

Who are the “Hard-to-Reach” groups in chronic-health and health technology research?

A scoping review

Meghan Bradway¹, Henriette Lauvhaug Nybakke^{1,2}, Stine Agnete Ingebrigtsen^{1,2}, and Kari Dyb^{1,2}

¹ Norwegian Centre for E-health Research, University Hospital of North Norway, Tromsø, Norway, Meghan.Bradway@ehealthresearch.no

² University of Tromsø – The Arctic University of Norway, Department of Social Science, Tromsø, Norway

Abstract

Many in health and technology research opt to focus on those who are already “engaged”, not those who are considered “hard-to-reach” or “unreached”. This exacerbates the digital divide and inequity in healthcare. We report findings of a scoping review of literature in PubMed/Medline from 2000-2022. 90 of 795 articles were identified based upon 1) the health researchers’ recruitment of unreached groups with a chronic condition for active participation in a study and 2) clear definitions of who they considered to be unreached. Findings support the need for interdisciplinary and community-level involvement to reach and include unreached groups in health studies.

Keywords

Chronic, digital health, unreached, underserved, study participation

1 INTRODUCTION

The words we use affect how we perceive and react to the world. The term “hard-to-reach” was first used in the 1970’s to describe the police officer’s stigmatizing perceptions of gay, lesbian, and bisexual individuals [1]. It was popularized in social marketing, referring to those who are more time and financially expensive to engage in whatever social intervention is offered [2]. In today’s healthcare setting, the connotations we apply are still and similarly stigmatizing; terms such as “hard-to-reach” or “unengaged” are used to primarily describe those who are non-compliant with or non-receptive to treatment [3]. This implies a lack of effort or blame, which affects how researchers and healthcare providers approach these groups. However, the situation is much more complex than a person simply choosing not to follow a doctor’s orders. Reasons for not engaging in the care they need could be within or outside out of their control, and everywhere in between. This is reflected in the different ways these terms are used to describe different groups within the population.

Within the context of chronic conditions - broadly defined as “continuing or occurring again and again for a long time” by Bernell and Howard [4] - the consequences of belonging to a “hard-to-reach” group are more cumulative compared to those of someone with an acute health condition. If health services and resources are not accessible to someone with a chronic condition, symptoms may be experienced in the short-term as well as more severe complications that are more costly to both the individual and the healthcare system, in the long-term. The number of preventable hospitalizations for those with an acute condition are half the number than for those with chronic condition in the US. Potentially preventable hospitalizations have also been cited as highly associated with social indicators of health [5]. These numbers also vary considerably by country [6],

suggesting a community-level impact to preventative care and treatment.

If health research does not represent individuals living with chronic conditions who are hard-to-reach, here-to-for referred to as unreached, the consequences are interventions that do not address the needs and contexts of these unreached groups.

In this paper, we present the results of a scoping review of literature describing those whom health research considers unreached, who also have a chronic condition. To the best of our knowledge, a review that focuses on how researchers describe unreached groups has not been performed. Recently, factors from environmental to societal infrastructure have changed rapidly. Climate, technological and socio-political activity changes affect our resources, social interactions and priorities, including how we interact with the healthcare system [7]. Therefore, it is prudent to look at who we consider to be unreached in chronic care and what contributes to them being unreached, to properly inform intervention development, testing and implementation. This work is completed as part of the project Watching the Risk Factors (WARIFA): Artificial intelligence and the prevention of chronic conditions [8].

2 METHODS

2.1 Literature search strategy

We followed the PRISMA-ScR checklist to perform the scoping review [9]. In March 2022, PubMed (including Medline) was searched using the following terms: (Recruit* OR Participa*) AND (“Hard-to-reach” OR “Difficult to reach” OR Hidden OR Underserved OR Disadvantaged OR Marginalized OR Unengaged) AND (Population* OR Group*) AND (Healthcare OR “healthcare services” OR health) AND (intervention OR survey OR study OR trial) NOT (Adolescent OR child OR children OR infant OR youth). Due to the broad, “catch-all” search strategy, one database was initially used, with the intention of involving

The 18th Scandinavian Conference on Health informatics, Tromsø, Norway, August 22-24, 2022. Organized by UiT The Arctic University of Norway. Conference Proceedings published by Linköping University Electronic Press at <https://doi.org/10.3384/ecp187>. © The Author(s). This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc/4.0/>

another if saturation, i.e., of descriptions used to describe unreached groups, was not reached.

2.2 Article review and inclusion

All references were uploaded into Rayyan [10]. A trial review of 10 titles and abstracts was conducted between three of the co-authors (MB, HLN, and SAI) to determine interrater agreement (Fleiss' kappa, κ_f) [11]. The interrater agreement was strong ($\kappa_f=0.85$). Disagreements and uncertainties regarding inclusion were resolved before data-extraction from full-texts.

Articles were included if they described any type of study that 1) specifically recruited unreached groups with chronic conditions to actively participate, 2) were conducted from 2000-2022, 3) were written in English, 4) included only adults, and 5) explicitly described why they described their recruited groups as unreached. Reviews and protocols without results were excluded, as well as articles that did not describe recruitment strategies specifically for the group they define as unreached. A protocol is not registered but exists and can be made available upon request. Quality assessment of the articles was not performed because this review focused only on the definitions or characteristics used to describe the unreached populations.

2.3 Data extraction

The following data were extracted from each article: year, country, study type, intervention type, health condition, group(s) recruited, number recruited and definition of that/those group(s) (i.e., description of why the target group was considered unreached).

“Definitions” of unreached groups were considered by the authors to be an explanation or characteristics of why certain groups of people were not receiving the care that they needed or were not achieving their health goals. The exact text used to describe these groups and their definitions were cut and pasted into a common document and underwent a thematic content analysis.

3 RESULTS

Of the 795 articles identified in the literature, 158 were included for data extraction. In this paper, we focus on the 90 articles that recruited groups with chronic conditions, who were described as unreached (Figure 1). We present a summary of the terms the researchers used to describe the unreached groups as well as factors that answered the question “why is this group(s) not receiving the care that they need?”. Note that some terms, e.g., socioeconomic status or rural residence/geography, may appear in both the group type and definition, based on the descriptions given by the authors.

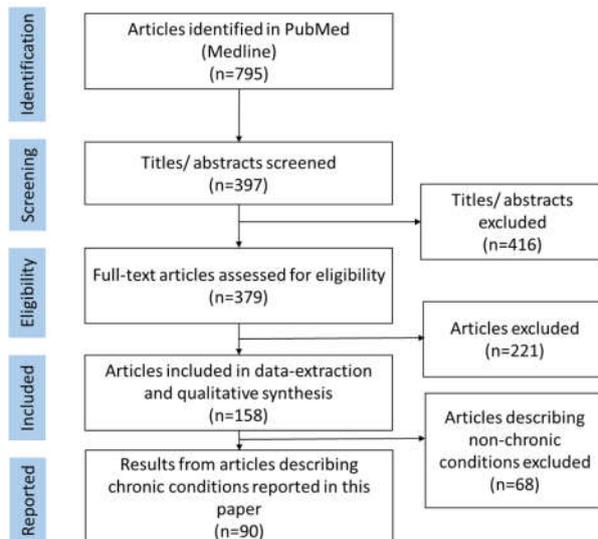


Figure 1 PRISMA flow diagram.

3.1 Articles focusing on chronic conditions

More than 76.6% of the articles that focused on chronic conditions were from one country, the United States ($n=69$), followed by Australia ($n=4$) and the UK ($n=4$). Nearly 66.6% (60/90) of the articles described randomized controlled trials (RCTs), followed by feasibility studies (6/90) and quasi-experimental studies (6/90). In terms of the intervention types, to which groups of unreached individuals with chronic conditions were recruited, half were programs (45/90), i.e., interventions coordinated via healthcare services or run by healthcare personnel, followed by telehealth/eHealth interventions (15/90), i.e. those that used technology initiated by/controlled by healthcare personnel, and screenings (10/90), i.e. those that offered screening services offered by healthcare professionals, primarily for cancer. Only three studies described mHealth interventions, i.e., those that used self-management technologies initiated by end-users. Cancer was discussed in 28.8% (26/90) of the articles, followed by diabetes (22/90), mental health conditions (21/90), and cardiovascular conditions (13/90).

3.2 Recruited group types

The results of the qualitative analysis of the text used to describe the groups recruited to the studies are summarized in Table 1. One group may be described by more than one category, indicating the complexity of group needs or deprivations. The most common descriptions of groups were those described as *People from racial/ethnic minority groups* ($n=42$), followed by *Residents of deprived, medically underserved, or rural areas* ($n=38$), and *people of Low socioeconomic status and/or uninsured* ($n=30$), and *Women* ($n=13$).

Health condition category	Recruited groups by category [reference]
Cancer	<p>Low socioeconomic status and/or uninsured [12-21]</p> <p>People from racial/ethnic minority groups [13-15, 18, 19, 22-31]</p> <p>People who are not compliant/up to date with health recommendations [18, 20]</p> <p>Residents of deprived, medically underserved, or rural areas [32-37]</p> <p>Seniors [14]</p> <p>Women [13, 16, 21, 34, 35]</p>
Cardiovascular conditions	<p>Immigrants, migrant/transient workers, refugees, or manual laborers [38]</p> <p>Low socioeconomic status and/or uninsured [39-43]</p> <p>People from racial/ethnic minority groups [38, 40, 44]</p> <p>Residents of deprived, medically underserved, or rural areas [40, 41, 45-49]</p> <p>Women [39, 45, 47]</p>
Chronic conditions (non-specific)	<p>Immigrants, migrant/transient workers, refugees, or manual laborers [50]</p> <p>People from racial/ethnic minority groups [50]</p> <p>Residents of deprived, medically underserved, or rural areas [51]</p>
Chronic obstructive pulmonary disease (COPD)	<p>Criminal offenders and/or people who use illicit drugs [52]</p>
Diabetes (non-specific)	<p>Low socioeconomic status and/or uninsured [41, 53-56]</p> <p>People from racial/ethnic minority groups [53, 54, 56, 57]</p> <p>People who are socially isolated or unengaged [54]</p> <p>People with underserved chronic condition [58]</p> <p>Residents of deprived, medically underserved or rural areas [41, 56, 57, 59-63]</p> <p>Women [53]</p>
Diabetes (Type 2)	<p>Immigrants, migrant/transient workers, refugees, or manual laborers [64]</p> <p>Low socioeconomic status and/or uninsured [64-66]</p> <p>People from racial/ethnic minority groups [64, 66-71]</p> <p>Residents of deprived, medically underserved or rural areas [49, 64-66, 69, 71, 72]</p>

Disability	<p>People who are socially isolated or unengaged [73]</p> <p>People who have been institutionalized, disabled and/or are dependent on others [73, 74]</p> <p>Women [73]</p> <p>Criminal offenders and/or people who use illicit drugs [75, 76]</p> <p>People from racial/ethnic minority groups [77]</p> <p>People who are not compliant/up to date with health recommendations [78]</p> <p>People without permanent homes [79]</p>
Hepatitis	<p>Veterans [78]</p>
Kidney disease	<p>People from racial/ethnic minority groups [80]</p> <p>Residents of deprived, medically underserved, or rural areas [80]</p> <p>Criminal offenders and/or people who use illicit drugs [81, 82]</p> <p>Immigrants, migrant/transient workers, refugees, or manual laborers [83]</p> <p>Low socioeconomic status and/or uninsured [56, 81, 83-87]</p> <p>People from racial/ethnic minority groups [56, 82, 88-94]</p> <p>People who are socially isolated or unengaged [83, 84]</p> <p>People who have been institutionalized, disabled and/or are dependent on others [95, 96]</p> <p>People with (serious) mental health conditions [82, 97-100]</p>
Mental health conditions	<p>Residents of deprived, medically underserved, or rural areas [56]</p> <p>Women [84, 85, 98]</p>
Multiple sclerosis	<p>People with underserved chronic condition [101]</p> <p>Criminal offenders and/or people who use illicit drugs [82]</p>
Alcohol, tobacco, or substance use/abuse	<p>People from racial/ethnic minority groups [82]</p> <p>People with (serious) mental health conditions [82]</p>

Table 1 Types of recruited unreach groups or populations, by health condition.

3.3 Definitions

The most common definitions of unreach groups with chronic conditions were based upon limitations due to *Healthcare system infrastructure*, *Socioeconomic status/factors*, and *Engagement in healthcare system*.

The definition category of *Healthcare system infrastructure* included the following factors; access to and availability of culturally appropriate and relevant healthcare services/resources, complexity of medical vocabulary and care pathways, healthcare quality and treatment options as well as racism experienced during health consultations from

providers and care coordination and continuity. *Socioeconomic status/factors* included income, education, and insurance as well as migrant-related work, and stressors of living in poverty. *Engagement in healthcare system* included factors such as adherence to recommendations, patient-provider interactions, and relationships as well as screening, other prevention and treatment seeking behaviours and use of healthcare resources.

Also of note were the community, social and political-level factors. *Community resources and setting* included factors such as inherent availability of community resources, socioeconomic status of the community, food security, place of residence or geography and history of community industrial downsizing. *Psychosocial/cultural factors* included culturally based beliefs toward health, e.g., cultural norms that do not support health recommendations, shame, stigma, social isolation, and social capital, i.e., an individual's level of support and participation in a community. *Socio-political factors* included devaluation of their culture, immigrant or minority status, marginalization, discrimination, and risk of deportation.

Of the more internal definition categories were *Personal skills/capacity, and logistic constraints* which included responsibilities of parenthood and caregiver status as well as skills to prepare fresh food, if available, and language. *Perception of/history with treatment/healthcare* was often mentioned as a barrier, citing such factors as knowledge of the healthcare system and level of experience using the healthcare services/resources, trust, and history of healthcare misconduct as well as fear of hospitalization, treatments, and diagnosis. The complete set of factors upon which definitions were based are listed in Table 2.

Categories of factors upon which definitions were based	References
Community resources and setting	[32, 36, 40-42, 48-50, 55, 56, 63, 65, 67-69, 71, 72, 74, 83, 84, 89]
Digital divide	[41, 60]
Engagement in healthcare system	[12, 13, 15, 17-19, 21, 23-27, 29, 31, 33, 36, 38, 42, 45, 50, 52, 57, 58, 64, 67, 75-79, 82, 83, 85, 87, 88, 90-97, 100]
Health beliefs and knowledge	[12, 21, 23, 26, 29, 31, 32, 38, 40, 41, 48, 57, 64, 67, 75, 77, 85, 87, 91]
Health history, status/capacity	[12, 14, 32, 37, 40, 43, 55, 58, 59, 63, 67, 70, 73, 74, 79, 84, 86, 97, 100]
Healthcare system infrastructure	[13, 15, 17, 21-25, 28, 29, 31-37, 39-41, 46-48, 51, 52, 55-62, 64-68, 70-73, 75-82, 84-87, 90-94, 96-99, 101]
Perception of/history with treatment/healthcare	[16, 22, 28, 38, 39, 48, 51, 64, 65, 75, 77, 82, 83, 86, 94, 97, 101],
Personal skills/capacity, logistical constraints	[12, 22-24, 29-32, 37, 41, 44, 49-51, 53, 54, 64, 65, 67, 68, 70, 74, 83, 85, 92, 95, 97, 101]

Psychosocial/cultural factors	[23, 25, 28-31, 39, 43, 47, 50, 55, 58, 64, 67, 73-77, 79, 82-87, 89-92, 94, 97],
Safety/security	[55, 78, 79, 86]
Socioeconomic status/factors	[12-18, 20-26, 28, 39-46, 49, 53-56, 63-67, 69, 70, 73, 74, 78, 79, 81-87, 92, 97, 99]
Socio-political factors	[13, 19, 22, 23, 27, 28, 30, 40, 41, 49, 51, 54-56, 64, 66, 67, 70, 73, 81-84, 86, 87, 90, 94, 99]

Table 2 Factors upon which definitions of unreached groups or populations are based.

4 DISCUSSION

Of the total 795 articles, we identified 90 that described the recruitment and active participation of those who were considered unreached and had chronic conditions. The most common reasons for being described as unreached were related to supply of healthcare system resources, socioeconomic factors related to a community or individual, and individuals' engagement in healthcare.

The variety of unique reasons given by the authors for why certain groups with chronic conditions were unreached was quite frankly disconcerting. Several articles cited a scepticism or lack of trust with the healthcare system due to a history of mistreatment of people like themselves [22, 65], e.g., the 1932-1972 Tuskegee syphilis experiments [102]. Unfortunately, this mistrust persists today due also to personal experiences with racism and stigma during encounters with the healthcare system or from healthcare providers [82].

While the promise of telehealth is greater access and use of healthcare resources amongst those with chronic conditions, the contextual barriers described in this review, including socioeconomic status, where they reside, and logistical challenges could stop them from using, or continue to use, a technology intervention [103]. Those in need exist within the general population, yet most studies include those who are already engaged in their health and care. If we in health research wish to pursue digital health interventions for the general population, we first must consider barriers, including cost and resources needed to support the use of such interventions – from recruitment of diverse informants to the implementation and continuity of the intervention [104].

The strengths of this review were the inclusive search strategy. We aimed not to limit the type of paper based on a certain classification of a "chronic" condition. This allowed us to explore a greater breadth of factors associated with a group not receiving the care they need.

The limitations of this review include human error. We do acknowledge the possibility that a factor was excluded in the extraction of the definitions from the article. We did attempt to minimize this possibility by copying and pasting article text for qualitative analysis instead of paraphrasing. Also, the introductions were primarily used to identify the definitions. Therefore, information presented in other sections would have been omitted.

5 CONCLUSION

As researchers and healthcare providers, we need to know not only why certain groups are not receiving the care that they need but also how those reasons came to be – the

history behind them. It was made clear by the articles that described personal and systemic history of healthcare misconduct, racism, stigma, and social exclusion, that perception is indeed everything. Awareness of the root causes of reluctance in addition to the systemic, political, or infrastructural barriers to seeking or receiving care is the only way in which we develop and effectively implement interventions for those with chronic conditions, including health technologies. Results from this work will contribute to WARIFA in terms of recruitment strategies and understanding the impact and barriers to reaching different populations for health technologies, specifically artificial intelligence.

6 REFERENCES

1. Logie, C., *Introduction*, in *Working with Excluded Populations in HIV: Hard to Reach or Out of Sight?* Springer International Publishing: Cham. p. 1-27. 2021,
2. Brackertz, N., *Who is hard to reach and why*. Institute of Social Research Working Paper, Swinburne University of Technology Institute of Social Research, Victoria. 2007.
3. United States. Congress. House. Committee on Appropriations. Subcommittee on Departments of Labor, et al., *Departments of Labor and Health, Education, and Welfare Appropriations for 1976: Hearings Before a Subcommittee of the Committee on Appropriations, House of Representatives*. U.S. Government Printing Office. 1974
4. Bernell, S. and S.W. Howard, *Use your words carefully: what is a chronic disease?* *Frontiers in public health*, **4**: p. 159. 2016.
5. Johnston, J., et al., *Study of potentially preventable hospitalisations (PPH) for chronic conditions: what proportion are preventable and what factors are associated with preventable PPH?* *BMJ open*, **10**(11): p. e038415. 2020.
6. OECD/European Union, *Health at a Glance: Europe 2020: State of Health in the EU Cycle*: Paris. 2020,
7. Walker, H.R. and M.L. Litchman, *Diabetes identity: A mechanism of social change*. *Qualitative Health Research*, **31**(5): p. 913-925. 2021.
8. *Watching the risk factors: Artificial intelligence and the prevention of chronic conditions*. European Commission: Norway, Romania, Spain. 2020,
9. *PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation*. *Annals of Internal Medicine*, **169**(7): p. 467-473. 2018.
10. Ouzzani, M., et al., *Rayyan-a web and mobile app for systematic reviews*. *Syst Rev*, **5**(1): p. 210. 2016.
11. Belur, J., et al., *Interrater reliability in systematic review methodology: exploring variation in coder decision-making*. *Sociological methods & research*, **50**(2): p. 837-865. 2021.
12. Smith, S.K., et al., *A decision aid to support informed choices about bowel cancer screening among adults with low education: randomised controlled trial*. *Bmj*, **341**: p. c5370. 2010.
13. Yi, J.K. and K.N. Luong, *Apartment-based breast cancer education program for low income Vietnamese American women*. *J Community Health*, **30**(5): p. 345-53. 2005.
14. Owusu, C., et al., *IMPROVE, a community-based exercise intervention versus support group to improve functional and health outcomes among older African American and non-Hispanic White breast cancer survivors from diverse socioeconomic backgrounds: Rationale, design and methods*. *Contemp Clin Trials*, **92**: p. 106001. 2020.
15. Doorenbos, A.Z., et al., *A randomized controlled calendar mail-out to increase cancer screening among urban American Indian and Alaska Native patients*. *J Cancer Educ*, **26**(3): p. 549-54. 2011.
16. Ahmed, N.U., et al., *Randomized controlled trial of mammography intervention in insured very low-income women*. *Cancer Epidemiol Biomarkers Prev*, **19**(7): p. 1790-8. 2010.
17. Gupta, S., et al., *Comparative effectiveness of fecal immunochemical test outreach, colonoscopy outreach, and usual care for boosting colorectal cancer screening among the underserved: a randomized clinical trial*. *JAMA Intern Med*, **173**(18): p. 1725-32. 2013.
18. Green, B.B., et al., *Financial Incentives to Increase Colorectal Cancer Screening Uptake and Decrease Disparities: A Randomized Clinical Trial*. *JAMA Netw Open*, **2**(7): p. e196570. 2019.
19. Basch, C.E., et al., *A Randomized Trial to Compare Alternative Educational Interventions to Increase Colorectal Cancer Screening in a Hard-to-Reach Urban Minority Population with Health Insurance*. *J Community Health*, **40**(5): p. 975-83. 2015.
20. Berkowitz, S.A., et al., *Building Equity Improvement into Quality Improvement: Reducing Socioeconomic Disparities in Colorectal Cancer Screening as Part of Population Health Management*. *J Gen Intern Med*, **30**(7): p. 942-9. 2015.
21. Roland, K.B., et al., *Changes in Knowledge and Beliefs About Human Papillomavirus and Cervical Cancer Screening Intervals in Low-Income Women After an Educational Intervention*. *J Prim Care Community Health*, **7**(2): p. 88-95. 2016.
22. Fischer, S.M., et al., *Apoyo con Cariño: Strategies to Promote Recruiting, Enrolling, and Retaining Latinos in a Cancer Clinical Trial*. *J Natl Compr Canc Netw*, **15**(11): p. 1392-1399. 2017.
23. Ma, G.X., et al., *Community-based colorectal cancer intervention in underserved Korean Americans*. *Cancer Epidemiol*, **33**(5): p. 381-6. 2009.
24. Lee, H.Y., et al., *Motivating underserved Vietnamese Americans to obtain colorectal cancer screening: evaluation of a culturally tailored DVD intervention*. *Asian Pac J Cancer Prev*, **15**(4): p. 1791-6. 2014.
25. Larkey, L.K., et al., *A cancer screening intervention for underserved Latina women by lay educators*. *J Womens Health (Larchmt)*, **21**(5): p. 557-66. 2012.

26. Williams, K.P., et al., *Kin KeeperSM: design and baseline characteristics of a community-based randomized controlled trial promoting cancer screening in Black, Latina, and Arab women*. *Contemp Clin Trials*, **34**(2): p. 312-9. 2013.
27. Wang, X., et al., *Evidence-based intervention to reduce access barriers to cervical cancer screening among underserved Chinese American women*. *J Womens Health (Larchmt)*, **19**(3): p. 463-9. 2010.
28. Calderón-Mora, J., et al., *Group Versus Individual Culturally Tailored and Theory-Based Education to Promote Cervical Cancer Screening Among the Underserved Hispanics: A Cluster Randomized Trial*. *Am J Health Promot*, **34**(1): p. 15-24. 2020.
29. Fang, C.Y., et al., *Addressing multilevel barriers to cervical cancer screening in Korean American women: A randomized trial of a community-based intervention*. *Cancer*, **123**(6): p. 1018-1026. 2017.
30. Juon, H.S., et al., *Effect of a liver cancer education program on hepatitis B screening among Asian Americans in the Baltimore-Washington metropolitan area, 2009-2010*. *Prev Chronic Dis*, **11**: p. 130258. 2014.
31. Kobetz, E., et al., *A randomized trial of mailed HPV self-sampling for cervical cancer screening among ethnic minority women in South Florida*. *Cancer Causes Control*, **29**(9): p. 793-801. 2018.
32. Kolovou, V., et al., *Recruitment and retention of participants from socioeconomically deprived communities: lessons from the Awareness and Beliefs About Cancer (ABACus3) Randomised Controlled Trial*. *BMC Med Res Methodol*, **20**(1): p. 272. 2020.
33. Price, J. and J. Brunet, *Feasibility and acceptability of a telehealth behavior change intervention for promoting physical activity and fruit and vegetable consumption among rural-living young adult cancer survivors*. *J Psychosoc Oncol*, **39**(6): p. 715-733. 2021.
34. Dorfman, C.S., et al., *Development and pilot testing of an mHealth behavioral cancer pain protocol for medically underserved communities*. *J Psychosoc Oncol*, **37**(3): p. 335-349. 2019.
35. Katz, M.L., et al., *Do cervical cancer screening rates increase in association with an intervention designed to increase mammography usage?* *J Womens Health (Larchmt)*, **16**(1): p. 24-35. 2007.
36. Preston, M.A., et al., *Colorectal cancer screening in rural and poor-resourced communities*. *Am J Surg*, **216**(2): p. 245-250. 2018.
37. Zernicke, K.A., et al., *A randomized wait-list controlled trial of feasibility and efficacy of an online mindfulness-based cancer recovery program: the eTherapy for cancer applying mindfulness trial*. *Psychosom Med*, **76**(4): p. 257-67. 2014.
38. Kim, M.T., et al., *Constructing and testing a self-help intervention program for high blood pressure control in Korean American seniors--a pilot study*. *J Cardiovasc Nurs*, **21**(2): p. 77-84. 2006.
39. Khare, M.M., et al., *A lifestyle approach to reducing cardiovascular risk factors in underserved women: design and methods of the Illinois WISEWOMAN Program*. *J Womens Health (Larchmt)*, **18**(3): p. 409-19. 2009.
40. Abbott, L., et al., *Exploring the intervention effect moderators of a cardiovascular health promotion study among rural African-Americans*. *Public Health Nurs*, **35**(2): p. 126-134. 2018.
41. Safford, M.M., et al., *Peer Coaches to Improve Diabetes Outcomes in Rural Alabama: A Cluster Randomized Trial*. *Ann Fam Med*, **13 Suppl 1**(Suppl 1): p. S18-26. 2015.
42. Abbas, S.Z., et al., *The effectiveness of using the workplace to identify and address modifiable health risk factors in deprived populations*. *Occup Environ Med*, **72**(9): p. 664-9. 2015.
43. Mildestvedt, T. and E. Meland, *Examining the "Matthew Effect" on the motivation and ability to make lifestyle changes in 217 heart rehabilitation patients*. *Scand J Public Health*, **35**(2): p. 140-7. 2007.
44. Han, H.R., et al., *Implementation and success of nurse telephone counseling in linguistically isolated Korean American patients with high blood pressure*. *Patient Educ Couns*, **80**(1): p. 130-4. 2010.
45. Greenberg, K.L., et al., *Cardiovascular health literacy and patient-physician communication intervention in women from disadvantaged communities*. *Eur J Prev Cardiol*, **26**(16): p. 1762-1770. 2019.
46. Samuel-Hodge, C.D., et al., *Strengthening community-clinical linkages to reduce cardiovascular disease risk in rural NC: feasibility phase of the CHANGE study*. *BMC Public Health*, **20**(1): p. 264. 2020.
47. Seguin-Fowler, R.A., et al., *The Strong Hearts, Healthy Communities Program 2.0: An RCT Examining Effects on Simple 7*. *Am J Prev Med*, **59**(1): p. 32-40. 2020.
48. Zha, P., et al., *Utilizing a Mobile Health Intervention to Manage Hypertension in an Underserved Community*. *West J Nurs Res*, **42**(3): p. 201-209. 2020.
49. Eakin, E., et al., *Telephone counseling for physical activity and diet in primary care patients*. *Am J Prev Med*, **36**(2): p. 142-9. 2009.
50. Lu, Y., et al., *The evaluation of a culturally appropriate, community-based lifestyle intervention program for elderly Chinese immigrants with chronic diseases: a pilot study*. *J Public Health (Oxf)*, **36**(1): p. 149-55. 2014.
51. Eakin, E.G., et al., *Recruitment and retention of Latinos in a primary care-based physical activity and diet trial: The Resources for Health study*. *Health Educ Res*, **22**(3): p. 361-71. 2007.
52. Burhan, H., et al., *Screening Heroin Smokers Attending Community Drug Services for COPD*. *Chest*, **155**(2): p. 279-287. 2019.
53. Ruggiero, L., S. Oros, and Y.K. Choi, *Community-based translation of the diabetes prevention program's lifestyle intervention in an underserved Latino population*. *Diabetes Educ*, **37**(4): p. 564-72. 2011.

54. Santoyo-Olsson, J., et al., *An innovative multiphased strategy to recruit underserved adults into a randomized trial of a community-based diabetes risk reduction program*. *Gerontologist*, **51 Suppl 1**(Suppl 1): p. S82-93. 2011.
55. Nelson, K., et al., *Peer Support for Achieving Independence in Diabetes (Peer-AID): design, methods and baseline characteristics of a randomized controlled trial of community health worker assisted diabetes self-management support*. *Contemp Clin Trials*, **38**(2): p. 361-9. 2014.
56. Wolff, L.S., et al., *The Effect of Integrating Primary Care and Mental Health Services on Diabetes and Depression: A Multi-site Impact Evaluation on the US-Mexico Border*. *Med Care*, **59**(1): p. 67-76. 2021.
57. Simmons, D. and J.A. Voyle, *Reaching hard-to-reach, high-risk populations: piloting a health promotion and diabetes disease prevention programme on an urban marae in New Zealand*. *Health Promot Int*, **18**(1): p. 41-50. 2003.
58. Lake, A.J., et al., *Effect of a tailored leaflet to promote diabetic retinopathy screening among young adults with type 2 diabetes: a randomised controlled trial*. *BMC Ophthalmol*, **20**(1): p. 80. 2020.
59. Liou, J.K., et al., *Shared care combined with telecare improves glycemic control of diabetic patients in a rural underserved community*. *Telemed J E Health*, **20**(2): p. 175-8. 2014.
60. Shea, S., *The Informatics for Diabetes and Education Telemedicine (IDEATel) project*. *Trans Am Clin Climatol Assoc*, **118**: p. 289-304. 2007.
61. Johnson, M., et al., *Evaluation of an Academic-Community Partnership to Implement MTM Services in Rural Communities to Improve Pharmaceutical Care for Patients with Diabetes and/or Hypertension*. *J Manag Care Spec Pharm*, **24**(2): p. 132-141. 2018.
62. Parra-Medina, D., et al., *Successful recruitment and retention strategies for a randomized weight management trial for people with diabetes living in rural, medically underserved counties of South Carolina: the POWER study*. *J Am Diet Assoc*, **104**(1): p. 70-5. 2004.
63. Piatt, G.A., et al., *Translating the chronic care model into the community: results from a randomized controlled trial of a multifaceted diabetes care intervention*. *Diabetes Care*, **29**(4): p. 811-7. 2006.
64. Timm, L., et al., *Early detection of type 2 diabetes in socioeconomically disadvantaged areas in Stockholm - comparing reach of community and facility-based screening*. *Glob Health Action*, **13**(1): p. 1795439. 2020.
65. Andrae, S.J., et al., *Recruitment of a rural, southern, predominantly African-American population into a diabetes self-management trial*. *Contemp Clin Trials*, **33**(3): p. 499-506. 2012.
66. Ramal, E., A. Champlin, and K. Bahjri, *Impact of a Plant-Based Diet and Support on Mitigating Type 2 Diabetes Mellitus in Latinos Living in Medically Underserved Areas*. *Am J Health Promot*, **32**(3): p. 753-762. 2018.
67. Kim, M.T., et al., *The Effect of a Community-Based Self-Help Intervention: Korean Americans With Type 2 Diabetes*. *Am J Prev Med*, **49**(5): p. 726-737. 2015.
68. Hawley, C.N., et al., *Cooking for Health: a healthy food budgeting, purchasing, and cooking skills randomized controlled trial to improve diet among American Indians with type 2 diabetes*. *BMC Public Health*, **21**(1): p. 356. 2021.
69. Vieira, E.R., et al., *Effects of Exercise and Diet on Body Composition and Physical Function in Older Hispanics with Type 2 Diabetes*. *Int J Environ Res Public Health*, **18**(15). 2021.
70. Spencer, M.S., et al., *Diabetes-specific emotional distress among African Americans and Hispanics with type 2 diabetes*. *J Health Care Poor Underserved*, **17**(2 Suppl): p. 88-105. 2006.
71. Davis, R.M., et al., *TeleHealth improves diabetes self-management in an underserved community: diabetes TeleCare*. *Diabetes Care*, **33**(8): p. 1712-7. 2010.
72. Jessee, B.T. and C.M. Rutledge, *Effectiveness of nurse practitioner coordinated team group visits for type 2 diabetes in medically underserved Appalachia*. *J Am Acad Nurse Pract*, **24**(12): p. 735-43. 2012.
73. Gudlavalleti, M.V., et al., *Access to health care and employment status of people with disabilities in South India, the SIDE (South India Disability Evidence) study*. *BMC Public Health*, **14**: p. 1125. 2014.
74. Melville, C.A., et al., *Effectiveness of a walking programme to support adults with intellectual disabilities to increase physical activity: walk well cluster-randomised controlled trial*. *Int J Behav Nutr Phys Act*, **12**: p. 125. 2015.
75. Brunings, P., et al., *"It's a big part of our lives": A qualitative study defining quality of hepatitis C care from the patient's perspective*. *Gastroenterol Nurs*, **36**(4): p. 249-57. 2013.
76. B, E.W., et al., *Life projects: the transformative potential of direct-acting antiviral treatment for hepatitis C among people who inject drugs*. *Int J Drug Policy*, **72**: p. 138-145. 2019.
77. Ma, G.X., et al., *Efficacy of a community-based participatory and multilevel intervention to enhance hepatitis B virus screening and vaccination in underserved Korean Americans*. *Cancer*, **124**(5): p. 973-982. 2018.
78. Groessl, E.J., et al., *The hepatitis C self-management programme: a randomized controlled trial*. *J Viral Hepat*, **18**(5): p. 358-68. 2011.
79. Bajis, S., et al., *Hepatitis C virus testing, liver disease assessment and direct-acting antiviral treatment uptake and outcomes in a service for people who are homeless in Sydney, Australia: The LiveRLife homelessness study*. *J Viral Hepat*, **26**(8): p. 969-979. 2019.
80. Nelson, R.G., et al., *Home-Based Kidney Care, Patient Activation, and Risk Factors for CKD Progression in Zuni Indians: A Randomized,*

- Controlled Clinical Trial*. Clin J Am Soc Nephrol, **13**(12): p. 1801-1809. 2018.
81. Henry, S.K., M.M. Grant, and K.L. Cropsey, *Determining the optimal clinical cutoff on the CES-D for depression in a community corrections sample*. J Affect Disord, **234**: p. 270-275. 2018.
 82. Jordan, A., et al., *A feasibility study providing substance use treatment in the Black church*. J Subst Abuse Treat, **124**: p. 108218. 2021.
 83. Goodkind, J.R., et al., *Randomized Controlled Trial of a Multilevel Intervention to Address Social Determinants of Refugee Mental Health*. Am J Community Psychol, **65**(3-4): p. 272-289. 2020.
 84. Mathias, K., et al., *"We've got through hard times before: acute mental distress and coping among disadvantaged groups during COVID-19 lockdown in North India - a qualitative study"*. Int J Equity Health, **19**(1): p. 224. 2020.
 85. van der Waerden, J.E., et al., *A randomized controlled trial of combined exercise and psycho-education for low-SES women: short- and long-term outcomes in the reduction of stress and depressive symptoms*. Soc Sci Med, **91**: p. 84-93. 2013.
 86. Burmaster, K.B., et al., *Impact of a private sector living wage intervention on depressive symptoms among apparel workers in the Dominican Republic: a quasi-experimental study*. BMJ Open, **5**(8): p. e007336. 2015.
 87. Kim, S.E., et al., *Does telephone care management help Medicaid beneficiaries with depression?* Am J Manag Care, **17**(10): p. e375-82. 2011.
 88. Grilo, C.M. and M.A. White, *Orlistat with behavioral weight loss for obesity with versus without binge eating disorder: randomized placebo-controlled trial at a community mental health center serving educationally and economically disadvantaged Latino/as*. Behav Res Ther, **51**(3): p. 167-75. 2013.
 89. Ong, M.K., et al., *A Community-Partnered, Participatory, Cluster-Randomized Study of Depression Care Quality Improvement: Three-Year Outcomes*. Psychiatr Serv, **68**(12): p. 1262-1270. 2017.
 90. Collado, A., et al., *Mental health stigma in depressed Latinos over the course of therapy: Results from a randomized controlled trial*. J Clin Psychol, **75**(7): p. 1179-1187. 2019.
 91. Gitlin, L.N., et al., *A community-integrated home based depression intervention for older African Americans: [corrected] description of the Beat the Blues randomized trial and intervention costs*. BMC Geriatr, **12**: p. 4. 2012.
 92. Shea, M., et al., *Mexican American women's perspectives on a culturally adapted cognitive-behavioral therapy guided self-help program for binge eating*. Psychol Serv, **13**(1): p. 31-41. 2016.
 93. Lovell, K., et al., *Development and evaluation of culturally sensitive psychosocial interventions for under-served people in primary care*. BMC Psychiatry, **14**: p. 217. 2014.
 94. Tondora, J., et al., *A clinical trial of peer-based culturally responsive person-centered care for psychosis for African Americans and Latinos*. Clin Trials, **7**(4): p. 368-79. 2010.
 95. Winter, L. and L.N. Gitlin, *Evaluation of a telephone-based support group intervention for female caregivers of community-dwelling individuals with dementia*. Am J Alzheimers Dis Other Demen, **21**(6): p. 391-7. 2006.
 96. Rubin, A.S., et al., *Effects on processes and costs of care associated with the addition of an internist to an inpatient psychiatry team*. Psychiatr Serv, **56**(4): p. 463-7. 2005.
 97. Jaroszewski, A.C., R.R. Morris, and M.K. Nock, *Randomized controlled trial of an online machine learning-driven risk assessment and intervention platform for increasing the use of crisis services*. J Consult Clin Psychol, **87**(4): p. 370-379. 2019.
 98. Grote, N.K., et al., *A Randomized Trial of Collaborative Care for Perinatal Depression in Socioeconomically Disadvantaged Women: The Impact of Comorbid Posttraumatic Stress Disorder*. J Clin Psychiatry, **77**(11): p. 1527-1537. 2016.
 99. Fortney, J.C., et al., *Comparison of Teleintegrated Care and Telereferral Care for Treating Complex Psychiatric Disorders in Primary Care: A Pragmatic Randomized Comparative Effectiveness Trial*. JAMA Psychiatry, **78**(11): p. 1189-1199. 2021.
 100. Ward-Ciesielski, E.F., et al., *Comparing brief interventions for suicidal individuals not engaged in treatment: A randomized clinical trial*. J Affect Disord, **222**: p. 153-161. 2017.
 101. Rimmer, J.H., et al., *Rationale and design of the tele-exercise and multiple sclerosis (TEAMS) study: A comparative effectiveness trial between a clinic- and home-based telerehabilitation intervention for adults with multiple sclerosis (MS) living in the deep south*. Contemp Clin Trials, **71**: p. 186-193. 2018.
 102. Brandt, A.M., *Racism and research: the case of the Tuskegee Syphilis Study*. Hastings center report: p. 21-29. 1978.
 103. Beratarrechea, A., et al., *The impact of mobile health interventions on chronic disease outcomes in developing countries: a systematic review*. Telemedicine and e-Health, **20**(1): p. 75-82. 2014.
 104. McMillan, J.R. and C. Conlon, *The ethics of research related to health care in developing countries*. Journal of Medical Ethics, **30**(2): p. 204-206. 2004.

7 ACKNOWLEDGEMENTS

We would like to thank the project under which this work was completed, Watching the Risk Factors (WARIFA): Artificial intelligence and the prevention of chronic conditions (Horizon 2020 grant agreement No 101017385). We also thank those who helped in reviewing the titles and abstracts of the 795 articles.