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## The Use of Technology in the Clinical Care of Depression: An Evidence Map

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### ABSTRACT

**Objective:** Depression is a highly prevalent clinical condition. The use of technologies in the clinical care of depressive disorders may increase the reach of clinical services for these disorders and support more comprehensive treatment. The objective of this evidence map is to provide an overview of the use of technology in the clinical care of depression.

**Data Sources:** We searched PubMed, PsycINFO, and the Web of Science from inception to June 2017 to identify published randomized controlled trials (RCTs).

**Study Selection:** Two reviewers used predetermined eligibility criteria to review 4,062 records and include 161 RCTs that met our inclusion criteria. We include studies evaluating any type of treatment-related technology in the clinical care of depression.

**Data Extraction:** We extracted data on sample sizes, the type of technology examined, the function of that technology, the effectiveness of the technology, and publication year.

**Results:** Out of 161 RCTs, we found the greatest amount of research for psychotherapy by computer (51 RCTs). The majority of studies were published after 2012 (94 RCTs; 58%). Few published studies involved videoconferences or smartphones, or provider feedback or auto-reminders. 145 studies (90%) reported that the intervention had a positive outcome of symptom improvement compared to baseline.

**Conclusions:** This evidence map provides a broad overview of the existing research evaluating technology in depression care. Computer applications are still most common. Almost all applications yield symptom improvement. More information is needed to evaluate the role of technology in clinical care.

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Depression is a highly prevalent clinical condition. According to the US National Institute of Mental Health, the 12-month prevalence for major depressive disorder is 7%.<sup>1,2</sup> Not only can it be emotionally challenging to be affected by these conditions, but the symptoms can lead to lost productivity, interpersonal difficulties, and even disability. Major depressive disorder is a leading cause of disability in the United States, second only to low back pain.<sup>3</sup> Given the toll this illness can take on patients, providing adequate clinical care is critical.

Studies have found that at times, only 51% to 71% of those with major depression received treatment.<sup>4-6</sup> Undertreatment is worse in the international context: only 16.5% of those with major depression in a group of high and middle income countries received minimally adequate treatment during a 1-year period.<sup>7</sup> Traditionally, depression treatment has been delivered via face-to-face psychosocial interventions. However, cited barriers to this type of intervention include geographical factors, cost of the interventions, cost of transportation, and stigmatization of visiting a therapist.<sup>8,9</sup> Recent technological advances in telephone and computer communication abilities have made it possible to circumvent some of these obstacles by providing care that is more private and convenient to the patient.<sup>10</sup>

Technology used in care can be any use of technology to expand access, exchange information between provider and patient, and deliver care in formats alternate to, or in addition to, face-to-face traditional treatment. The Health Resources and Services Administration defines *telehealth*<sup>11</sup> as “the use of telecommunications and information technologies to share information and provide clinical care, education, public health, and administrative services at a distance.” Telemedicine is using technology to improve a patient’s health by permitting 2-way, real time interactive communication between the patient and the physician or other health care provider. Many different types of technology can be used to support clinical interventions, including video, computer, telephone, smartphones, and others. The types of treatment can be provider-guided, self-guided, or a mixture of the two. The interventions can range from merely providing feedback or reminders to engaging in a complete course of psychotherapy. There are many online interventions available, including social support forums, psychoeducation, and self-help materials.<sup>12</sup> In addition, psychotherapy can be delivered online. For instance, cognitive-behavioral therapy (CBT), which seeks to resolve problems by changing maladaptive thinking and behavior,<sup>13</sup> can be delivered entirely or partially online. Partially online CBT can be guided in-person by a therapist using online materials. A systematic review of online-supported CBT found that it is both accepted by patients and effective for treating anxiety and depression.<sup>14</sup> A recent evidence map by the Agency for Healthcare Research and Quality (AHRQ) that looked at systematic reviews of

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- Patients face many barriers to the face-to-face treatment of depression.
- Many technological interventions for depression, especially therapy via computer, have considerable evidence of effectiveness.

patient outcomes from telehealth for a range of medical conditions found that there is sufficient evidence to support the effectiveness of telehealth for psychotherapy as part of behavioral health.<sup>15</sup>

The known range and uses of the technologies require the assessments to cover an expansive body of literature. The breadth of this topic suggests that an evidence map is an effective way to summarize the existing research. Evidence maps synthesize large areas of research in an accessible and user-friendly manner. Through the use of visual displays of the volume and content areas of research, evidence maps can organize and help with understanding the evidence.<sup>16</sup> While evidence maps involve methods similar to a traditional systematic review, uniform conduct and reporting standards for evidence maps do not currently exist.<sup>16</sup> However, evidence maps can help to identify critical gaps in research. The purpose of this evidence map is to provide a broad overview of the research field of the use of technology in the clinical care in depression. This overview can assist practitioners, policy makers, and researchers who seek to incorporate technology into their clinical care or to identify research gaps in the use of such technology.

Previous reviews and meta-analyses of technological interventions for depression have been conducted,<sup>17-19</sup> but they were relatively small,<sup>17-19</sup> focused heavily on online CBT,<sup>17</sup> excluded US studies,<sup>19</sup> included non-RCTs,<sup>17,19</sup> or included studies of patients with non-depression comorbidities.<sup>17-19</sup> This evidence map provides a visual overview of the distribution of evidence for the different types of technology for which there are randomized controlled trials (RCTs) examining their use in the treatment of depression disorders. The map concentrates on evaluations using this robust study design that allows drawing strong conclusions about the effectiveness of the technology. Furthermore, the evidence map focuses on treatment-related technology that has the potential for use in clinical depression care. Although technological treatment such as biofeedback, transcranial magnetic stimulation, or electroconvulsive therapy may be used in depression, this evidence map is limited to telehealth, telemedicine, and online interventions. While some of the included interventions could not exist without technology (eg, auto-reminders), most are digital versions of existing face-to-face treatments (eg, provider therapy). The map documents both what is known and where there is little or no evidence, and it describes the volume, nature, and characteristics of research in this field.

## Key Questions

The following areas are addressed in this evidence map:

1. How many studies evaluate the use of technology in depression care? What are the types and functions of the evaluated technologies?
2. What is the direction of effect in studies evaluating the technology?
3. How does the effectiveness of the evaluated technologies change over time, by technology type and function?

## METHODS

The evidence map is based on a systematic review that is registered in PROSPERO (registration number CRD42017069691), an international prospective registry for systematic reviews. The evidence map also complies with criteria set forth for broad overviews such as umbrella reviews.<sup>20</sup>

## Sources

We searched the electronic databases PubMed, PsycINFO, and Web of Science to identify published English-language RCTs. We reference-mined published reviews by screening studies included in pertinent reviews on the topic. In addition, we consulted with topic experts reviewing the draft report of this evidence map to check the sample for completeness.

## Search Strategy

The search strategy was developed by an evidence-based practice center librarian together with a psychiatrist familiar with the clinical conditions and treatment approaches, informed by search results of the prior feasibility scans conducted for this project and existing reviews on telehealth. The search was done as part of a larger review of both depression and anxiety disorders, with those studies specific to depression separated out for the focus of this current evidence map. The search strategy is documented in Appendix 1.

We retrieved and screened full texts of RCTs evaluating any type of technology in the clinical care in depression to determine whether the publication meets the inclusion criteria. The results of the literature search and screening are documented in a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) literature flow diagram (Figure 1).

## Inclusion Screening

Two reviewers (the project lead, who is an experienced reviewer and psychiatrist, and a RAND research associate with extensive literature review experience) independently screened titles and abstracts of retrieved citations. Citations judged as potentially eligible by 1 or both reviewers were obtained as full text.

Following a pilot session to ensure similar interpretation of the inclusion and exclusion criteria, the 2 reviewers

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independently screened full text publications against the inclusion and exclusion criteria. Any disagreements were resolved through discussion in the review team. Reasons for exclusion are recorded in an electronic database.

### Eligibility Criteria

Study inclusion and exclusion criteria can be summarized in the following “PICOTSS” framework (participants, interventions, comparators, outcomes, timing, setting, and study design).

- **Participants.**

**Inclusion criteria.** Studies of male and female participants, 18 years of age or older, were eligible for inclusion. Children were excluded to limit the size of the included evidence base. Participants could have any type of depression symptoms, diagnosis, or disorders, including major depressive disorder, dysthymia, premenstrual dysphoric disorder, or other specified or unspecified depressive disorder. Participants with depression due to a substance/medication or medical condition were excluded.

**Exclusion criteria.** Participants with other diagnoses such as obsessive-compulsive disorder or posttraumatic stress disorder not classified as depression disorders according to the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (*DSM-5*) were excluded. Studies exclusively reporting on participants with self-limited, situational depression were excluded. Studies that did not include a majority of patients with depression disorders were excluded. Studies that involved a population of patients with a particular medical diagnosis or situation (such as caregivers), in which the intervention addressed primarily the medical or situational needs and secondarily depression symptoms, were excluded.

- **Interventions.** Studies evaluating technology to directly treat depression or in the clinical care in depressive disorders were eligible. Interventions focused on collaborative care, such as between a primary care provider and a psychiatrist, were excluded. Interventions designed to treat or manage another condition, where the effects of the intervention on depression were secondary, were excluded. We included phone, smartphone, video, or computer-based technology for clinical care, but technological treatment such as biofeedback, transcranial magnetic stimulation, or electroconvulsive therapy offered in a health care setting was excluded. The interventions could be delivered in addition to nonpharmacologic or medication-based care.
- **Comparators.** Studies that compare to depression disorder treatment, with or without the use of technology, wait-list control, or no treatment were eligible.

- **Outcomes.** Studies reporting symptom improvement, response to treatment, and remission of depression were eligible.
- **Timing.** Studies could involve any treatment duration and any follow-up period.
- **Setting.** Studies were not limited by setting.
- **Study design.** Studies that did not randomize to intervention versus comparator were excluded. Studies using any form of randomization (eg, parallel and crossover) were acceptable and included.

Only studies published in English were eligible for inclusion in this evidence map.

### Data Extraction

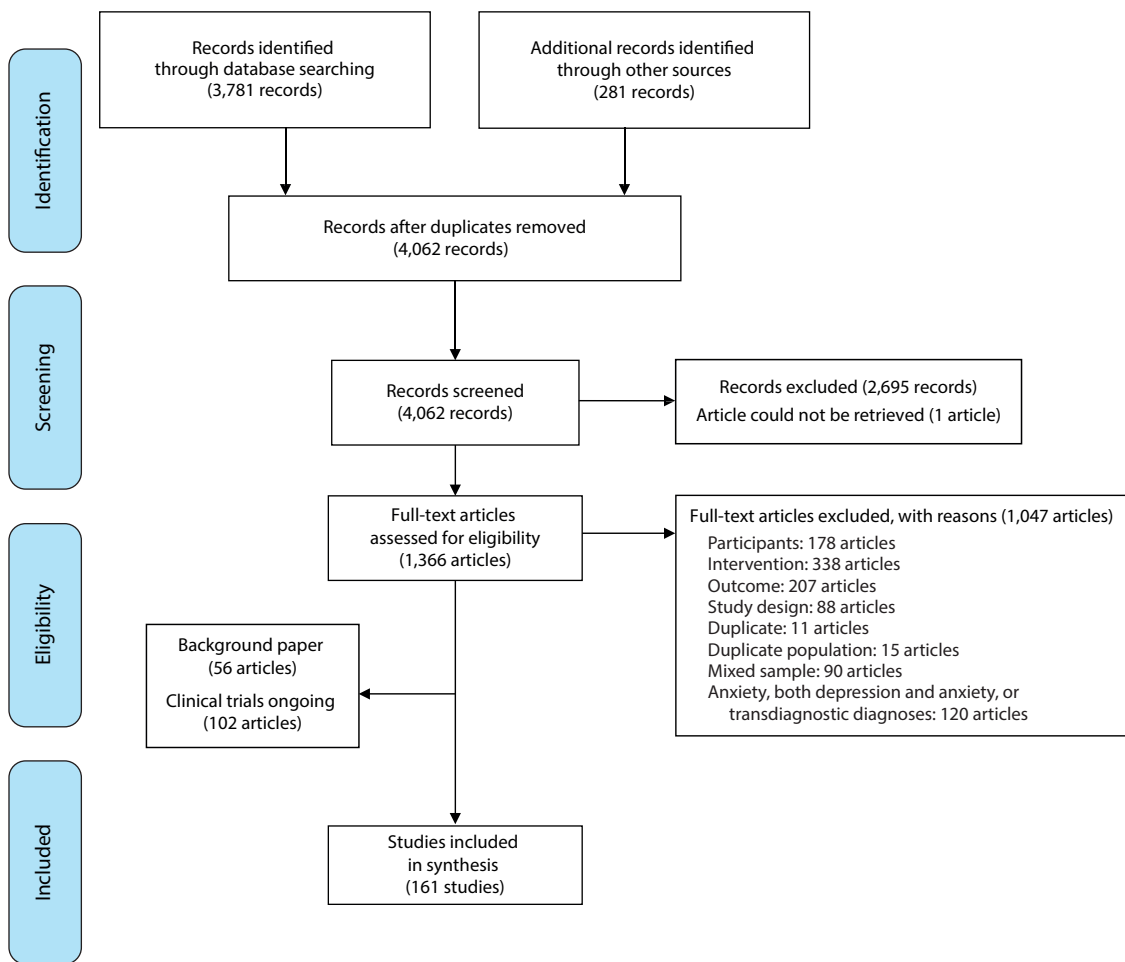
An evidence map aims to provide a broad overview of a large literature base. To ensure the overview is meaningful, the number of variables that can be abstracted and displayed in result figures must be selected carefully. Data collection forms were designed by the project team in advance of literature screening. Reviewers pilot tested the data collection forms on 10 randomly selected studies to ensure agreement of interpretation. The reviewers abstracted study-level data using database software designed for systematic reviews. Unclear descriptions and ambiguities were discussed in the review team.

A listing of data abstraction variables follows:

- **Study size.** Number of randomized participants (if this was not available, the number of participants analyzed).
- **Type of technology.** Categories of the type of technology used in supporting clinical care, according to the type of technology most likely chosen by the participant, based on the lowest level of technology most likely to fully implement the intervention: phone only, computer only (online treatment, e-mail communication with providers), smartphone only (app or texting), videoconferencing (interaction with provider, needs a dedicated piece of technology with a camera, not video or webcam chat over a computer), multiple technology (explicitly using more than 1 technology, not for studies in which patients have the choice between using a normal phone or a smartphone), and other (technology could not be classified into the preceding categories).
- **Function of technology.** Categories of the function of the technology in clinical care: automated reminders (fully automated), provider-sent reminders (requires interaction with provider, provider-initiated), patients’ self-directed support (online resources for patients, peer support), provider support (eg, provider-run support group), self-directed psychotherapy (eg, online modules), provider-directed psychotherapy (virtual interaction with provider, eg, interaction by phone or online), automated feedback (eg, after task completion; patient has instructions to record task and to watch it back with specific instruction), provider feedback

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Figure 1. PRISMA Flow Diagram



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(eg, provider watches recorded video from patient and gives feedback), multiple functions, and other (function could not be classified into the preceding categories).

- **Effectiveness signal.** Category of directionality of effectiveness measure (ie, are the symptoms of depression improved relative to no technology?): negative (ie, intervention group outcomes are worse than the control group or baseline outcomes), unclear (effect unclear, no change, or not applicable because 2 active technologies were compared), or positive (ie, intervention group outcomes are better than control group or baseline outcomes). The category is based on results as reported by the original study authors and will be based on the outcomes most relevant to the diagnosis in the respective study (eg, depression symptoms in patients treated for depression) compared to no use of technology.
- **Publication year.** Year the study was published.

**Quality of Evidence**

This evidence map quantifies the number of RCTs available for the areas of interest. The map documents

technologies in clinical care of depression that have been evaluated with the strong study design of RCT. RCTs allow confident evidence statements, and available research will be of particular interest to policy makers. The evidence map further broadly characterizes the quality of evidence using 2 aspects of the GRADE approach<sup>21</sup>: imprecision and inconsistency.

For documented evidence characteristics, the evidence map figures display the size of the study. The size of the study is instrumental in determining for which interventions precise estimates are currently available in the literature. Given the large number of pertinent studies, this aspect evaluates the potential for precise estimates, and the study size is used as a proxy.

Furthermore, we highlight intervention evaluations and findings that have been consistently replicated in multiple RCTs published by independent researcher groups.

**RESULTS**

The search and selection of RCTs are summarized in the literature flow diagram in Figure 1. Database searches of published literature and reference mining of accepted RCTs

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Table 1. Evidence Table

Study	N	Comparator	Technology		Effectiveness Signal
			Type	Function	
Adler, 2015 <sup>22</sup>	167	TAU	Phone	Multiple	Positive
Alavi, 2016 <sup>23</sup>	93	No treatment	Computer	Provider therapy	Positive
Alegria, 2014 <sup>24</sup>	257	TAU; Face-to-face provider-directed CBT and care management	Phone	Multiple	Positive
Andersson, 2005 <sup>25</sup>	117	Alternative technology	Computer	Multiple	Positive
Andersson, 2013 <sup>26</sup>	69	Group face-to-face CBT	Computer	Provider therapy	Positive
Arean, 2016 <sup>27</sup>	626	Alternative technology; Control app with daily health tips	Smartphone	Self-therapy	Positive
Au, 2015 <sup>28</sup>	96	Alternative technology	Phone	Provider feedback	Positive
Bae, 2008 <sup>29</sup>	272	Waitlist	Computer	Self-support	Positive
Baikie, 2012 <sup>30</sup>	688	Alternative technology	Computer	Self-therapy	Positive
Bee, 2010 <sup>31</sup>	53	TAU	Phone	Provider therapy	Unclear
Beevers, 2017 <sup>32</sup>	376	Waitlist	Computer	Self-therapy	Positive
Berger, 2011 <sup>33</sup>	76	Waitlist; Alternative technology	Computer	Self-therapy	Positive
Birney, 2016 <sup>34</sup>	300	Sent links for educational websites	Multiple	Self-therapy	Positive
Blackwell, 2015 <sup>35</sup>	150	Sham imagery-based cognitive bias modification	Computer	Multiple	Positive
Boeschoten, 2017 <sup>36</sup>	171	Waitlist	Computer	Multiple	Positive
Bombardier, 2013 <sup>37</sup>	92	Waitlist	Phone	Provider therapy	Positive
Botella, 2016 <sup>38</sup>	69	Alternative technology; No treatment	Computer	Self-therapy	Positive
Brabyn, 2016 <sup>39</sup>	369	Alternative technology	Computer	Self-therapy	Positive
Buntrock, 2015 <sup>40</sup>	406	Alternative technology	Multiple	Multiple	Positive
Burton, 2016 <sup>41</sup>	28	TAU	Computer	Self-therapy	Positive
Calkins, 2015 <sup>42</sup>	56	Alternative technology	Computer	Self-therapy	Positive
Carlbring, 2013 <sup>43</sup>	80	Waitlist	Computer	Multiple	Positive
Choi, 2012 <sup>44</sup>	63	Waitlist	Computer	Multiple	Positive
Choi, 2014 <sup>45</sup>	158	In-person PST	Computer	Provider therapy	Positive
Choi, 2014 <sup>46</sup>	121	In-person PST; Alternative technology	Videoconference	Provider therapy	Positive
Chong, 2012 <sup>47</sup>	167	TAU	Computer	Other function	Positive
Christensen, 2004 <sup>48</sup>	525	Interviewer contact; Alternative technology	Computer	Multiple	Positive
Christensen, 2006 <sup>49</sup>	2,794	Alternative technology	Computer	Self-therapy	No change
Clarke, 2002 <sup>50</sup>	299	TAU	Computer	Self-therapy	No change
Clarke, 2005 <sup>51</sup>	255	TAU; Alternative technology	Computer	Multiple	Positive
Clarke, 2009 <sup>52</sup>	160	TAU	Computer	Multiple	Positive
de Graaf, 2011 <sup>53</sup>	303	TAU; computerized CBT + TAU	Computer	Self-therapy	Positive
Dennis, 2003 <sup>54</sup>	42	TAU	Phone	Self-support	Positive
Donker, 2013 <sup>55</sup>	1,929	Face-to-face CBT and IPT	Computer	Self-therapy	Positive
Donkin, 2013 <sup>56</sup>	562	Unclear	Computer	Self-therapy	Positive
Dwight-Johnson, 2011 <sup>57</sup>	101	Enhanced usual care	Phone	Provider therapy	Positive
Ebert, 2014 <sup>58</sup>	150	Waitlist	Computer	Multiple	Positive
Egede, 2015 <sup>59</sup>	241	In-person behavioral activation therapy	Other	Provider therapy	Positive
Eisdorfer, 2003 <sup>60</sup>	225	Family therapy, minimal support	Other	Provider therapy	Positive
Farrer, 2011 <sup>61</sup>	155	Alternative technology; No treatment	Computer	Self-therapy	Positive
Fischer, 2015 <sup>62</sup>	90	Waitlist	Computer	Self-therapy	Positive
Fledderus, 2012 <sup>63</sup>	376	Waitlist; Alternative technology	Computer	Provider support	Positive
Fortney, 2007 <sup>64</sup>	395	TAU	Multiple	Other function	Positive
Fortney, 2013 <sup>65</sup>	364	Practice-based collaborative care	Multiple	Other function	Positive
Fritsch, 2007 <sup>66</sup>	345	TAU	Phone	Provider support	Positive
Furukawa, 2012 <sup>67</sup>	118	TAU	Phone	Provider therapy	Positive
Geraedts, 2014 <sup>68</sup>	231	TAU	Computer	Multiple	Positive
Geraedts, 2014 <sup>69</sup>	231	TAU	Computer	Multiple	Positive
Gilbody, 2015 <sup>70</sup>	691	TAU; Alternative technology	Computer	Multiple	No change
Glozier, 2013 <sup>71</sup>	562	Online educational modules	Computer	Other function	Positive
Glueckauf, 2012 <sup>72</sup>	14	Face-to-face CBT	Phone	Provider therapy	Positive
Griffiths, 2012 <sup>73</sup>	478	Alternative technology	Computer	Self-support	No change
Hallgren, 2016 <sup>74</sup>	945	TAU; Exercise	Computer	Other function	Positive
Hickie, 2010 <sup>75</sup>	83	Enhanced general practitioner care	Computer	Multiple	Positive
Hilty, 2007 <sup>76</sup>	94	Alternative technology	Videoconference	Other function	Positive
Hilty, 2007 <sup>77</sup>	94	TAU	Multiple	Multiple	Positive
Himelhoch, 2013 <sup>78</sup>	34	Face-to-face CBT	Phone	Provider therapy	Positive
Højfød, 2013 <sup>79</sup>	106	Waitlist	Computer	Multiple	Positive
Hungerbuehler, 2016 <sup>80</sup>	107	Face-to-face consultations	Videoconference	Other function	Positive
Hunkeler, 2000 <sup>81</sup>	302	TAU; Alternative technology	Phone	Provider support	Positive
Hunkeler, 2012 <sup>82</sup>	103	TAU	Computer	Multiple	Positive
Johansson, 2012 <sup>83</sup>	121	Online discussion group; Alternative technology	Computer	Multiple	Positive
Johansson, 2012 <sup>84</sup>	92	Alternative technology	Computer	Multiple	Positive
Johansson, 2013 <sup>85</sup>	121	Alternative technology	Computer	Multiple	Positive
Kafali, 2014 <sup>86</sup>	257	TAU; Face-to-face psychotherapy	Phone	Provider therapy	Positive
Katzelnick, 2000 <sup>87</sup>	407	TAU	Phone	Other function	Positive
Kelders, 2015 <sup>88</sup>	239	Alternative technology	Computer	Self-therapy	Positive
Kenter, 2016 <sup>89</sup>	269	Self-help book	Computer	Multiple	Positive
Kersting, 2011 <sup>90</sup>	83	Waitlist	Computer	Multiple	Positive
Kessler, 2009 <sup>91</sup>	297	Waitlist	Computer	Provider therapy	Positive

(continued)

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**Table 1 (continued).**

Study	N	Comparator	Technology		Effectiveness Signal
			Type	Function	
Kim, 2011 <sup>92</sup>	507	Sent letter encouraging to seek treatment	Phone	Provider support	No change
Kivi, 2014 <sup>93</sup>	92	TAU	Computer	Multiple	Positive
Klein, 2016 <sup>94</sup>	1,013	TAU	Computer	Multiple	Positive
Kok, 2015 <sup>95</sup>	239	TAU	Smartphone	Multiple	Positive
Kolovos, 2016 <sup>96</sup>	269	TAU plus a self-help book	Computer	Multiple	Positive
Kraaij, 2010 <sup>97</sup>	73	Waitlist; Alternative technology	Computer	Self-therapy	No change
Lamers, 2015 <sup>98</sup>	174	Waitlist; Alternative technology	Computer	Provider therapy	Positive
Lappalainen, 2013 <sup>99</sup>	24	No treatment	Multiple	Multiple	Positive
Lappalainen, 2014 <sup>100</sup>	38	Face-to-face ACT	Computer	Provider therapy	Positive
Lappalainen, 2015 <sup>101</sup>	39	Waitlist	Computer	Multiple	Positive
Lerner, 2015 <sup>102</sup>	431	TAU	Phone	Provider therapy	Positive
Littlewood, 2015 <sup>103</sup>	691	TAU; Alternative technology	Computer	Self-therapy	No change
Lokman, 2017 <sup>104</sup>	329	Waitlist	Computer	Self-therapy	Positive
Ludman, 2007 <sup>105</sup>	600	TAU; Care management	Phone	Provider therapy	Positive
Luxton, 2016 <sup>106</sup>	121	In-person treatment	Computer	Provider therapy	Positive
Ly, 2014 <sup>107</sup>	84	Alternative technology	Smartphone	Multiple	Positive
Ly, 2015 <sup>108</sup>	93	Face-to-face therapy	Smartphone	Self-therapy	Positive
Lynch, 2004 <sup>109</sup>	54	TAU; Alternative technology	Phone	Provider therapy	Positive
Mackinnon, 2008 <sup>110</sup>	182	Alternative technology; No treatment	Computer	Multiple	Positive
Marasinghe, 2012 <sup>111</sup>	68	Waitlist	Smartphone	Self-therapy	Positive
Meyer, 2009 <sup>112</sup>	396	Waitlist	Computer	Self-therapy	Positive
Meyer, 2015 <sup>113</sup>	163	Waitlist; TAU	Multiple	Multiple	Positive
Migliorini, 2016 <sup>114</sup>	59	Waitlist	Computer	Multiple	Positive
Milgrom, 2016 <sup>115</sup>	43	TAU	Computer	Multiple	Positive
Millán-Calenti, 2015 <sup>116</sup>	160	No treatment	Computer	Self-therapy	No change
Mohr, 2005 <sup>117</sup>	127	Alternative technology	Phone	Provider therapy	Positive
Mohr, 2011 <sup>118</sup>	85	TAU	Phone	Provider therapy	No change
Mohr, 2012 <sup>119</sup>	325	Face-to-face CBT	Phone	Provider therapy	Positive
Mohr, 2013 <sup>120</sup>	102	Waitlist; Alternative technology	Multiple	Multiple	Positive
Montero-Marín, 2016 <sup>121</sup>	296	TAU; Alternative technology	Computer	Self-therapy	Positive
Moreno, 2012 <sup>122</sup>	167	TAU	Videoconference	Provider therapy	Positive
Morris, 2015 <sup>123</sup>	265	Alternative technology	Computer	Self-support	Positive
Moritz, 2012 <sup>124</sup>	210	Waitlist	Computer	Self-therapy	Positive
Mota Pereira, 2014 <sup>125</sup>	60	TAU; Alternative technology	Computer	Provider support	Positive
Neugebauer, 2006 <sup>126</sup>	19	TAU	Phone	Provider therapy	Positive
Newby, 2017 <sup>127</sup>	106	TAU	Multiple	Multiple	Positive
Ngai, 2015 <sup>128</sup>	397	TAU	Phone	Provider therapy	Positive
Nobis, 2015 <sup>129</sup>	260	Alternative technology	Multiple	Multiple	Positive
Nyström, 2017 <sup>130</sup>	312	Alternative technology	Computer	Multiple	Positive
O'Leary, 2015 <sup>131</sup>	62	Waitlist; Alternative technology	Computer	Self-therapy	No change
O'Mahen, 2013 <sup>132</sup>	910	TAU	Computer	Multiple	Positive
O'Neil, 2015 <sup>133</sup>	121	TAU	Phone	Provider therapy	Positive
Perini, 2009 <sup>134</sup>	48	Waitlist	Computer	Provider therapy	Positive
Pictet, 2016 <sup>135</sup>	101	Waitlist; Control CBM	Computer	Multiple	Positive
Piette, 2011 <sup>136</sup>	339	TAU + Feeling Good Handbook and educational materials; Unclear	Phone	Provider therapy	Positive
Pinto, 2013 <sup>137</sup>	28	Alternative technology	Computer	Other function	Positive
Pinto, 2016 <sup>138</sup>	60	No treatment	Computer	Self-support	Positive
Pots, 2016 <sup>139</sup>	236	Waitlist; Active control/expressive writing	Computer	Self-therapy	Positive
Proyer, 2014 <sup>140</sup>	510	Alternative technology	Computer	Self-therapy	Positive
Pugh, 2016 <sup>141</sup>	50	Waitlist	Computer	Provider therapy	Positive
Pyne, 2010 <sup>142</sup>	430	TAU	Phone	Provider support	No change
Richards, 2013 <sup>143</sup>	101	Alternative technology	Computer	Provider therapy	Positive
Richards, 2015 <sup>144</sup>	262	Waitlist	Computer	Multiple	Positive
Rickhi, 2015 <sup>145</sup>	32	Waitlist	Computer	Self-therapy	Positive
Rickles, 2005 <sup>146</sup>	63	TAU	Phone	Provider support	Positive
Roepke, 2015 <sup>147</sup>	283	Waitlist; Alternative technology	Smartphone	Self-therapy	Positive
Rollman, 2009 <sup>148</sup>	302	TAU	Phone	Provider support	Positive
Romero-Sanchiz, 2017 <sup>149</sup>	296	TAU; Alternative technology	Computer	Self-therapy	Positive
Rosso, 2017 <sup>150</sup>	77	MAC	Computer	Multiple	Positive
Ruskin, 2004 <sup>151</sup>	131	In-person treatment	Phone	Multiple	Positive
Ruwaard, 2009 <sup>152</sup>	54	Waitlist	Computer	Provider therapy	Positive
Salisbury, 2016 <sup>153</sup>	609	TAU	Phone	Provider support	Positive
Sandoval, 2017 <sup>154</sup>	45	No treatment	Computer	Self-therapy	Positive
Selmi, 1991 <sup>155</sup>	36	Waitlist; TAU	Computer	Self-therapy	Positive
Shamshiri, 2015 <sup>156</sup>	54	TAU	Phone	Self-support	Positive
Sheeber, 2012 <sup>157</sup>	70	TAU	Computer	Multiple	Positive
Simon, 2004 <sup>158</sup>	600	TAU; Alternative technology	Phone	Multiple	Positive
Simon, 2006 <sup>159</sup>	207	TAU	Phone	Multiple	No change
Simon, 2011 <sup>160</sup>	208	TAU	Computer	Provider support	Positive

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Study	N	Comparator	Technology		Effectiveness Signal
			Type	Function	
Spek, 2007 <sup>161</sup>	102	Waitlist, group therapy	Computer	Self-therapy	Positive
Steffen, 2016 <sup>162</sup>	74	Alternative technology	Multiple	Multiple	Positive
Stein, 2007 <sup>163</sup>	177	No treatment	Phone	Self-support	No change
Stiles-Shields, 2014 <sup>164</sup>	325	Face-to-face CBT	Phone	Provider therapy	Positive
Ström, 2013 <sup>165</sup>	48	Waitlist	Computer	Other function	Positive
Taleban, 2016 <sup>166</sup>	203	Booklet only; No treatment	Smartphone	Auto-reminders	Positive
Titov, 2010 <sup>167</sup>	141	Waitlist; Alternative technology	Computer	Provider therapy	Positive
Titov, 2015 <sup>168</sup>	290	Alternative technology	Computer	Provider therapy	Positive
Titov, 2015 <sup>169</sup>	54	Waitlist	Computer	Provider therapy	Positive
Uebelacker, 2011 <sup>170</sup>	38	TAU	Phone	Provider support	Positive
Ünlü Ince, 2013 <sup>171</sup>	96	Waitlist	Computer	Self-therapy	No change
van Bastelaar, 2011 <sup>172</sup>	255	Waitlist	Computer	Multiple	Positive
Vernmark, 2010 <sup>173</sup>	88	Waitlist; Alternative technology	Computer	Provider therapy	Positive
Wagner, 2014 <sup>174</sup>	62	TAU; Face-to-face psychotherapy	Computer	Provider therapy	Positive
Warmerdam, 2008 <sup>175</sup>	263	Waitlist; Alternative technology	Computer	Self-therapy	Positive
Watkins, 2012 <sup>176</sup>	121	TAU; Alternative technology	Phone	Multiple	Positive
Watts, 2013 <sup>177</sup>	52	Alternative technology	Smartphone	Self-therapy	Positive
Williams, 2013 <sup>178</sup>	69	Waitlist	Computer	Self-therapy	Positive
Williams, 2015 <sup>179</sup>	121	iCBT + sham CBM	Computer	Self-therapy	No change
Wozney, 2017 <sup>180</sup>	62	TAU	Multiple	Multiple	Positive
Wright, 2005 <sup>181</sup>	45	CBT with therapist; Waitlist	Computer	Self-therapy	Positive
Yang, 2015 <sup>182</sup>	77	Placebo computer task; No treatment	Computer	Other function	Positive

Abbreviations: CBM = cognitive bias modification, CBT = cognitive-behavioral therapy, iCBT = internet cognitive-behavioral therapy, IPT = interpersonal psychotherapy, MAC = monitored attention control, N = number of participants, PST = problem-solving therapy, TAU = treatment as usual.

resulted in 4,062 potentially relevant articles. After dual review of titles and abstracts, 1,366 RCTs were selected for full-text dual review. Of these, 161 RCTs met the inclusion criteria and are included in the evidence map.<sup>22-182</sup>

The earliest study was published in 1991, and the number of studies published each year increased from 1 in that year to 22 in 2016 (9 were published in 2017 when we conducted our search). The evidence table (Table 1) lists the details of the included studies.

### Key Question 1: How Many Studies Have Evaluated the Use of Technology in Depression Care? What Are the Types and Function of the Evaluated Technologies?

To answer the key questions, we have documented the evidence in scatter plots. Each point in the plots represents 1 of the 161 included RCTs.

Figure 2 shows the types of technology and functions of the technology used in treatment for patients with depression, as well as the size of each study. In examining this evidence map, the key questions regarding technology type and functions are answered. The majority of the studies utilized computer (98 studies; 61%) and phone (37 studies; 23%) technology, followed by 12 studies (7%) using more than 1 technology. Eight studies used smartphones (5%), and 4 used videoconferences (2%). The 2 studies in the “other” category (1%) included a computer-telephone system and an analog videophone.

Most studies (51; 32%) examined technologies with multiple functions, patient self-directed therapy (41; 25%), and provider-directed therapy (38; 24%). The category “multiple types of technology” often indicated a program designed to be used at home on the computer, with additional phone or text support. For example, the participants may complete self-directed psychotherapy via

computer with e-mail and SMS reminders, requiring that they also use a smartphone to receive the SMS texts.<sup>183</sup> Often, this was completing self-directed psychotherapy with additional support from a therapist by e-mail and phone calls.<sup>127</sup> A minority of studies looked at provider-directed support (11; 7%), patient self-directed support (7; 4%), provider-directed feedback (1; 1%), and auto-reminders (1; 1%). There were 11 studies (7%) of “other” technological functions. The most common type/function combinations were computer/patient self-therapy (35 studies, 22% of total), computer/multiple interventions (34 studies, 21%), and phone/provider-directed therapy (18 studies, 11%).

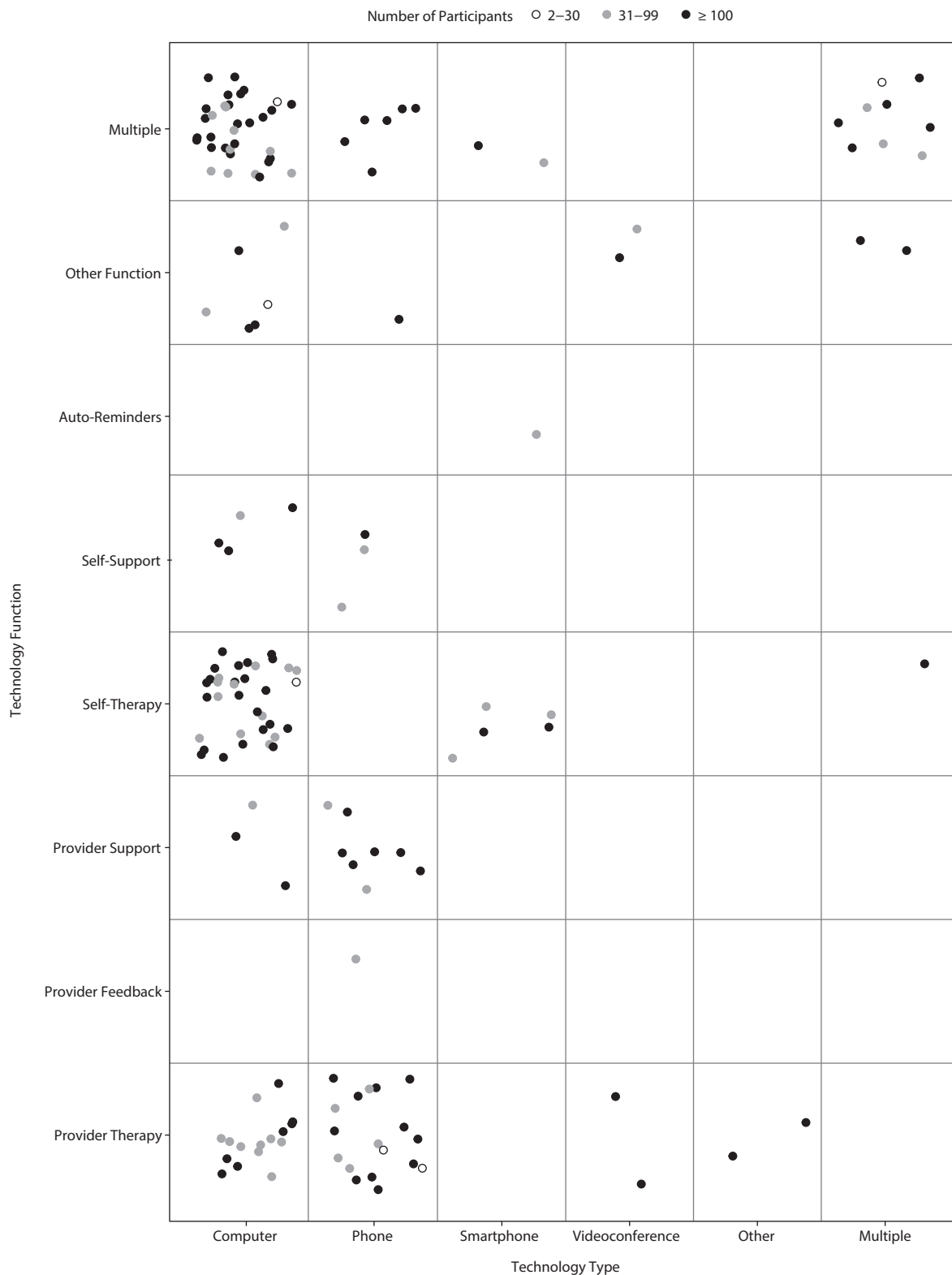
In the studies examined, 96% (155 out of 161 studies) included more than 31 participants and 63% (101) included 100 or more participants. There were 54 studies (34%) that included between 31 and 99 participants and 6 small studies (4%) that included up to 30 participants. The smallest study included 7 participants.<sup>184</sup> The largest study, with 2,794 participants, recruited participants who spontaneously accessed the MoodGym website.<sup>49</sup>

### Key Question 2: What Is the Direction of Effect in Studies Evaluating the Technology?

We also reviewed the reported treatment effects for a broad overview of the effectiveness of the technology. Figure 3 gives further information about the evidence base of technology utilized to treat depression by documenting the direction of effect of the study.

Regardless of the function of the technology used, 90% (145) of studies reported that the intervention had a positive outcome on symptoms, particularly for depression. There were 15 studies (9%) that reported no change, particularly for self-directed interventions, such as self-directed psychotherapy (8 studies) and patient self-directed support

Figure 2. Technology by Type and Function<sup>a</sup>



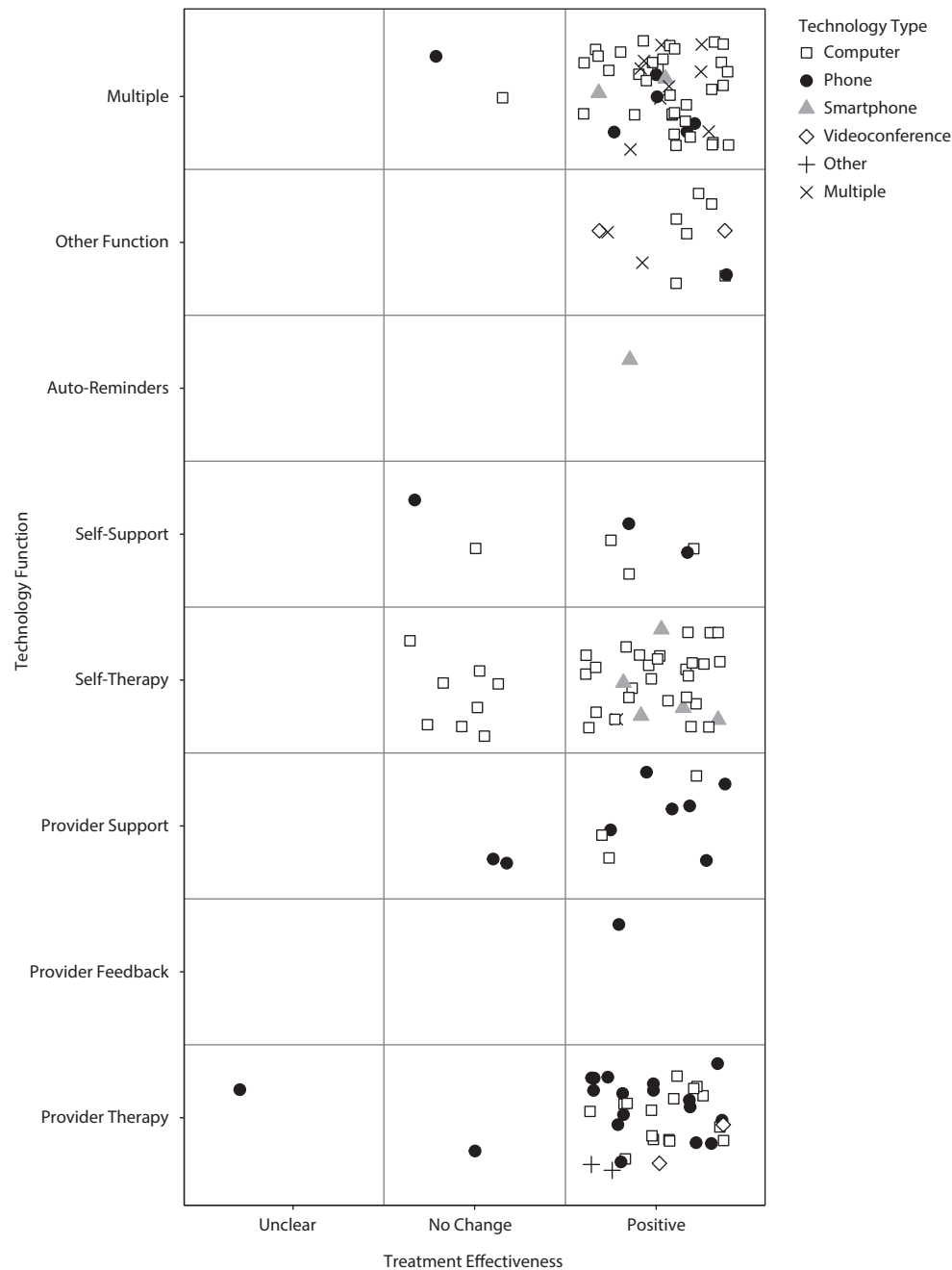
<sup>a</sup>This scatter plot summarizes the randomized-controlled trial evidence of technological interventions for the clinical care of depression published until June 2017.

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**Figure 3. Effect of Technology by Technology Function**



(2 studies), but also provider-directed psychotherapy (1 study), provider support (2 studies), and multiple (2 studies). One study of provider-directed therapy had outcomes that were judged to be unclear (1%).

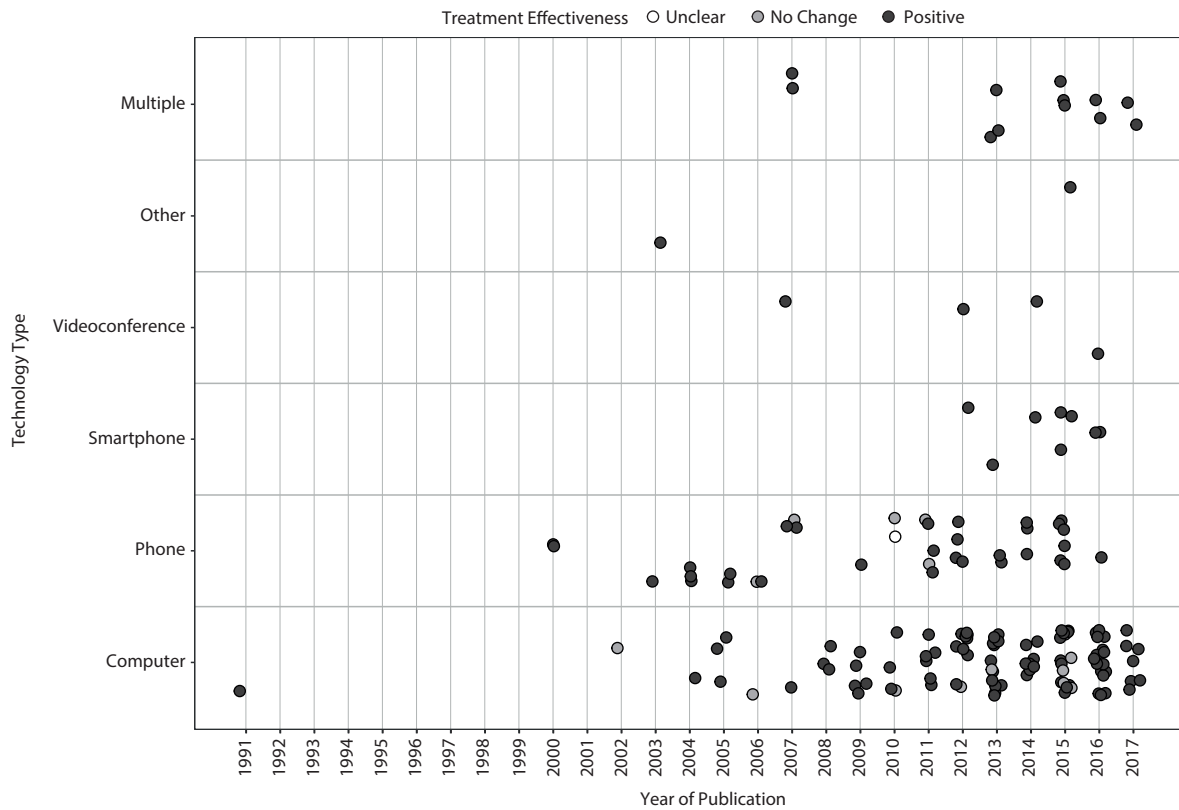
### Key Question 3: How Does Effectiveness of the Evaluated Technologies Change Over Time, by Technology Type and Function?

Technology changes over time, and newer technology is likely to be more highly evaluated. To disentangle the volume of evaluations and the recency of technology, we also examined treatment effects by publication year. Figures

4 and 5 detail reported treatment effectiveness by publication year and technology type and function, respectively.

Most evaluations of computer (62 studies; 63%), smartphone (7 studies; 88%), and multiple interventions (10 studies; 83%) were published within the last 5 years of this search. Evaluations of videoconference (2 studies within the last 5 years; 50%) and other interventions (1 study within the last 5 years; 50%) were published evenly before and after this period. A minority of studies of phone interventions (12 studies, 32%) were published after 2012. A slight majority of all studies were published in the last 5 years of this search (94 studies; 58%) regardless of intervention technology.

Figure 4. Effect of Technology by Year of Publication and Technology Type



Eighty-eight of these studies (94%) reported positive effects of the studied technology. Conversely, only 57 of the 67 studies (85%) published in or before 2012 reported positive effects.

Most of the included studies of self-therapy (27 studies; 66%), provider therapy (20 studies; 53%), multiple functions (33 studies; 65%), and other functions (7 studies; 64%) were published after 2012. Fewer than half of studies of interventions involving self-support (3 studies; 43%) and provider support (2 studies; 18%) were published in the last 5 years of this search. Only 1 study of auto-reminders (published in 2016) and 1 study of provider feedback (published in 2015) met our inclusion criteria.

**DISCUSSION**

This evidence map provides an overview of the broad research field of the use of technology in the clinical care in depression. We summarized the evidence published in RCTs.

We identified 161 published RCTs that included different types of technologies that performed different functions in the clinical care of depressive disorders. We chose the type of technologies that scoping searches revealed were most common, including those requiring the use of computer, phone, smartphone, videoconference, or multiple technologies, while allowing for uncommon technologies in the category labeled other. In addition, we further defined

the treatments by identifying what function the technology served, including auto-reminders, support given between patients, patient self-directed psychotherapy, provider support, provider feedback, provider-directed psychotherapy, multiple functions within 1 treatment, and other. The most common type of evaluated technology application is currently computer-based psychotherapy. This technology has the potential to expand access to mental health care.

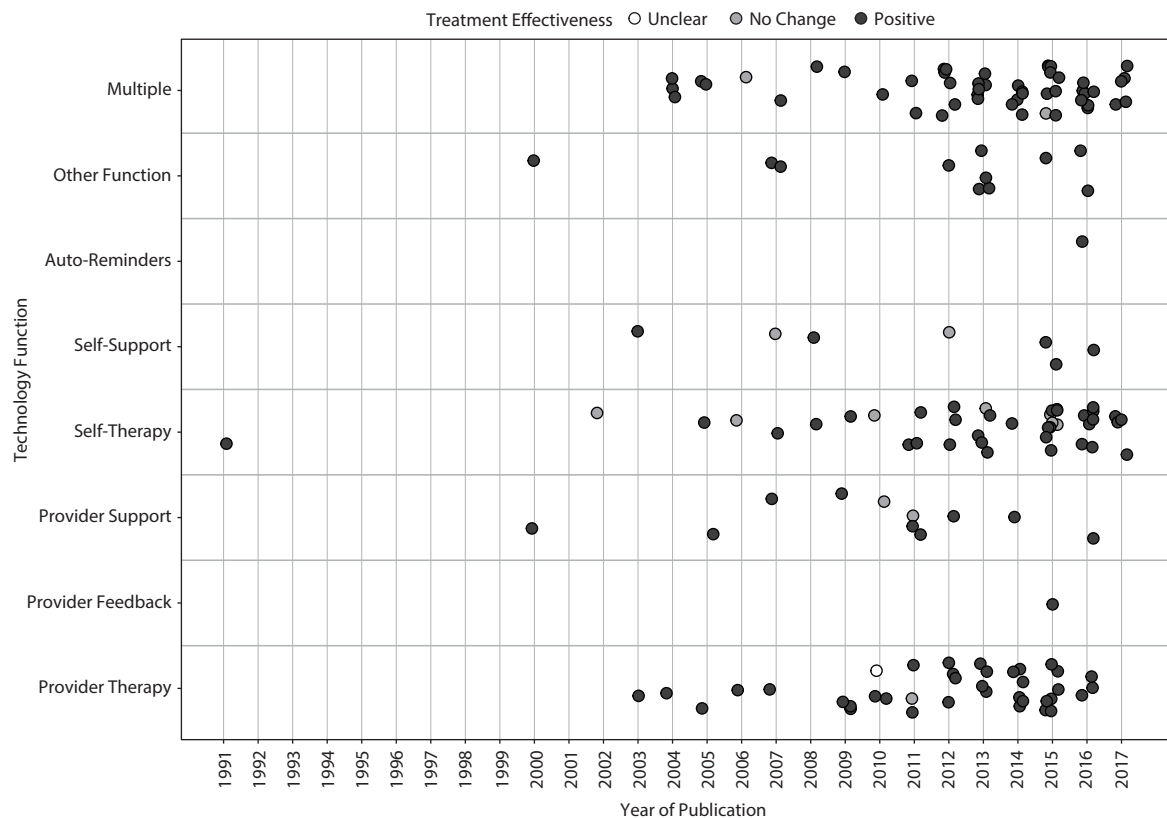
A key factor in deciding whether to implement new technologies is whether or not they are effective in reducing symptoms. One hundred forty-five of the 161 studies found a positive outcome in depression symptoms at follow-up assessment compared to baseline. However, 15 found no change, and 1 reported unclear results, and these were primarily self-directed interventions such as self-directed psychotherapy or patient directed support.

Technology changes over time, and so it is expected that newer technologies were evaluated more recently. Most of the included studies involving a computer, smartphone, or multiple technologies were published in the last 5 years of this search, while most evaluations of phone interventions were published before 2013. It is less clear that the evaluation of technology function changed over time. A majority of included studies of self-therapy, provider therapy, multiple functions, and other functions were published in the last 5 years of the search, but so were a majority of all included studies. This increase in publication of studies of these

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**Figure 5. Effect of Technology by Year of Publication and Technology Function**



technology functions may just represent an overall increase in the evaluation of technological interventions for depression.

### Limitations

The evidence map is well suited to identify promising areas that should be reviewed in more detail in subsequent systematic reviews. However, an evidence map is a broad overview that cannot provide accurate estimates of the effectiveness of interventions or the magnitude of effects across studies.

Given the large body of literature, evidence maps must focus on a limited number of characteristics. We attempted to capture the types of technology as well as the functions of technology that a scoping search suggested would be most likely. However, there remain a large number of studies that fell into the categories “other” or “multiple.” These studies addressed unique and study-specific technology. Studies could also use multiple types of technology and multiple functions within the technology type. Almost all of these studies of combined technologies and functions showed positive symptom outcomes, and therefore there may be technologies that are more effective when combined, though that is not defined in this evidence map. In addition, it is possible that by combining technologies or functions, one may have a more effective treatment, but the particular items combined would need to be delineated more than an evidence map is able to do.

It is also noteworthy that in this broad-stroke overview, the large majority of studies appeared to have positive effects. When abstracting data regarding outcomes, we allowed for any measurement of symptom improvement. We abstracted data provided by the authors regarding whether the treatment had a positive outcome on symptoms. This outcome could be determined in a variety of ways including patient report, clinician assessment, or need for further care. Symptoms were assessed by a variety of scales or without a scale. It is likely that there would have been a different number of studies with a positive outcome if all studies were held to the same standard for determining this result. A meta-analysis is needed to determine the size of the treatment effect and for a more refined discussion of the effects of technology in depression treatment.

The vast majority of all studies (90%) reported positive effects, but this proportion was higher (94%) among studies published in the last 5 years of the search than among those published before (85%). This discrepancy could represent publication bias,<sup>185</sup> in that more studies reporting positive effects may have been published after the effects of such interventions became well known. We did not conduct a meta-analysis, and so we cannot employ traditional statistical methods<sup>186</sup> to detect and correct for publication bias. However, such a bias is likely irrelevant, as the most commonly included interventions, self- and provider-directed therapy, are already well established in their effectiveness.<sup>187,188</sup>

### Comparison to Other Research

Our review is consistent with other research in this area. A systematic review and meta-analysis of computer based psychological treatments for depression analyzed 40 studies and found this treatment to be effective.<sup>17</sup> A meta-analysis of computerized cognitive training for depression examined 9 trials and found this treatment to be effective, as well.<sup>18</sup> A meta-analysis of computerized treatment for depression also found positive effects over 12 trials,<sup>18</sup> and a narrative review of 13 online self-help programs for mental illness found the interventions to be feasible in low and middle income countries.<sup>19</sup>

A recent evidence map created by AHRQ provided an overview of the evidence about telehealth, in general, which included behavioral health.<sup>15</sup> The report used a bubble plot format to display the distribution of evidence from systematic reviews in terms of volume (number of reviews and number of patients in included studies), conclusions about benefit by clinical focus, and telehealth function. The authors also determined how much evidence was available about combinations of clinical areas and telehealth functions reported in the existing systematic reviews. For behavioral health, they utilized systematic reviews for the treatment of conditions including depression, anxiety, and addiction (including substance abuse, smoking cessation, alcohol abuse, and pathological gambling). The map included 7 systematic reviews, examining 137 studies (83 RCTs) and 32,770 patients. They determined that there was sufficient evidence to support the effectiveness of telehealth for psychotherapy as a part of behavioral health.<sup>15</sup> Fifty-eight of their RCTs looked at psychotherapy, compared to 79 of ours. Also, we further divided by provider-directed and self-directed psychotherapy and separated these studies by type of technology. Most of the behavioral health studies they found reported benefit or potential benefit, except for 1 that found insufficient evidence for correctional or forensic psychiatry. This is similar to our findings of positive outcomes for the majority of our studies.

Another review summarized the findings of 10 systematic reviews of telepsychiatry. The emphasis of this review was on the feasibility of use in resource constrained environments. The studies in the reviews were conducted in the United States, Canada, Europe, Australia, Japan, and Hong Kong.<sup>190</sup> Many of the studies presented in this evidence map were in resource-constrained environments, with the express purpose of finding more economical ways to bring mental health treatment to these areas or populations. The researchers reviewing the systematic reviews reported that the reviews were of acceptable quality but that common deficiencies were lack of grading the strength of evidence or linking the quality of the included studies to the conclusions. Consistent with our evidence map finding, the review of reviews concluded that telepsychiatry is as effective as face-to-face treatment and does improve symptoms.<sup>190</sup>

### Future Research

This evidence map documents the existing literature as well as research gaps in the evidence base. In fact, an evidence

map is often explicitly used not only to identify relevant evidence, but also to initiate the process of developing a research agenda that can address remaining gaps.<sup>16</sup> The figures indicate where there are few or no published studies for some types of technology, like videoconference or smartphones, or for a particular function the technology serves, like provider feedback or auto-reminders. Research gaps were not apparent for studies that evaluate symptom outcomes, as all did so. However, it was interesting to note that most of the studies that did not find a positive change were those of self-directed psychotherapy or patient-directed support. Further research into whether self-directed versus provider-directed interventions are more effective would be valuable in determining whether the allocation of resources to provider-directed interventions may be warranted. Having a provider administer treatment can greatly affect cost and feasibility of implementation and therefore should be examined. Studies of smartphones were less numerous than studies of phone or computer. Given the fact that so many patients have smartphone technology available to them, more studies involving this technology may be beneficial.

### CONCLUSION

This evidence map provides a broad overview about the types and functions of technology used in the clinical care of depressive disorders. The most research was available for computer and phone treatments for self- or provider-directed psychotherapy. The majority of studies reported symptom improvement and were published in the last 5 years of this search.

Several areas of future research were identified including research regarding smartphone capabilities, as these are becoming far more utilized by patients, yet studies utilizing smartphones are far fewer than phone and computer studies. Also, investigation into whether provider-directed versus self-directed interventions are more effective is needed, as this may affect resource allocation.

Limitations included a large number of studies whose technology types and/or functions did not fit into our predetermined categories. Delineation of these technologies, as well as further exploration into the studies that combined technology types or treatments, would give more extensive data.

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## **Supplementary Material**

**Article Title:** The Use of Technology in the Clinical Care of Depression: An Evidence Map

**Authors:** Eric A. Apaydin, PhD; Alicia Ruelaz Maher, MD; Laura Raaen, MPH;  
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and Susanne Hempel, PhD

**DOI Number:** 10.4088/JCP.18r12118

### **List of Supplementary Material for the article**

1. [Appendix 1](#) Search Methodology

### **Disclaimer**

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

## **Appendix 1. Search methodology (for original study of the use of technology in the clinical care of both anxiety and depressive disorders)**

### **DATABASE SEARCHED & TIME PERIOD COVERED:**

PubMed – From inception to 6/28/2017

### **LANGUAGE:**

English

### **SEARCH STRATEGY:**

"Telemedicine"[Mesh] OR telemedicine[tiab] OR telehealth[ti] OR email[tiab] OR internet[ti] OR video[tiab] OR videos[tiab] OR skype[tiab] OR computer-based OR phone-based OR telephone-based OR web-based[tiab] OR computerized OR smartphone OR avatar OR "information and communication technology" OR ict OR cell phone\* OR mobile phone\* OR "interactive voice response" OR text message\* OR "digital communication" OR "e-health" OR (virtual AND communicat\*) OR "interactive video" OR web-cam\* OR webcam\* OR remote monitor\* OR remotely monitor\* OR two-way camera\* OR personal monitor\* OR web-based portal\* OR social network\* OR "secure chat" OR chatroom\* OR chat room\* OR online[tiab] OR online[ot] OR information technolog\*

AND

"Anxiety Disorders"[Mesh] OR "Depressive Disorder"[Mesh] OR anxiety OR phobia\* OR panic OR depressive disorder\* OR depression[tiab] OR depression[ot] OR depressive[tiab] OR depressive[ot] OR dysthymi\*

AND

"Professional-Patient Relations"[mh] OR "Health Services Accessibility"[mh] OR physician-patient relation\* OR patient-physician relation\* OR doctor-patient relation\* OR patient-doctor relation\* OR access\*[tiab] OR access\*[ot]

AND

randomi\* OR "random allocation" OR rct\* OR Filters: Randomized Controlled Trial

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### **DATABASE SEARCHED & TIME PERIOD COVERED:**

PsycINFO – From inception to 6/28/2017

### **LANGUAGE:**

English

### **SEARCH STRATEGY:**

TI, SU, AB ( telemedicine OR telehealth OR email OR internet OR video OR videos OR skype OR computer-based OR phone-based OR telephone-based OR web-based OR computerized OR smartphone OR avatar OR "information and communication technology" OR ict OR "cell phone" OR "cell phones" OR cellphone\* OR "mobile phone" OR "mobile phones" OR "interactive voice response" OR "text message" OR "text messages" OR "text messaging" OR "digital communication" OR "e-health" OR (virtual AND communicat\*) ) OR DE "Information Technology" OR DE "Automated Information Processing" OR DE "Bioinformatics" OR TI, SU, AB ( "interactive video" OR web-cam\* OR webcam\* OR "remote monitoring" OR "remote monitor" OR "remote monitors" OR "remotely monitor" OR "remotely monitoring" OR "two-way camera" OR "two-way cameras" OR "personal monitor" OR



"personal monitors" OR "web-based portal" OR "web-based portals" OR "social network" OR "social networks" OR "social networking" OR chatroom\* OR "chat room" OR "chat rooms" OR online )  
AND

DE "Major Depression" OR DE "Anaclitic Depression" OR DE "Dysthymic Disorder" OR DE "Endogenous Depression" OR DE "Late Life Depression" OR DE "Reactive Depression" OR DE "Recurrent Depression" OR DE "Treatment Resistant Depression" OR DE "Anxiety" OR DE "Social Anxiety" OR DE "Anxiety Management" OR DE "Panic" OR DE "Phobias" OR DE "Anxiety Disorders" OR DE "Generalized Anxiety Disorder" OR DE "Obsessive Compulsive Disorder" OR DE "Panic Disorder" OR TI ( anxiety OR phobia\* OR panic OR depression OR depressive ) OR SU ( anxiety OR phobia\* OR panic OR depression OR depressive OR dysthym\* ) OR AB ( anxiety OR phobia\* OR panic OR depression OR depressive )

AND

TI ( "physician-patient relationship" OR "patient-physician relationship" OR "physician-patient relations" OR "patient-physician relations" OR "professional-patient relationship" OR "professional-patient relations" OR access\* ) OR SU ( "physician-patient relationship" OR "patient-physician relationship" OR "physician-patient relations" OR "patient-physician relations" OR "professional-patient relationship" OR "professional-patient relations" OR access\* ) OR AB ( "physician-patient relationship" OR "patient-physician relationship" OR "physician-patient relations" OR "patient-physician relations" OR "professional-patient relationship" OR "professional-patient relations" OR access\*

AND

TI ( randomi\* OR "random allocation" OR rct\* ) OR SU ( randomi\* OR "random allocation" OR rct\* ) OR AB ( randomi\* OR "random allocation" OR rct\* )

#### **DATABASE SEARCHED & TIME PERIOD COVERED:**

Web of Science – From inception to 6/28/2017

#### **LANGUAGE:**

English

#### **SEARCH STRATEGY:**

ts=(telemedicine OR telehealth OR email OR internet OR video OR videos OR skype OR computer-based OR phone-based OR telephone-based OR web-based OR computerized OR smartphone OR avatar OR "information and communication technology" OR ict OR "cell phone" OR "cell phones" OR cellphone\* OR "mobile phone" OR "mobile phones" OR "interactive voice response" OR "text message" OR "text messages" OR "text messaging" OR "digital communication" OR "e-health" OR (virtual AND communicat\*) OR "Information Technology" OR "Automated Information Processing" OR "Bioinformatics" OR "interactive video" OR web-cam\* OR webcam\* OR "remote monitoring" OR "remote monitor" OR "remote monitors" OR "remotely monitor" OR "remotely monitoring" OR "two-way camera" OR "two-way cameras" OR "personal monitor" OR "personal monitors" OR "web-based portal" OR "web-based portals" OR "social network" OR "social networks" OR "social networking" OR chatroom\* OR "chat room" OR "chat rooms" OR online)

AND

ts=(anxiety OR phobia\* OR panic OR depression OR depressive OR dysthym\*)

AND

ts=("physician-patient relationship" OR "patient-physician relationship" OR "physician-patient relations" OR "patient-physician relations" OR "professional-patient relationship" OR "professional-patient relations" OR access\*)

AND

ts=(randomi\* OR "random allocation" OR rct\*)

=====

**DATABASE SEARCHED & TIME PERIOD COVERED:**

Cochrane CENTRAL – From inception to 6/28/2017

**LANGUAGE:**

English

**SEARCH STRATEGY:**

telemedicine or telehealth or email or internet or video or videos or skype or computer-based or phone-based or telephone-based or web-based or computerized or smartphone or avatar or "information and communication technology" or ict or "cell phone" or "cell phones" or cellphone\* or "mobile phone" or "mobile phones" or "interactive voice response" or "text message" or "text messages" or "text messaging" or "digital communication" or "e-health" or (virtual and communicat\*) or "information technology" or "interactive video" or web-cam\* or webcam\* or "remote monitoring" or "remote monitor" or "remote monitors" or "remotely monitor" or "remotely monitoring" or "two-way camera" or "two-way cameras" or "personal monitor" or "personal monitors" or "web-based portal" or "web-based portals" or "social network" or "social networks" or "social networking" or chatroom\* or "chat room" or "chat rooms" or online:ti,ab,kw (Word variations have been searched) OR MeSH descriptor: [Telemedicine] explode all trees

AND

anxiety or phobia\* or panic or depression or depressive or dysthym\*:ti,ab,kw (Word variations have been searched) OR MeSH descriptor: [Depression] this term only OR MeSH descriptor: [Depressive Disorder] explode all trees OR MeSH descriptor: [Anxiety] this term only OR MeSH descriptor: [Panic] this term only

AND

"physician-patient relationship" or "patient-physician relationship" or "physician-patient relations" or "patient-physician relations" or "professional-patient relationship" or "professional-patient relations" or access\*:ti,ab,kw (Word variations have been searched) OR MeSH descriptor: [Professional-Patient Relations] explode all trees OR MeSH descriptor: [Health Services Accessibility] explode all trees

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