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## A Systematic Review of Electronic Community Resource Referral Systems

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### Abstract

**Introduction:** Community Resource Referral Systems (CRRSs) delivered electronically through healthcare Information Technology (IT) systems (e.g., Electronic Medical Records (EMRs)) have become more common in efforts to address patients' unmet Health Related Social Needs (HRSNs). CRRSs connect patients with social supports such as food assistance, utility support, transportation, and housing. This systematic review identifies barriers and facilitators that influence CRRS implementation in the United States (US) by identifying and synthesizing peer-reviewed literature over a 15-year period.

**Methods:** This systematic review was conducted following PRISMA guidelines through a search of five scientific databases to capture literature published between January 2005 and December 2020. Data analysis occurred from August 2021 to July 2022.

**Results:** This review includes 41 articles out of 2,473 initial search results. Included literature revealed that CRRSs functioned to address a variety of HRSNs and were delivered in different

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ways. Integrating CRRS into clinic workflows, maintenance of community-based organization (CBO) inventories and strong clinic-CBO partnerships facilitated implementation. The sensitivity of HRSNs, technical challenges and associated costs presented as barriers. Overall, EMR-integration and automation of the referral process was reported as advantageous for stakeholders.

**Discussion:** This review provides information and guidance for healthcare administrators, clinicians, and researchers designing or implementing electronic CRRSs in the US. Future studies would benefit from stronger implementation science methodological approaches. Sustainable funding mechanisms for CBOs, clear stipulations regarding how healthcare dollars can be spent on HRSNs, and innovative governance structures that facilitate clinic-CBO collaboration are needed to promote growth and sustainability of CRRSs in the US.

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## Introduction:

Social and economic factors have an outsized effect on health<sup>1</sup>, explaining up to 90% of health outcomes<sup>2</sup>. High-quality healthcare that traditionally focuses on physical health factors alone cannot result in optimal outcomes or health equity<sup>3</sup>. Emerging evidence suggests that interventions addressing patients' unmet health related social needs (HRSNs) (e.g., food insecurity, housing instability) can improve health outcomes and reduce costs<sup>4-6</sup>. Driven by this evidence, several national organizations, including the American Academy of Pediatrics, the National Association of Community Health Centers, and the American Academy of Family Physicians, now recommend screening for patients' unmet HRSNs<sup>7,8</sup>. Screening for HRSNs alone is insufficient; actionable linkages must follow the identification of unmet HRSNs, such as referring patients to community-based organizations (CBOs) to help meet their needs<sup>9</sup>.

Federal- and state-level initiatives have focused on addressing HRSNs and developing whole-person models of care that prioritize holistic patient needs such as social conditions that impact overall health<sup>7-9</sup>. These include the Accountable Health Community model proposed by the Centers for Medicare and Medicaid Services (CMS)<sup>10</sup> and efforts by states including Oregon, North Carolina, and California, and private payers<sup>11-13</sup>.

Although initiatives to address unmet HRSNs are becoming more widespread, care teams involved in these initiatives face significant challenges. For instance, screening for and managing HRSNs has historically been outside the scope of medical practice<sup>14,15</sup>. Additionally, US-based healthcare organizations, institutions and physicians report lack of time and inadequate information technology (IT) systems as critical barriers to HRSN screening and partnerships<sup>14,16,17</sup>.

In attempts to address technological barriers, there has been an increase in digital platform availability, either as stand-alone platforms or add-ons integrated with health IT systems such as electronic medical records (EMRs) that facilitate the creation of electronic Community Resource Referral Systems (CRRSs)<sup>18</sup>. Electronically delivered (e-delivered) CRRSs vary in scope, but all utilize technological solutions to capture patients' unmet HRSNs and/or provide referrals to local community resources<sup>18</sup>.

Despite increased e-delivered CRRS use, limited evidence exists on barriers and facilitators that influence their implementation within healthcare systems in the US<sup>18</sup>. Previous systematic reviews restricted to US settings focused on the impact of interventions addressing individual HRSNs like transportation<sup>9</sup> or food insecurity<sup>19,20</sup> and on the methodological quality of their evaluations<sup>7</sup>. Pescheny and colleagues assessed factors that facilitate and hinder the implementation and delivery of CRRSs, but only included UK-based studies in their review<sup>21</sup>. Given the structural differences between British and American health systems, these lessons, while valuable, are not directly applicable to the US context. A recently published technical brief for the US Preventive Services Task Force describes some facilitators and barriers for screening for social needs; however, the publication is not specific to e-delivered CRRSs and its focus is not on factors affecting implementation, so the described facilitators and barriers are not comprehensive<sup>22</sup>. Another recent publication by the Social Interventions Research and Evaluations Network reviews implementation strategies for social screening and recommends using technology (e.g., digital device-assisted screening) in future studies, but does not evaluate screening within the e-delivered CRRS context<sup>23</sup>. This systematic review aims to address this gap in knowledge by examining and synthesizing peer-reviewed literature on the factors that affect the implementation of e-delivered CRRSs for HRSNs, to provide critical findings to healthcare providers and systems interested in implementing these interventions.

## Methods:

The authors conducted this systematic review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The authors searched PubMed, Web of Science, Scopus, CINAHL, and ProQuest Health Management in March 2021, restricting searches to studies published in or between January 2005 and December 2020 (see Appendix Table 1 for complete search strings). Considering how rapid technology changes, the authors opted only to include the prior 15 years to when the search was initially conducted in an effort to ensure that findings were current.

Search results were deduplicated and managed using Covidence software<sup>24</sup>. Two reviewers screened each article's title and abstract (from a total of seven reviewers). The retained articles were subject to a full-text review. The authors resolved discrepancies during any part of the screening process via a third reviewer or full team discussion if needed. Decisions were not considered final during a full team discussion until a group consensus was achieved (100% agreement). The authors identified additional sources by searching bibliographies of included articles after a full-text review.

To be included, a study had to 1) describe an intervention or program (but not required to have a clinical trial study design); 2) be US-based; 3) be published between January 2005 and December 2020; 4) address one or more HRSNs; 5) include a referral/linkage with a CBO; and 6) use an electronic platform to screen for unmet HRSNs and/or refer patients to CBOs (e-delivery). The authors defined HRSNs using the domains included in The Accountable Health Communities Health-Related Social Needs Screening Tool<sup>10</sup>: housing instability, food insecurity, transportation problems, utility help needs, interpersonal safety, financial strain, employment, family and community support, education, physical activity,

substance use (including alcohol, tobacco, and other substances), and disabilities. Mental health was considered a clinical need, not an HRSN<sup>25</sup>. For the electronic delivery criterion, the authors defined an intervention to be e-delivered if HRSN screening and/or referral tools were embedded within the EMR or supported by a stand-alone digital platform (e.g., care coordination system). Studies were excluded if they were not published in a peer-reviewed journal.

One author extracted data from each included study using a comprehensive Excel abstraction form, included in Appendix Table 2.

## Results:

The authors identified 2,473 articles from the search query and an additional 52 from citation review of included studies. After de-duplication, the authors screened 1,874 titles and abstracts and 174 studies in full text. After the full-text assessment, the authors retained 41 studies that met inclusion criteria (see Figure 1).

Eleven studies targeted multiple HRSNs simultaneously<sup>26–36</sup>. These HRSNs included food insecurity<sup>26–31,34–36</sup>, housing instability/homelessness<sup>26,27,29–32,34–36</sup>, interpersonal violence/safety<sup>28–31</sup>, transportation<sup>26,27,29,31,34,36</sup>, social isolation<sup>29–31</sup>, education/health literacy<sup>26,27,30,36</sup>, employment<sup>26,27,35</sup>, financial strain<sup>30,31,35</sup>, healthcare affordability<sup>26,27</sup>, utility needs<sup>26,27,31</sup>, legal needs<sup>26</sup>, caregiving needs<sup>26,27,35</sup>, physical activity counseling/access to safe exercise<sup>30,31,33</sup>, tobacco cessation/exposure<sup>30,32,33</sup>, racism<sup>30</sup>, incarceration<sup>35</sup>, and substance/alcohol abuse<sup>28,30,32,35</sup>.

Fourteen included studies targeted a single HRSN<sup>37–50</sup>. Tobacco cessation (with 11 studies) was the most common HRSN among these<sup>37–47</sup>. Two studies targeted food insecurity alone<sup>48,49</sup>, while one focused on interpersonal violence<sup>50</sup>.

Sixteen studies did not specify which HRSNs the intervention was targeting or indicated that they addressed HRSNs in general<sup>18,51–65</sup>.

Studies employed a variety of methods to detect HRSNs that could be addressed through CRRSs. Fifteen studies identified HRSNs through screening by clinical/social care staff (e.g., nurses, medical assistants, or community health workers (CHWs) entering information into the EMR or a different digital platform)<sup>26,37–39,42–44,46–48,50,52,54,57,58</sup>. Two studies identified HRSNs through patient self-screening on a tablet or paper form that could later be digitized<sup>27,34</sup>. Six studies included options for either patient self-screening or clinic staff entering information into a digital platform<sup>28–31,49,64</sup>.

Four interventions<sup>32,53,56,63</sup> did not screen patients and used clinical and/or HRSN data already available in the EMR or in other information systems to identify the CBOs most relevant to people's needs or to pinpoint the most vulnerable patients. Six studies complemented information already available in their systems with HRSN self-screening<sup>33,35,40,41,59,61</sup>. In seven studies, HRSNs were identified prior to CBO referral in an unclear process<sup>36,45,51,55,60,62,65</sup>, while in one study describing early adopters of e-delivered CRRSs, screening methods varied from site to site<sup>18</sup>. See Appendix Table 2 for more details.

Various CRRS methods were utilized across included studies. Seven studies employed resource referral guides or “prescriptions” with relevant CBO information for patients<sup>28,32,48,53,56,59,63</sup>. For example, a patient with uncontrolled diabetes might be given information on food assistance programs and healthy eating classes. In six of these studies<sup>28,32,53,56,59,63</sup>, resource referral guides were automatically generated using algorithms or clinical decision support systems in the EMR. One study supplemented CBO information with vouchers that could be redeemed by patients to purchase products<sup>48</sup>.

In five studies, patients were referred to CBOs directly from the EMR or a care coordination system<sup>39,45–47,60</sup>, while in sixteen studies, a CHW or benefits access organization was responsible for connecting patient to CBOs<sup>26,33,35,36,40–42,49–51,54,55,57,62,64,65</sup>.

Nine studies used a combination of the above methods to deliver referrals to CBOs<sup>27,29,30,34,37,38,43,44,58</sup>. Three studies did not specify how referrals to CBOs were made<sup>31,52,61</sup>. One study focused on early CRRSs across the US and described variability in how referrals were implemented across sites<sup>18</sup>.

Twenty-nine studies described the staff’s ability to follow up on patient referrals to CBOs<sup>18,26–31,36,37,39–41,43–49,51,52,54,55,57–60,62,64</sup>. However, only six of these studies described closed-loop systems enabling CBOs to digitally communicate with clinics and confirm whether patients made contact with the CBO and/or received service<sup>39,40,45,46,54,59,60</sup>. See Appendix Table 2 for more information.

Barriers and facilitators to implementation of e-delivered CRRSs are categorized into each of the different stages of the clinic-community linkage process (HRSN screening, referral to CBOs, follow-up), indicating (when possible) whether they are related to different stakeholder groups—e.g., patients, providers or other clinic staff or CBO staff. Some are relevant at different stages or for different stakeholders, so these classifications are not always mutually exclusive. Table 1 provides an overview of the types barriers and facilitators reported by included studies.

Patient-related screening obstacles include language barriers, low (digital) literacy, stigma, privacy concerns, and patient burden, particularly among patients that already feel overwhelmed by the healthcare system<sup>27,49,59,64</sup>. Provider-related barriers are linked to concerns about asking stigmatizing questions<sup>64</sup>, concerns about additional workload/workflow changes<sup>18,29,30</sup>, time constraints<sup>27,49</sup>, inadequate training<sup>27</sup>, provider inclinations to screen (or not to screen) based on patient appearance<sup>64</sup> and perceptions that HRSN screenings fail to provide a holistic view of the patient<sup>30</sup>.

Reported technology-related barriers include logistical challenges related to the use of computers/tablets for screening, such as uncertainty around who would assist patients to self-screen and device storage<sup>29</sup>. Inadequate interoperability between digital screening tools and EMR systems, manual entry requirements, and challenges to customize EMR tools are also among mentioned barriers<sup>29,30,33,59</sup>. Other general barriers to screening include lack of financial incentives<sup>54</sup>, uncertainty about best screening practices, unvalidated screening questions<sup>54</sup>, concerns about sharing information with external CBOs<sup>18,49,54</sup> and the additional workload associated with large patients volumes to screen<sup>30,59</sup>.

Reported obstacles associated with providers, clinic staff, or CBO staff include lack of authorization of certain staff members to access the EMR and make referrals to CBOs<sup>29,57</sup>, inadequate information about CBOs<sup>39,49</sup>, inadequate familiarity with the referral process<sup>39,49</sup>, or with the role of Community Navigators/Patient Navigators/Community Resource Specialists<sup>55,57</sup>, resistance to workflow changes<sup>18,29,30,49</sup>, time constraints<sup>18,30,49</sup>, and high staff turnover at CBOs and clinics<sup>55</sup>.

Reported patient-related barriers to community linkages include refusal of or ambivalence to the referral<sup>42</sup>. Other referral barriers include: disagreements between clinics and CBOs about cost-sharing and sustainability plans<sup>33,60</sup>, lack of financial incentives for CBOs to participate<sup>18,54</sup>, lack of alignment between workflows across different organizations or across different departments within the same organization<sup>32,33,47,49,57</sup>, limited capacity and organizational changes at CBOs<sup>32,33</sup>, stringent patient eligibility requirements for some social services<sup>49</sup>, and legal concerns regarding data sharing and consent<sup>18,32,49,54</sup>. Authors also report barriers related to EMR system changes after study initiation<sup>47</sup> and challenges with the customization of the referral and tracking process in the EMR<sup>47,55</sup>.

Provider and clinic/CBO staff-related barriers to follow-up include inability to document what services patients are offered and those which are actually received<sup>50</sup> and staff shortages<sup>46</sup>. Changes in patients' phone numbers, transient patient populations, and time constraints are also described as barriers to follow-up<sup>49,62</sup>.

Studies reported general barriers including risk averse attitudes among staff, inexperience with quality improvement, funding instability, lack of reimbursement for community navigation services, changes in clinic or CBO locations, and data quality issues (e.g., unstructured or missing data)<sup>33,36,37,62,65</sup>. Furthermore, some studies implementing an intervention across multiple organizations highlight heterogeneous levels of resources across clinics and lack of standardization as barriers to the implementation CRRSs<sup>50,51,59</sup>. Finally, vendor-related challenges are linked to unexpected fees, reactions of technological vendor to the implantation of a tool by an external vendor and propriety idiosyncrasies that complicate interoperability<sup>33,60</sup>.

Studies report on multiple patient-related facilitators to screening, including low literacy accommodations, multiple language offerings<sup>64</sup>, and response options that allow patients to refuse to answer or decline to be referred at the time of screening<sup>29,34</sup>. Other facilitators include the adaptation of screening tools to focus on HRSNs relevant to the local population<sup>61</sup> and building relationships between patients and providers to increase trust. One study mentions that patient feedback can help avoid stigmatizing word choices and improve comprehensibility<sup>27</sup>. Another reports having volunteers reassure patients that screening is optional to reduce stigma around seeking help<sup>59</sup>.

Other reported facilitators include recruiting staff champions to customize HRSN data tools in the EMR<sup>30</sup>, and integrating screening into the check-in process<sup>39,64</sup>. One multi-site study mentions that using a common EMR helps clinics view HRSNs identified at other sites on their own system<sup>40</sup>.



There is some overlap between screening and referrals facilitators. One study reports that screening early in the patient visit helps flag issues needed to be addressed by the care team later in the visit<sup>64</sup>. Additional training for staff (to overcome a risk-averse culture around data sharing outside of the clinic systems)<sup>33</sup> are also among reported facilitators.

Automating the referral process<sup>27,56,63</sup> and EMR integration<sup>39,42,45,54</sup> are mentioned as staff related facilitators. Reviewed manuscripts described other facilitators for providers and staff including clear templates and statements for care management<sup>39,62</sup> and referral priority options that inform the team when no referral is required for the patient's care<sup>29</sup>. Regularly updating CBO inventories<sup>27,29,51</sup> and EMR-integrated CBO repositories are also described as facilitators<sup>29</sup>. Additionally, networking with local CBOs and coordinating efforts through an "umbrella" organization comprised of collaborating partners facilitates referrals<sup>33,60</sup>. Furthermore, CHWs and patient navigators can promote the intervention among providers and facilitate referrals thanks to their knowledge about local resources and needs and by building trust with patients<sup>55,57,58,65</sup>. Included manuscripts indicated that clearly delimiting the role of these CHWs/patient navigators/community resource specialists and increasing their visibility and interactions with the clinical care team facilitates their integration into care pathways<sup>55,58</sup>.

Patient-related facilitators described by included manuscripts include referrals to CBOs that offer services regardless of insurance status or language, have no out-of-pocket costs<sup>37</sup> and include proactive outreach to patients to link them to resources<sup>40</sup>.

EMR-integration of the screening and referral processes creates trackable data<sup>29</sup> and allows for a staged approach with intermittent reinforcement of referral options at subsequent visits if a patient is not immediately ready to be linked to a CBO<sup>37</sup>. Adding "no follow up needed" labels helps prevent unnecessary efforts on who choose not to receive referrals<sup>29</sup>.

Some studies stress the importance of frequent follow-up in the initial stages of referrals to establish trust between patients and navigators<sup>51,58</sup>. One study indicated that follow-up by a nurse or medical assistant might be preferable to non-medically trained clinic staff since they are equipped to answer medical questions<sup>51</sup>.

Multiple studies stress the importance of establishing partnerships between CBOs, healthcare providers, and other public, private, and non-profit entities<sup>29,35,51,60,61</sup>. Widespread adoption of IT infrastructure is also necessary to facilitate referrals between healthcare organizations and CBOs<sup>32,35</sup>. One study suggests that engaging CBOs in selecting the electronic platform and hiring staff to maintain ongoing communication helps recruit CBOs to which patients can be referred<sup>18</sup>. Furthermore, improved regulatory guidance and updated legislation could support data interoperability and facilitate the referral process<sup>33</sup>.

Cost minimization of the referral process and training requirements<sup>56,63</sup> and having implementation champions to motivate staff<sup>18,39</sup> are reported as enablers of a smooth integration process. Testing the intervention on a smaller scale before expanding and ensuring the leadership involvement to develop institutional support for the intervention<sup>27,51,59,61</sup> also facilitates implementation. Additionally, in some studies,

connecting patients to external resources with government funding<sup>36,37</sup> may have fostered sustainable support to patients while also generating relevant financial incentives for implementation.

Some factors affecting implementation are perceived differently (as facilitators or barriers) by different studies. Similarly, some studies provided contradictory recommendations. In this section is a brief description of these factors and recommendations.

Some facilitators and barriers described in the previous sections revolve around factors that help or hinder the integration of screening into the EMR or other digital systems. However, studies also report on the advantages and disadvantages of EMR-based screening itself. For example, EMR integration of the screening process can allow for automated generation of International Classification of Disease (ICD)-10 codes for HRSN. Yet, including ICD codes can add complexity to the process<sup>29</sup>, and ICD codes sometimes fail to reflect relevant HRSNs<sup>27</sup>. For example, the ICD-10 code for educational attainment classifies individuals into high-school graduates or drop-outs, failing to provide relevant information on whether the patient has low health literacy<sup>27</sup>. Furthermore, although EMR-based screening can help increase data trackability and longitudinal follow-up<sup>29,37</sup>, incomplete or inconsistent documentation in the EMR can be a disadvantage of this approach<sup>57</sup>.

Included studies provide different recommendations for how to best implement screening by clinic staff. Some suggest that clinical support staff, rather than physicians, should administer screenings<sup>39</sup>, but this additional task should not become a burden<sup>61</sup>. Alternative approaches like phone outreach, patient portal questionnaires, self-administered patient surveys, kiosks, or tablets could alleviate this burden<sup>29,34,61</sup>. Some patients require assistance to use these technologies<sup>34</sup> and screening for more sensitive social needs such as substance abuse and domestic or interpersonal violence should be completed in-person to allow for immediate action<sup>61</sup>. In some cases, in-person meetings help identify needs that may otherwise go unnoticed<sup>58</sup>.

Integrating the workflow into the EMR and existing processes is generally reported as advantageous<sup>27,39,40,45,51,54</sup>. However, one study reports choosing not to integrate the referral system into the EMR (electing a separate digital platform instead), as EMR integration would disrupt existing workflows<sup>64</sup>.

One study indicated that in the case of screening, having support staff complete the referral can reduce the burden placed on physicians<sup>39</sup>. Developing automated referral systems and triage protocols can further reduce burden on clinic staff and increase efficiency<sup>27,34,51,54,56,63</sup>. However, these automated methods have drawbacks, and some studies suggest that patient interactions with staff helps create trust and improves the referral process<sup>55,63</sup>.

According to two studies, involving both clinics and CBOs in the design of referral platforms can help ensure that e-delivered CRRSs adapt to their specific workflows, but standardization of referral platforms across communities or at the state-level can help increase data interoperability between clinics and CBOs<sup>18,60</sup>.



## Discussion:

This review contributes to the understanding of factors that affect implementation of e-delivered CRRSs within the US healthcare system. It provides a comprehensive overview of implementation barriers and facilitators across interventions targeting different HRSNs and employing a wide range of screening and referral methods.

Many barriers or facilitators of screening found in this review are related to factors that impact screening burden for patients (e.g., literacy requirements, digital and language accessibility, stigma and trust) or healthcare professionals (e.g., time burden, workflow complexity, confidence and knowledge). Similar findings were reported by previous systematic reviews<sup>21,66</sup>, provider surveys<sup>16,17</sup> and qualitative studies involving patients and clinicians<sup>15,67</sup>. Another important barrier identified is the lack of clear best practices and validated screening tools. Indeed, recent systematic reviews<sup>68,69</sup> found many commonly used HRSN screening tools lack psychometric validation. Empirical evidence shows that invalidated measures can have both sensitivity and specificity problems<sup>70</sup>. In other words, people with genuine risk might not be flagged while low-risk individuals might falsely be identified as being at risk (sometimes based on stereotypes). Considering this, and the fact that many studies identified in this review did not specify the screening tool they used<sup>26,33,35,37,38,40–44,46,47,52,54,58</sup>, it is important not only to encourage the validation of existing tools, but also to ensure that future interventions utilize only empirically tested instruments. Additionally, there was disagreement across included studies about whether patients should self-screen or whether screening should be part of a real-time conversation between patients and providers. Other studies found that while different screening modalities are acceptable to patients<sup>67,72</sup>, preferences are heterogeneous. Some patients prefer to discuss their situation with their providers<sup>67</sup>, while some evidence suggests that self-screening might facilitate disclosure of socially sensitive needs<sup>73</sup>. Future studies should investigate the contexts and populations in which each type of screening is more appropriate.

Like the screening-related facilitators, many referral-related facilitators were centered around operational improvements to the referral workflow and decreases to patient burden. Other referral enablers and recommendations mentioned in included studies (e.g., better data sharing and operational integration between clinics and communities) are reflected in the wider literature and current policy efforts. For example, several national initiatives were launched to support the digitization, standardization and interoperability of capturing patient HRSNs<sup>74–76</sup>, while community involvement has been shown to facilitate the development of CRRSs<sup>77</sup>. In terms of referral automation, there is more disagreement among included studies. Many studies perceive automation as a facilitator that minimizes workflow disruption, but some studies indicate that a “warmer” referral approach involving a social worker or CHW might be beneficial for patients. More research is needed to better understand the circumstances in which automated vs “warm” referrals are preferred and whether some combination can improve receptivity and efficiency.

Lastly, most structural factors affecting implementation and sustainability of CRRSs were related to the cultural characteristics and financial incentives of the US healthcare system.

CRRSs represent a radical transformation in the provision of health and social care in the US, where CBO and clinical settings have historically been funded separately and operated in silos. The growth and sustainability of CRRSs requires long-term funding arrangements<sup>14</sup>. Without increased long-term financing, increased referral activity by healthcare organizations may overwhelm CBOs. Programs that use healthcare funds to pay for social services like housing and transportation, like North Carolina's Healthy Opportunity Pilots, might offer a suitable model to ensure CRRS sustainability<sup>11</sup>. Evaluation of programs like this will offer valuable insight into the role of innovative payment structures in bridging health and social care.

## Limitations:

This review is not without limitations. Firstly, this review only includes programs implemented in the US. The authors chose this criterion because the idiosyncratic nature of the American healthcare system can limit the applicability of best practices imported from abroad. Nonetheless, systematic reviews of CRRSs implemented internationally (notably the UK), reveal that, while adaptation to context-specific needs and resources is essential, many barriers and facilitators are similar across settings<sup>21,77</sup>. Secondly, because screening alone is insufficient to address HRSNs, the authors only included studies in which HRSN screening was followed by referrals/linkages to CBOs. Finally, the authors did not assess bias or the methodological quality of included studies. This review was purposed not to draw causal inferences about (or quantify) the effect of different factors. Rather, it aimed to comprehensively describe the existing evidence on barriers and facilitators of e-delivered CRRS implementation in the US. This review found that most of the implementation barriers, facilitators and lessons identified by the literature are reported by studies that do not use an explicit implementation science approach (e.g., some clinical trials mention barriers and facilitators in an inconsistent manner throughout the text). Future studies employing rigorous implementation science methods are likely to produce richer knowledge on the factors that affect different steps in the clinic-community linkage workflow across different settings.

## Conclusions:

This review provides timely information for healthcare administrators, clinicians, and researchers designing or implementing e-delivered CRRSs in the US. Although the current literature offers rich and actionable information on barriers to and facilitators of HRSN screening and subsequent referrals, it only offers superficial insights into the factors affecting follow-up. As more sophisticated CRRSs are implemented across the US, future studies should focus on examining this key step. Furthermore, while CRRSs need to adapt to unique local needs and preferences, future research should clarify the contexts and populations in which different screening, referral, and follow-up modalities might be preferred. Future studies would also benefit from stronger implementation science methodological approaches.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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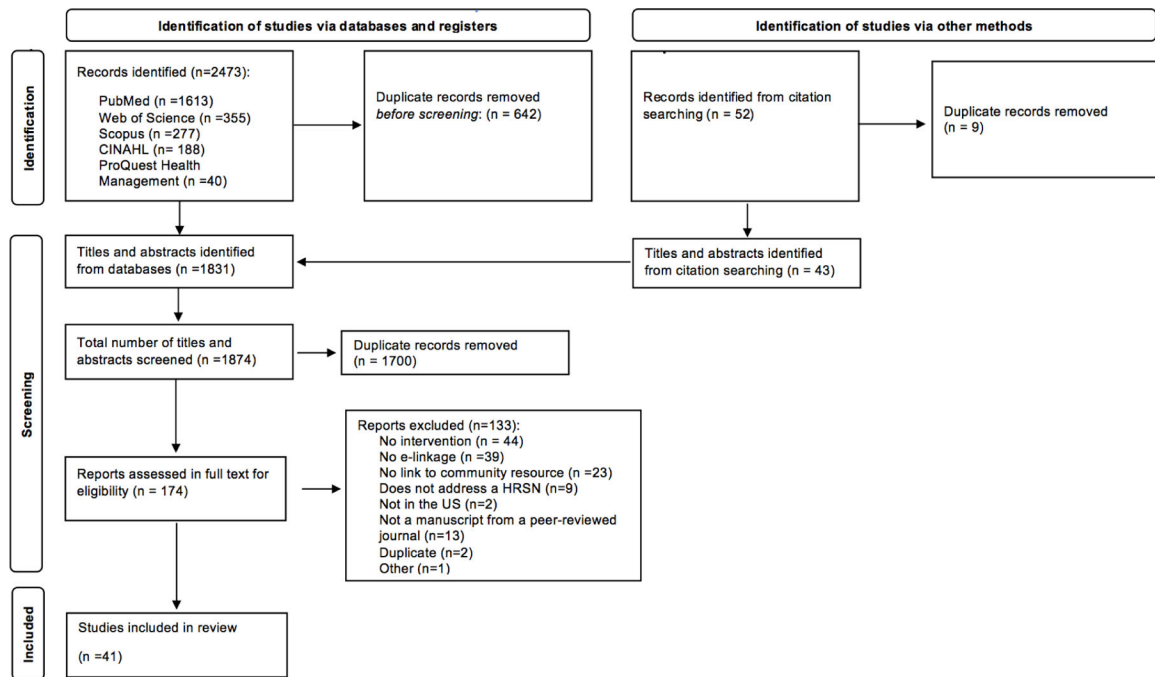
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**Figure 1.**  
PRISMA Flow Chart Diagram  
[included in separate document]

**Table 1.**

Types of Barriers and Enablers Reported By Included Studies

Study	Screening barriers	Referral barriers	Follow-up barriers	Other barriers	Screening enablers	Referral enablers	Follow-up enablers	Other enablers
Bentz et al., 2006 <sup>37</sup>				x		x	x	x
Brown et al., 2015 <sup>51</sup>				x		x	x	x
Buitron de la Vega et al., 2019 <sup>27</sup>	x				x	x		x
Cartier et al., 2020 <sup>18</sup>	x	x						x
Clark et al., 2019 <sup>50</sup>			x	x				
Fernandez et al., 2020 <sup>47</sup>		x						
Flocke et al., 2019 <sup>39</sup>		x			x	x		x
Gold et al., 2017 <sup>29</sup>	x	x			x	x	x	x
Gold et al., 2018 <sup>30</sup>	x	x			x			
Gottlieb et al., 2015 <sup>54</sup>	x	x				x		
Haas et al., 2015 <sup>40</sup>					x	x		
Hsu et al., 2018 <sup>55</sup>		x				x		
Knowles et al., 2018 <sup>49</sup>	x	x	x		x			
Lindau et al., 2016 <sup>32</sup>		x						x
Lindau et al., 2019 <sup>56</sup>						x		x
Lohr et al., 2019 <sup>57</sup>		x				x		
Messmer et al., 2020 <sup>58</sup>						x	x	
Meyer et al., 2020 <sup>59</sup>	x			x	x			x
Nagykaldi et al., 2017 <sup>33</sup>	x	x		x		x		x
Opel, 2019 <sup>60</sup>		x		x		x		x
Palacio et al., 2017 <sup>61</sup>					x			x
Palakshappa et al., 2021 <sup>34</sup>					x			
Sherman et al., 2008 <sup>42</sup>		x				x		
Snowdon et al., 2020 <sup>35</sup>								x
Taveras et al., 2017 <sup>62</sup>			x	x		x		
Thompson et al., 2018 <sup>65</sup>				x		x		
Tung et al., 2020 <sup>63</sup>						x		x
Wallace et al., 2020 <sup>64</sup>	x				x	x		
Warner et al., 2012 <sup>45</sup>						x		
Ylioja et al., 2017 <sup>46</sup>			x					
Zazworsky and Johnson, 2014 <sup>36</sup>				x				x

Footnote: CCRS: Clinic-Community Referral System. When possible, barriers and enablers are included into categories representing different stages of the CCR process (screening, referral to community organizations, follow-up). For more information, refer to the Results section of the manuscript. The following studies did not report on barriers or facilitators relevant to the implementation of e-CCRSs; Battaglia et al. (2020)<sup>26</sup>, Gold et al., 2019<sup>30</sup>, Vidrine et al. (2013a)<sup>44</sup>, Collins et al. (2018)<sup>38</sup>, Counsell et al., (2006)<sup>52</sup>, Joshi et al., (2019)<sup>48</sup>, Vidrine et al., (2013b)<sup>43</sup>, Kalkhoran et al., (2019)<sup>41</sup>, Dubowitz et al., (2020)<sup>28</sup>, Feldmeth et al., (2019)<sup>53</sup> CRediT Author Statement

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