even with the lower 50% response rate) could reach considerably more children in need and have a far more substantial public health impact. Traditional clinical trial designs testing relative efficacies between remote and clinic-based formats, therefore, may yield only part of the empirical portrait needed to evaluate the merits of telemental health.

Moreover, it has become increasingly clear that simplistic factorial designs examining overall main effects can only carry our field so far. The more appropriate and clinically relevant pursuit is to evaluate key moderators of treatment response (see Kendall et al. 2013) across telemental health and standard clinic-based formats. The question should not be simply *whether* telemental health strategies are supported, but rather *when, under what circumstances, and for whom* telemental health formats may be most indicated. For example, telemental health may show a large advantage over clinic-based treatment for managing child behavior problems—particularly if telemental health services are remotely delivered directly to the home where child symptoms are most problematic (see Comer et al. 2015)—but only among families who have relatively high technological literacy and who live in rural or other remote communities that are regionally underserved by quality mental healthcare. Among families dwelling in regions with quality mental healthcare who show more limited technological literacy, clinic-based care may considerably outperform telemental healthcare. And among families dwelling in regions with quality mental healthcare who show high technological literacy, the effects of telemental healthcare and clinic-based care may be rather comparable. Such a nuanced set of findings might "wash out" in a simplistic main effects approach to data analysis, and in this

example, investigators failing to pursue complex interactions and potential moderators might erroneously conclude that telemental healthcare and clinic-based formats serve families equally well. As with most questions in intervention science, the most likely answer to the question “Are telemental health formats effective?” is “*It depends.*”

Another reason researchers must be cautious against a misguided search for a decisive “winner” regarding the ultimate effectiveness of child telemental healthcare versus traditional clinic-based treatments is that as innovations evolve, the boundaries between clinic-based and telemental healthcare will likely become increasingly fuzzy. Recent practices in clinic-based care are increasingly incorporating mobile technologies to complement and augment the scope of ongoing face-to-face services (Comer et al. 2014a; Jones et al., 2015; Whiteside, 2015). In addition, providers are increasingly integrating telemental health and clinic-based services, such that a small handful of sessions are conducted in person and spaced somewhat far apart, and remote technologies are used to conduct the majority of sessions in between. It is likely that in the near future of child mental healthcare, treatment will rarely dichotomously sort into clinic-based or telemental health services, but rather will be characterized by sequences of care, some of which will entail technology-augmented remote care and some of which will not. Clinical trials dichotomously evaluating telemental healthcare versus clinic-based services are poorly designed to inform optimal sequences or combinations of care.

Recent advances in intervention science offer innovative trial design options for the systematic evaluation of treatment sequences that flexibly adapt to patients’ fluctuating responses over time (i.e., adaptive treatment regimens). Specifically, in recent years we have seen the development and increased use of sequential multiple assignment randomized trials (SMARTs) (Murphy 2005; Dawson and Lavori 2012; Barlow and Comer 2013) to yield high quality data with which to develop evidence-based adaptive treatment regimens that differentially incorporate the benefits of different strategies of care, depending upon key moderator variables across critical treatment points. SMARTs re-randomize participants at key decision points as a function of their interim treatment response, and as such, are more generalizable to the typical course-correcting clinical decision making seen in practice, while also maintaining a rigorous randomized trial methodology. As child telemental healthcare evolves in the age of personalized medicine, patient-centered care, and the Affordable Care Act (McWilliams 2015), SMARTs are needed to go beyond nomothetic groups-based (factorial) design strategies and afford rigorous experimental methods with which to meaningfully inform the development of evidence-based adaptive intervention regimens that differentially incorporate clinic-based and telemental healthcare formats depending upon key factors and moderators at critical decision points in clinical care.

Rigorous clinical trials are large-scale endeavors, and will require considerable funding. As such, securing the needed research support for child telemental healthcare trials will be a serious challenge in the years ahead, particularly in light of current mental health funding priorities that are focused predominantly on biological pathogenesis and underlying mechanisms of disorder. Many intervention scientists have strategically incorporated neurodevelopmental assessments into their clinical trial designs in order to reframe their work as fitting within an “experimental therapeutics” agenda, in which interventions are conceptualized as experimental probes of underlying biological mechanisms of mental health problems that inform neurodevelopmental trajectories of illness (Insel and Gogtay 2014). Given the remote nature of telemental

healthcare, it may be relatively harder to incorporate neurodevelopmental evaluations and biological assessments into telemental healthcare trials, and as such, securing the funding to build the needed empirical support for child telemental healthcare may be a considerable challenge in the years ahead. Strong research partnerships and collaborations with industry and technological innovators will likely be essential.

Research on children’s telemental healthcare must also be agile, and able to respond to rapidly shifting innovations in technology. We recommend that researchers focus on testing principles of treatment delivery, systems of care, and modes of treatment, but be cautious about investing too much energy and resources into specific technologies, given how quickly innovations can become obsolete. For example, although there have been considerable recent advances in the development of CD-ROM programs for treating child mental health problems, an increasing proportion of computing devices sold on the consumer-grade market today no longer include a CD drive. Again, research partnerships with industry and technological innovators are essential in order to solve problems in children’s mental healthcare with the relevant technologies expected on the horizon.

In addition to setting an agenda for child telemental healthcare research, payer issues and matters of reimbursement for remote care must be resolved in order for child telemental healthcare to fulfill its promise for expanding the reach of supported care to underserved individuals. Current Procedural Terminology (CPT) codes do not readily define mental healthcare delivered remotely via technology, nor do current codes indicate how best to distinguish telemental health services from face-to-face services. Accordingly many telemental healthcare providers are left unsure how to appropriately characterize their work. Clarifying such matters will be critical in order to ensure that telemental health services are available to the full spectrum of children needing care, regardless of economic resources. To date, federal and state programs (e.g., Medicaid and programs run by the Department of Veterans Affairs or the Department of Defense) have collectively been more progressive than private health insurance programs in providing reimbursement for telemental health services (see Comer and Barlow 2014). For example, although Medicaid reimbursement varies from state to state, the vast majority of states already provide some forms of reimbursement for telemental health services (Thomas and Capistrant 2014). Many of these states provide for such services by reimbursing under traditional CPT codes, plus a separate code for a “telehealth originating site facility fee.” Importantly, states differ with regard to whether documentation is needed to authenticate that services were provided to a rural or otherwise underserved region. For example, California Law AB 415 recently streamlined approval processes for telemental health services by removing the previous Medi-Cal rule requiring documentation of an existing barrier for the patient to clinic-based services. In contrast, coverage for telemental health services in Oklahoma is limited to rural and other underserved regions and documentation of local mental health workforce shortages. Overall trends, however, toward increasing Medicaid coverage for telemental healthcare, are nonetheless encouraging with regard to ensuring the accessibility of telemental healthcare for all in the coming years.

Matters of licensure and practice jurisdiction will also need to be further resolved. At this time, providers in most states cannot routinely deliver care to individuals outside of states in which they are licensed. However, licensure regulations appear to be evolving, as some states with particularly large rural and otherwise

underserved populations are increasing their allowance of licensing reciprocity across state lines to allow providers in other states to practice within state lines (Comer and Barlow 2014). As Kramer and Luxton (2015) noted earlier in this special series, although the American Medical Association continues to support a state-based licensure system and opposes the notion of federal licensure of telemedicine, the Federation of State Medical Boards has approved a policy to evaluate the adoption of an “interstate compact” licensure system to increase efficiency in the licensing of physicians who practice across multiple states (Federation of State Medical Boards 2014).

Another challenge ahead for telemental healthcare lies in the increased use of remote technologies to treat children in non-professional settings. The exciting potential of telemental healthcare is not simply the ability to extend the *reach* of evidence-based care, but also the ability to enhance the *ecological validity* of care by treating child problems in children’s natural settings (e.g., homes, schools, public settings) (Comer et al. 2014b; Comer et al., 2015; Stephan et al., in press). Treating children in the very settings in which symptoms are most problematic may be critical to improving the generalization of treatment gains, but telemental healthcare providers in turn have less control over children’s treatment environments and, accordingly, it can be more difficult to ensure safety than in office-based care. As Crum and Comer (2015) noted earlier in this special issue, providing care to families in relatively unsupervised settings—such as the home—carries risks not seen in office-based care. Certain high-risk families, such as families with maltreatment histories, may be inappropriate for remote telemental healthcare. When providing remote care—especially in the home, a relatively unsupervised setting compared with a doctor’s office or school—it is important to have emergency contact information for families, including their pediatrician and local emergency dispatch. Luxton and colleagues (2010, 2012) have started an important literature addressing crisis planning and management strategies for telemental healthcare, and their work provides important comprehensive information on avoiding and addressing safety concerns specific to telemental healthcare delivery to home settings.

As a final comment, it is important to recognize that technology can enhance clinical practices and extend the accessibility of supported care, but that technology can never replace solid grounding in scientific principles and evidence-based practices. Technological innovations—no matter how dazzling, user-friendly, or engaging—will fail when applied to children’s mental health in the absence of strong theory and careful attention to the empirical literature on best practices for child psychopathology.

### Concluding Thoughts

The telemental healthcare field is still at the earliest stages of evaluating the potential of applying remote technologies to expand the reach and scope of children’s mental health services, and considerable work is required before telemental health practices are to be considered a well-established vehicle for the systematic delivery of children’s services. As providers increasingly draw on remote technologies to expand their practices, the articles in this special series collectively offered a critical step forward in the establishment of a guiding literature to provide informed direction. These articles also presented many recent efforts that uniquely illustrate the great promise, potential, and challenges associated with the incorporation of remote technologies into children’s mental healthcare, and it is to

be hoped that they will prompt future creative efforts in telemental healthcare that can strategically address various challenges in the quality and availability of children’s services.

### Clinical Significance

Disparities in Internet access and technological literacy may interfere with the accessibility of telemental healthcare in the immediate coming years, as one quarter of families in the United States do not currently have household Internet (United States Census Bureau 2011). However, national trends find that demographic groups currently showing the lowest access to and facility with the Internet and with mobile platforms—senior citizens and low-income and rural-dwelling families—are showing the most rapid growth in adoption of household Internet (Horrigan 2009). Furthermore, recent trends and large federal investments in the expansion of Internet access and mobile connectivity to underserved regions suggest it is conceivable that Internet access will soon show relative household ubiquity (File and Ryan 2014; United States Department of Commerce 2013; Pew Research Center 2014). As we come closer and closer to Internet access and mobile connectivity for all United States families, it is exciting to see how much progress has been made in such a short period of time in the science and practice of children’s telemental healthcare. Continued efforts are needed in order to fully actualize the potential of children’s telemental healthcare to optimize the quality and transform the accessibility of mental health services for all children, regardless of income or geography.

### Disclosures

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### References

- Barlow DH, Comer JS: What are the optimal treatment courses for geriatric anxiety, and how do we find out? *Am J Psychiatry* 170:707–711, 2013.
- Comer JS: Introduction to the special section: Applying new technologies to extend the scope and accessibility of mental health care. *Cogn Behav Pract* 22:253–257, 2015.
- Comer JS, Barlow DH: The occasional case against broad dissemination and implementation: Retaining a role for specialty care in the delivery of psychological treatments. *Am Psychol* 69:1–18, 2014.
- Comer JS, Elkins RM, Chan PT, Jones DJ: New methods of service delivery for children’s mental health care. In: *Comprehensive Evidence-Based Interventions for School-Aged Children and Adolescents*, edited by C.A. Alfano, D. Beidel. New York: Wiley, 2014a, pp. 55–72.
- Comer JS, Furr JM, Cooper–Vince C, Kerns C, Chan PT, Edson AL, Khanna M, Franklin ME, Garcia AM, Freeman JB: Internet-delivered, family-based treatment for early-onset OCD: A preliminary case series. *J Clin Child Adolesc Psychol* 43:74–87, 2014b.
- Comer JS, Furr JM, Cooper–Vince C, Madigan RJ, Chow C, Chan PT, Idrobo F, Chase RM, McNeil CB, Eyberg SM: Rationale and considerations for the Internet-based delivery of Parent–Child Interaction Therapy. *Cogn Behav Pract* 22:302–316, 2015.
- Crum KI, Comer JS: Using synchronous videoconferencing to deliver family-based mental health care. *J Child Adolesc Psychopharmacol*, October 14, 2015, ahead of print. doi:10.1089/cap.2015.0012.
- Dawson R, Lavori PW: Efficient design and inference for multistage randomized trials for individualized treatment policies. *Biostat* 13:142–152, 2012.

- Dwyer T: Telepsychiatry: Psychiatric consultation by interactive television. *Am J Psychiatry* 130:865–869, 1973.
- Federation of State Medical Boards: State Medical Boards' Appropriate Regulation. Model Policy for the Appropriate Use of Telemedicine Technologies in the Practice of Medicine, 2014. Available at [http://www.fsmb.org/Media/Default/PDF/FSMB/Advocacy/FSMB\\_Telemedicine\\_Policy.pdf](http://www.fsmb.org/Media/Default/PDF/FSMB/Advocacy/FSMB_Telemedicine_Policy.pdf) Accessed March 20, 2015.
- File T, Ryan C: Computer and Internet use in the United States: 2013. Issued November 2014. Available at <http://www.census.gov/content/dam/Census/library/publications/2014/acs/acs-28.pdf> Accessed March 10, 2015.
- Horrigan JB: Home broadband adoption 2009. Pew Internet & American Life Project, 2009. Available at <http://pewinternet.org/Reports/2009/10-Home-Broadband-Adoption-2009.aspx>. Accessed June 23, 2015.
- Insel TR, Gogtay N: National Institute of Mental Health clinical trials: New opportunities, new expectations. *JAMA Psychiatry* 71:745–746, 2014.
- Jones DJ: Future directions in the design, development, and investigation of technology as a service delivery vehicle. *J Clin Child Adolesc Psychol* 43:128–142, 2014.
- Jones DJ, Anton M, Gonzalez M, Honeycutt A, Olga K, Forehand R, Parent J: Incorporating mobile phone technologies to expand evidence-based care. *Cogn Behav Pract* 22:281–290, 2015.
- Luxton DD, O'Brien K, McCann RA, Mishkind MC: Home-based telemental healthcare safety planning: What you need to know. *Telemed J E Health* 18:629–633, 2012.
- Luxton DD, Sirotnin AP, Mishkind MC: Safety of telemental healthcare delivered to clinically unsupervised settings: A systematic review. *Telemed J E Health* 16:705–711, 2010.
- Kendall PC, Comer JS, Chow C: The randomized controlled trial: Basics and beyond. In: *The Oxford Handbook of Research Strategies for Clinical Psychology*, edited by J.S. Comer, P.C. Kendall. New York, NY: Oxford University Press, 2013.
- Kramer GM, Luxton DD: Telemental health for children and adolescents: An overview of legal, regulatory, and risk management issues. *J Child Adolesc Psychopharmacol*, August 10, 2015. doi:10.1089/cap.2015.0018.
- McWilliams JK: Integrating telemental health with the patient-centered medical home model. *J Child Adolesc Psychopharmacol*, August 10, 2015. doi:10.1089/cap.2015.0044.
- Merikangas KR, He, JP, Burstein M, Swanson SA, Avenevoli S, Cui L, Benjet C, Georgiades K, Swendsen J: Lifetime prevalence of mental disorders in in U.S. adolescents: Results from the National Comorbidity Survey–Adolescent Supplement (NCS-A). *J Am Acad Child Adolesc Psychiatry* 49:980–989, 2010.
- Merikangas KR, He, JP, Burstein M, Swendsen J, Avenevoli S, Case B, Georgiades K, Heaton L, Swanson S, Olfson M: Service utilization for lifetime mental disorders in U.S. adolescents: Results of the National Comorbidity Survey–Adolescent Supplement (NCS-A). *J Am Acad Child Adolesc Psychiatry* 50:32–45, 2011.
- Murphy SA: An experimental design for the development of adaptive treatment strategies. *Stat Med* 24:1455–1481, 2005.
- Myers K, Comer JS: The case for telemental health for improving the accessibility and quality of children's mental health services. *J Child Adolesc Psychopharmacol*, in press.
- Myers KM, Palmer NB, Geyer JR: Research in child and adolescent telemental health. *Child Adolesc Psychiatr Clin N Am* 20:155–171, 2011.
- Myers KM, Valentine JM, Melzer SM: Child and adolescent telepsychiatry: Utilization and satisfaction. *Telemed J E Health* 14:131–137, 2008.
- Myers KM, Valentine JM, Melzer SM: Feasibility, acceptability, and sustainability of telepsychiatry for children and adolescents. *Psychiatr Serv* 58:1493–1496, 2007.
- Myers K, Vander Stoep A, McCarty CA, Klein JB, Palmer NB, Geyer JR, Melzer SM: Child and adolescent telepsychiatry: Variations in utilization, referral patterns and practice trends. *J Telemed Telecare* 16:128–133, 2010.
- Myers K, Vander Stoep A, Zhou C, McCarty C, Katon W: The children's attention-deficit hyperactivity disorder telemental health treatment study (CATTs): Outcome of a community-based randomized controlled trial. *J Am Acad Child Adolesc Psychiatry* 54:263–274, 2015.
- Pew Research Center: Cell Phone and Smartphone Ownership Demographics. Pew Research Center Internet Project Survey 2014, January 2014. Available at <http://www.pewinternet.org/data-trend/mobile/cell-phone-and-smartphone-ownership-demographics/>. Accessed March 2, 2015
- Stephan S, Lever N, Bernstein L, Edwards S, Pruitt D: Telemental health in schools. *J Child Adolesc Psychopharmacol*, in press.
- Thomas L, Capistrant G: 50 State Telemedicine Gaps Analysis Coverage & Reimbursement. American Telemedicine Association, September 2014. Available at <http://www.americantelemed.org/docs/default-source/policy/50-state-telemedicine-gaps-analysis—coverage-and-reimbursement.pdf?sfvrsn=8> Accessed February 15, 2015.
- United States Census Bureau: Statistical abstract of the United States, 2011. Available at <http://www.census.gov/compendia/statab/2011/tables/11s1154.pdf> Accessed April 4, 2013.
- United States Department of Commerce, National Communication and Information Administration: Broadband Availability Beyond the Rural/Urban Divide, 2013. Available at <http://www.ntia.doc.gov/report/2013/broadband-availability-beyond-ruralurban-divide> Accessed March 20, 2015.
- Whiteside S: Mobile device-based applications for childhood anxiety disorders. *J Child Adolesc Psychopharmacol*, August 10, 2015. doi:10.1089/cap.2015.0010.

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