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Social Needs Resource Connections: A Systematic Review of Barriers, Facilitators, and Evaluation

Katherine DuBose Broadwell
Oregon Health & Science University

Dawn Michele Richardson
OHSU-PSU School of Public Health, dawn.richardson@pdx.edu

Christina M. Nicolaidis
Portland State University, christina.nicolaidis@pdx.edu

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Title:

Social needs resource connections: A systematic review of barriers, facilitators and evaluation

Author names and affiliations:

Anna Louise Steeves-Reece, MPH, MA¹⁻², Annette Marie Totten, PhD, MPA, MA¹⁻⁴, Katherine DuBose Broadwell, BA², Dawn Michele Richardson, DrPH, MPH¹, Christina Nicolaidis, MD, MPH⁵⁻⁶, Melinda Marie Davis, PhD, MCR^{1,2,7}

1. Oregon Health & Science University-Portland State University School of Public Health, Portland, Oregon
2. Oregon Rural Practice-based Research Network, School of Medicine, Oregon Health & Science University, Portland OR
3. Pacific Northwest Evidence-based Practice Center, Oregon Health & Science University, Portland, OR
4. Department of Medical Informatics & Clinical Epidemiology, School of Medicine, Oregon Health & Science University, Portland, OR
5. School of Social Work, Portland State University, Portland, OR
6. Division of General Internal Medicine and Geriatrics, School of Medicine, Oregon Health & Science University, Portland, OR
7. Department of Family Medicine, School of Medicine, Oregon Health & Science University, Portland, OR

Corresponding author information:

Anna Louise Steeves-Reece¹⁻²

Mail Code: VPT

3181 SW Sam Jackson Park Road

Portland, OR 97239

(541) 206-4824

steevesr@ohsu.edu

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Abstract:

Introduction. Healthcare organizations are increasingly screening patients for social needs (e.g., food, housing) and referring them to community resources. We conducted a systematic mixed studies review to a) assess how studies evaluate social needs resource connections and b) identify patient and caregiver-reported factors that may inhibit or facilitate resource connections.

Methods. We searched PubMed and CINAHL for articles published from October 2015 to December 2020 and used dual review to determine inclusion based on our a priori selection criteria. We abstracted data related to study design, setting, population of interest, intervention, and outcomes. Articles' quality was assessed using the Mixed Methods Appraisal Tool (MMAT). Data analysis was conducted in 2021.

Results. We identified 34 articles from 32 studies. We created a taxonomy of quantitative resource connection measures with 4 categories: whether participants made contact with resources; received resources; had their social needs addressed; and/or rated some aspect of their experience with resources. Barriers to resource connections were inadequacy, irrelevancy, or restrictiveness; inaccessibility; fears surrounding stigma or discrimination; and factors related to staff training and resource information sharing. Facilitators were referrals' relevancy; the degree of support and simplicity embedded within the interventions; and interventions being comprehensive and inclusive.

Discussion. Our synthesis of barriers and facilitators indicates areas where healthcare organizations may have agency to improve the efficacy of social needs screening and referral interventions. We also recommend that resource connection measures be explicitly defined and focus on whether participants received new resources and/or whether their social needs were addressed.

1 INTRODUCTION

2 Numerous health disciplines, including public health and primary care, have long recognized the
3 interconnections between social justice, social conditions, and health outcomes.¹⁻³ Recently, the
4 healthcare sector revitalized “an explosion of interest”⁴ in both identifying patients’ social risks
5 (e.g. housing instability and food insecurity) and addressing patients’ social needs (the social
6 risks they wish to have addressed).⁵ In the United States, this renewed focus on healthcare-based
7 social interventions corresponds with an ongoing shift towards value-based care, reflecting the
8 intentions of multiple policies and incentives, especially the Affordable Care Act, to foster better
9 care, better health, and lower costs.⁶⁻⁹ The COVID-19 pandemic further accelerated these efforts
10 by highlighting and exacerbating longstanding social injustices that cause health disparities.¹⁰⁻¹³

11
12 Healthcare-based social interventions encompass a wide range of contexts and approaches and
13 may potentially improve patients’ health through a variety of mechanisms, including by
14 connecting patients with resources to decrease their unmet social needs.^{14,15} In the U.S.,
15 prominent organizations—especially the American Academy of Pediatrics (AAP) and the
16 American Academy of Family Physicians (AAFP)¹⁶—and initiatives have been influential in
17 promoting screening and referral strategies to facilitate access to resources. For example, since
18 2015 the AAP has recommended pediatricians implement routine screening and referral
19 interventions for food insecurity.^{16,17} Likewise, the Centers for Medicare & Medicaid Services
20 (CMS) is currently testing whether systematically identifying social risks and addressing social
21 needs among Medicare and Medicaid beneficiaries can reduce healthcare costs and utilization
22 through their Accountable Health Communities (AHC) model.¹⁸

23

24 A key component of healthcare-based social interventions is facilitating resource connections for
25 patients, yet the idea of what a “resource connection” entails is neither straightforward nor
26 universally understood by healthcare organizations. For example, it may refer to a patient
27 speaking with a staff member at a food bank, enrolling in a program to receive food boxes, or
28 acquiring sufficient food through having received food boxes. Definitions matter because they
29 inform how organizations design interventions and evaluate their impact. As health systems
30 increasingly respond to patients’ social needs, clarifying the range of “resource connection”
31 definitions currently in use (as well as their potential advantages and drawbacks) is critical.
32 Additionally—regardless of the definition(s) an organization selects—it is vital to understand
33 what factors patients say do or do not allow them to connect with needed resources.

34

35 Therefore, the authors conducted a systematic mixed studies review (SMSR)^{19,20} of social needs
36 screening and referral interventions to a) assess the ways in which healthcare organizations
37 define—and subsequently measure—resource connections; and b) identify patient-reported
38 factors that may inhibit or facilitate all types of resource connections. A SMSR follows the same
39 guidelines as a traditional systematic review, but places greater emphasis on synthesizing results
40 across diverse study designs. This type of review may be particularly helpful when synthesizing
41 “complex and highly context-sensitive interventions.”¹⁹ A SMSR was salient for this project, as
42 the authors knew a priori that articles would include diverse contexts, study designs, populations
43 of interest, and interventions.²¹

44

45 **METHODS**

46 **Data Sources and Search Strategy**

47 The review followed PRISMA guidelines and is registered in PROSPERO (CRD42021232123).
48 Working with a health sciences librarian, the authors developed search strategies for MEDLINE
49 and CINAHL databases. They identified a combination of subject terms and keywords for each
50 of 3 concepts: screening, social needs, and referral. These concepts were combined using “AND”
51 to ensure inclusion of all three concepts. The search was restricted to English-language studies
52 published from October 2015 (when the AAP began recommending pediatricians screen for food
53 insecurity)²² through December 23, 2020. The full search strategy for MEDLINE is available as
54 Supplemental Material 1. The authors identified additional articles through the SIREN (Social
55 Interventions Research & Evaluation Network) Evidence & Resource Library.²³

56

57 **Study Selection and Eligibility Criteria**

58 Articles were imported into EndNote X9 software and duplicates were removed. Two authors
59 (ASR and KB) independently reviewed titles and abstracts for inclusion or exclusion based on
60 the protocol. The same authors read the full texts of the remaining articles, again using the
61 protocol to make inclusion and exclusion decisions. At both stages, the authors compared their
62 choices and resolved any points of confusion or disagreement. Included articles assessed U.S.
63 healthcare-based social needs screening and referral interventions. Interventions screened
64 patients or caregivers for at least 1 of 5 domains from the AHC Health-Related Social Needs
65 Screening Tool: housing, food, transportation, utilities, and safety.²⁴ Most social needs screening
66 tools include these domains.²⁵ “Referral” meant any attempt to link participants with needed
67 resources, such as by providing a resource sheet or facilitating a handoff to a community-based
68 organization (CBO). Referrals did not need to depend on screening results. Finally, articles had
69 to report quantitative or qualitative outcomes on participants’ ability to access resources and/or

70 have their social needs addressed. Qualitative outcomes needed to come from patients or
71 caregivers who had participated in an intervention. As the review emphasized material resource
72 connections, studies focusing exclusively on interpersonal safety were excluded.

73

74 **Data Abstraction, Analysis, and Quality Appraisal**

75 The authors abstracted information on study design, setting, population, intervention, and
76 outcomes into a spreadsheet. The raw data is available from the lead author upon request. The
77 analytic process was inductive, iterative, and applied a parallel-results convergent synthesis
78 design, an optional synthesis approach for SMSRs.²⁰ First, one author (ASR) reviewed abstracted
79 data for the outcomes of interest at the level of individual studies (i.e., resource connection
80 measures, barriers and facilitators) using codes generated directly from the text. In a second pass,
81 ASR identified emerging themes across studies.²⁶ Initial codes and themes were shared with the
82 senior author (MD), practitioners of healthcare-based social interventions, and an expert in the
83 field for further validation. Next, three authors (ASR, MD, and KB) used negative case
84 analysis²⁷—a process in which a theory is proposed and then tested and refined based on the
85 data—to categorize resource connection measures into a taxonomy. Regarding barriers and
86 facilitators to resource connections, the same three authors collaborated to summarize the
87 breadth and prevalence of themes initially developed by ASR.

88

89 Authors used the Mixed Methods Appraisal Tool (MMAT) to assess articles' quality.²⁸ The
90 MMAT assesses 5 types of designs: quantitative descriptive, non-randomized, randomized
91 controlled trials (RCTs), qualitative, and mixed methods. Reviewers identify the study type and
92 then assess 5 corresponding methodological criteria, rating each as 'yes', 'no', or 'can't tell'. The

93 MMAT recommends against quality scores, as this can obscure patterns in the types of
94 weaknesses or strengths that exist.²⁸ One author (ASR) completed quality appraisals for all
95 included studies. A second individual (either AT or a research assistant) independently
96 completed second quality appraisals for a subset of the articles. The 2 quality appraisers for each
97 article met to compare their work and draw conclusions through dialogue and consensus.

98

99 **RESULTS**

100 Two authors (ASR and KB) reviewed 1,826 unique abstracts, of which 118 articles underwent
101 full-text review. Eighty-four articles were excluded due to interventions or outcomes being out of
102 scope. Thirty-four articles met inclusion criteria (see Figure 1) that report results from 32 studies.

103

104 **Mixed Methods Appraisal Tool (MMAT) Results**

105 Included articles encompassed diverse study designs, including descriptive (n=14),²⁹⁻⁴²
106 qualitative (n=9),⁴³⁻⁵¹ articles with descriptive and qualitative components (n=2),^{52,53} explicitly
107 mixed methods (n=4),⁵⁴⁻⁵⁷ RCTs (n=4),⁵⁸⁻⁶¹ and a non-randomized approach (n=1),⁶² see
108 Supplemental Material 2 for each article's full MMAT assessment. The majority of articles
109 adhered with all or most of their respective quality criteria on the MMAT, though descriptive
110 studies appeared particularly prone to selection biases.

111

112 **Study Participants and Settings**

113 As summarized in Supplemental Material 3, 16 studies focused on caregivers of pediatric
114 patients^{29,31,33,34,38,39,42,43,47,48,51-53,56,58-61}; 12 focused on adults^{30,37,40,44-46,49,50,54,55,57,62}; 3 appeared
115 to include participants of all ages^{35,36,41}; and 1 focused on adolescents.³² Some articles further

116 incorporated participants with certain characteristics, including veterans,^{30,44,55} adults with
117 diabetes,^{40,46} and children with certain chronic diseases.^{34,42} Common exclusion criteria were
118 language (e.g., non-English or Spanish speakers) and health status (e.g., severe illness).

119

120 The studies represented many healthcare settings (see Supplemental Material 3), including
121 community health centers, federally qualified health centers, specialty clinics, emergency
122 departments, and others. Twenty-three studies (72%) came from 5 states (California,
123 Massachusetts, Pennsylvania, Minnesota, and New York) and most studies (n=20, 63%) were
124 conducted in urban environments.

125

126 **Screening and Resource Connection Strategies**

127 *Screening tools*

128 As shown in Table 1, 12 studies (38%) concentrated on food insecurity, using either the Hunger
129 Vital SignTM or U.S. Household Food Security Survey Module screening tools.<sup>29,31,36,37,41-43,46-
130 48,52,54,56</sup> Three studies (9%) focused on housing instability, using the Homelessness Screening
131 Clinical Reminder (HSCR).^{30,44,55} The remaining 17 studies (53%) identified multiple social
132 needs using 8 screening tools; the most common being modifications of a tool developed by
133 Health Leads (n=7 studies).^{33,35,39,45,50,57,62} All tools with multiple social needs included food and
134 housing and several included childcare, transportation, employment, finances, and utilities.

135

136 *Screening processes*

137 In 14 studies (44%), participants appeared to complete the screening for themselves, either
138 through paper, tablet, or a web-based platform (see Table 1).^{29,31,32,34,37-39,42,45,47,51,53,57,59} In many

139 cases, healthcare staff were available to support completion when challenges arose (e.g.,
140 comprehension, literacy, vision). The screening was administered verbally for 12 studies (38%),
141 either in person or by phone.^{30,36,40,41,44,46,48,54-56,58,60-62} In 5 studies (16%), the screenings were
142 both self- and staff-administered.^{33,35,43,50,52}

143

144 ***Resource connection strategies***

145 The authors identified 4 types of referral/resource connection strategies (see Table 1).
146 Approximately 30% of studies applied more than one type of strategy. These strategies included
147 one-to-one navigation support; the provision of written materials or resource sheets; a
148 community partner facilitating the resource connections; and other community collaboration or
149 on-site resources. The authors defined one-to-one navigation support as personalized assistance
150 to understand and connect with relevant resources; varied types of healthcare staff or trained
151 volunteers provided this help. Sixteen studies (50%) used one-to-one navigation support, most of
152 which screened for multiple social needs.^{32,33,35,37-40,45,46,50,51,54,57,58,60-62} Ten studies (31%)
153 provided written materials or resources sheets.^{29,32,34,40,43,46,47,53,58,59} Eight studies (25%), all of
154 which focused on food insecurity, worked with a community partner who was responsible for
155 facilitating the resource connections.^{31,36,41-43,48,52,54,56} Finally, 7 studies (22%) described
156 additional types of community partnerships and/or offered on-site resources.^{37-39,46,47,51,54}

157

158 **Resource Connection Outcome Measures**

159 Twenty-five studies included diverse quantitative outcome measures related to participants' (i.e.,
160 patients or caregivers) social needs resource reconnections. The authors created a taxonomy of
161 these measures, classifying them into 4 categories (see Table 2).

162

163 *Whether participants made contact with services, organizations, or other resources*

164 Most studies with quantitative outcomes discussed resource connections as participants having
165 made contact with services or organizations (n=22, 88%).^{29-42,46,52-56,59,62} This was stated
166 explicitly in most cases. For example, the number of participants who were “successfully
167 contacted by [the community partner]”⁴¹; or reported that more intervention than control group
168 participants “had contacted a community resource.”⁵⁹ At other times, resource connections were
169 indicated despite ambiguous language used by the study authors. For example, the percentage of
170 participants who “received services”⁵⁵ or “successfully utilized program-provided resources.”³⁸

171

172 *Whether participants enrolled in or received new services*

173 Fewer studies (n=13, 52%) provided evidence for whether participants enrolled in or received
174 new services.^{31,33,35-37,39-42,46,52,56,59} This mostly occurred in the food-related studies, which often
175 reported on whether or not participants enrolled in SNAP. Other studies provided specific details
176 around what types of resources participants appeared to access through the intervention. Garg et
177 al. reported a higher proportion of participants in the intervention group enrolled in a job training
178 program, enrolled children in childcare, and were receiving fuel assistance.⁵⁹

179

180 *Whether social needs were successfully addressed*

181 Six studies (24%) included outcomes on whether participants’ social needs resolved, which may
182 or may not have been attributed to the intervention.^{32,33,35,57,58,60,61} Hassan et al. provided
183 information regarding the percentage who “reported resolution of their top-priority problem.”³²
184 Berkowitz et al. collected pre- and post-intervention data regarding the types of needs, and

185 reported whether there were significant decreases in the prevalence of each need.⁵⁷ Two
186 randomized controlled trials by Gottlieb et al. examined changes in the number and types of
187 “social needs”^{60,61} or “social risk factors.”⁵⁸ For example, Gottlieb et al. (2016 and 2018) found
188 significant reductions in social needs for intervention versus control groups.^{60,61}

189

190 *Participants’ ratings of their experiences with resources*

191 Finally, 2 studies included quantitative outcome measures that seemed to reflect an aspect of
192 participants’ experiences with the resources. Bottino et al. asked participants whether they were
193 getting “[none, a little, most, or all] of the help they needed with their referral selection.”²⁹ And
194 Power-Hays et al. reported on the percentage who found organizations to be “helpful.”³⁴

195

196 **Participant-Reported Barriers and Facilitators to Resource Connections for Social Needs**

197 Table 3 summarizes participant-reported barriers and facilitators to resource connections across
198 the qualitative components of the studies. Results also include the ways in which additional
199 sources of data from the studies (e.g., quantitative data, clinicians’ perspectives) corroborate and
200 expand upon participants’ perspectives.

201

202 *Barriers to resource connections*

203 *Inadequate, Irrelevant, or Restrictive Resources.* The most frequent participant-reported barrier
204 included the resources being inadequate or irrelevant. Inadequacy related to a lack of resources
205 in the community (e.g., housing)^{45,50} and/or the resources offered not being tailored to or
206 adequately addressing participants’ social needs.^{44-46,48,51,52,54,57} For example, an inability to take
207 advantage of food resources due to not having a place to cook⁴⁶ or food resources not being

208 tailored to medical recommendations.⁵⁴ A related barrier was restrictive eligibility
209 criteria.^{44,45,48,54} Articles with quantitative outcomes also found participants disclosing food
210 insecurity, but being ineligible for or already enrolled in SNAP.^{31,36,41,42,52}
211

212 *Inaccessible Resources.* Multiple factors related to resource inaccessibility. Broadly, participants
213 discussed challenges of navigating complex systems and applications,^{44,45,48,49} including delayed
214 or absent resource follow-up.^{51,54} Inaccessibility also included mobility and transportation. Those
215 with certain diseases or disabilities reported difficulty in accessing services^{45,57} and resources
216 were sometimes geographically inconvenient.^{43,46,47,50} Other barriers were language and/or
217 literacy inaccessibility.^{45,50,54,57} Zhu et al. reported that participants described language barriers
218 when filling out social services forms.⁵⁰ In a descriptive study, Spanish speakers had
219 significantly lower odds of successfully acquiring resources compared to English speakers in 3
220 of 4 regions examined.³³ Finally, participants' competing demands inhibited accessibility (e.g.,
221 not having childcare).^{43,46,47,49,50,54,57}
222

223 *Stigma, Discrimination, Fear.* Studies discussed participants' concerns around stigma or
224 discrimination in relation to both disclosure of social needs, as well as pursuing resource
225 referrals.^{43,45,46,52} In particular, 2 studies (1 from participants' and 1 from clinicians'
226 perspectives) pointed out fear due to immigration policies.^{46,52} In another study, a participant-
227 reported systems barrier was immigration status and policies.⁴⁵ One descriptive study explicitly
228 examined disparities related to immigration status. It found families with a non-U.S. citizen were
229 most likely to be lost to follow-up, but were also most likely to utilize resources if they did
230 engage.³⁸

231
232 *Staff Training, Resource Information Sharing.* Some participants noted unsatisfactory
233 experiences with healthcare or social services personnel. One study described mistreatment,⁵² but
234 most reported staff not having the necessary knowledge, skills, or time to support with resource
235 connections.^{44,45,49} A descriptive study found the type of professional conducting the screening
236 was associated with participants receiving services.⁵⁵ Other barriers were resource information
237 sharing and perceived information quality. Information retention, misplacing resource sheets,
238 and/or participants inconsistently being told about resources may have inhibited
239 connections.^{43,44,46,47,49,53,54} Additionally, participants reported low-quality information, such as
240 when resources were out of date or hyperlinks were nonfunctional.^{45,57}

241

242 ***Facilitators to resource connections***

243 *Relevancy.* A finding across many studies was participants' desire for referrals relevant to their
244 needs and contexts.^{46,48,50,51,53,54,57} This included referrals to resources that existed in the
245 community, that were geographically convenient, for which participants met the eligibility
246 criteria, and that adequately aligned with the needs disclosed. For example, 2 articles indicated
247 the importance of food resources beyond SNAP,^{48,54} especially given some participants already
248 receiving SNAP remained food insecure. Two similar RCTs compared the effectiveness of
249 resource sheets (control group) versus navigation (intervention group) in decreasing participants'
250 social needs.^{58,60} While the first study only found decreases in the intervention group, the second
251 found decreases in both groups. Authors speculated this might have occurred due to improved
252 resource sheets in the second study, with better updated information, listing contact names at the
253 relevant agencies, and highlighting the resources that most aligned with participants' priorities.⁵⁸

254
255 *Support, Simplicity.* Patients and caregivers shared the importance of receiving help navigating
256 systems and enrolling in services,^{44,45,48-50,52,54} including effective communication to establish
257 trust and rapport. Similarly, participants expressed a desire for prompt, simple, and convenient
258 follow-ups.^{44,46,51} In 2 of the descriptive articles, more follow-ups were associated with
259 “successful referrals”³⁹ and “optimally successful resource connections.”³⁵ In 1 of these studies,
260 outreach occurring within 30 days from the start of the intervention was associated with a higher
261 proportion of “successful referrals.”³⁹ Participants also suggested receiving resource information
262 in one form versus another (e.g., electronic versus printout) could ease connections.^{43,44}
263
264 *Comprehensive, Inclusive Approaches.* Final facilitating factors addressed the kinds of resources
265 offered and who is helped. A finding by Berkowitz et al. described “nonlinearity” between which
266 resources addressed which needs. For instance, getting help with medication costs could free up
267 monies for food.⁵⁷ This may suggest an advantage of offering resources for multiple needs. In 2
268 studies, participants suggested resources be advertised to everyone versus only those with
269 positive screening results.^{43,53} This recommendation is supported by quantitative findings from
270 Bottino et al. that 14.7% of participants selected referrals despite not disclosing food insecurity.²⁹

271

272 **DISCUSSION**

273 While a number of reviews explore various facets of healthcare-based social interventions,^{21,63-68}
274 this is the first to focus squarely on resource connections across varied social needs. The review
275 makes 3 notable contributions: a taxonomy of resource connection measures; a synthesis of

276 patient- and caregiver-reported barriers and facilitators to resource connections; and the
277 application of a SMSR approach that may be useful for both practitioners and researchers.

278

279 **Taxonomy of Resource Connection Measures**

280 The findings on resource connection measures indicate most of the included studies had
281 outcomes about whether participants contacted services or organizations, and fewer provided
282 details on participants' ability to enroll in or receive new services, success with addressing social
283 needs, or experiences with resource connection processes. Additionally, vague language in some
284 of the studies made process measures difficult to interpret or categorize. As others have pointed
285 out, a key aspect of determining whether healthcare-based social interventions improve
286 participants' health is first establishing whether the interventions perform as intended.^{15,21} As
287 screening and referral programs are meant to link participants with resources that will address
288 their needs, the authors argue study designs and measures demonstrating enrollment in new
289 services and whether needs are reduced are likely the most meaningful outcomes. By identifying
290 distinct forms of resource connections, the review's taxonomy may help lay the groundwork for
291 future comparative work, including meta-analyses, on the extent to which screening and referral
292 interventions connect patients with resources.

293

294 **Synthesis of Participant-Reported Barriers and Facilitators to Resource Connections**

295 The barriers and facilitators synthesis suggests areas where healthcare organizations may have
296 agency to improve the likelihood of success across all components of the resource connection
297 taxonomy: making contact with community-based organizations, enrolling in services, getting
298 needs resolved, and having a good experience with the process at large. Namely—given the

299 complexity of U.S. healthcare and social services systems; the priorities that patients and
300 caregivers are juggling; and stigma and discrimination concerns—the authors recommend
301 simplicity, accessibility, adequate training for healthcare teams, and more CBO partnerships.
302 Interventions could minimize the number of handoffs and follow up quickly with participants.
303 Healthcare organizations could consider whether programs are inclusive of those with limited
304 English proficiency, low health literacy, disabilities, and/or other factors that may inhibit
305 accessibility. It is also crucial referrals be tailored to the unique needs and preferences of
306 participants to the extent possible. This includes referrals corresponding with social needs, being
307 geographically convenient, and for which participants are eligible. Adequate training for
308 healthcare personnel, both in terms of communication skills (e.g., empathic inquiry)⁶⁹ and an
309 understanding of local resources could also enhance connections. This is particularly salient for
310 easing participants’ legitimate concerns around stigma or discrimination (e.g., fears related to
311 child welfare involvement and/or immigration policies),^{70,71} which could impact decisions to
312 pursue referrals. Finally, many studies in our review did not describe CBO partnerships, a critical
313 dimension given these are likely crucial for improving connections.^{68,72,73} Future research could
314 focus on effective collaboration strategies and how to overcome structures that make health and
315 social services organizations reluctant to collaborate.⁷⁴

316

317 Results around the frequent unavailability and inadequacy of resources also reaffirm the limits of
318 healthcare organizations to address participants’ social needs without major upstream
319 investments in public health initiatives and policies.^{75,76} As healthcare settings collect more data
320 about resource gaps within their communities, the authors suggest they advocate for population-
321 level investments to improve the conditions in which people live.⁷⁷ In that regard, it is notable

322 that few studies in the review explicitly included rural areas, which often experience a scarcity of
323 healthcare and social services resources.^{76,78,79}

324

325 While the review focuses on barriers and facilitators at the point when participants had disclosed
326 social risks and consented to receive help with social needs, other researchers have noted the
327 importance to understanding what affects connections along the entire “pathway” of screening
328 and referral interventions; there are other instances in which “drop-offs” in participant
329 engagement occur (A Schweitzer, Senior Fellow, Mossavar-Rahmani Center for Business &
330 Government, Harvard Kennedy School, unpublished work, 2021). For example, many studies
331 report drop-offs in terms of participants declining resource navigation assistance after having
332 disclosed social risks.⁸⁰ Also, interventions only including certain groups (e.g. those with
333 medical complexity) are prone to bias and may overlook people who would otherwise benefit.⁸¹

334

335 **Systematic Mixed Studies Review Approach**

336 A third contribution is the use of a SMSR approach to highlight the ways in which findings
337 garnered from diverse methodologies coalesced around the topic of interest. To avoid privileging
338 one form of evidence over another, the authors used the MMAT²⁸ to assess the quality of study
339 designs in their own right, keeping in mind that all methodologies operate through distinct
340 epistemologies⁸² and inform different aspects of theory creation and practice. While RCTs are
341 frequently identified as the gold standard when it comes to establishing causality, other study
342 designs are also vital for understanding real-world applications of complex interventions across
343 multiple contexts.⁸³⁻⁸⁷ Instead of jumping to whether healthcare-based social interventions
344 connect patients and caregivers with needed resources, a SMSR approach prompted and allowed

345 the authors to explore the paradigmatically pragmatic⁸⁸ questions of *how* to meaningfully define
346 “resource connections” and *why* resource connections may or may not be successful across
347 diverse contexts. Due to the highly complex nature of healthcare-based social interventions,
348 other researchers may find a SMSR approach to be beneficial for their research questions.

349

350 **Limitations**

351 The review has 2 primary limitations. First, by focusing on interventions with a screening
352 component, studies using alternative strategies to link participants with resources (e.g.,
353 “CommunityRx”)^{89,90} were excluded. All approaches to resource connections merit exploration,
354 but the authors narrowed the scope to screening and referral interventions given their current
355 prominence across various healthcare organizations and initiatives. Second, the search terms and
356 strategy removed certain types of information that are likely salient for better understanding this
357 topic, including evidence from the gray literature; articles published outside the U.S.; and those
358 published before October 2015. Regarding the cutoff date, this decision would have been more
359 problematic had the authors intended to perform a meta-analysis. Instead, the goal was to
360 synthesize current evaluation approaches and narratives, beginning at a time when there was a
361 notable momentum shift surrounding these interventions. Lastly, although authors consulted with
362 a health sciences librarian, it is possible that different or additional search terms may have
363 identified more studies.

364

365 **CONCLUSIONS**

366 As healthcare organizations increasingly develop interventions to connect patients and caregivers
367 with resources for social needs, the review summarizes current efforts and offers specific

368 recommendations regarding design and evaluation. To the extent that is feasible, organizations
369 should be thoughtful about how to create programs that are simple, accessible, and incorporate
370 adequate training for all healthcare personnel involved. Evaluation measures of resource
371 connection should be clearly stated, and ideally focus on whether participants accessed new
372 resources and whether the resources were able to address their needs. Effective partnerships with
373 CBOs may increase the likelihood of both resource connections and the ability to track
374 outcomes. Finally, advocacy for upstream public health policies is critical to the success of
375 healthcare-based social interventions, as a primary challenge for healthcare is to connect patients
376 when resources are not available in their local communities.

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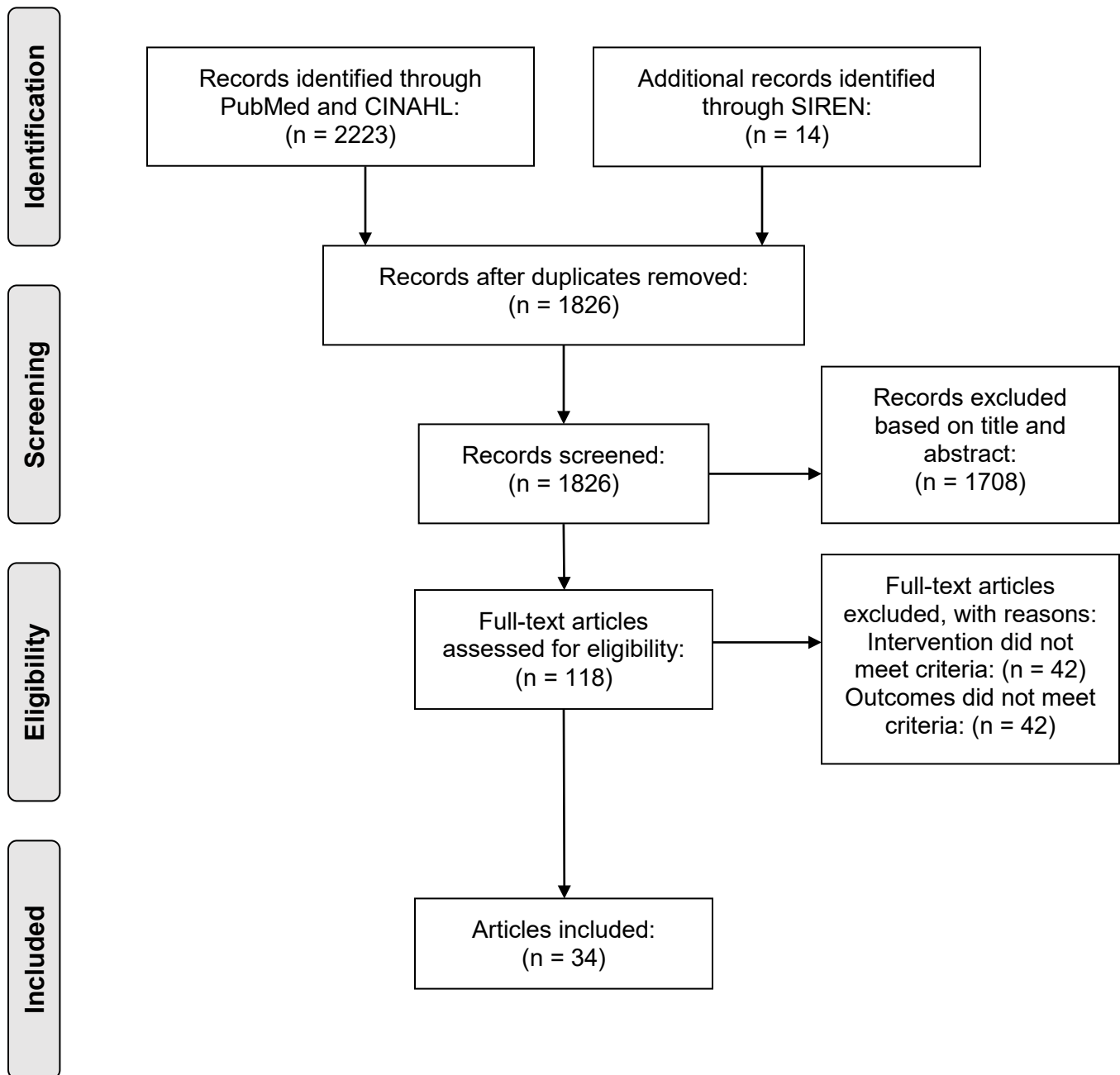
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677

678 **FIGURES**

679 Figure 1. PRISMA Flow Diagram



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Table 1. Screening and Resource Connection Strategies (n=32 studies)

	Screening	Resource Connection Strategy					
		Screening Tool	Screening Process ^a	One-to-one navigation support	Written materials/resource sheets	Community partner facilitates resource connections	Other community partner or resources on-site
Marpadga (2019) ⁴⁶	Hunger Vital Sign	Healthcare personnel ^a	X	X		X	
Swavely (2019) ⁵⁴	Hunger Vital Sign	Healthcare personnel	X		X	X	
Cullen (2020) ⁴³	Hunger Vital Sign	Healthcare personnel OR Participants ^a		X	X		
Orr (2019) ⁴⁷	Hunger Vital Sign	Participants		X		X	
Fox (2016) ³¹	Hunger Vital Sign	Participants			X		
Fritz (2020) ⁴²	Hunger Vital Sign	Participants			X		
Martel (2018) ⁴¹	Hunger Vital Sign	Healthcare personnel			X		
Knowles (2018) ⁵²	Hunger Vital Sign	Healthcare personnel OR Participants			X		
Palakshappa (2017a) ⁵⁶ Palakshappa (2017b) ⁴⁸	Hunger Vital Sign	Healthcare personnel			X		
Smith A (2020) ³⁶	Hunger Vital Sign	Healthcare personnel			X		
Smith S (2017) ³⁷	U.S. Household Food Security Survey Module	Participants	X			X	

Bottino (2017) ²⁹	U.S. Household Food Security Survey Module (Embedded within Online Advocate, now HelpSteps)	Participants		X			
Hassan (2015) ³²	HelpSteps (Online Advocate)	Participants	X	X			
Cusack (2020) ⁴⁴	Homelessness Screening Clinical Reminder (HSCR)	Healthcare personnel					X
Fargo (2017) ³⁰	HSCR	Healthcare personnel					X
Montgomery (2020) ⁵⁵	HSCR	Healthcare personnel					X
Berkowitz (2019) ⁵⁷	Health Leads	Participants	X				
Fiori (2020) ³⁹	Health Leads	Participants	X			X	
Hsu (2020) ⁴⁵	Health Leads	Participants	X				
Polk (2020) ³³	Health Leads	Healthcare personnel OR Participants	X				
Manian (2020) ³⁵	Health Leads	Healthcare personnel OR Participants	X				
Schickedanz (2019) ⁶²	Health Leads	Healthcare personnel	X				
Zhu (2020) ⁵⁰	Two different tools, both inspired by Health Leads	Healthcare personnel OR Participants	X				
Garg (2015) ^{b 59}	WE CARE	Participants		X			
Power-Hays (2019) ³⁴	WE CARE	Participants		X			
Emengo (2020) ⁵¹	Social Health Alliance to Promote Equity (SHAPE)	Participants	X			X	

	(Formerly “Family Needs”)						
Uwemedimo (2018) ³⁸	Social Health Alliance to Promote Equity (SHAPE) (Formerly “Family Needs”)	Participants	X			X	
Gottlieb (2020) ^{b 58}	18-item social risk screening questionnaire (iScreen)	Healthcare personnel	X	X			
Gottlieb (2018) ^{b 61} Gottlieb (2016) ^{b 60}	14-item social and mental health needs questionnaire (iScreen)	Healthcare personnel	X				
Nguyen (2016) ⁴⁰	7-item social needs checklist	Healthcare personnel	X	X			
Ray (2020) ⁵³	59-item survey (7 questions related to social needs)	Participants		X			
Hamity (2018) ⁴⁹	Your Current Life Situation (YCLS) tool	Unclear					X
			16	10	8	7	4

a) Screening process = Person who administered the screening.

Healthcare personnel = People administering the screening to the participants (i.e., study team members, healthcare personnel, volunteers).

Participants = Patients or caregivers completed the screening tool on their own.

b) For the randomized controlled trials, the table reflects what appeared to be done for the intervention groups.

Table 2. Taxonomy of Quantitative Resource Connection Outcome Measures (n=25 studies)

	Whether made contact with a service / organization	Whether enrolled in or received new services	Whether social needs were addressed	Participants' ratings of their experiences with resources
Fargo (2017) ³⁰	X			
Montgomery (2020) ⁵⁵	X			
Ray (2020) ⁵³	X			
Schickedanz (2019) ⁶²	X			
Uwemedimo (2018) ³⁸	X			
Swavely (2019) ⁵⁴	X			
Power-Hays (2019) ³⁴	X			X
Bottino (2017) ²⁹	X			X
Fiori (2020) ³⁹	X	X		
Garg (2015) ⁵⁹	X	X		
Nguyen (2016) ⁴⁰	X	X		
Fox (2016) ³¹	X	X		
Knowles (2018) ⁵²	X	X		
Palakshappa (2017a) ⁵⁶	X	X		
Marpadga (2019) ⁴⁶	X	X		
Smith S (2017) ³⁷	X	X		
Fritz (2020) ⁴²	X	X		
Martel (2018) ⁴¹	X	X		
Smith A (2020) ³⁶	X	X		
Polk (2020) ³³	X	X	X	
Manian (2020) ³⁵	X	X	X	
Hassan (2015) ³²	X		X	
Berkowitz (2019) ⁵⁷			X	
Gottlieb (2020) ⁵⁸			X	
Gottlieb (2018) ⁶¹			X	
Gottlieb (2016) ⁶⁰			X	

Supplemental Material 1. Systematic Mixed Studies Review Search Strategy

PubMed (MEDLINE) Search Strategy
Concept #1 – Screening
mass screening [MeSH Terms] OR screening [Title/Abstract] OR surveys and questionnaires [MeSH Terms] OR needs assessment [MeSH Terms] OR needs assessment [Title/Abstract] OR assessing [Title/Abstract] OR identifying [Title/Abstract]
Concept #2 – Social Needs
social determinants of health [MeSH Terms] OR social determinants of health [Title/Abstract] OR health-related social needs [Title/Abstract] OR social needs [Title/Abstract] OR social risks [Title/Abstract] OR food [Title/Abstract] OR housing [Title/Abstract] OR violence (Title/Abstract)
Concept #3 – Referral
referral and consultation [MeSH Terms] OR referral [Title/Abstract] OR patient navigation [MeSH Terms] OR navigation [Title/Abstract] OR navigating [Title/Abstract] OR social support [MeSH Terms] OR connecting [Title/Abstract] OR linking [Title/Abstract]
Additional Filters
<ul style="list-style-type: none"> • English • Articles published from 10/01/2015 through 12/23/2020

Final Search:

Concept #1 AND Concept #2 AND Concept #3

Supplemental Material 2. Mixed Methods Appraisal Tool (MMAT) Results^a

	Qualitative					RCT					Non-Randomized					Descriptive					Mixed Methods				
	1.1 ^b	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Bottino (2017) ²⁹																Y	Y	Y	Y	Y					
Fargo (2017) ³⁰																Y	Y	Y	Y	Y					
Fox (2016) ³¹																Y	Y	Y	Y	Y					
Hassan (2015) ³²																Y	Y	Y	Y	Y					
Polk (2020) ³³																Y	Y	Y	Y	Y					
Power-Hays (2019) ³⁴																Y	Y	Y	Y	Y					
Manian (2020) ³⁵																Y	Y	Y	Y	Y					
Smith A (2020) ³⁶																Y	Y	Y	Y	Y					
Smith S (2017) ³⁷																Y	Y	Y	Y	Y					
Uwemedimo (2018) ³⁸																Y	Y	Y	C	Y					
Fiori (2020) ³⁹																Y	C	Y	C	Y					
Nguyen (2016) ⁴⁰																Y	C	Y	C	C					
Martel (2018) ⁴¹																C	C	Y	C	Y					
Fritz (2020) ⁴²																Y	N	Y	N	Y					
Knowles (2018) ⁵²	Y	Y	C	Y	Y											Y	Y	Y	Y	Y					
Ray (2020) ⁵³	N	N	C	Y	N											Y	Y	Y	N	Y					
Cullen (2020) ⁴³	Y	Y	Y	Y	Y																				
Cusack (2020) ⁴⁴	Y	Y	Y	Y	Y																				
Hsu (2020) ⁴⁵	Y	Y	Y	Y	Y																				
Marpadga (2019) ⁴⁶	Y	Y	Y	Y	Y																				
Orr (2019) ⁴⁷	Y	Y	Y	Y	Y																				
Palakshappa (2017b) ^{c 48}	Y	Y	Y	Y	Y																				
Hamity (2018) ⁴⁹	Y	C	Y	Y	C																				
Zhu (2020) ⁵⁰	Y	C	C	Y	Y																				
Emengo (2020) ⁵¹	Y	N	Y	Y	C																				
Gottlieb (2020) ⁵⁸						Y	Y	Y	Y	Y															
Garg (2015) ⁵⁹						C	Y	Y	Y	Y															
Gottlieb (2016&2018) ^{60,61}						N	Y	N	N	Y															
Swavely (2019) ⁵⁴	Y	Y	Y	Y	Y											Y	C	Y	Y	Y	Y	Y	Y	Y	Y
Montgomery (2020) ⁵⁵	Y	C	Y	Y	Y											Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Palakshappa (2017a) ^{c 56}	Y	Y	Y	Y	Y											Y	C	Y	C	Y	Y	Y	Y	Y	Y
Berkowitz (2019) ⁵⁷	Y	Y	Y	Y	Y						Y	Y	Y	N	Y						Y	Y	Y	Y	Y
Schickedanz (2019) ⁶²											Y	Y	Y	Y	Y										

a) “Y” = Yes – study adheres criterion; “N” = No – study doesn’t adhere to criterion; “C” = Can’t tell – study doesn’t include enough information to make a clear judgement about criterion. Detailed descriptions of MMAT criteria are here:

http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/attach/127916259/MMAT_2018_criteria-manual_2018-08-01_ENG.pdf

b) MMAT methodological quality criteria:

- 1.1. – Is the qualitative approach appropriate to answer the research question?
- 1.2. – Are the qualitative data collection methods adequate to address the research question?
- 1.3. – Are the findings adequately derived from the data?
- 1.4. – Is the interpretation of results sufficiently substantiated by data?
- 1.5. – Is there coherence between qualitative data sources, collection, analysis and interpretation?
- 2.1. – Is randomization appropriately performed?
- 2.2. – Are the groups comparable at baseline?
- 2.3. – Are there complete outcome data?
- 2.4. – Are outcome assessors blinded to the intervention provided?
- 2.5. – Did the participants adhere to the assigned intervention?
- 3.1. – Are the participants representative of the target population?
- 3.2. – Are measurements appropriate regarding both the outcome and intervention (or exposure)?
- 3.3. – Are there complete outcome data?
- 3.4. – Are the confounders accounted for in the design and analysis?
- 3.5. – During the study period, is the intervention administered (or exposure occurred) as intended?
- 4.1. – Is the sampling strategy relevant to address the research question?
- 4.2. – Is the sample representative of the target population?
- 4.3. – Are the measurements appropriate?
- 4.4. – Is the risk of nonresponse bias low?
- 4.5. – Is the statistical analysis appropriate to answer the research question?
- 5.1. – Is there an adequate rationale for using a mixed methods design to address the research question?
- 5.2. – Are the different components of the study effectively integrated to answer the research question?
- 5.3. – Are the outputs of the integration of qualitative and quantitative components adequately interpreted?
- 5.4. – Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?
- 5.5. – Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

c) While Palakshappa 2017a & 2017b articles came from the same study (i.e., focusing on the same intervention in the same setting), the 2017b article was qualitative and the 2017a article applied mixed methods.

Supplemental Material 3. Study Participants and Settings (n=32 studies)

	Patient Population^a	Exclusion Criteria	Sample Size	Setting	U.S. State	Geography
Smith A (2020) ³⁶	Pts of all ages	Unspecified	2,314	Large health system (16 primary care clinics)	Massachusetts	Unspecified
Manian (2020) ³⁵	Pts of all ages	Pts w/o social needs Pts with missing data	38,404	Hospitals & clinics; FQHCs & academic medical centers	Nationwide "11 states"	Unspecified
Martel (2018) ⁴¹	Pts visiting the ED	N/A	1,519	County ED	Minnesota	Urban
Schickedanz (2019) ⁶²	Adult pts	Not in top 1% of care utilization	34,225	KP Southern California	California	Unspecified
Marpadga (2019) ⁴⁶	Adult pts w/diabetes	Non-English or Spanish spkrs	240 total; 31 qual	Hospital-based diabetes clinic	California	Urban
Zhu (2020) ⁵⁰	Adult pts	Unspecified	19	Hospital-affiliated primary care center & children's hospital	Rhode Island	Urban
Berkowitz (2019) ⁵⁷	Adult pts	Unable to complete screening; Non-English or Spanish spkrs	141 quant; 80 qual	3 academic primary care clinics	Massachusetts	Urban
Hamity (2018) ⁴⁹	Adult Medicare pts, w/complex needs: Georgia; primary care panel: Northwest	Unspecified	10 Georgia; 11 Northwest	KP Georgia & Northwest	Georgia & "Northwest"	Unspecified
Nguyen (2016) ⁴⁰	Adult pts >60 w/diabetes	Non-English or Spanish spkrs; Not Hispanic; Does not have diabetes	28 total; 18 qual	FQHC	California	Unspecified

Swavely (2019) ⁵⁴	Quant: Adult pts >18 Qual: Adult pts 33-69	Unspecified	3,860 total; 123 analysis of interest; 89 qual	Hospital	Pennsylvania	Urban
Hsu (2020) ⁴⁵	Adult pts >18	Non-English or Spanish spkrs	102	CHC	California	Urban
Smith S (2017) ³⁷	Adult pts >18	Unspecified	463	Student-run clinics	California	Urban
Fargo (2017) ³⁰	Adults, veterans	Unable to perform screening; Prior engagement w/VHA homeless programs; Nursing home residents	5,771,496	VHA, outpatient settings	Nationwide	Unspecified
Montgomery (2020) ⁵⁵	Adults, veterans	Veterans w/o housing instability	100,022	VHA, outpatient settings	Nationwide	Varied
Cusack (2020) ⁴⁴	Adults, veterans	Veterans w/o housing instability	60	VA medical center, outpatient settings	“Northeast”	Urban
Hassan (2015) ³²	Adolescents/young adult pts 15-25	Distressed at time of visit; Unable to comprehend intervention due to language/developmental barriers	401	Hospital-based adolescent & young adult clinic	Massachusetts	Urban
Polk (2020) ³³	Households w/peds pts	Non-English or Spanish spkrs	10,916	8 peds practices	“Northeast” & “Mid-Atlantic”	Unspecified
Fox (2016) ³¹	Caregivers, peds pts	Unspecified	116	University peds weight management clinic	Minnesota	Urban

Fiori (2020) ³⁹	Caregivers, peds pts	Unspecified	4,948 total; 287 analysis of interest	FQHC	New York	Urban
Knowles (2018) ⁵²	Caregivers, peds pts	Unspecified	103 total; 19 qual	Children's hospital: 3 peds primary care clinics	Pennsylvania	Urban
Gottlieb (2018) ^b ₆₁	Caregivers, peds pts	Families seeking health care for a child w/a severe illness; Non-English or Spanish spkrs	1,237	Urgent care at 2 safety-net hospitals	California	Urban
Gottlieb (2016) ⁶⁰			1,809	Primary & urgent care at 2 safety-net hospitals		
Power-Hays (2019) ³⁴	Caregivers, peds pts w/sickle cell disease	Unspecified	132	Peds hematology clinic at academic safety-net hospital	Massachusetts	Urban
Cullen (2020) ⁴³	Caregivers, pts <18	Those in critical condition; Non-English spkrs; Previously enrolled	40	ED of large children's hospital	Pennsylvania	Urban
Uwemedimo (2018) ³⁸	Caregivers, pts <18	Unspecified	148	Peds hospital-based primary care practice	New York	Urban
Emengo (2020) ⁵¹	Caregivers, peds pts	Unspecified	6	Peds hospital-based primary care practice	New York	Urban
Gottlieb (2020) ⁵⁸	Caregivers, pts <17	Pts seen for abuse; Non-English or Spanish spkrs; Enrolled in similar program; in foster care	611	Peds urgent care clinic at an urban safety-net hospital	California	Urban

Palakshappa (2017a) ^{b 56}	Caregivers presenting for well-child visits	Unspecified	4,371 total; 122 analysis of interest	Children's hospital: 6 primary care practices	Pennsylvania	Suburban
Palakshappa (2017b) ⁴⁸		Did not report food insecurity; Non-English spkrs; Caregivers <18	23			
Fritz (2020) ⁴²	Caregivers, well-child visits (primary care); Caregivers (Inpatient); Pts w/asthma (ED)	Non-English or Spanish spkrs; Relationship w/social workers; Screened within 6 months	5,735 total; 371 analysis of interest	Children's hospital: 2 primary care clinics, 1 inpatient setting, & 1 ED	Colorado	Varied
Ray (2020) ⁵³	Caregivers, pts <5	Presenting w/urgent need; Non-English or Spanish spkrs	146 total; 61 analysis of interest	Academic peds ED	Pennsylvania	Varied
Bottino (2017) ²⁹	Caregivers, pts 3-10	Pts w/special health needs; Non-English spkrs; Previous screening	340	Peds hospital-based primary care clinic	Massachusetts	Urban
Orr (2019) ⁴⁷	Caregivers, pts 1-5	Pts premature or w/condition affecting their eating or growth; Non-English or Spanish spkrs	17	Peds clinic affiliated w/academic medical center	North Carolina	Unspecified
Garg (2015) ⁵⁹	Caregivers, pts <6 mths	Pts w/special health needs; Non-English or Spanish spkrs; Not pts's mother, mother <18, foster parents	336	8 CHCs	Massachusetts	Urban

CHC = Community Health Center; ED = Emergency Department; FQHC = Federally Qualified Health Center; KP = Kaiser Permanente; Peds = Pediatric; Pts = Patients; Qual = Qualitative Data; Quant = Quantitative Data; Spkrs = Speakers; VA = Veterans Affairs; VHA = Veterans Health Administration

- a) While some articles included data from non-patient/caregiver participants, this table focuses on patient/caregiver participants for whom relevant outcome data were collected.
- b) Articles by Gottlieb 2016 & 2018 and Palakshappa 2017a & 2017b each came from the same studies (i.e., focusing on the same intervention in the same setting), respectively.