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. However, developing countries prioritize these resources for communicable disease prevention and maternal and child health. In the recent past, developing countries experience epidemiological transition. 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.

The Ottawa charter for health promotion makes it apparent that favorable political, economic, social, cultural, environmental, behavioral, and biological factors influence and shape health. North Karelia project over the years has demonstrated how

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social and behavioral science concepts were applied for health promotion. 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. 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. 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. Community-based programs are based on the fact that human behavior is molded through the interactions occurring in the social environment. As a result, these programs use community-focused public health approach and primary prevention strategy for modifying factors influencing community health. 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.” 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.” 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. Many models and theories guide the planning and implementation of community-based health interventions.

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 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. 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. The reviewed articles reported a number of intervention strategies. Even though many of those interventions are commonly used in community health programs, a few innovative ones were also reported [Table 4]. The focus of interventions was individual, group, community, and policy levels [Table 5].
Table 1: Characteristics of included studies

| No | Author and year | Country     | Study design                        | Model/method                                                                 | Health issue                        | Study population                                        |
|----|-----------------|-------------|------------------------------------|-------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------|
| 1  | Chen et al., 2015 | Taiwan     | Quasi-experimental                 | -                                                                             | Suicide prevention                  | General population                                      |
| 2  | Ono et al., 2008  | Japan       | Quasi-experimental                 | Social support                                                                | Suicide prevention                  | General population                                      |
| 3  | Langford et al., 2014 | USA | Program                           | Health belief model, stress and coping, social support                     | Cancer prevention                  | Lay community men (African American)                  |
| 4  | Blumenthal et al., 2010 | USA | RCT                               | CBPR, social ecological theory, social cognitive theory                      | Cancer prevention, colorectal      | 369 African American people                           |
| 5  | Blumenthal et al., 2005 | USA | Multicomponent community intervention trial/quasi-experimental | CBPR, health belief model, community organization, social marketing         | Cancer prevention                  | African American community                              |
| 6  | Hiatt et al., 2008  | USA         | Quasi-experimental (2*2 factorial design) | -                                                                             | Cancer screening                  | Multi ethnic underserved women                         |
| 7  | Park et al., 2011  | South Korea | Quasi-experimental                 | HBM, TTM, PRECEDE -PROCEDE                                                    | Cancer prevention                  | Women in community                                     |
| 8  | Emery et al., 2014 | Australia   | RCT (2*2 factorial)                | Community engagement models                                                   | Cancer prevention                  | Rural population                                       |
| 9  | Westfall et al., 2013 | USA | Quasi-experimental                 | CBPR                                                                          | Cancer prevention                  | Rural community                                        |
| 10 | Aragones et al., 2015 | USA | Quasi-experimental                 | -                                                                             | Cancer prevention                  | 69 Mexican Americans                                   |
| 11 | Williams et al., 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 et al., 2012 | USA | Qualitative | CBPR | Cancer prevention | HIV infected native population |
| 13 | Jayakrishnan et al., 2013 | India | RCT | - | Tobacco control | Rural current daily smoking men |
| 14 | Muramoto et al., 2014 | USA | RCT | SCT | Tobacco | Health influencers |
| 15 | Mishra et al., 2014 | India | Program pre-post | Tobacco | Tobacco | Women |
| 16 | Levinson et al., 2015 | USA | RCT | Motivation interviewing | Tobacco | Smokers among parents |
| 17 | Bhagabaty et al., 2015 | India | Quasi-experimental | - | Tobacco | Tobacco users in the community |
| 18 | Sarrafzadegan et al., 2009 | Iran | Quasi-experimental | - | Cardiovascular | General population |
| 19 | Fornari et al., 2013 | Brazil | RCT | - | Cardiovascular | School children, parents |
| 20 | Austin and Claiborne, 2011 | USA | PROGRAM | CBPR | Diabetes | African American community |
| 21 | Volta et al., 2013 | USA | Quasi-experimental | - | Diabetes | Prediabetic people |
| 22 | Katula et al., 2010, 2013 | USA | RCT | - | Diabetes | 300 obese and overweight people |
| 23 | Parikh et al., 2010 | USA | RCT | CBPR | Diabetes | Prediabetic |
| 24 | Colaguirri et al., 2010 Vita et al., 2016 | Australia | Quasi-experimental | SCT | Diabetes | People aged at high-risk of developing type 2 diabetes |
| 25 | Lu et al., 2015 | China | RCT | Three different interventions | - | Hypertension | Diagnosed hypertensive, age between 40 and 75 |
| 26 | Zoellner et al., 2011 | USA | Quasi-experimental phase followed by RCT | CBPR, social support, and motivational interviewing | Hypertension | African Americans |
| 27 | Thankappan et al., 2013 | India | Quasi-experimental | - | Hypertension | General population |
| 28 | Land et al., 2014 | Australia | Quasi-experimental | Communication for behavioral Impact framework | Hypertension/salt reduction | General population |
| 29 | Perry et al., 2015 | USA | Program | Care group approach | MCH | Women |
| 30 | Tripathy et al., 2016 | India | RCT | Participatory learning and action | MCH | Women aged 15–49 years |
| 31 | Yassin et al., 2013 | Ethiopia | Quasi-experimental | - | TB | General population |
| 32 | Eastmen et al., 2006 | USA | PROGRAM | Social learning theory, health belief model, theory of reasoned action | Sexual education | Parents of sixth to tenth graders |
| 33 | Johnson et al., 2008 | USA | RCT | TTM | Weight management | Obese adults |
| 34 | Woelk et al., 2016 | Swaziland, Uganda, and Zimbabwe | RCT | - | HIV | General population |
| 35 | Morisky et al., 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 rates, decrease risk behaviors, and correct cancer-related myths.\[19,21,22,24-26,28,30,33,34\] 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.\[26\] 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    | Diabetes prevention             | 2   |
| 1.3    | Cardiovascular disease prevention| 2   |
| 1.4    | Hypertension prevention         | 4   |
| 1.5    | Maternal and child health       | 2   |
| 1.6    | HIV prevention                  | 2   |
| 1.7    | Suicide prevention              | 2   |
| 1.8    | Tobacco control                 | 3   |
| 1.9    | Others                          |     |
| 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 community engagement model social support model, participatory learning and action Participatory action research Community based participatory research | Trans-theoretical model Social learning theory Theory of reasoned action Social cognitive theory Health belief model Social-ecological theory | Kin keepers model Patient navigation model Motivational interviewing Communication for behavioral impact framework Care group approach |

at their houses.[26] 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[35,38,39] and the remaining two were intervention studies with no control.[37,44] The study population included rural men current smokers on a daily basis,[38] women[44] and parents.[35] “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.[39] “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.[39]

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.[45] 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.[45] 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.[46] 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[41]) were reported in the reviewed articles. Except one,[17] all other studies reported intervention duration of 1 year or more. The target population in diabetes prevention programs where people at risk of developing diabetes.[23,51,47,48]

Community-based interventions in other health issues

Care group approach[29] and participatory learning and action model[12] 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

| Serial no | Author(s)            | Individual level | Group level                  | Community level | Policy level | Person delivering the intervention |
|-----------|----------------------|------------------|------------------------------|----------------|-------------|------------------------------------|
| 1         | Chen et al., 2015    | -                | -                            | -              | Access restriction (charcoal)      | -                                  |
| 2         | Ono et al., 2008, 2013 | 1. Counseling   | 1. Panel discussions         | 1. Fellowship breakfasts | -          | -                                  |
| 3         | Langford et al., 2014 | -                | 1. Group education           | 1. Street promotion | -          | -                                  |
| 4         | Blumenthal et al., 2010 | 1. One-on-One education | 1. Education sessions       | 1. Partnership with church | -          | -                                  |
| 5         | Blumenthal et al., 2005 | 1. Fliers        | 1. Group education           | 1. Awareness campaign | -          | Yes Rural                          |
| 6         | Hiatt et al., 2008   | 1. One to one education | 1. Group education           | 1. Awareness campaign | -          | Yes Ethic                          |
| 7         | Park et al., 2011    | 1. Posters       | 1. Group education           | 1. Street promotion | -          | -                                  |
| 8         | Emery et al., 2014   | -                | 1. GP intervention           | 1. Awareness campaign | -          | -                                  |
| 9         | Westfall et al., 2013 | -                | -                            | 1. Awareness campaign | -          | -                                  |
| 10        | Aragones et al., 2015 | 1. Text messaging | 1. Lay health worker         | -              | -          | -                                  |
| 11        | Williams et al., 2013 | -                | -                            | -              | -          | -                                  |
| 12        | Shiramizu et al., 2012 | -                | -                            | -              | -          | Yes, Ethnic                         |

CHW=Community health worker

Table 5: Levels of intervention

| Serial no | Author(s)            | Individual level | Group level                  | Community level | Policy level | Culturally sensitive |
|-----------|----------------------|------------------|------------------------------|----------------|-------------|---------------------|
| 1         | Chen et al., 2015    | -                | -                            | -              | Access restriction (charcoal)      | -                                  |
| 2         | Ono et al., 2008, 2013 | 1. Counseling   | 1. Panel discussions         | 1. Fellowship breakfasts | -          | -                                  |
| 3         | Langford et al., 2014 | -                | 1. Group education           | 1. Street promotion | -          | -                                  |
| 4         | Blumenthal et al., 2010 | 1. One-on-One education | 1. Education sessions       | 1. Partnership with church | -          | -                                  |
| 5         | Blumenthal et al., 2005 | 1. Fliers        | 1. Group education           | 1. Awareness campaign | -          | Yes Rural                          |
| 6         | Hiatt et al., 2008   | 1. One to one education | 1. Group education           | 1. Awareness campaign | -          | Yes Ethic                          |
| 7         | Park et al., 2011    | 1. Posters       | 1. Group education           | 1. Street promotion | -          | -                                  |
| 8         | Emery et al., 2014   | -                | 1. GP intervention           | 1. Awareness campaign | -          | -                                  |
| 9         | Westfall et al., 2013 | -                | -                            | 1. Awareness campaign | -          | -                                  |
| 10        | Aragones et al., 2015 | 1. Text messaging | 1. Lay health worker         | -              | -          | -                                  |
| 11        | Williams et al., 2013 | -                | -                            | -              | -          | -                                  |
| 12        | Shiramizu et al., 2012 | -                | -                            | -              | -          | Yes, Ethnic                         |

Contd...
Table 5: Contd...

| Serial no | Author(s) | Individual level | Group level | Community level | Policy level | Culturally sensitive |
|-----------|-----------|------------------|------------|-----------------|--------------|---------------------|
| 13.       | Jayakrishnan et al., 2013 | 1. Leaflet | 1. Group counseling | 1. Medical camps | -- | - |
| 14.       | Muramoto et al., 2014 | 1. Personal training | 1. Health influencers | - | - | - |
| 15.       | Mishra et al., 2014 | - | 1. Rapport building session | - | - | - |
| 16.       | Levinson et al., 2015 | 1. Motivation interviewing | 1. Smoking solution guides | 1. Existing health system resource utilization | - | - |
| 17.       | Bhagabaty et al., 2015 | 1. IEC materials | 1. Medical social worker | - | - | - |
| 18.       | Sarrafzadegan et al., 2009 | - | 1. Health professional | 1. Mass media | 1. Legislation and policy |
|           |           |                  |            | 2. Inter-sectoral cooperation and collaboration |           |
| 19.       | Fornari et al., 2013 | 1. IEC material | 1. Age appropriate classes | - | - | - |
| 20.       | Austin and Claiborne, 2011 | - | 1. Workshop | - | - | Yes |
| 21.       | Vojta et al., 2013 | - | 1. Lifestyle coaches | - | - | - |
| 22.       | Katula et al., 2010, 2013 | 1. Individual meetings with a registered dietitian | 1. CHWs | - | - | - |
|           |           | 2. Monthly newsletter | 2. Group education |           |           |           |
| 23.       | Parikh et al., 2010 | 1. IEC materials | 1. Workshop | - | - | yes |
| 24.       | Colagiuri et al., 2010; Vita et al., 2016 | 1. Individual sessions | 1. Group sessions | - | - | - |
|           |           | 2. Telephone calls | 2. Lifestyle officers |            |            |            |
|           |           |                  | 3. Primary care physician |            |            |            |
| 25.       | Lu et al., 2015 | 1. IEC materials | 1. Group education | - | - | - |
|           |           |                  | 2. Workshop |            |            |            |
| 26.       | Zoellner et al., 2011 | 1. Pedometer diary self-monitoring | 1. Walking groups | - | - | - |
|           |           |                  | 2. Education sessions |            |            |            |
| 27.       | Thankappan et al., 2013 | 1. Booklets | 1. Lay health volunteers | 1. Video film | - | - |
|           |           |                  | 2. Anganwadi workers |            |            |            |
|           |           |                  | 3. Elected members |            |            |            |
| 28.       | Land et al., 2014 | 1. Food switch | - | 1. Community mobilization | 1. Public advocacy |
|           |           |                  |            | 2. Advertisement | 2. Salt substitution |
|           |           |                  |            | 3. Point of service |            |            |
| 29.       | Perry et al., 2015 | - | 1. Care group facilitators | - | - | - |
|           |           |                  | 2. Volunteers |            |            |            |
| 30.       | Tripathy et al., 2016 | - | 1. ASHA worker | - | - | - |
| 31.       | Yassin et al., 2013 | - | 1. Female health extension | - | 1. Advocacy |            |
|           |           |                  | 2. Workers (HEWs) |            |            |            |
| 32.       | Eastmen et al., 2006 | - | 1. Interactive lecture | - | - | - |
| 33.       | Johnson et al., 2008 | 1. Individualized reports | - | - | - | - |
| 34.       | Woelk et al., 2016 | - | 1. Community leaders 2. Community peer group | 1. Community days | - | - |
| 35.       | Morisky et al., 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. 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. A systematic review of obesity prevention programs in Europe showed fewer intervention programs were reported in the less affluent eastern and southern European countries. 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, interventions without control and longitudinal crossover design. 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. 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. 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. 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. The review by Gubbel et al. 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.

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. 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. The co-learning process in community-based interventions result in the exchange of knowledge and skills and thus by empowers the participating communities. CBPR will be an effective intervention research strategy if all the participants recognize the usefulness of such collaborations.

Culture-sensitive interventions targeting religious and ethnic minorities were also reported. 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. Culturally competent, CHW leads interventions to prevent chronic disease among culturally and linguistically diverse communities were found to be successful. 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. The community intervention projects commonly take 2–3 years for implementation and evaluation with some project extending to 5–7 years.

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 adopt 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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References
1. Nissinen A, Berrios X, Puska P. Community-based noncommunicable disease interventions: Lessons from developed countries for developing ones. Bull World Health Organ 2001;79:963-70.
2. Maher D, Ford N, Unwin N. Priorities for developing countries in the global response to non-communicable diseases. Global Health 2012;8:14.
3. McKeown RE. The epidemiologic transition: Changing patterns of mortality and population dynamics. Am J Lifestyle Med 2009;3:196-268.
4. McAlister A, Puska P, Salonen JT, Tuomilehto J, Koskela K. Theory and action for health promotion illustrations from the North Karelia project. Am J Public Health 1982;72:43-50.
5. Kumar S, Preetha G. Health promotion: An effective tool for global health. Indian J Community Med 2012;37:5-12.
6. Puska P, Vartiainen E, Nissinen A, Laatikainen T, Jousilahti P. Background, principles, implementation, and general experiences of the North Karelia project. Glob Heart 2016;11:173-8.
7. WHO | Risk Factors. WHO. Available from: http://www.who.int/ncd/risk_factors/en/.[Last accessed on 2017 Apr 01].
8. Merzel C, D’Afflitti J. Reconsidering community-based health promotion: Promise, performance, and potential. Am J Public Health 2003;93:557-74.
9. Winkleby MA. The future of community-based cardiovascular disease intervention studies. Am J Public Health 1994;84:1369-72.
10. MacQueen KM, McLellan D, Metzger DS, Kegeles SS, Strauss RP, Scotti R, et al. What is community? An evidence-based definition for participatory public health. Am J Public Health 2001;91:1929-38.
11. McLeroy KR, Norton BL, Kegler MC, Burdine JN, Sumaya CV. Community-based interventions. Am J Public Health 2003;93:529-33.
12. WHO | Healthy Settings. WHO. Available from: http://www.who.int/healthy_settings/en/.[Last accessed on 2017 Apr 01].
13. Israel BA, Schulz AJ, Parker EA, Becker AB. Review of community-based research: Assessing partnership approaches to improve public health. Annu Rev Public Health 1998;19:173-202.
14. Nilsen P. Making sense of implementation theories, models and frameworks. Implement Sci 2015;10:53.
15. Glanz K, Bishop DB. The role of behavioral science theory in development and implementation of public health interventions. Annu Rev Public Health 2010;31:399-418.
16. Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, et al. Guidance on the conduct of narrative synthesis in systematic reviews. Prog ESRC Methods Programme Version 2006;1:92.
17. Austin SA, Claiborne N. Faith wellness collaboration: a community-based approach to address type II diabetes disparities in an African-American community. Soc Work Health Care. 2011;50(5):360-75.
18. Eastman KL, Corona R, Schuster MA. Talking parents, healthy teens: A worksite-based program for parents to promote adolescent sexual health. Prev Chronic Dis 2006;3:A126.
19. Langford AT, Griffith DM, Beasley DD, Braxton EI. A cancer center’s approach to engaging African American men about cancer: The men’s fellowship breakfast, Southeastern Michigan, 2008-2014. Prev Chronic Dis 2014;11:E164.
20. Perry H, Morrow M, Borger S, Weiss J, DeCoster M, Davis T, et al. Care groups I: An innovative community-based strategy for improving maternal, neonatal, and child health in resource-constrained settings. Glob Health Sci Pract 2015;3:358-69.
21. Blumenthal D, Smith SA, Majett CD, Alemia-Mensah E. A trial of
3 interventions to promote colorectal cancer screening in African Americans. Cancer 2010;116:922-9.

22. Blumenthal DS, Fort JG, Ahmed NU, Semenya KA, Schreiber GB, Perry S, et al. Impact of a two-city community cancer prevention intervention on African Americans. J Natl Med Assoc 2005;97:1479-88.

23. Parikh P, Simon EP, Fei K, Looker H, Goytia C, Horowitz CR, et al. Results of a pilot diabetes prevention intervention in East Harlem, New York city: Project HEED. Am J Public Health 2010;100 Suppl 1:S232-9.

24. Shiramizu B, Milne C, Terada K, Cassel K, Matsuno RK, Killeen J, et al. A community-based approach to enhancing anal cancer screening in Hawaii’s HIV-infected ethnic minorities. J AIDS Clin Res 2012;3: pii: 162.

25. Westfall JM, Zittleman L, Sutter C, Emsermann CB, Staton EW, Van Vorst R, et al. Testing to prevent colon cancer: Results from a rural community intervention. Ann Fam Med 2013;11:500-7.

26. Williams KP, Roman L, Meghea CI, Penner L, Hammad A, Gardiner J, et al. Kin keepersSM: Design and baseline characteristics of a community-based randomized controlled trial promoting cancer screening in black, Latina, and Arab women. Contemp Clin Trials 2013;34:312-9.

27. Zoellner JM, Connell CC, Madson MB, Wang B, Reed VB, Molaison EF, et al. H.U.B city steps: Methods and early findings from a community-based participatory research trial to reduce blood pressure among African Americans. Int J Behav Nutr Phys Act 2011;8:59.

28. Emery JD, Gray V, Walter FM, Cheatham S, Croager EJ, Slevin T, et al. The improving rural cancer outcomes (IRCO) trial: A factorial cluster-randomised controlled trial of a complex intervention to reduce time to diagnosis in rural patients with cancer in Western Australia: A study protocol. BMJ Open 2014;4:e006156.

29. Ono Y, Awata S, lida H, Ishida Y, Ishizuka N, Iwasa H, et al. A community intervention trial of multimedal suicide prevention program in Japan: A novel multimodal community intervention program to prevent suicide and suicide attempt in Japan, NOCOMIT-J. BMC Public Health 2008;8:315.

30. Park K, Hong WH, Kye SY, Jung E, Kim MH, Park HG, et al. Community-based intervention to promote breast cancer awareness and screening: The Korean experience. BMC Public Health 2011;11:468.

31. Katula JA, Vitolins MZ, Rosenberger EL, Blackwell C, Espeland MA, Lawlor MS, et al. Healthy living partnerships to prevent diabetes (HELP PD): Design and methods. Contemp Clin Trials 2010;31:71-81.

32. Tripathy P, Nair N, Sinha R, Rath S, Gope RK, Rath S, et al. Effect of participatory women’s groups facilitated by accredited social health activists on birth outcomes in rural Eastern India: A cluster-randomised controlled trial. Lancet Glob Health 2016;4:e119-28.

33. Aragones A, Bruno DM, Ehrenberg M, Tonda-Salcedo J, Ganey FM. Parental education and text messaging reminders as effective community based tools to increase HPV vaccination rates among Mexican American children. Prev Med Rep 2015;2:554-8.

34. Hiatt RA, Pasick RJ, Stewart S, Bloom J, Davis P, Gardiner P, et al. Cancer screening for underserved women: The breast and cervical cancer intervention study. Cancer Epidemiol Biomarkers Prev 2008;17:1945-9.

35. Levinson AH, Valverde P, Garrett K, Kimminau M, Burns EK, Albright K, et al. Community-based navigators for tobacco cessation treatment: A proof-of-concept pilot study among low-income smokers. BMC Public Health 2015;15:627.

36. Morisky DE, Ang A, Coly A, Tsegay T. A model HIV/AIDS risk reduction programme in the Philippines: A comprehensive community-based approach through participatory action research. Health Promot Int 2004;19:69-76.

37. Bhagabaty SM, Katalic AC, Kalita M, Salkar S. Community-based intervention for tobacco cessation: A pilot study experience, North East India. Asian Pac J Cancer Prev 2015;16:811-4.

38. Jayakrishnan R, Uuteala A, Mathew A, Auvinen A, Mathew PS, Sebastian P, et al. Smoking cessation intervention in rural Kerala, India: Findings of a randomised controlled trial. Asian Pac J Cancer Prev 2013;14:6797-802.

39. Muramoto ML, Hall JR, Nichter M, Nichter M, Aickin M, Connolly T, et al. Activating lay health influencers to promote tobacco cessation. Am J Health Behav 2014;38:392-403.

40. Thankappan KR, Sivsankaran S, Mini GK, Daivadamn M, Sarma PS, Abdul Khader S, et al. Impact of a community based program on awareness, treatment and control of hypertension in a rural Panchayat, Kerala, India. Indian Heart J 2013;65:504-9.

41. Land MA, Jeffery P, Webster J, Crino M, Chalmers J, Woodward M, et al. Protocol for the implementation and evaluation of a community-based intervention seeking to reduce dietary salt intake in Lithgow, Australia. BMC Public Health 2014;14:357.

42. Lu CH, Tang ST, Lei YX, Zhang MQ, Lin WQ, Ding SH, et al. Community-based interventions in hypertensive patients: A comparison of three health education strategies. BMC Public Health 2015;15:33.

43. Chen YY, Chen F, Chang SS, Wong J, Yip PS. Assessing the efficacy of restricting access to barbecue charcoal for suicide prevention in Taiwan: A community-based intervention trial. PLoS One 2015;10:e0133809.

44. Mishra GA, Kulkarni SV, Majnumdar PV, Gupta SD, Shastrirri SS. Community-based tobacco cessation program among women in Mumbai, India. Indian J Cancer 2014;51 Suppl 1:554-9.

45. Sarrafzadegan N, Kelishadi R, Esmaillzadeh A, MohammadiFarid N, Rabiei K, Roohafza H, et al. Do lifestyle interventions work in developing countries? Findings from the Isfahan healthy heart program in the Islamic republic of Iran. Bull World Health Organ 2009;87:39-50.

46. Fornari LS, Giuliano I, Azevedo F, Pastana A, Vieira C, Caramelli B, et al. Children first study: How an educational program in cardiovascular prevention at school can improve parents’ cardiovascular risk. Eur J Prev Cardiol 2013;20:301-9.

47. Colaguirri S, Vita P, Cardona-Morrell M, Singh MF, Farrell L, Milat A, et al. The Sydney diabetes prevention program: A community-based translational study. BMC Public Health 2010;10:328.

48. Vojta D, Koehler TB, Longjohn M, Lever JA, Caputo NF. A coordinated national model for diabetes prevention: Linking health systems to an evidence-based community program. Am J Prev Med 2015;44:S301-6.

49. Gubbels JS, Mathisen FK, Samdal O, Lobstein T, Kohl LF, Leversen I, et al. The assessment of ongoing community-based interventions to prevent obesity: Lessons learned. BMC Public Health 2015;15:216.

50. Yassin MA, Datiko DG, Tulloch O, Markus P, Aschalew M, Shargie EB, et al. Innovative community-based approaches doubled tuberculosis case notification and improve treatment outcome in Southern Ethiopia. PLoS One 2013;8:e63174.

51. Pennell ML, Hade EM, Murray DM, Rhoda DA. Cutoff designs for community-based intervention studies. Stat Med 2011;30:1865-82.

52. Bonell CP, Hargreaves J, Coughens S, Ross D, Hayes R, Petticrew M, et al. Alternatives to randomisation in the evaluation of public health interventions: Design challenges and solutions. J Epidemiol Community Health 2011;65:582-7.

53. Salimi Y, Shahandeh K, Malekafzali H, Loori N, Kheiltash A, JamiShidi E, et al. Is community-based participatory research (CBPR) useful? A systematic review on papers in a decade. Int J Prev Med 2012;3:386-93.

54. Saab KK, Kendrick J, Yracheta JM, Lanaspa MA, Pollard M, Johnson R, et al. New insights on the risk for cardiovascular disease in African Americans: The role of added sugars. J Am...
55. Bully P, Sánchez Á, Zabaleta-del-Olmo E, Pombo H, Grandes G. Evidence from interventions based on theoretical models for lifestyle modification (physical activity, diet, alcohol and tobacco use) in primary care settings: A systematic review. Prev Med 2015;76 Suppl:S76-93.

56. Haggis C, Sims-Gould J, Winters M, Gutteridge K, McKay HA. Sustained impact of community-based physical activity interventions: Key elements for success. BMC Public Health 2013;13:892.

57. Katula JA, Vitolins MZ, Morgan TM, Lawlor MS, Blackwell CS, Isom SP, et al. The healthy living partnerships to prevent diabetes study: 2-year outcomes of a randomized controlled trial. Am J Prev Med 2013;44:S324-32.

58. Vita P, Cardona-Morrell M, Bauman A, Singh MF, Moore M, Pennock R, et al. Type 2 diabetes prevention in the community: 12-Month outcomes from the Sydney Diabetes Prevention Program. Diabetes Res Clin Pract 2016;112:13-9.

59. Henderson S, Kendall E, See L. The effectiveness of culturally appropriate interventions to manage or prevent chronic disease in culturally and linguistically diverse communities: A systematic literature review. Health Soc Care Community 2011;19:225-49.