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# Community-based interventions for health promotion and disease prevention in noncommunicable diseases: A narrative review

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## Abstract:

**PURPOSE:** Noncommunicable disease (NCD) prevention is emerging as a public health priority in developing countries. For better health outcome in these countries, it is necessary to understand the different community-based interventions developed and implemented across the world.

**OBJECTIVE:** The objective of the current review is to identify the best strategies used in community-based health intervention (CBHI) programs across the world.

**MATERIALS AND METHODS:** For review, we searched in PubMed and Google Scholar with the keywords “community based,” “health interventions,” “health promotions,” “primary prevention,” “chronic diseases,” “lifestyle-related diseases,” and “NCD.” Data were extracted using predesigned data extraction form. CBHI studies detailing their intervention strategies only were included in the review.

**RESULTS:** Out of 35 articles reviewed, 14 (40%) were randomized control trials, while 18 (51.4%) were quasi-experimental design. Individual level ( $n = 14$ ), group level ( $n = 5$ ), community level ( $n = 6$ ), and policy level ( $n = 4$ ) intervention strategies were identified. Twenty-three (64%) studies were based on interventions for 1 year and above. Twenty-eight (80%) studies were intervened among specific populations such as Latinos and so on.

**CONCLUSION:** Successful programs advocate for a package or a chain of interventions than a single intervention. The type of interventions at different levels, namely individual, group, community, and policy levels vary across studies, but individual, and group level interventions are more frequently used.

## Keywords:

Community interventions, disease prevention, health promotion, noncommunicable disease

## Introduction

It is a common practice in the developed countries to have community-based health interventions (CBHI) in noncommunicable disease (NCD) prevention.<sup>[1]</sup> However, developing countries prioritize these resources for communicable disease prevention and maternal and child health.<sup>[2]</sup> In the recent past, developing countries experience epidemiological transition.<sup>[3]</sup> Increase in the share of NCDs

in total disease burden compelled the policy makers and researchers to focus on NCD problem. Classic experiments such as North Karelia project have demonstrated the feasibility of interventions at the community level and with a specific focus in preventing NCD and with a specific focus on the cardiovascular diseases.<sup>[4]</sup> The Ottawa charter for health promotion makes it apparent that favorable political, economic, social, cultural, environmental, behavioral, and biological factors influence and shape health.<sup>[5]</sup> North Karelia project over the years has demonstrated how

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social and behavioral science concepts were applied for health promotion.<sup>[4,6]</sup> Similar programs such as Stanford Three Community Study, Stanford Five-City Project, Minnesota Heart Health Program, and Pawtucket Heart Health Program were carried out in the United States of America for cardiovascular disease prevention.<sup>[1]</sup> Tobacco use, physical inactivity, unhealthy diet, and harmful use of alcohol are the common risk factors for NCDs such as hypertension, cardiovascular disease, and cancer.<sup>[7]</sup> Thus, the focus has shifted from cardiovascular disease prevention to NCD prevention due to the similarity in risk factors. Programs initiated by the World Health Organization (WHO) then served as templates for program planning and implementation at different regions. Interhealth, countrywide integrated NCD intervention program, and CARMEN were WHO promoted programs for NCD prevention.<sup>[1]</sup> Community-based programs are based on the fact that human behavior is molded through the interactions occurring in the social environment.<sup>[8]</sup> As a result, these programs use community-focused public health approach and primary prevention strategy for modifying factors influencing community health.<sup>[9]</sup> Furthermore, a community is described and interpreted in different ways. A community is “a group of people with diverse characteristics who are linked by social ties, share common perspectives, and engage in joint action in geographical locations or settings.”<sup>[10]</sup> The word community used in CBHI may be interpreted in accordance with the role it plays in that intervention. It may be the “setting,” “target,” “resource,” or the “agent.”<sup>[11,12]</sup> CBHIs recognize community as a unit of identity and builds on the strengths and resources within the community. It encourages the involvement of all participants in all phases of research. It endorses co-learning and blends knowledge and action for the collective gain of all participants.<sup>[13]</sup> Many models and theories guide the planning and implementation of community-based health interventions.<sup>[14,15]</sup>

The objective of the current review is to identify the best strategies used in community-based health intervention programs across the world.

## Materials and Methods

A systematic literature search and narrative synthesis<sup>[16]</sup> was performed on studies published in the English language from January 2004 to July 2016. Original studies published in peer-reviewed scientific journals having full-text availability were included in this review. No restrictions were made on the article search process on the basis of the type of study, type of intervention, or type of participants. Articles on community-based health intervention programs detailing their intervention strategy were included in

this study. Commentaries and hospital-based studies were excluded from the study.

## Literature search strategy

Articles listed in electronic databases PubMed and Google Scholar were searched using the following keywords. “community based,” “health interventions,” “health promotions,” “primary prevention,” “chronic diseases,” “lifestyle-related diseases,” “cardiovascular diseases,” “diabetes,” “hypertension,” “obesity,” “tobacco,” “cancer,” and “community-based interventions.” The keywords were combined using the Boolean operations “OR” and “AND.” Two reviewers independently screened the title and abstract of the identified articles to confirm the eligibility. Disagreements if any were resolved through discussion and when required, a third reviewer was consulted. Duplicate articles were removed using Zotero reference management software, and the result was cross-checked manually.

## Data extraction process

Data extraction forms were prepared through expert consultation and were verified and filled by the first reviewer. The experts were from the field of epidemiology, biostatistics, and community oncology. Two reviewers independently extracted data. The completed forms were cross-checked for accuracy by the third reviewer and differences were resolved through mutual discussion among reviewers. The extracted data included the author details, country, title, and year of publication, objectives, outcome, intervention area, study design, target population, intervention model or theory, intervention strategy, and intervention duration.

## Results

Figure 1 shows the process of selecting 35 articles included in the review. A meta-analysis was not possible due to the heterogeneity of the included studies. Table 1 shows the characteristics of articles from 14 countries included in the review. Qualitative research designs were less commonly used.<sup>[17-20]</sup> Table 2 summarizes the key findings from the current review. Articles report various theories and models used for intervention development and implementation [Table 3: Theories and models identified in the review] and some studies used multiple theories for their intervention program development. Community-based participatory research (CBPR) was the most commonly used model.<sup>[17,21-27]</sup> The reviewed articles reported a number of intervention strategies. Even though many of those interventions are commonly used in community health programs,<sup>[20-22,25,26,28-38]</sup> few innovative ones were also reported<sup>[17,19,22,23,33,39-43]</sup> [Table 4]. The focus of interventions was individual, group, community, and policy levels [Table 5].

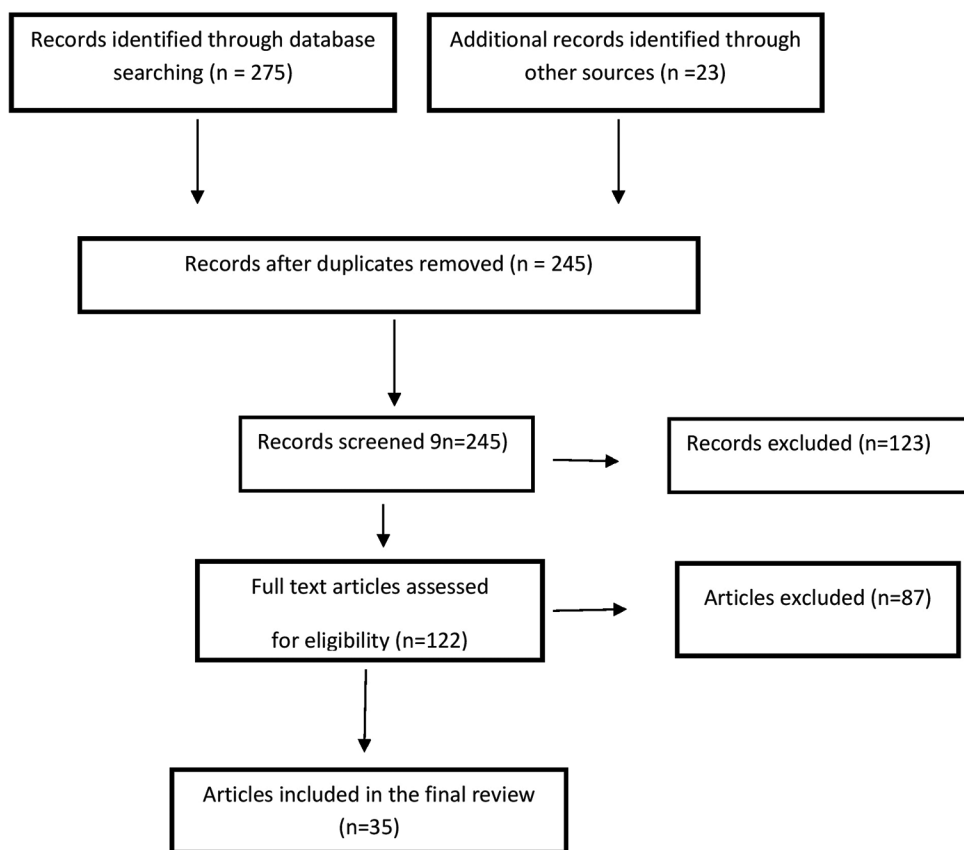


Figure 1: Flowchart depicting the article selection process

**Table 1: Characteristics of included studies**

No	Author and year	Country	Study design	Model/method	Health issue	Study population
1	Chen <i>et al.</i> , 2015	Taiwan	Quasi-experimental	-	Suicide prevention	General population
2	Ono <i>et al.</i> , 2008	Japan	Quasi-experimental	Social support	Suicide prevention	General population
3	Langford <i>et al.</i> , 2014	USA	Program	Health belief model, stress and coping, social support	Cancer prevention	Lay community men (African American)
4	Blumenthal <i>et al.</i> , 2010	USA	RCT	CBPR, social ecological theory, social cognitive theory	Cancer prevention, colorectal	369 African American people
5	Blumenthal <i>et al.</i> , 2005	USA	Multicomponent community intervention trial/quasi-experimental	CBPR, health belief model, community organization, social marketing	Cancer prevention	African American community
6	Hiatt <i>et al.</i> , 2008	USA	Quasi-experimental (2*2 factorial design)	-	Cancer screening	Multi ethnic underserved women
7	Park <i>et al.</i> , 2011	South Korea	Quasi-experimental	HBM, TTM, PRECEDE -PROCEDE	Cancer prevention	Women in community
8	Emery <i>et al.</i> , 2014	Australia	RCT (2*2 factorial)	Community engagement models	Cancer prevention	Rural population
9	Westfall <i>et al.</i> , 2013	USA	Quasi-experimental	CBPR	Cancer prevention	Rural community
10	Aragones <i>et al.</i> , 2015	USA	Quasi-experimental	-	Cancer prevention	69 Mexican Americans
11	Williams <i>et al.</i> , 2013	USA	RCT	CBPR, kin keepers model	Cancer prevention	Black, Latina, Arab women

Contd...

**Table 1: Contd...**

No	Author and year	Country	Study design	Model/method	Health issue	Study population
12	Shiramizu <i>et al.</i> , 2012	USA	Qualitative	CBPR	Cancer prevention	HIV infected native population
13	Jayakrishnan <i>et al.</i> , 2013	India	RCT	-	Tobacco control	Rural current daily smoking men
14	Muramoto <i>et al.</i> , 2014	USA	RCT	SCT	Tobacco	Health influencers
15	Mishra <i>et al.</i> , 2014	India	Program pre-post		Tobacco	Women
16	Levinson <i>et al.</i> , 2015	USA	RCT	Motivation interviewing	Tobacco	Smokers among parents
17	Bhagabaty <i>et al.</i> , 2015	India	Quasi-experimental	-	Tobacco	Tobacco users in the community
18	Sarrafadegan <i>et al.</i> , 2009	Iran	Quasi-experimental	-	Cardiovascular	General population
19	Fornari <i>et al.</i> , 2013	Brazil	RCT	-	Cardiovascular	School children , parents
20	Austin and Claiborne, 2011	USA	PROGRAM	CBPR	Diabetes	African American community
21	Vojta <i>et al.</i> , 2013	USA	Quasi-experimental	-	Diabetes	Prediabetic people
22	Katula <i>et al.</i> , 2010, 2013	USA	RCT	-	Diabetes	300 obese and overweight people
23	Parikh <i>et al.</i> , 2010	USA	RCT	CBPR	Diabetes	Prediabetic
24	Colagiuri <i>et al.</i> , 2010 Vita <i>et al.</i> , 2016	Australia	Quasi-experimental	SCT	Diabetes	People aged at high-risk of developing type 2 diabetes
25	Lu <i>et al.</i> , 2015	China	RCT Three different interventions	-	Hypertension	Diagnosed hypertensive, age between 40 and 75
26	Zoellner <i>et al.</i> , 2011	USA	Quasi-experimental phase followed by RCT	CBPR, social support, and motivational interviewing	Hypertension	African Americans
27	Thankappan <i>et al.</i> , 2013	India	Quasi-experimental	-	Hypertension	General population
28	Land <i>et al.</i> , 2014	Australia	Quasi-experimental	Communication for behavioral Impact framework	Hypertension/salt reduction	General population
29	Perry <i>et al.</i> , 2015	USA	Program	Care group approach	MCH	Women
30	Tripathy <i>et al.</i> , 2016	India	RCT	Participatory learning and action	MCH	Women aged 15–49 years
31	Yassin <i>et al.</i> , 2013	Ethiopia	Quasi-experimental	-	TB	General population
32	Eastmen <i>et al.</i> , 2006	USA	PROGRAM	Social learning theory, health belief model, theory of reasoned action	Sexual education	Parents of sixth to tenth graders
33	Johnson <i>et al.</i> , 2008	USA	RCT	TTM	Weight management	Obese adults
34	Woelk <i>et al.</i> , 2016	Swaziland, Uganda, and Zimbabwe	RCT	-	HIV	General population
35	Morisky <i>et al.</i> , 2004	Philippines	Longitudinal crossover design	Participatory action research	HIV	High-risk male heterosexual populations (6 arms)

RCT=Randomized control trial, CBPR=Community-based participatory research

### Community-based interventions in cancer prevention

The objectives of these intervention programs were to increase cancer-related knowledge, reduce the time to diagnosis, improve screening rate, decrease risk behaviors, and correct cancer-related myths.<sup>[19,21,22,24-26,28,30,33,34]</sup> CBPR model was used in five articles. Peer leaders, general practitioners, patient

navigators, community health workers (CHWs), kin keepers, and lay health workers led interventions were the persons delivering the intervention in five articles. The “Kin keeper” intervention is a CBPR study that relies on the teamwork and natural contact that exist among women in families.<sup>[26]</sup> The trained CHWs select clients from their usual practice and suggest each client gather other women in the family for a group education session

**Table 2: Summary of key findings from the review**

Number	Focus of review	n
1	Health issue/disease	
1.1	Cancer prevention	10
1.2	Tobacco control	5
1.3	Cardiovascular disease prevention	2
1.4	Diabetes prevention	5
1.5	Hypertension prevention	4
1.6	Maternal and child health	2
1.7	HIV prevention	2
1.8	Suicide prevention	2
1.9	Others	3
2	Study designs	
2.1	Randomized controlled trials	14
2.2	Quasi-experimental designs	17
2.3	Qualitative methods	4
3	Target population	
3.1	General population	7
3.2	Specific population	28
4	Intervention models and theories	
4.1	Community participatory models	15
4.2	Health promotion theories	12
4.3	Communication and counseling models	6
4.4	Other models	3
5	Intervention duration	
5.1	<1 year	12
5.2	1 year	6
5.3	>1 year	17

**Table 3: Theories and models identified in the review**

Community participatory models	Health promotion theories	Communication and counseling models
Community organization model	Trans-theoretical model	Kin keepers model
community engagement model	Social learning theory	Patient navigation model
social support model, participatory learning and action	Theory of reasoned action	Motivational interviewing
Participatory action research	Social cognitive theory	Communication for behavioral impact framework
Community based participatory research	Health belief model	Care group approach
	Social-ecological theory	

at their houses.<sup>[26]</sup> Men’s fellowship breakfasts, panel discussions, health fairs, and education sessions were also used as intervention strategies. Tobacco control is an integral part of any cancer or other NCD prevention programs.

### Community-based interventions in tobacco control

Three studies used a randomized control trial (RCT) design<sup>[35,38,39]</sup> and the remaining two were intervention studies with no control.<sup>[37,44]</sup> The study population included rural men current smokers on a daily basis,<sup>[38]</sup> women<sup>[44]</sup> and parents.<sup>[35]</sup> “Smoking solution guides”

were used in community-based cessation programs. They help and persuade the participants to utilize the existing tobacco cessation facilities in the health system.<sup>[35]</sup> “Health influencers” (HIs) were a set of people having varied levels of relationship and social distance with the tobacco users. A “health influencer” may be a friend, relative, subordinate, colleague, companion, service provider, or even a stranger. Here, these “health influencers” were given training in tobacco cessation strategies to persuade the tobacco user to give up the habit.<sup>[39]</sup>

### Community-based interventions in cardiovascular, diabetes, and hypertension prevention

Isfahan Healthy Heart Program is a lifestyle intervention program from Iran which demonstrated the effectiveness of such programs in the developing country.<sup>[45]</sup> In this project, the intervention was channeled through 10 distinct projects targeting worksites, nongovernmental organizations and specific populations such as women, children, health professionals and high-risk groups. The assessment of smoking behaviors, diet, and physical activity was done at baseline and every year for 4 years. Key intervention strategies include public education through mass media, community participation and education, legislation and policy development. Significant changes were observed in dietary habits but no such changes observed in smoking behaviors.<sup>[45]</sup> Children first study is a school-based cardiovascular prevention program from Brazil. In this 10 months’ prospective study, 6–10-year-old school children and their parents were randomized to intervention and control group.<sup>[46]</sup> Intervention group children received weekly 1 h age-appropriate class on cardiovascular prevention by a specially constituted health team. The policy level intervention was illustrated in the dietary salt intake reduction program. Policy level (public advocacy and salt substitution), community level (community mobilization), and individual level interventions (food switch smartphone application<sup>[41]</sup>) were reported in the reviewed articles. Except one,<sup>[17]</sup> all other studies reported intervention duration of 1 year or more. The target population in diabetes prevention programs were people at risk of developing diabetes.<sup>[23,31,47,48]</sup>

### Community-based interventions in other health issues

Care group approach<sup>[20]</sup> and participatory learning and action model<sup>[32]</sup> were the two interesting intervention model reported from maternal and child health studies. In a care group approach, the volunteers share messages with the mothers of the households to promote important health behaviors and to use key health services. The care groups demonstrate a cost-effective model with an augmented effect for reaching out the community.



**Table 4: Summary of Intervention strategies used in community health interventions**

Personal education and counseling	Individual level		Group level	Community level	Policy level	Person delivering the intervention
	Self-learning printed materials	Phone and web-based				
Counseling (n=2)	Pamphlets and leaflets (n=8)	Phone calls (n=2)	Panel discussions (n=1)	Awareness campaign (n=4)	Public advocacy (n=2)	CHWs (n=3)
One to one education (n=6)	Booklets (n=4)	Text messaging (n=1)	Group exercises (n=1)	Health fairs (n=1)	Salt substitution (n=1)	Health providers (n=5)
Individualized reports (n=1)	Posters (n=2)	Web based training (n=1)	Workshops (n=3)	Mass media (n=1)	Access restriction (n=1)	Lay health worker (n=9)
Pedometer monitoring (n=1)		Mobile application (n=1)	Group education (n=11)	Network meeting (n=1)	Legislation (n=1)	Patient navigators (n=1)
Motivational interviewing (n=1)		Mailing (n=2)	Cooking demonstration (n=1)	Video films (n=1)		Medical social worker (n=2)
				Community mobilization (n=1)		Health influencers (n=1)
						Peer counselors (n=1)

CHW=Community health worker

**Table 5: Levels of intervention**

Serial no author	Individual level	Group level	Community level	Policy level	Culturally sensitive
1. Chen <i>et al.</i> , 2015	-	-	-	Access restriction (charcoal)	-
2. Ono <i>et al.</i> , 2008, 2013	1. Counseling	-	1. Network meetings 2. Public awareness campaigns 3. High-risk screening 4. Outreach	-	-
3. Langford <i>et al.</i> , 2014	-	1. Panel discussions 2. Small group exercises 3. Cooking demonstrations	1. Fellowship breakfasts 2. Health fairs	-	Yes Ethnic
4. Blumenthal <i>et al.</i> , 2010	1. One-on-One education 2. Out-of-pocket expenses 3. Pamphlets	1. Group education 2. CHW	-	-	-
5. Blumenthal <i>et al.</i> , 2005	1. Fliers 2. Posters 3. Booklets	1. Education sessions 2. Clinicians	1. Partnership with church 2. Health fairs 3. Mass media 4. Professional help	-	Yes Ethnic
6. Hiatt <i>et al.</i> , 2008	1. One to one education	1. Group education 2. Lay health worker 3. Clinic provider	-	-	-
7. Park <i>et al.</i> , 2011	1. Posters 2. Leaflets 3. Mailing 4. Phone calls	1. Group education	1. Street promotion	-	-
8. Emery <i>et al.</i> , 2014	-	1. GP intervention	1. Awareness campaign	-	Yes Rural
9. Westfall <i>et al.</i> , 2013	-	-	1. Awareness campaign	-	Yes rural
10. Aragonés <i>et al.</i> , 2015	1. Text messaging 2. One to one education 3. Booklet	1. Lay health worker	-	-	-
11. Williams <i>et al.</i> , 2013	-	1. CHWs 2. Group education	-	--	-
12. Shiramizu <i>et al.</i> , 2012	-	1. Community sessions 2. Patient navigators	-	-	Yes, Ethnic

*Contd...*

**Table 5: Contd...**

Serial no author	Individual level	Group level	Community level	Policy level	Culturally sensitive
13. Jayakrishnan <i>et al.</i> , 2013	1. Leaflet 2. Booklets	1. Group counseling 2. medical social worker	1. Medical camps	--	-
14. Muramoto <i>et al.</i> , 2014	1. Personal training 2. Mailed material 3. Web-based training	1. Health influencers	-	-	-
15. Mishra <i>et al.</i> , 2014	-	1. Rapport building session 2. Group discussion 3. Group counseling	-	-	-
16. Levinson <i>et al.</i> , 2015	1. Motivation interviewing	1. Smoking solution guides 2. Group sessions	1. Existing health system resource utilization	-	-
17. Bhagabaty <i>et al.</i> , 2015	1. IEC materials 2. Home counseling	1. Medical social worker	-	-	-
18. Sarrafzadegan <i>et al.</i> , 2009	-	1. Health professional	1. Mass media 2. Inter-sectoral cooperation and collaboration	1. Legislation and policy	-
19. Fornari <i>et al.</i> , 2013	1. IEC material	1. Age appropriate classes	-	-	-
20. Austin and Claiborne, 2011	-	1. Workshop	-	-	Yes
21. Vojta <i>et al.</i> , 2013	-	1. Lifestyle coaches 2. Education sessions	-	-	-
22. Katula <i>et al.</i> , 2010, 2013	1. Individual meetings with a registered dietitian 2. Monthly newsletter	1. CHWs 2. Group education	-	-	-
23. Parikh <i>et al.</i> , 2010	1. IEC materials	1. Workshop	-	-	yes
24. Colagiuri <i>et al.</i> , 2010; Vita <i>et al.</i> , 2016	1. Individual sessions 2. Telephone calls	1. Group sessions 2. Lifestyle officers 3. Primary care physician	-	-	-
25. Lu <i>et al.</i> , 2015	1. IEC materials	1. Group education 2. Workshop	-	-	-
26. Zoellner <i>et al.</i> , 2011	1. Pedometer diary self-monitoring	1. Walking groups 2. Education sessions	-	-	-
27. Thankappan <i>et al.</i> , 2013	1. Booklets	1. Lay health volunteers 2. Anganwadi workers 3. Elected members	1. Video film	-	-
28. Land <i>et al.</i> , 2014	1. Food switch	-	1. Community mobilization 2. Advertisement 3. Point of service	1. Public advocacy 2. Salt substitution	-
29. Perry <i>et al.</i> , 2015	-	1. Care group facilitators 2. Volunteers	-	-	-
30. Tripathy <i>et al.</i> , 2016	-	1. ASHA worker	-	-	-
31. Yassin <i>et al.</i> , 2013	-	1. Female health extension 2. Workers (HEWs)	-	1. Advocacy	-
32. Eastmen <i>et al.</i> , 2006	-	1. Interactive lecture	-	-	-
33. Johnson <i>et al.</i> , 2008	1. Individualized reports	-	-	-	-
34. Woelk <i>et al.</i> , 2016	-	1. Community leaders 2. Community peer group	1. Community days	-	-
35. Morisky <i>et al.</i> , 2004	-	1. Peer counselors	-	-	-

CHW=Community health worker, HEWs=Health extension worker, ASHA=Accredited Social Health Activists, IEC=Information Education and Communication

Prevention study conducted on the high-risk male heterosexual population in the Philippines report a longitudinal crossover study design.<sup>[36]</sup> In this intervention study, peer counselors were selected from among the study population and were trained to educate fellow men. These trained peer counselors were expected to educate at least ten of their peers on STI/HIV/AIDS.

## Discussion

This review exposes the paucity of community-based health intervention programs and research from the developing world. Nearly three-fourth (64%) of the studies reviewed were reported from developed countries. Owing to the increased burden of NCDs in the developed world since the 1960s, most of the integrated NCD prevention programs were reported from these countries.<sup>[1]</sup> A systematic review of obesity prevention programs in Europe showed fewer intervention programs were reported in the less affluent eastern and southern European countries.<sup>[49]</sup> The reason for fewer studies from the developing world may also be attributed to an overburdened and cash stripped public health systems in those countries. In many developing countries, communicable diseases are still a cause of worry.

Community-based programs reviewed in this paper described experimental and quasi-experimental study designs. The quasi-experimental designs include non-RCTs,<sup>[25,29,30,34,43,45,50]</sup> interventions without control<sup>[37,40,41,44,47,48]</sup> and longitudinal crossover design.<sup>[36]</sup> The quasi-experimental study design was used in half of the articles reviewed. Even though the randomized trial is the gold standard in the evaluation of community intervention trials, practical and ethical issues argue against it.<sup>[51]</sup> Random allocation often faces hurdles for implementation. Policy makers and administrators often demand to roll out of the intervention in a needy area. They may also advocate excluding “control areas” if the intervention is considered as useful and devoid of any ill effects.<sup>[52]</sup> In RCTs, subject recruitment may be difficult in the control group. These may be the reasons for the perceived preference observed in the review for quasi-experimental designs. A systematic review of CBPR showed few studies used RCT.<sup>[53]</sup>

About 81 of the reviewed articles reported interventions in specific groups such as ethnic, religious and linguistic minorities, women, smokers, prediabetic people, and high-risk individuals. A review of obesity prevention intervention found that half of the interventions were targeted at the general population.<sup>[49]</sup> The review by Gubbels *et al.*<sup>[49]</sup> was exclusively on obesity prevention but that condition is quite common among specific communities and the general population in developed

countries. That may be the reason for reported targeting of the general population in half of the studies. In our study, we included articles detailing prevention strategies in different fields such as cancer, diabetes, hypertension, smoking, and cardiovascular disease. The prevalence of cardiovascular diseases, hypertension, diabetes, and other NCDs is higher among African Americans of the United States. This may be a reason for targeting specific population rather than the general population in the US-based NCD prevention studies.<sup>[54]</sup>

Community participatory models and behavioral modification theories of health promotion were used for program development in reviewed articles. Most of the studies describing the models and theories did not explain how they utilized these theories for developing the intervention. A systematic review of theory-based lifestyle intervention studies reports a similar observation that only a few articles explicitly mentioned the role of theory in all phases of the intervention program.<sup>[55]</sup> CBPR model was widely used in the reviewed articles. Participatory action research and social ecological models were identified as key to successful community-based physical activity intervention programs.<sup>[56]</sup> The co-learning process in community-based interventions result in the exchange of knowledge and skills and thus by empowers the participating communities.<sup>[13]</sup> CBPR will be an effective intervention research strategy if all the participants recognize the usefulness of such collaborations.<sup>[53]</sup>

Culture-sensitive interventions targeting religious and ethnic minorities were also reported.<sup>[17,19,21,22,24,26,27,33,34]</sup> This tailoring aims to address the culture divide existing between the urban-rural or ethnic, religious, and linguistic minorities. Culture-sensitive intervention approaches will help in program implementation and intervention penetration. Some other interventions were specifically focused on individuals at high risk of developing certain diseases like diabetes.<sup>[57,58]</sup> Culturally competent, CHW leads interventions to prevent chronic disease among culturally and linguistically diverse communities were found to be successful.<sup>[59]</sup> Intervention duration varies from 2 months to 6 years in our review. Community-based interventions are generally of greater durations. The North Karelia project was initially planned for 5 years only, but later, it was extended nationwide and concluded in 1997 only. The project still continues in North Karelia.<sup>[6]</sup> The community intervention projects commonly take 2–3 years for implementation and evaluation with some project extending to 5–7 years.<sup>[8]</sup>

## Conclusion

Intervention programs that engage the population through multiple activities or activities that are spaced



over the entire duration of the program are more successful than the one based on a single activity. Person led interventions are also well accepted at the community level. Community-based health interventional studies are generally reported from the developed countries. These studies prefer quasi-experimental designs over RCTs due to practical, ethical, provider, and policy level reasons. Their intervention strategies are targeted at individuals, groups, communities, and policy levels. A single intervention program may target its intervention strategies at multiple levels. Group-level interventions were part of almost all intervention programs. Most of the interventions target a specific community rather than general populations. Interventions targeting specific groups such as linguistic, ethnic, or religious minorities or rural communities may adapt their interventions to suit the cultural and regional requirements of those communities. CBPR models are increasingly used in community interventions as these models ensure equal partnerships for all stakeholders at different levels of interventions. Care group approach and kin keeper's model were two intervention strategies which explored the women groups' potential for intervention delivery. One to one education, interactive group sessions, workshops, printed materials group counseling, and mass media were the frequently used intervention tools. CHWs, lay health workers, peer leaders, and clinic providers were used for intervention delivery. Interventions delivered in person had good acceptance but unviable in large community settings.

The paucity of articles from developing countries underscores the need for conducting similar studies in those countries to understand the practical difficulties in translating the knowledge gained through the experiences of developed countries in the field of community-based health interventions. We need to know how issues such as underdeveloped health-care system and insufficient health care spending for NCD prevention will affect the rolling out of large-scale community-based health intervention programs in the developing countries.

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### Conflicts of interest

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