First annual evaluation of Isfahan Healthy Heart Program (IHHP): full report

Introduction:

The current burden of chronic diseases reflects past exposure to their risk factors, and the future burden will be largely determined by current exposures.[1] The global prevalence of all the leading chronic diseases is increasing, with the majority occuring in developing countries and projected to increase substantially over the next two decades.[2]

In 1995, circulatory diseases mainly cardiovascular diseases (CVD) represented 47.3% of all Iranian deaths.[3] The prevalence of ischemic heart disease (IHD) is shown to be more common among people with lower socio-economic state in Iran.[4] Non-communicable disease (NCD) mainly CVD, stroke, cancers, diabetes and some respiratory diseases share common risk factors which could be modified.[5] Previous studies in Iran showed that 32% of men and 41% of women had at least two CVD risk factors namely, high blood pressure, smoking, hypercholesterolemia, diabetes mellitus and obesity,[6] with a higher prevalence in urban than rural areas.[7] In addition, in recent years, this prevalence has rapidly increased particularly for hyperlipidemia and obesity, among Iranian children and adolescents.[8-9]

Among the primary prevention strategies developed to control the NCD epidemic, multifactorial integrated community-based interventions tackling the common risk factors and combining population and high-risk approaches are of particular interest.[10]

Isfahan Healthy Heart Program (IHHP) was planned to address the feasibility and the impact of comprehensive integrated community-based interventional strategies for NCD's prevention and health promotion, and currently is at its demonstration phase.[11] IHHP's main target was CVD including IHD and stroke, as well as prevention of related risk factors prevention in its original protocol[11], however it was realized that a comprehensive integrated approach addressing tobacco control, healthy nutrition and physical activity would lead to achievement of broader public health aims for prevention of other NCDs (e.g. diabetes, cancers, hypertension, COPD), as well as for health in general. IHHP main goals are to improve population behaviours, to prevent and control the common risk factors and diseases, to delay the

onset of NCD's, to reduce disabilities and to postpone death. It involves individual, community and environmental changes to support health behaviour modification. The design of IHHP is described in full elsewhere.[11]

This paper describes the evaluation design and early impact data while summarizing the program objectives, strategies, models of intervention and early field experiences.

Background:

- **Objectives:**

  In brief, IHHP long term objectives are to decrease the future occurrence of NCD's namely CVD (including IHD and stroke), diabetes, hypertension, cancers and their subsequent disabilities and mortality. The short-term objectives are to improve the knowledge, awareness of general population and the health professionals about the causes and consequences of NCD's and the skills to take action to control them. Other important objectives are to reduce the prevalence of risk factors, to improve the knowledge and skills to achieve early identification, treatment, control levels and rehabilitation of individuals at high risk or with clinical manifestation of the disease, to improve healthy social and physical environment, to evaluate the process, impact and outcomes of interventions at the individual-, community- and environmental levels, to facilitate maintenance of the program beyond the termination of external research funding.

- **Target population:**

  Two intervention counties (Isfahan and Najaf-Abad) and a reference area (Arak), all located in the central part of Iran, were included in the study. According to the National population census in 2000, the population was 1.895.856 in Isfahan and 275.084 in Najaf-Abad- a neighbouring county to Isfahan. Arak- 375 km far and without mass media coverage from Isfahan with a population of 668.531- was selected as a reference area because of its socioeconomic, demographic picture and health profile similarities to the

intervention areas. While mass media campaigns and healthy policies are targeting the general populations in urban and rural areas in intervention communities, specific interventional actions are being carried out for women, children, adolescents, workers, employees, elderly, high risk group- namely people with at least one risk factor or with disease symptoms- and health professionals including physicians, nurses, health workers and health volunteers. Arak remains as reference area and is monitored without the intensified mentioned actions.

Brief Description of the interventions:

- **Models, key strategies and fields:**

  The model of IHHP interventions combines elements from the precede-proceed model[12], the social learning theory[13], the Ottawa charter for health promotion[14] and the innovation diffusion approach.[15] IHHP strategies have integrated activities related to different parts of the health sector (health promotion, disease prevention and health care-treatment and rehabilitation). Some of those are undertaken by other sectors. Key strategies are focusing on health services, public health professional's education, community organization, and regulation. The priorities of the strategies for intervention are public education and the mass media, intersectoral cooperation and collaboration, professional education and involvement, marketing and organizational development, legislation and coordination, policy development, as well as research and evaluation. Specific criteria for IHHP interventional strategies are described in details elsewhere[11]. IHHP main fields of intervention are healthy nutrition, increased physical activity, tobacco control and stress coping.

- **Interventional projects:**

The whole interventional actions were described previously.[11] In brief, IHHP interventions are operative at the individual, population and environmental levels. Based on the results obtained from primary surveys, need assessment, the existed health, human and economic resources and systems, the whole program activities were arranged in a set of nine projects addressing different target groups. These projects are: Women Healthy Heart Project, Heart Health Promotion from Childhood, Health Professional Education Project, Young Healthy Yacht, Worksite Intervention Project, Healthy Lifestyle for High Risk Groups, Healthy Food for Healthy Community, Isfahan Exercise Project and Non Governmental Organizations (NGO'S) and Volunteers Intervention Project. Each project is supervised by a group of directors including academic, health providers, stakeholders and some have decision makers as directors, as well. All directors are members in the High Council of IHHP[11] and are involved in the planning, implementation and evaluation of their projects. IHHP team is trying throughout the nine mentioned projects to have close contact with many representatives of different community organizations. The team worked intensively and closely with the representatives of mass media (television, newspapers, radio, etc) with people of health and other services (administrators, physicians, nurses, health workers and volunteers, social workers, school staff, etc), with business and market leaders (food-industries, groceries, bakeries, fast food shops), with key persons of NGO's and local political decision makers (county, municipal and provincial leaders). The Mayer, Governor and Governor General of Isfahan and Najaf-Abad are involved and the Governor General is the honory president of the whole program.

As part of the mass media strategy, the quarterly published IHHP Newsletter was developed and is published by stakeholders and volunteers. The main purpose is increasing the community awareness and improving attitudes toward healthy lifestyle, giving feedback on previous activities and announcing

the upcoming events and healthy products. Contents are provided by IHHP Scientific Committee.[11]

The public education is conducted on a one-to-one basis, in small groups and population-wide approach. NCD prevention messages, such as anti smoking campaign in the mass media, originated with government, voluntary sector, business or a combination of the three. The project directors kept continuous discussions on how different target groups perceive health issues and of the best ways to reach various audiences. They recognized that it is important not only to communicate health information, but also to teach practical skills for change, to provide social support, to promote environmental changes and to introduce prevention and health promotion on the general agenda.

Physicians, nurses, health workers and volunteers received educational programs mainly through postgraduate and continuing education on the methods to prevent disease and to promote and foster behaviour and lifestyle change. In addition, these educational programs emphasize the influence of the health professionals as role models for behavioural change by patients.

The idea of being role models in IHHP was discussed further and was used to motivate school and kindergarten staff, health workers, school children, parents workers and patients to become heart-health promoters for their students, patients and friends subsequently.

IHHP Organization:

IHHP structure have been reported before.[11] The major feature is the High Council which is supervising and controlling the whole program based on information reported by its members. IHHP High Council members are the principle investigator(PI), Co-PI's, project directors(PD), Co-PD's, project coordinators, chairs of committees and representatives of provincial government, other governmental organizations, NGO's, private sector, professional associations, voluntary agencies and local health units, some of them while representing their own organizations are one of the PD's or Co-PD's, as well. There are four committees (coordination,

scientific, evaluation and monitoring, publication), some include subcommittees with clearly defined objectives, strategies and actions.[11] The originally reported Legislation Committee have been merged to other communities.

Evaluation:

The interventions, activities and evaluation are integrated components in IHHP. Generally, the functions of monitoring and evaluation are to assess the extent to which the program has attained its objectives and to assess the process of the program's development and performance.

- Objectives:

The main objectives of IHHP evaluation are to gain insight on the program implementation, to improve the interventional projects, to determine what impacts/effects of the program will be achieved and to affect those who participated in the program.

- Hypothesis:

Our hypothesis for IHHP evaluation are:

- IHHP may empower the program participants.
- IHHP may supplement or reinforce the interventions.
- IHHP may promote staff development.
- IHHP may contribute to organizational growth.

- IHHP Evaluation Model:

The Kipling six questions model[16] was used during the process of designing IHHP evaluation program. The basic simplified questions are: Who is the evaluation for? What do we need to find out? Why do we need to find that out? When will the results be needed? Where should we gather the information? and How will the results be used?

* A variety of stakeholders are engaged in IHHP evaluation process. Some participated as active and other as passive respondents with different interests. We defined stakeholders as those who involved in implementing the program, those who served or affected by the program and the primary users of the evaluation. They could be individuals, groups, communities, agencies or organizations.

* This paragraph can be transferred to the Evaluation Design one.

IHHP Evaluation & Monitoring Questions:

IHHP was planned in order to answer these questions:

1. How and why IHHP interventional activities are successful?
2. What elements of the program are successful enough to be disseminated at the provincial/national level?
3. Are communities/organizations able to be responsible for their health and create environments supportive of health?
4. What is the possibility and feasibility of providing timely feedback to IHHP managers, stakeholders, policy makers to permit readjustment of interventions, if necessary?
5. What is the possibility of integrating healthy lifestyle program activities into the existing public health system?
6. Is creating and maintaining the coalitions (partnerships) associated with IHHP possible?
7. What organizational/process factors contribute to sustained healthy lifestyle interventions?

Evaluation Design:

IHHP was formulated and launched as an action-oriented, quasi-experimental demonstration program with simultaneous evaluation and other research studies.[11] IHHP is evaluated in two study designs: four annual repeated independent sample surveys and a six-year longitudinal cohort sample survey, both of which compared

levels of modifiable risk factors for NCD's among the general population, high risk-group and health professionals in interventional and reference areas before, during and after the implementation of interventions. During the first two years of activities of interventional projects (2001-2002), the program became to have closer collaboration with the national authorities in the Ministry of Health in Iran and the WHO regional and the headquarters as a major pilot or demonstration study to test the usefulness of this approach for national and international purposes. To our knowledge, there is no evidence on the effectiveness of comprehensive integrated community-based interventional programs for NCD prevention using quasi-experimental trial with control group and different levels of evaluation in developing countries.

In general, we use the WHO STEPwise surveillance approach for evaluation of risk factors, NCD-specific morbidity and mortality table(1).[17] NCD risk factor surveillance was performed at all steps using the three modules (core, expanded and optional) in the baseline survey in the year 2000.[11] Data on behaviours, physical measurements and biochemical variables were collected in interventional and reference areas.[11] IHHP impacts were evaluated using the behavioural questionnaire-based model (Step1) on an annual base since late 2001 and will be continued till 2005(Fig1). Data are collected from an independent adults, adolescents, health professionals and high risk group samples, based on different age groups, gender, rural/urban living area, etc.

WHO STEPwise approach is applied simultaneously to heart disease and stroke registry for all steps on continuous basis. Cancer registry is being done continuously based on age, gender and disease-specific types. Data from the National Registration of Deaths is used beside the continuous ongoing surveillance of mortality using WHO STEPwise approach based on age, gender and cause of death both in intervention and reference areas. Along with the repeated annual cross-sectional behavioural surveys which test the short-term impacts, all eligible individuals aged ≥35 years from the original pre-intervention sample are followed by annual longitudinal studies for the

occurrence of fatal or non-fatal myocardial infarction (MI) or stroke, sudden death, hospitalization, physician visits, etc.

It is planned to follow up the cohort for 10 years since 2001 by annual contacts and to repeat the annual impacts every 2 years in the intervention areas during the dissemination phase since 2006 in order to determine the relative risk based on each risk factors for CVD events in Iran.

The whole studies performed in first phase will be repeated in the third phase on an independent similar sample sizes of adults, children, health professionals and high risk groups. To assess the impacts at individual level on those aged<35 years, a small sample comprised of participants selected at random from the original population in intervention and reference areas will be studied as well.

The whole sample size, studied impacts and outcomes, target population and sites are described in Fig.1, while the timeline have been reported previously.[11]

This combination of cross-sectional and longitudinal surveys provide a research design that controls for many biases in addition to allowing the monitoring of changes within communities and individuals.

Main components of IHHP evaluation:

Process, impact and outcome evaluation. The process evaluation is performed only in the intervention area, while impact and outcome evaluation are performed in both intervention and reference areas.

1- Process Evaluation:

Information on IHHP implementation, exposure to intervention and diffusion level, the process of changing health behaviour and risk factors is obtained from this level of evaluation done by survey data, annual process notes and site visits. Some of process evaluation general questions concerning the community awareness and participation levels in IHHP were added to the annual WHO STEPwise behavioural impact evaluation questionnaire in interventional areas. While some process evaluation questions addressed IHHP partners, leaders, volunteers, health professionals, coalition trying to monitor their role activities and contributions, other

questions addressed the environmental changes in worksites, schools and communities as well. All interventional activities in Isfahan and Najaf-Abad are being monitored to see why and how some are successful and sustainable, their related mechanisms and the barriers and facilitators to each interventional activity. Consistant feedback of the results is an integral part in the process evaluation of IHHP.

2- Impact Evaluation:

This level of evaluation focus on the short term/intermediate impacts of IHHP interventions and is used to assess whether and to what extent the intermediate objectives are achieved. Thus the indicators of different objectives were defined and if not found in the WHO STEPwise approach to behavioural risk factors (Step1), were added to the questionnaire. Some process evaluation questions concerning the exposure level to interventions were included in the original questionnaire as well.

The impact evaluation-sometimes defined as proximal or short term impacts- is answering the specific question of: Did IHHP interventional activities cause changes in the target knowledge, awareness, attitudes, practices and or skills?

IHHP impact is being evaluated in four repeated independent sample surveys in 2002, 2003, 2004 and 2005 started in October every year and comparing the modifiable behavioural risk factors in intervention and reference areas. Since the interventions' target is the whole community, data were collected to represent the whole population in the baseline study, as well as in the four annual independent, cross-sectional studies. Multistage random sampling and age-based CINDI protocol sampling methods were used for the baseline and subsequent annual impact evaluation. Another independent cross-sectional study was done on school students, their parents and schools staff, as well as the health professionals using the same approach. Qualitative and quantitative questions on sociodemographic characteristics, smoking behaviours, physical activity, dietary habits and psychosocial variables were asked beside questions used in the WHO STEPwise approach. The target population, sample size and frequency of cross-sectional studies are presented in Fig.1.

Another set of questions on the awareness, knowledge, treatment and control levels as well as lifestyle changes are used to address the impact of interventions in high-risk group including CVD patients, diabetic, hypertensive and dyslipidemic subjects. Separate questions providing details about "how", "when" and "where", the interventions take place and their contents are asked in intervention areas to support the process evaluation.

3- Outcome Evaluation:

This refers to long-term outcomes indicating the achievement of long term objectives by the same instrument used in the first phase of IHHP for population, health professionals high risk and environmental changes. This level of evaluation will be conducted in the year 2006.

The WHO STEPwise approach to risk factors at three steps and modules for behavioral, physical and biochemical measures will be done on an independent sample of adult population ≥ 19 years, children and adolescents, health professionals and high risk groups. The sample size of each group is explained elsewhere.[11] Another small random sample from the original pre-intervention population will be studied to address the individual changes.

Since the beginning it was planned that the intermediate outcome indicators at the community- and environmental levels, as well as assessment of the individual changes by conducting the same annual study for short term impacts performed on a random sample from the original pre-intervention group, to be studied in 2004, however due to economical shortage, conducting both studies was not possible. Outcome evaluation addresses the change in prevalence of core risk factors defined by WHO STEPwise approach, improvement in related behaviours and change in the determinants at the population level, as well as the levels of morbidity, disability and mortality among the high risk group. The continued involvement of community partners, coalitions, NGO's and the public health system in IHHP interventional actions at the environmental level, as well as policy change effects are considered in outcome evaluation.

Two periodic assessments have been performed in the cohort comprised of all participants aged ≥ 35 years from the pre-intervention cross-sectional survey. The entire cohort is recontacted once a year looking for the occurrence of fatal or non-fatal IHD, stroke, sudden death, hospitalization, physician visits, new medication use, etc. If one of the above happens, the team will investigate the medical reports and make interview with the patient or his/her family. This cohort of 6542 adults is ongoing since 2001 in intervention and reference areas and is planned to be continued for ten years. All participants underwent the (behavioural, physical and biochemical measurements) STEPwise approach for risk factors surveillance in the year 2000 and a smaller subsample will undergo the same measurements in the year 2006 while the entire cohort will be studied in 2010 to determine the Iranian CVD risk chart which allows the possibility of predicting future CVD events based on one or more of the studied risk factors. Some of the new risk factors such as fibrinogen, Lp(a), homocystein, C-Reactive Protein (CRP), Apolipo Protein (ApoB) and (ApoA), small dense-LDL cholesterol have been measured in a subsample of this cohort in both intervention and reference areas.

Study participants, outcome measures, target sites and research instruments are presented in figure 1.

Data Analysis:

Data from the baseline survey in 2000 and late 2001-2002 independent sample surveys were used to evaluate the impacts of the first year of intervention and to compare the unadjusted prevalence of risk behaviours between the intervention and control communities over time based on univariate analyses. The patterns of smoking, physical activity and type of cooking fat were compared by fitting logistic regression models to dichotomous variables which fits for each gender separately. The behavioural impacts are studied in adults, adolescents, health professionals and high risk groups living in urban and rural areas. The education level was assessed by the years of education, and categorized to less than 10 years as low, 10 to 12 years as medium and at least 13 years as high education levels. To assess the continuity/

discontinuity of the individual level relationships over time, the interactions of year with age, education and living area were included separately in the adjusted main effect model. The first category of each factor was considered as the reference category. Results of the adjusted main effect models are presented in odds-ratios (OR) and 95% confidence intervals (CI) in tables 4 to 6. Differences between the prevalence of some healthy habits among adolescents and health professionals were tested by the Chi-square test. Data were analysed with the SPSS statistical package version 12 for windows (SPSS Inc., Chicago, USA).[18]

Results:

The IHHP first year behavioural impacts in an independent sample from each of the three target populations are reported here while results from the first year impact among high risk group, the repeated-measures analysis of variance used to study the impact of the program on continuous variables in the longitudinal study, as well as in the continuous mortality and morbidity surveillance data will be reported separately.

Table 2 presents the characteristics of the participants in both surveys. Response rate for participation in the first survey (2001-2002) was generally lower than the baseline one, especially among health professionals and high risk group individuals, respectively. Two different sample sizes were considered for the baseline and independent surveys in adults. The reasons for increasing the original baseline sample was reported before.[11] About 61, 26 and 13 percent of people in intervention area fit in low, medium and high education levels while 72, 20 and 8 percent of people in reference area fit in these levels, respectively. There was no marked changes in the education level in the first annual survey (data not shown).

Table 3 shows that the selected health characteristics of intervention and reference subjects at baseline were approximately similar in both genders. However, there was significant increase in the consumption of liquid oil after the first year of IHHP interventions compared to the baseline survey in intervention and control areas separately ($P<0.05$). The results on psychosocial and stress variables will be reported separately.

Among men, daily smoking was decreased, the liquid oil consumption and daily physical activity were increased after one year of intervention. Table 3 shows opposite changes among men living in the reference area. Although the comparison of baseline and the first year follow-up about the daily smoking among women shows less favorite results in both intervention and reference counties (Table 3), the use of liquid vegetable oil was increased significantly among women in interventional area ($P<0.05$).

Tables 4 to 6 present the change in the prevalence of these health characters after being adjusted for some sociodemographic variables. The prevalence of smoking is more prevalent among younger, less educated men living in urban areas both in interventional and reference counties. No statistically significant differences between communities in the odds ratios for year were detected.

Daily smoking was significantly increased in women of both intervention and reference areas in the first year of evaluation. It was more prevalent among older, higher educated women living in urban areas.

The difference between urban and rural smoking levels was lower among men than women (Table 4).

Both in urban and rural areas, liquid oil consumption was higher among older, higher educated men and women living in urban areas (Table 5). Table 6 shows that the prevalence of daily physical activity was higher in the 50-64-year- age group except for the women in the reference area, it was more prevalent among higher-educated men and women, but less prevalent in subjects living in rural areas.

Data shown in Table 7 suggest that physical activity, using liquid oil in food have been increased significantly among adolescents after one year of intervention, in addition attempt to smoke was significantly decreased. Although the added salt to food was decreased in reference are, however the difference between intervention and reference areas was not significant ($P>0.05$) (Table 7).

Table (8) compares the level of risk factors in an independent sample survey of health professionals compared to the baseline data. The reported data suggest similar trends in intervention and reference areas. While the percentage of health professionals who

participated in daily exercise increased significantly in both communities, daily smoking decreased after interventions. The knowledge about healthy lifestyle and medical advice was significantly increased among physicians and nurses after one year of intervention. ($P<0.05$)

Discussion:

Since the 1970's several community-based studies have been carried out for NCD prevention in developed countries.[19-20] The experiences gained over many years can be of worth in planning and implementing nearly similar NCD prevention activities in developing countries. Carefully planned demonstration programs provide an important effort to help solving this problem. One of such successful demonstration projects was conducted in Finland since 1972. The North Karelia Project[21] was started as a demonstration project in least developed area of Finland where the socioeconomic setting was, in some ways similar to that in many developing countries today.

IHHP, a replication of the North Karelia model is a quasi-experimental study with reference community using the basic idea of comprehensive community participation and organization through an integrated approach. This comes mainly from bottom to up and to lesser extent top to bottom approach. Integrated community-based intervention programs are comprehensive packages in which different kinds of feasible activities are combined to produce synergistic effects.

The evaluation of such studies is an important issue. Obviously the effect of each interventional component in comprehensive integrated programs cannot be determined. The principles and methods of evaluation have been developed along with many community-based interventional programs, however, in most of these studies, the evaluations are not sufficient to draw valid conclusions on their impacts or effectiveness. A Swedish review[22] pointed out that only eight of the community based heart health programs met with the criteria for study design and evaluation. Similar American[23] and British[24] reviews arrived at similar conclusions. They agree that these projects show only a modest or no real effect on the target risk factors or disease rates. This is because of the varying nature and dose of interventions, defining non-realistic impacts or outcomes, diffusion to other areas and linkage to national trends which led to difficulties in assessing the true overall impact. The principles and methods of evaluation have been developed along with those programs.

IHHP used both frequent cross-sectional independent population samples and cohort design in the impact and outcome assessments. The independent samples will assess the magnitude of changes in the whole population, while the cohort approach can give more information on the type of changes that have actually taken place at the individual level.

Meanwhile, it is most useful to understand how and why the program has worked and what are the mechanisms, barriers and or facilitators to interventional activities.

Process evaluation performed frequently in Isfahan and Najaf-Abad as interventional areas is concerned with answering the above-mentioned questions at the individual as well as environmental and policy levels.

The WHO STEPwise approach for surveillance of NCD risk factor, morbidity and mortality have been used in IHHP impact and outcome evaluation. This WHO approach was originally developed based on the concept that NCD surveillance systems require standardized data collection to ensure comparability over time and across communities.

To our knowledge, this is the first time that the WHO surveillance approach for NCD risk factors is used as a tool to evaluate preventive interventions and use the information collected to influence health policies in a comprehensive integrated program for NCD prevention and health promotion, not only in healthy adult population, but among children, health professionals and high risk groups. We believe that this approach is sufficiently flexible to be appropriate in a variety of country situations.

Obviously, one year of intervention is a relatively short time period to assess lifestyle changes at population level, however the evidence on obtaining changes in risk-related behaviours in a short time have been reported before.[25]

For the present paper, data on one key indicator from each of the four areas of health behaviours (except psychosocial ones) were selected. In both genders, the use of liquid oil have been increased following one year of intervention. Similar changes have been seen in adolescents, as well. Most people used vegetable hydrogenated fat for cooking, baking and frying in Isfahan and Najaf-Abad before IHHP interventions

and buying this kind of fat is still subsidized by the government, however following IHHP educational programs, and the increase of request by the population and the distribution agents, several meetings were organized with the Provincial Chief of Commercial Office by IHHP High Council members and the Healthy Nutrition Project PD and Co-PDs about the issue of replacing the subsidized hydrogenated fat by liquid oil was discussed. Based on these negotiations, the percent of distributed hydrogenated fat and liquid oil have been changed from 82% & 18% in 2000 to 68% and 32% in 2002, respectively. The hydrogenated fat have been analyzed in eight domestic industries in Iran and the level of trans fatty acids was 34%[26] while saturated and trans fatty acids together comprised 60% of hydrogenated fats.[27]

Following these reports, IHHP officials followed a health policy statement to be issued by the Provincial government. This statement indicates the necessity of inclusion of trans fatty acids in the labels of food products.

Among men, smoking has been declining significantly in interventional area while among women, an opposite impact is seen both in interventional and reference areas. One possibility is that many of innovative antismoking campaigns in Iran including the interventional Quit and Win Campaign had targeted men more than women. Another possibility is the already growing smoking epidemic in Iranian women and youth[28] which necessitate more specified interventions towards these susceptible groups. Future trends in prevalence of smoking following the next annual impact evaluation studies will give better idea regarding the level of change in interventional or reference areas.

Attempt to smoking have been significantly decreased in adolescents in interventional areas compared to reference area, while passive smoking was not significantly changed. A law was passed by the Iranian government in 1998 for prohibition of indoor smoking, however for real implementation, this needs more enforcement by the population and policy makers.

Although there has been some decline in added salt to food among adolescents in reference area, but the overall difference between two areas was not significant ($P>0.05$).

Physical activity became clearly more common in adult men, adolescents and health professionals. It is suggested that this finding can be attributable to many physical activity health promotion active programs that has been conducted in Isfahan and Najaf-Abad schools, worksites, etc.

Among women, this change was less common which possibly need further follow-up and redesigning some of targeted interventions to increase physical activity in Iranian women.

With regard to medical community, regular educational sessions, seminars, workshops, etc concerning the role of diet, antismoking activities and regular exercise in NCD prevention, early detection and diagnosis by recommending guidelines for cholesterol, fasting blood sugar (FBS) screening were organized and integrated with continuous medical education programs. These activities showed significant impact on knowledge and behaviour of health professionals.

The relationships between health behaviours and the socioeconomic background variables used were somehow mixed. While smoking was more common in higher educated women and less educated men, liquid oil consumption was higher among highly educated men and women. It is well known that higher educated groups generally enjoy better health,[25] however that was not applicable for smoking among Iranian women. The effect of place of residence was inconsistent, as well. The fact that regular physical activity was less prevalent among Iranian rural men and women, both in interventional and reference areas was interesting and inconsistent with previous studies.[7] One possibility is that media campaigns and group education programs might have less impact in rural communities, therefore, different intervention activities should be implemented.

In summary, the feasibility of this study and the integration of evaluation with intervention suggest that, conducting comprehensive integrated approach for NCD prevention in developing countries and integrating research with practice is possible and can be successful for population behavioural lifestyle and public health improvement.

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Fig 1. Evaluation Design of Isfahan Healthy Heart Program

Phase I → **Phase II** → **Phase III**

Situational Analysis (I & R)❖

Populations:
- Adults (age>19 Y)†
  N= 6300 in each community
- Adolescents (11-18Y)†
  N= 1000 in each community
- Health Professionals††
  N= 1000 in each community
- High Risk & CVDs Patients††
  N= 1000 in each community

Environment:
- Food Industries & Groceries
- Hospitals & Health Centers
- Worksites ***(e.g. Offices, Factories, Terminals, Industries, etc)***
- NGOs
- Schools & Kindergartens

Indicators ***(Communities)***
1- **BASK indicators:**
   Nutrition
   Physical Activity
   Smoking
   Stress
2- **Physical Measurements:**
   SBP, DBP, PR, BMI, WC, WHR
3- **Biochemical indicators:**
   FBS, 2hhp,TG, Cht (Total, HDL, LDL)
4- **Socio-economic Status:**
   (e.g. Income, Educational level, etc)
5- **Disease indicators:†††**
   MI, Stroke, Cancer Registry
   Disease control level & awareness
   (i.e. DM, HTN, Dyslipidemia)
   Attack rates
6- **Mortality indicators††††**
7- **Cost indicators**

Indicators *(Environmentals)*
1- **Legislations**
2- **Allied Centers in Helthy Heart Programs**
   (e.g. Restaurants, Sport centers, Work-sites, Schools, Hospitals, NGOs, etc)
3- **Mass Media**

❖ Interventional and Refrence Area

† Based on WHO stepwise approach for risk factors (all 3 steps)

†† Based on WHO stepwise approach for risk factors surveillance (step 1 & 2)

††† Based on WHO stepwise approach for disease surveillance (all 3 steps)

†††† Based on WHO stepwise approach for death (step 1 & 2)

* CS: Cross Sectional

Interventions

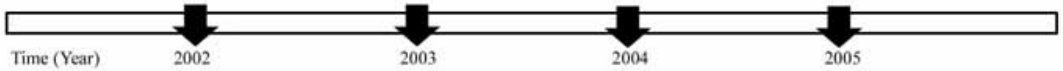
Only in Interventional Community

What?	How?	Who?	To Whom?
✓ Physical Activity	✓ Education	✓ Mass Media	General Population
✓ Healthy Nutrition	✓ Legislation & Coordination	✓ Legislators	Health Professionals
✓ Tobacco Control	✓ Community Mobilization	✓ Educational Centers	High risk population
✓ Stress Management	✓ Health Policy Development	✓ Health Care Providers	Health Related Environments (groceries, creational centers, schools, worksites, etc)
			Housewives
			Children & Adolescents

Evaluation and Monitoring

Both in Interventional and Reference Communities

❤ Impact Evaluation



Both in I&R. Community impacts & Environmental impacts
Independent sampling from each community (Adults: 2400, Adolescents: 1000, Health Profesionnals: 500, Patients: 500)
Survey on BASK indicators & Diseases indicators. Using step 1 WHO STEPwise approach for risk factors.

❤ Process Evaluation
Only in interventional area. Is performed separately & with impact evaluation.

❤ Event Registry:
Continous mortality and morbiidity registry, coincident with WHO STEPwise approach for disease and mortality surveillance.

❤ Longitudinal Study:
Objective: To create the Iranian Risk Chart for future CVDs based on classic known risk factors & to assess individual changes related to interventions
Study Population: Adults aged > 35 Y (6000 persons from baseline survey in interventional & refrence communities)
Study Duration: 10 years (it will be continued 4 years after the 3rd phase of IHHP)
Outcomes: Fatal & Non-fatal MI & Stroke, sudden death, hospitalization, physician referee, attack rate, etc.

Simultaneous Studies

❤ IHHP New Risk Factors Study:
Objective: To assess the effect of community-based interventions on CVD new RFs & drawing Irania risk chart based on new RFs
Study Population: Random sampling from baseline survey & 3rd phase survey
Study Intervals: 1st and 3rd phase of IHHP

❤ Childhood NCD Risk Behaviours Study:
Objectives: To follow the IHHP goals in children (2-10Y) and their families, based on WHO stepwise approach
Study Population: Samples from children aged 2-10 Y in refrence & interventional community
Study Intervals: Annual BASKs survey,

❤ Nutritional Habits Study:
Objective: To assess the effect of interventions on dietary habits at the micro & macro nutrient levels.
Method: 24-hour dietary recall questionnaire, Iranian food table & computer based analysis.
Study Intervals: At the 1st & 3rd phase of IHHP.

Outcome Evaluation

Population Outcomes:❖
BASK about Physical Activity, Nutrition, Smoking & Stress.
Physical Measurements.
Biochemical Indicators.
Socioeconomic Indicators.
Demographic Characteristics.
Morbidity:
Disease Registry (Age & Sex Specific Prevalence, Incidence Rate, Attack Rate, Disability Indicators & etc.)
Mortality: Age, Sex & Cause Specific based.

Individual Outcomes:❖
BASK about Physical Activity, Nutrition, Smoking & Stress.
Physical Measurement
Biochemical Indicators
Cohort of Population over 35 years old annually assessed
Outcome measurement in a random sample from original preintervention phase

Environmental Outcomes:
Continuity of involved centers (eg. Agencies, NGOs, Partners, etc.)
Coalition Building
Sustainability of Health System
Participation & Cooperation
Policy Change Effects

Costs

❖ *All parts of design will be as the same as 1st phase in both interventional and refrence communities on independent samples from target populations (Adults, Adolescents, CVD Patients, Health Professionals).*

Isfahan Healthy Heart Program

Table 2. Characteristics of Respondents

	General Adult Population		Adolescents		Health Professionals[¶]		High Risk Population & CVD Patients	
	Interventional Area	Reference Area	Interventional Area	Reference Area	Interventional Area	Reference Area	Interventional Area	Reference Area
Year								
2000	6300	6300	1000	1000	1000	1000	1000	1000
2001-2002	3000	3000	1000	1000	500	500	500	500
Participation Rate								
2000	96.4%	99.2%	96.9%	98.1%	95.6%	94.1%	81.2%	92.5%
2001-2002	99%	96%	96.4%	96.1%	74%	61.8%	80.6%	79.6%
Gender								
Male	50.9%	50.8%	50%	50%	41.8%	47.7%	56%	48%
Female	49.1%	49.2%	45.6%	48.3%	58.2%	52.3%	44%	52%
Place of Residence								
Urban Area	79.7%	66.6%	68%	62%	81.2%	76.3%	78%	67%
Rural Area	20.3%	34.4%	32%	38%	19.8%	23.7%	22%	33%

[¶] Health Professionals: Physicians, Nurses & Primary Health Care Providers

Table 1. WHO STEPwise approach for NCD surveillance in Isfahan Healthy Heart Program

NCD	Step 1	Step 2	Step 3	Data collection intervals
Deaths (Past)	Death rates by age & sex	Death rates by age, sex & cause of death (verbal autopsy)	Death rates by age, sex & cause of death (death certification)	Continuous data collection
Diseases (Present)	Hospital or clinic admission by age & sex *plus* reason for admission	Rates & principal condition NCDs	Cause specific disease incidence or prevalence, case fatality	Continuous data collection
Risk factors (Future)	Questionnaire-based report on key risk factors	Questionnaires *plus* physical measurements	Questionnaires *plus* physical measurements *plus* biochemical measurements	Step 1: Annually[¶] Step 2: Every 5 years[¶¶] Step 3: Every 5 years[¶¶¶]

(with permission of Surveillance Unit for NCD in WHO)

[¶] Step 1 is performed in adult populations, adolescents, high risk populations & health professionals

[¶¶] Probably is performed at 3rd year of study on adult and adolescent populations.

[¶¶¶] Will be continued even after the study termination

Table 3. Prevalence of the selected health behaviors in adults aged≥19 years in the period 2000-2001

	Male		Female	
	Interventional Area %(95% CI)	Reference Area %(95% CI)	Interventional Area %(95% CI)	Reference Area %(95% CI)
Daily Smoking				
2000	26.1 (24.9-27.3)	26.8 (25.7-27.9)	1.3 (0.8-1.7)	0.8 (0.65-0.96)
2001-2002	21.8 (20.2-23.4)	28.3 (26.7-29.9)	2.5 (1.8-3.3)	1.6 (0.95-2.1)
Use of Liquid Oil in Cooking				
2000	52.4 (46.2-56.6)	40.3 (39.6-46.1)	56.1 (51.3-59.2)	49.2 (42.5-55.9)
2001-2002	57.6 (49.3-65.9)	39.8 (33.1-46.5)	63.3 (59.1-67.5)	45.8 (40.4-51.2)
Daily physical exercise				
2000	20.5 (18.3-22.7)	20.9 (18.1-23.7)	10 (8.3-11.7)	8.3 (6.9-9.7)
2001-2002	23.3 (21.8-24.8)	19.8 (16.9-21.7)	12 (10.7-13.3)	9.2 (7.9-10.3)

ΔPi versus ΔPr is significant only about “use of liquid oil in cooking” in both genders (P<0.05).

ΔP: Difference between prevalence in baseline (2000) and first evaluation (2001)

Table 4. Prevalence of Daily Smoking by sociodemographic variables[¶]

	Male		Female	
	Interventional Area	Reference Area	Interventional Area	Reference Area
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Year				
2000	1	1	1	1
2001	0.86 (0.75-0.99)	1.08 (0.94-1.2)	2.5 (1.7-3.7)	1.5 (1.05 – 2.4)
Age Group				
19-34	1	1	1	1
35-49	0.83 (0.68 – 1.01)	1.1 (0.96 – 1.32)	1.77 (0.95 – 3.27)	1.61 (0.68-3.78)
50-64	0.68 (0.57 – 0.72)	0.69 (0.59 – 081)	1.17 (0.61-2.24)	0.79 (0.34 – 1.82)
Education Group				
Low	1	1	1	1
Medium	0.62 (0.49 – 0.79)	0.81 (0.62 – 1.04)	0.9 (0.48 – 1.7)	0.81 (0.25 – 2.62)
High	0.43 (0.35 – 0.54)	0.52 (0.41 – 0.64)	1.1 (0.56 – 2.41)	0.82 (2.93)
Place of Residence				
Urban Area	1	1	1	1
Rural Area	0.89 (0.76 – 1.04)	0.71 (0.62-0.81)	0.28 (0.13 – 0.57)	0.28 (0.14- 0.54)

[¶] Adjusted for all other terms of the model

*Table 5. Prevalence of use of liquid oil in cooking by sociodemographic variables**

	Male		Female	
	Interventional Area	Reference Area	Interventional Area	Reference Area
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Year				
2000	1	1	1	1
2001	1.32 (1.17-1.51)	0.64 (0.58-0.68)	1.23 (1.09-1.4)	0.75 (0.62-0.79)
Age Group				
19-34	1	1	1	1
35-49	0.93 (0.75-1.16)	1.3 (1.1-1.69)	1.16 (0.93-1.46)	1.11 (0.89-1.39)
50-64	1.03 (0.82-1.29)	1.5(1.23-1.93)	1.37 (1.08-1.73)	1.1 (0.87-1.38)
≥ 65	1.16 (0.90-1.49)	1.5 (1.21-1.97)	1.2 (0.96-1.60)	1.09 (0.85-1.40)
Education Group				
Low	1	1	1	1
Medium	1.5 (1.2-1.8)	1.5 (1.19- 1.9)	1.14 (0.90-1.44)	0.96 (0.71-1.30)
High	2.9 (2.4-3.5)	2.4 (2.02-2.93)	2.45 (1.98-3.03)	1.74 (1.32-2.29)
Place of Residence				
Urban Area	1	1	1	1
Rural Area	0.39 (0.34-0.45)	0.60 (0.53-0.68)	0.38 (0.33-0.45)	0.66 (0.58-0.75)

* Adjusted for all other terms of the model

*Table 6. Prevalence of use of daily exercise by sociodemographic variables**

	Male		Female	
	Interventional Area	Reference Area	Interventional Area	Reference Area
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Year				
2000	1	1	1	1
2001	1.18 (1.01-1.37)	0.89 (0.79-1.06)	1.22 (1.01-1.48)	1.12 (0.9-1.39)
Age Group				
19-34	1	1	1	1
35-49	0.82 (0.59-1.14)	0.82 (0.57-1.16)	0.46 (0.26-0.81)	0.69 (0.39-1.2)
50-64	0.99 (0.73-1.34)	0.90 (0.65-1.26)	0.49 (0.29-0.84)	0.56 (0.34-0.94)
≥ 65	0.52 (0.39-0.69)	0.39 (0.29-0.53)	0.31 (0.18-0.52)	0.38 (0.23-0.63)
Education Group				
Low	1	1	1	1
Medium	1.06 (0.87-1.29)	1.21 (0.97-1.51)	1.12 (0.84-1.49)	1.2 (0.89-1.51)
High	3.04 (2.51-3.69)	3.9 (3.21-4.84)	2.72 (2.07-3.58)	4.4 (3.12-6.4)
Place of Residence				
Urban Area	1	1	1	1
Rural Area	0.65 (0.54-0.79)	0.41 (0.32-0.47)	0.74 (0.58-0.96)	0.32 (0.26-3.42)

* Adjusted for all other terms of the model

Table 7. Changes in selected health behaviors in adolescents in the first annual evaluation

Habit	Baseline Survey		1st Annual Evaluation	
	Interventional Area %(95% CI)	Reference Area %(95% CI)	Interventional Area %(95% CI)	Reference Area %(95% CI)
Daily Regular Exercise¶	14.6 (13.1-16.1)	13.1 (11.7-14.5)	21.7 (17.9-24.5)	14.3 (11.1-17.5)
Frequent use of Fruits & Vegetables ¥	26.2 (25.1-27.3)	27.6 (26.3-28.9)	25.7 (23.0-28.4)	24.3 (21.2-27.4)
Added Salt to Food*	27.2 (26.0-28.4)	32.7 (31.4-33.9)	26.8 (24.5-29.1)	26.6 (23.7-29.5)
Liquid Oil in Food¶	49.6 (47.9-51.3)	44.7 (43.1-46.3)	53.7¶ (49.9-57.5)	45.1 (40-50.2)
Attempt to Smoking¶	39.3 (35.1-43.6)	32.7 (27.9-37.5)	34.3 (27.1-41.5)	33.1 (26.3-39.9)
Passive Smoking	43 (40.2-45.8)	38 (35.3-40.7)	42.4 (38.2-46.6)	39.5 (35.8-44.2)

¶ ΔP is significant between interventional versus reference area (P<0.05)

¥ More than 4 times in a week.

* ΔP is significant between interventional versus reference area (P<0.05).

Table 8. Prevalence of some health knowledge and performance among health professionals

Variable	Baseline Survey		1st Annual Evaluation	
	Interventional Area %(95% CI)	Reference Area %(95% CI)	Interventional Area %(95% CI)	Reference Area %(95% CI)
Regular Daily Exercise	22.3 (19.8-23.5)	19.8 (17.5-20.1)	26.2 (23.5-28.9)	21.2 (18.4-24.1)
Current Smoking	7.8 (6.6-9.1)	8.3 (7.2-8.4)	6.3 (4.1-8.4)	8.1 (5.9-10.3)
Acceptable Knowledge about Healthy Life Style[¶]				
• **Physician**	74.3 (70.1-78.8)	68.6 (62.7-74.5)	78.2 (71.1-85.3)	69.2 (62.5-75.9)
• **Nurse**	59.5 (55.1-63.9)	51.8 (46.1-57.6)	67.5 (60.3-74.7)	53.4 (45.5-61.3)
• **Other Health Care Providers**	34.6 (31.8-37.4)	36.3 (33.4-39.2)	37.8 (32.9-42.6)	38.9 (33.6-44.1)
Health Advises to Cardiovascular Patients				
• **Physician**	36.3 (33.6-39.1)	37.8 (35.1-40.3)	43.2 (38.3-48.1)	38.6 (34.9-42.3)
• **Nurse**	59.4 (55.6-63.2)	56.8 (52.5-61.1)	64.2 (58.3-70.1)	55.2 (50.6-60.5)
• **Other Health Care Providers**	24.6 (21.3-27.9)	31.2 (27.8-34.6)	28.9 (24.1-32.7)	30.8 (25.7-35.9)

[¶] Score above 70% of total score is defined as acceptable knowledge

Data analysis was done by logistic regression test (binary and multinomial according to variables units) in SPSS version 12. Pattern of behaviors were compared by fitting logistic regression models to dichotomous variables. All the models were fit separately in each community (interventional vs reference) to males and females and the main effect was included in their temporal order. The overall effect was added first followed by age, education, and urbanization (table 3-5). Differences between prevalence of some healthy habits among adolescents were tested by chi-square (table 6).