
Perspectives

Community-based cardiovascular health promotion in Argentina. A systematic review

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Summary

In Argentina, cardiovascular disease (CVD) accounts for 30% of deaths and more than 600 000 disability-adjusted life years. However, no reviews describing local studies on interventions to address CVD risk factors have been identified. The purpose of this study is to characterize those population-based interventions and public policies implemented in Argentina to reduce the burden of cardiovascular disease with an adequate evaluation of their impact on population health. We conducted a systematic review of studies that assessed interventions in health promotion and/or primary prevention conducted in adult populations of Argentina, addressing specific CVD factors, from 1999 to 2016. We searched major bibliographic databases, grey literature, ministries and secretariats of health, and academic national libraries. Key informants, non-governmental organizations, universities, hospitals and experts were also contacted. We applied specific inclusion criteria. We assessed the methodological quality of the studies and reported the effectiveness and impact of population interventions and policies, as well as process evaluations' characteristics. After removing duplicates we identified 1686 references from databases. After reviewing title and abstracts 18 studies were selected, five of them corresponded to evaluations of public policies—all addressing tobacco smoking. We presented a structured review of each experience. Most of the studies were deemed to entail moderate or high risk of bias. We summarized the findings and characteristics of these studies, including implementation strategies, process and impact evaluation. This is the first systematic review of interventions focused on primary prevention and health promotion to counter CVD and diabetes in Argentina.

Key words: community-based studies, health promotion, health policies, cardiovascular diseases, risk factors

INTRODUCTION

Worldwide, non-communicable diseases produced 36 million deaths in 2010, accounting for 63% of all global deaths. Among them, cardiovascular diseases (CVD) are

the leading cause of premature death ([World Health Organization, 2011](#)). It is expected that cardiovascular and cerebrovascular deaths would represent 10.4% of the disease burden in developing countries by 2030

(World Health Organization, 2008). Moreover, the rates of major cardiovascular disease and death are higher in low-income countries (Yusuf *et al.*, 2014). In Argentina, 97 107 deaths (30.5% of total) were due to cardiovascular causes and stroke, and 8 069 deaths (2.5%) due to diabetes in 2010 (Ministerio de Salud de Argentina, 2011). Only heart disease and cerebrovascular disease in Argentina produce over 600 000 Adjusted Life Years (DALYs) lost each year (Rubinstein *et al.*, 2010).

This CVD-related disease burden is caused mainly by the presence of cardiovascular risk factors (CVRF) in the population. In effect, modifiable risk factors explained about 3/4 of CVDs, costs due to acute events and DALY lost (Rubinstein *et al.*, 2010). Although there is an increasing awareness to counter them, it is still a growing problem. It was found that between 2005 and 2013, there has been a significant increase in physical inactivity, unhealthy diet, obesity, diabetes and dyslipidemia in Argentina, despite a decrease in tobacco use (Ferrante *et al.*, 2011, Ministerio de Salud de la Nación e Instituto Nacional de Estadísticas y Censos, 2015).

At community level, CVD prevention demands complex interventions to facilitate healthy choices for people. Reducing sodium and artificial trans-fatty acids intake, increasing physical activity and implementing policies to reduce smoking remain one of the cornerstones of preventative CVD intervention at a population level. The World Health Organization (WHO) has redoubled its efforts to promote population-wide primary prevention through the Framework Convention for Tobacco Control and issuing the Global Strategy on Diet, Physical Activity and Health (Waxman and World Health, 2004). Finally, the September 2011 UN High-level Meeting on the Prevention and Control of Non-Communicable Disease set the prevention and control of NCD as a global health goal comparable with the attainment of the health-related MDG in 2015 (United Nations, 2011).

There is a significant history of community-based intervention studies for risk factor control, which showed success in different high-income countries. The best-known ones are the Stanford Five-Cities Project (Farquhar *et al.*, 1990), the North Karelia Project (Puska, 1981; Vartiainen *et al.*, 1991; Puska, 1995), the Pawtucket Heart Health Program (Winkleby *et al.*, 1997) and the Minnesota Heart Health Program (Luepker *et al.*, 1994). In Latin America, there have also been regional initiatives to address the reduction of non-communicable diseases (NCDs) such as the CARMEN Initiative, from the Pan American Health Organization (PAHO) (World Health Organization, 1995, Moiso, 1996; da Silva *et al.*, 2013).

Argentina is an upper-middle income country in the Southern Cone which, as most of the countries in Latin America, has largely entered into the demographic, epidemiological and nutritional transition, with NCDs now responsible for more than 70% of the burden of disease where CVD is largely its first killer (Rubinstein *et al.*, 2010).

In this regard, Argentina has developed numerous actions in the last decade to reduce CVRF, including building surveillance systems for NCD risk factors, the creation of a Directorate for NCD control at the National ministry of Health and other subnational levels, and the incorporation of Essential Functions in Public Health Programs in Argentina's Ministry of Health (Ministerio de Salud de Argentina, 2012), provincial and municipal programs to promote healthy lifestyles (Ministerio de Salud de la Nación, 2010, 2011). However, most of these programs have not been monitored or evaluated regarding population impact. The effect of trans-fatty-acids consumption, tobacco interventions and salt reduction interventions, however, has been assessed through public-health modeling (Rubinstein *et al.*, 2010; Pichon-Riviere *et al.*, 2011; Rubinstein *et al.*, 2015; Ferrante *et al.*, 2012a)

The overall aim of the review was to increase knowledge regarding population-based interventions conducted in Argentina to reduce the burden of cardiovascular disease and diabetes, which included a proper assessment of their implementation and impact on population health metrics. Despite this report is focused only on interventions, programs and policies implemented in Argentina, its perspective and impact evaluation will help to assess other interventions strategies in Latin America and other low and middle income countries, to counter CVD and their risk factors.

METHODS

A systematic review of interventions carried out in adults in Argentina from January 1999 to April 2016 was conducted, searching major bibliographic databases, grey literature, official Ministry of Health publications and academic sources. We searched Medline, EMBASE and LILACS (search strategy is available as [Supplementary File 1](#)). We also examined regional and local published and unpublished data, annual Ministry of Health (MOH) reports, government programs with emphasis on the program 'Healthy Municipalities', institutional reports, national campaigns and university programs. The reference lists of the articles finally included were hand-searched for additional information. We also manually searched major medical libraries in the cities of Buenos

Aires and La Plata, consulted national medical societies and reviewed abstracts and communications presented at national conferences and relevant cardiovascular scientific events. In order to supplement the information, we administered a survey (by telephone and e-mail) to key informants, governmental and non-governmental organizations, universities, hospitals, and national researchers and experts in the field.

Inclusion criteria

The inclusion criteria for the systematic review of studies included were the following: (a) interventions in health promotion and primary prevention conducted in Argentina, (b) carried out in adult population, (c) from January 1999 to April 2016, (d) addressing specific CVD factors such as tobacco use, dyslipidemia, physical inactivity, high glycemia and high blood pressure, (e) had been part of a community-based epidemiological study or health policy and (f) formally evaluated with a set of process or impact indicators.

We also included implementation projects in municipalities that had included formally assessed interventions in cardiovascular health promotion in the last 17 years and have included assessments with appropriate and adequate information reported. A wide range of epidemiological study designs was considered. Priority was given to those highly documented experiences, with strong evaluation of results, conducted at multiple locations, and with a wide range of populations and settings. Exclusion criteria were (a) secondary prevention studies, (b) institutionalized populations, (c) experiences with drugs at the individual level, and (d) lack of enough information regarding their implementation or impact evaluation.

Risk of bias assessment

We used an algorithm to estimate a summary risk of bias for observational studies considering four major criteria (methods for selecting study participants, methods for measuring exposure and outcome variables, methods to control residual confounding and comparability among groups) and two minor criteria (statistical methods excluding confounding and conflict of interest). This algorithm was based on the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) checklist (von Elm *et al.*, 2007), but we also considered the Cochrane Handbook for grading the methodological quality of RCTs, the Cochrane Effective Practice and Organization of Care Review Group data collection checklist Quality criteria, and two methodological papers (Fowkes and Fulton, 1991; Sanderson *et al.*,

2007). Independent reviewers assessed the methodological quality. Discrepancies were solved by consensus of the whole team. Additional information on the tools used is available on demand. We followed the MOOSE guidelines (Stroup *et al.*, 2000) and the PRISMA statement (Liberati *et al.*, 2009; Moher *et al.*, 2009) for reporting observational meta-analyses and systematic reviews, respectively. The tools used can be found in Supplemental File 2.

Article selection and data abstraction

Pairs of reviewers independently evaluated assigned articles by title and abstract according to pre-specified criteria, assessed the methodological quality and abstracted data of full texts. Discrepancies were solved by consensus of the whole team. Authors of articles were contacted when necessary to obtain missing or [Supplementary information](#). Two rounds of article screening were done, one with titles and abstracts, and the other with full texts.

As a part of the strategy to retrieve unpublished data, we designed a questionnaire administered by email and phone to different research groups, individual researchers with a proven track record, or who have made scientific publications on relevant topics, and also health officials and policy-makers. Informants were contacted twice by email contacts for 15 days, and then once by telephone.

Outcome measures

As types of outcome measures, we collected population changes in the prevalence or incidence of risk factors and medical conditions in the study period (e.g. weight reduction, fasting total cholesterol, HDL-cholesterol, smoking prevalence, and second-hand smoking) and process indicators (e.g. number of subjects who participated in the intervention and number of persons exposed to media campaigns). We extracted the intervention strategy (media campaigns, voluntary agreements with supermarkets, and legislations), the central activities of the program, the ecological level of interventions, the setting (e.g. school education, work, churches or parishes, clubs, recreation, fitness or sports clubs, restaurants, pharmacies, grocery stores and vegetable shops, markets, nursing homes and prisons), population (age range, gender and ethnicity), external validity and sustainability.

Although a very high level of heterogeneity was expected, planned analyses included proportion and incidence meta-analyses, including arc-sine transformations to stabilize the variance of proportions and selecting random-effect meta-analyses where possible.

RESULTS

After removing duplicates, the initial yield was 1686 references. Subsequent to the first assessment by title and abstract, 580 studies were retrieved in full-text for the second screening phase. After applying the aforementioned criteria, we pre-selected 41 studies and finally included 18 (see Figure 1). No meta-analyses were possible due to extreme heterogeneity of interventions, outcomes, methods and population groups addressed.

Tables 1 shows the characteristics of population-level studies included; Table 2 shows characteristics of identified studies that specifically evaluated public policies and Table 3 addresses the methodological quality of all studies identified. Regarding those interventions addressing multiple conditions and risk factors, we identified the three experiences. Between 2000 and 2005 in the city of Balcarce, Province of Buenos Aires, the DEMOBAL project was implemented by the Program for Infarction Prevention of the National University of La Plata (PROPIA) being the first ‘demonstration area’ in the country (Tavella *et al.*, 2000; Bardach *et al.*, 2001, 2005). Its epidemiological design was an uncontrolled before–after study, with multistage cluster sampling for both independent surveys done. In the year 2000, a total of 2177 people were interviewed in order to establish baseline levels of cardiovascular risk factors and dietary habits. The second survey, corresponding to the process evaluation took place in 2005, with a sample of 1886 subjects. Local teams of health agents delivered 35 integrated interventions covering several health promotion topics. Antún *et al.* (2014, 2015) described the experience with the Healthy Stations, which are 34 points of prevention of chronic diseases in squares, parks and subway stations of the city of Buenos Aires. Free counseling is provided by nurses and graduates in nutrition.

Between 2004 and 2005, the Municipality of Rosario undertook a major project to promote cardiovascular health including the delivery of educational brochures, the organization of workshops given by specially trained health workers, actively involving 2000 people (Municipalidad de Rosario, 2008). Educational interventions were specially adapted for children, and healthy canteens in schools were established. There were also important anti-smoking activities. The project reached an estimated figure of 16 000 beneficiaries.

In the field of primary prevention of hypertension, as well as the mentioned studies, we identified two relevant experiences: one carried out in the city of Rauch (Salazar *et al.*, 2005; Salazar *et al.*, 2014), and a feasibility project assessing salt reduction in processed products

in Argentina, conducted by the National Ministry of Health and the National Institute of Industrial Technology (INTI), in the city of ‘Nueve de Julio’ (Ferrante *et al.*, 2011). In the three largest cities of the province of La Pampa, the same author reported a similar feasibility experience with bakers. Salt content estimated through surveys was reduced in bread (1.7% vs. 1.4% of salt, $p < 0.0001$) and other products (Ferrante and Macchia, 2012).

The Rauch study was conducted in 1997 and in 2003 over a 6-year period in 1526 randomly selected individuals. The central interventions were community education, the media dissemination of the results of the previous cross-sectional study on hypertension carried out by the authors, free distribution of antihypertensive drugs, nurse training in health centers, seminars with nutritionists on promoting healthy eating habits, promoting vegetable gardens and professional advice in seeding, and physical activity promotion in sports centers guided by physical education teachers. An increase in the percentage of population under pharmacological treatment with antihypertensive drugs was verified in 2003, along with an improvement in several indicators of treatment compliance. The population’s mean systolic BP (SBP) decreased approximately 5 mm Hg, but BP changes were heterogeneous. Eight years after the intervention had stopped, 1124 individuals of the cohort were surveyed to evaluate incident CVD events. Individuals who had increased SBP showed an adjusted HR for CVD that was double that of those whose SBP levels decreased or did not change. On the other hand, the sodium feasibility study was aimed at evaluating the impact of salt content reduction in highly consumed processed foods like bread, using a cross-over clinical trial. The intervention was done in 1250 bakeries and 98 volunteer subjects. More information is shown in Table 1. Despite being a small sample of subjects, this represented a pioneering study for Argentina.

Regarding dyslipidemia, Calandrelli *et al.* (2002) reported the results of a prevention campaign conducted between 2000 and 2001 in the local media (printed press, radio and TV), with gymnastics demonstration in the city of Bariloche, by the ‘San Carlos de Bariloche Clinic’. Testasecca *et al.* (2004) reported in a congress’ abstract a small field trial conducted in an outpatient clinic at the National University of Cuyo in the province of Mendoza. The intervention consisted of a managed care program for preventing dyslipidemia and obesity in the field of primary prevention. They reported positive changes in blood pressure, body mass index and HDL cholesterol at 3 months of implementation.

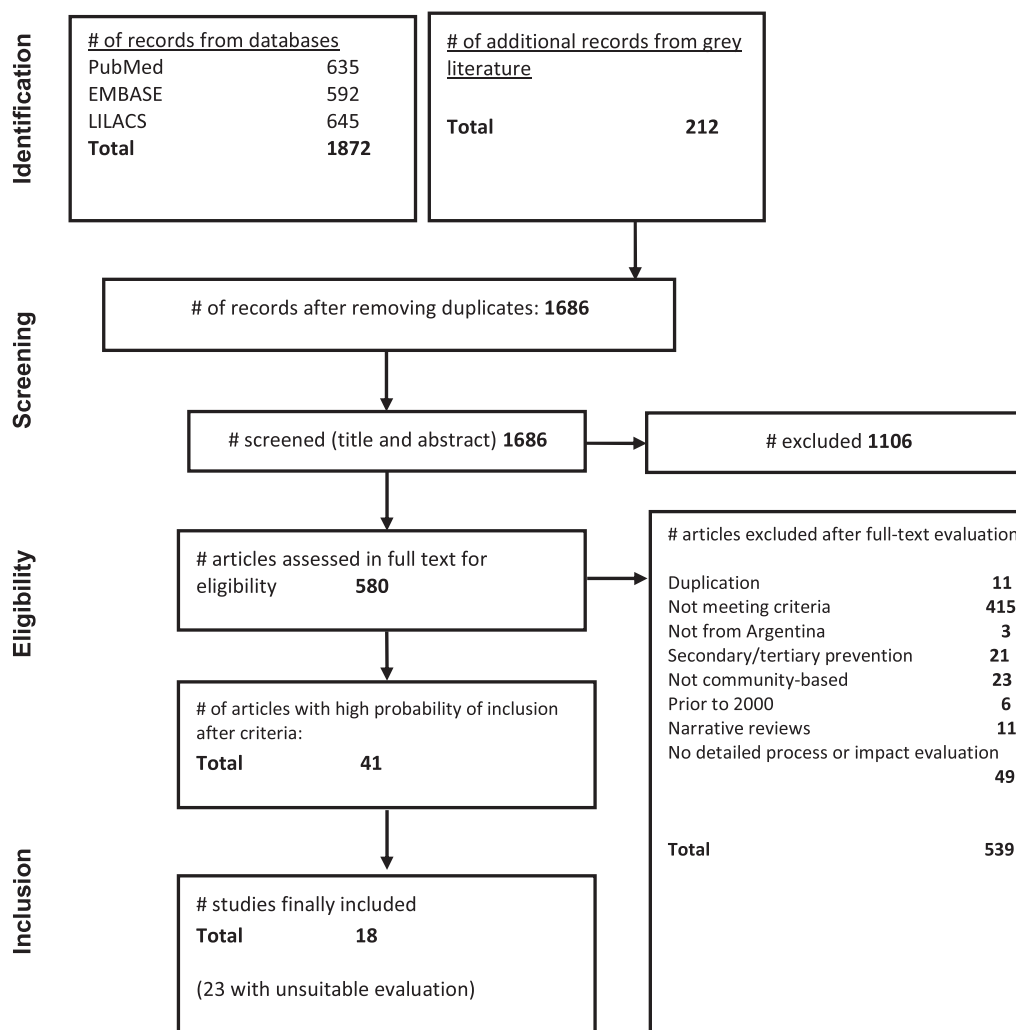


Fig. 1. Study flowchart.

With respect to inadequate physical activity, two studies published by Marin et al both in 2009 and in 2010 were identified (Marin *et al.*, 2009). The study ‘Add health to your years’ was carried out by the Province of Buenos Aires Ministry of Health and La Plata’s School of Medical Sciences, in the city of Berisso in 2009. It tackled the problem of physical inactivity in the population over 65 years old in that city. It used the strategy of skill development and personal-level education in the elderly. This study reported positive changes as reducing systolic blood pressure, the BMI and the proportion of subjects with hypercholesterolemia. In 2010 and 2011, the La Plata’s School of Medical Sciences, La Plata’s School of Dentistry, and La Plata ‘s Physical Education School carried out the experience ‘La Plaza de la Salud’ (Marin *et al.*, 2009). The activities were aimed at adults, using the streets and squares of the city of La Plata, many of which currently have adequate infrastructure for doing physical activity.

More than 300 subjects adopted regular physical activity habits.

In the field of tobacco reduction, we identified five evaluations of public policies (see Table 2). In 2005, Argentina became the first country in Latin America to implement 100% smoke-free policies at the sub-national level in the province of Santa Fe (Sebrie and Glantz, 2010) and, in 2011, a federal smoke-free policy was approved and implemented in the country. Until then, even when several cities/provinces had some related legislation, the scope varied from: ‘100%’ smoke-free policies with no smoking allowed in any public place, ‘comprehensive’ with no smoking allowed in any public place with the exception of certain specific venues such as smokers’ clubs, casinos and/or discos; and ‘partial’ legislation which allows for designated smoking areas and indoor air ventilation by means of air purifier. Schoj *et al.* (2010b) compared the concentration of suspended particles (PM2.5) in a convenience sample of venues in

Table 1: Characteristics of community-based studies included, Argentina 1999–2016

Study (author year of publication)	Name of the intervention	City	Year of implementation	Duration (months)	Design	Risk factor addressed	Target population	Health determinants	Implementation strategy	N intervened	Process evaluation	Impact evaluation	Adaptability
Aleccio <i>et al.</i> , (2004)	"Madrin no pares"	Puerto Madryn, Chubut	2004–2010	60	Community integrated interventions	Physical activity, obesity	Children and adults, including special activities for the elderly	Social environment and personal skills	Workshops on capacity building on preventive practices delivered at secondary schools. Physical activity interventions in specific centers. Behavioral and anthropometric measurements. Printed media and radio interventions	Unknown, probably more than 3000	Projects dissemination activities reached hundreds of participants in the different workshops. Inter-institutional networks created	Activities reached more than 3200 people of all ages. The city increased the number of physical activity options for children and adults, including 22 new municipal sport centers	Medium
Antin <i>et al.</i> , (2014)	Nutritional Counselling in Estaciones Saludables (Health Stations, HS)	Buenos Aires	June 2012–March 2014		Cross-sectional study	Modifiable risk factors for NCD	Adults	Personal skills, education, social environment	The Healthy Stations (ES) are points of prevention of chronic diseases. There were 34 located in squares, parks and subway stations Buenos Aires. Free counselling is provided by nurses and graduates in nutrition	124 493	193 029 nutritional counseling sessions were carried out		High
Antin <i>et al.</i> , (2015)	Estaciones Saludables (Health Stations, HS)	Buenos Aires	2012–2015		Cross-sectional self-reported survey among users on Jun 2015	Modifiable risk factors for NCD	Adults	Personal skills, social support networks, education, social environment	Health stations at parks and metro stations offering free BP, glycaemia, weight control, and brief dietary counselling sessions. Also included group educative activities and offer of physical activity classes and other sports events	more than 780.000 persons (sample: 605 adults)		Following the participation in HS, adults reported that they acquired new knowledge regarding-benefits of physical activity (61.2%) and healthy diet (59.7%) how to practice physical activity (40%), or what foods should eat to maintain a healthy diet (40%) Forty-four % reported doing more physical activity, 54 % eating more fruits and vegetables and 51 % adding less salt to food than before the program	High
Calandrelli <i>et al.</i> , (2002)	Prevention campaign "San Carlos de Bariloche "Clinic	Bariloche	2000–2001	7	Cross Sectional	Hypercholesterolemia	Adults	Personal skills	Media campaign	Unknown, probably more than 1000 subjects	Blood cholesterol samples. Survey on behavioral changes	Reduction of cholesterol levels. OR 2.67	Medium
Ferrante <i>et al.</i> , (2011)	Feasibility of reducing salt in processed foods in Argentina	9 de Julio	2009	24	Crossover clinical trial and cross-sectional survey	High blood pressure	General population	Social environment and health nutrition	Changes in sodium content of bread. Healthy food choices	2150 Bakerites, 98 volunteer subjects		Reduction of 25 mEq in 24 h sodium excretion in urine, decreased systolic blood pressure of 1.66 mmHg	High

(continued)

Table 1: (Continued)

Study (author year of publication)	Name of the intervention	City	Year of implementation	Duration (months)	Design	Risk factor addressed	Target population	Health determinants	Implementation strategy	N intervened	Process evaluation	Impact evaluation	Adaptability
Ferrante and Macchia (2012)	Reduction of sodium and trans-fat acids in food in La Pampa Province	La Pampa	2009	?	Cross sectional	High blood pressure	General population	Social environment	Training of bakers (supplying measuring tools to add a standard quantity of salt), along with food quality control and communication strategies within the frame of the campaign "Menos sal, más vida" (Less salt, more life)	Surveys were conducted to all bakeries (<i>n</i> =72) and in 355 restaurants in the 3 most populated cities of La Pampa)	NA	The intervention was restricted to salt reduction in bakeries. 80,6% of bakeries participated. Salt content estimated through surveys was reduced in bread (1.7% vs. 1.4% of salt, <i>p</i> < 0.001) and other products (crackers: 3.2% vs. 1.6%, <i>p</i> < 0.001). Through laboratory analysis a non-significant reduction was observed in crackers (2.16–1.7%, <i>p</i> =0.17). No changes were observed in sodium intake in the 77 subjects included	High
González <i>et al.</i> (2016) (RASP in Press)	Estaciones Saludables (Health Stations Program, HSP)	Buenos Aires	2012–2015	3y	Records of the programs	Modifiable risk factors for NCD	All		Health stations at parks and metro stations offering free BP, glycaemia, weight control, and brief dietary counselling sessions. Also include group educative activities and offer of physical activity classes and other sports events	831 784	From Jan 2012 to Oct 2015, 831 784 people visited the HS. (44% men; 56% women). 96% adults. There were 2 901 331 consultations (2 433 791 from Nurse service and 467 540 brief nutrition counseling sessions). There were about 20 000 first-time visits per month. During the visits the program facilitated 4294 users to enter the Public City Health Plan. 10 773 people participated in educative activities and on average of 8212 people/month participated of the sport activities such as classes of yoga, running and other activities	High	

(continued)

Table 1: (Continued)

Study (author year of publication)	Name of the intervention	City	Year of implementation	Duration (months)	Design	Risk factor addressed	Target population	Health determinants	Implementation strategy	N intervened	Process evaluation	Impact evaluation	Adaptability
Marin <i>et al.</i> (2009)	Add Health to Your Years	Berisso	2006–2007	12	Quasi-experimental. Integrated interventions	Physical inactivity and inadequate diet	Elderly population (65 years and older)	Social environment, social networks, personal skills	Personal and group education. Social networks generation. Ongoing workshops for seniors	350		SBP: 15.3% decrease in intervened group ($p < 0.01$). Percent change-2.7% mmHg/BMI: % of pre-intervention subjects $> 25 = 49.1\%$. Post-intervention = 31.0% ($p = 0.01$)	High
Marin <i>et al.</i> (2009)	The Public Squares of Health	La Plata	2010	9	Quasi-experimental. Integrated interventions	Physical inactivity	Adults	Personal skills and social networks	Sporting activities, recreational and cultural meetings, by trained personnel. Radio Program	Approximately 750 adults	Public squares with rinks, trails and staircases used as resources for physical activity. Borg scale and ParQ questionnaire for physical activity. Anthropometric measurements	Sustainable activities were delivered. More than 300 subjects adopted regular physical activity habits	High
National University of La Plata (PROPIA program) (Bardach <i>et al.</i> , 2001; Bardach <i>et al.</i> , 2005)	Balcarce National Demonstration Project. Process and Impact Evaluations	Balcarce	2000–2005	60	Uncontrolled before-after study. Probability Sampling	Modifiable risk factors for NCD	General population	Social support networks, education, physical and social environments	Initial cross-sectional behavioral survey and biochemical measurements in 2177 subjects. Multiple levels: Media campaign, individual and group education.	More than 3000 people	Process and Impact indicators registered. Survey done in 1886 subjects. 37% general knowledge of the project. 16% active involvement in Demolab Project	Significant positive changes in reported smoking cessation attempts, active lifestyle and use of salt and fats in cooking	High
Rosario Municipality, Province of Santa Fe (Municipalidad de Rosario, 2008)	Cardiovascular Health Promotion in the city of Rosario	Rosario	2004–2005	24	Uncontrolled before and after study	Dyslipemia, arterial hypertension, obesity and y sedentarianism, active and passive smoking	Adults, urban area		Physical Environment/Food/individual capabilities. Community Health Workers Strategy	Unknown	16,000 direct beneficiaries, five schools started health nutrition programs, 100 community pharmacies accredited	Not reported	High
Salazar <i>et al.</i> (2005, 2014)	Community-based intervention to lower blood pressure	Rauch	1997–2003	?	Cross-sectional surveys in 1997 and 2003	High blood pressure	General population	Social environments	Multiple activities of health promotion. media campaign	1307		A total of 1307 subjects (85.65%) were re-interviewed. SBP decreased from 137.98 ± 0.57 – 132.49 ± 0.53 mm Hg ($p < 0.01$) and DBP of 88.73 ± 0.38 – 81.87 ± 0.33 mm Hg ($p < 0.01$). Eight years after the intervention had stopped. 1124	High

(continued)

Table 1: (Continued)

Study (author year of publication)	Name of the intervention	City	Year of implementation	Duration (months)	Design	Risk factor addressed	Target population	Health determinants	Implementation strategy	N intervened	Process evaluation	Impact evaluation	Adaptability
Rubinstein <i>et al.</i> (2016)	mHealth intervention to improve the cardiometabolic profile of people with prehypertension in low-resource settings	Health-care centers, workplaces, and community centers in low-resource urban settings in Argentina, Guatemala, and Peru.	2012	12 month	Parallel-group, randomized controlled trial	High blood pressure, obesity, waist circumference, physical activity and dietary quality	Adults (30–60 years) with prehypertension	Personal skills	Monthly motivational counseling calls and weekly personalized text messages to their mobile phones about diet quality and physical activity, vs. usual care	637 participants (212 in Argentina), 316 in the intervention group	The intervention did not affect change in SBP (mean net change -0.37 mm Hg [95% CI -2.15 – 1.40]; $p=0.43$) or DBP (mean net change 0.01 mm Hg [95% CI -1.29 – 1.32]; $p=0.99$) compared with usual care. Significant net reduction in body weight (-0.66 kg [-1.24 to -0.07]; $p=0.04$) and intake of high-fat and high-sugar foods (-0.75 [-1.30 to -0.20]; $p=0.008$) in the intervention group compared with the control group	Individuals of the cohort were surveyed to evaluate incident CVD events. Individuals who had increased SBP showed an adjusted HR for CVD that was double that of those whose SBP levels decreased or did not change	High
Testasecca <i>et al.</i> (2004)	Faculty of Medical Sciences, Cuyo. Primary Care Clinic	Mendoza	2003	3	Non-randomized, controlled field clinical trial	High blood pressure, obesity, dyslipidemia	Adults	Personal skills	Nutritional counseling in dyslipidemia and hypertension primary prevention	50	SBP: pre intervention= 153 ± 26 . Post-intervention 125 ± 13 BMI change units: Pre= $BMI 30 \pm 5$. Post= $BMI 29 \pm 4$ Changes in cholesterol: Pre= 216 ± 47 188 ± 41 Post-intervention Changes in HDL: Pre: 41 ± 17 45 ± 18 Post= $Changes in \pm 18$ TG: Pre= 172 ± 47 . Post= 140 ± 72 Changes in LDL: Pre: 139 ± 40 115 ± 31 Post	Medium	

Table 2: Characteristics of studies included that evaluated public policies (Tobacco legislation), Argentina, 1999–2016

Study (author year of publication)	Name of the intervention	City	Year of implementation	Design	Risk Factor Addressed	Target Population	Health Determinants	Implementation Strategy	Intervened	Process evaluation	Impact evaluation	Adaptability
Ferrante <i>et al.</i> (2012b)	100% smoke-free legislation	Santa Fe and Buenos Aires	3 years (2006–2009)	Time series analysis Compared before and after the implementation of the laws	Dyslipemia, arterial hypertension, obesity and sedentarism, active and passive smoking	Smokers and Second Hand in the National Risk Factor Survey	Lifestyles	The final intervention (multicomponent) was tailored according to the barriers identified in the first qualitative phase. All interventions were implemented in each PHC, but the intensity of each component was adjusted according to the main barrier at each site	Buenos Aires (n=2000) and Santa Fe (n=2000)	In 2009, more smokers attempted to quit in the year prior to the survey in Santa Fe than in Buenos Aires (53.2%, 95% CI 42.5–63.6% vs. 44.4%, 95% CI 34.3–55.0%, p=0.045). No changes were observed in the proportion of daily smokers or cigarettes consumed per day in both provinces, both in 2005 and 2009. In 2009, SHS exposure in specific public places tended to be lower in Santa Fe compared with Buenos Aires, although none of the differences was statistically significant	In Santa Fe, an immediate decrease in ACS admissions was observed after implementation (2.5 admissions per 100 000, p<0.03; 13% reduction), compared with no change in Buenos Aires city (increase of 1.74 admissions per 100 000 inhabitants, 95% CI 1.43–4.92, P=0.28)	High
Ministerio de Salud de la Nación Argentina (2009)	100% Tobacco Free Legislation	Rosario (Santa Fe province) and Buenos Aires City	2005–2006	Ecological study. Interrupted time series using the ARIMA model	Active and passive smoking	Adults	Social environment	Tobacco-Free Legislation	Unknown	In Santa Fe, there were 1591 admissions in 2005, before the law and 1602 in 2006. In 2007, there were 1140 hospitalizations for ACS, representing a reduction of 28.3% between 2006 and 2007 (95% CI 26.1–30.6%)	In Santa Fe, there were 1591 admissions in 2005, before the law and 1602 in 2006. In 2007, there were 1140 hospitalizations for ACS, representing a reduction of 28.3% between 2006 and 2007 (95% CI 26.1–30.6%)	High
Ministerio de Salud de la Nación Dirección de Promoción de la Salud y Control de Enfermedades No Transmisibles (2011)	Tobacco Legislation	15 Jurisdictions of Argentina	2010	Cross sectional study 483 buildings between Nov and Dec 2010 Convenience sampling (governmental buildings, public hospitals, universities, airports, bus stations, bingo, casinos)	Active and passive smoking	General population	Social environment	Tobacco Legislation	Unknown	In the surveyed establishments, where a 100% smoke-free law did not apply compliance with current legislation was lower (60.67% vs. 78.70% p<0.001). In bus terminals, discotheques and universities non-compliance was higher (64%, 57% and 54%, respectively)	In the surveyed establishments, where a 100% smoke-free law did not apply compliance with current legislation was lower (60.67% vs. 78.70% p<0.001). In bus terminals, discotheques and universities non-compliance was higher (64%, 57% and 54%, respectively)	High

(continued)

Table 2: (Continued)

Study (author year of publication)	Name of the intervention	City	Year of implementation	Design	Risk Factor Addressed	Target Population	Health Determinants	Implementation Strategy	N Intervened	Process evaluation	Impact evaluation	Adaptability
Schoj <i>et al.</i> (2010b)	Smoke-free provincial level	Santa Fe and Rosario (Santa Fe), Corrientes (Corrientes), Tucumán (Tucumán), Córdoba (Córdoba) city of Buenos Aires, Tandil, Mar del Plata Olavarría, La Plata, Morón, Bahía Blanca (Buenos Aires), Neuquén (Neuquén), Godoy Cruz and Mendoza (Mendoza)	2007–2009	and discos) probability sampling (bars, restaurants) Cross sectional (comparison between 100% smoke-free, comprehensive smoke-free legislation) and without tobacco legislation)- Uncontrolled before-after study (before and after 100% smoke-free legislation)	Active and passive smoking	Adults	Social environment	Tobacco Legislation	Up to August 2010, about 35.9% of the total Argentinean population was covered by 100% smoke-free policies	In the three cities evaluated before and after legislation, PM2.5 levels decreased dramatically ($p < 0.001$ each). Across all five smoke-free cities the mean PM2.5 level was lower during daytime vs. evening hours, 24 vs. 98 PM2.5 respectively ($p = 0.012$). The non-smoking areas in cities with partial legislation had significantly higher ($p = 0.017$) PM2.5 levels compared with 100% smoke-free venues in the same city (two-fold higher) PM2.5 levels were five times higher ($p < 0.001$) in cities with no legislation compared with those with 100% or comprehensive legislation	High	High
Schoj <i>et al.</i> (2010a)	100% smoke-free legislation in bars and hotels in Neuquén	Neuquén	2007–2008	Uncontrolled before-after study	Active and Passive smoking	Hotels and bars employees	Social environment	Tobacco-Free Legislation	71 bars and restaurants	Pre-ban: exposure in hours = 8, post = 0, respiratory symptoms pre-ban = 57.5% and post 7.28 to ($p < 0.001$) Exertional dyspnea 41.2 vs. 16.2 ($p < 0.002$). Spirometry FVC 88% vs. 96% ($p < 0.001$)	High	High

15 cities with different types of legislation. Most of the participating cities had significantly lower PM_{2.5} levels after the implementation of 100% smoke-free legislation as compared with cities with no legislation or with partial smoking restrictions. They also compared PM_{2.5} levels before and after 100% smoke-free legislation in three cities, evidencing a significant important mean reduction, even when across all five smoke-free cities the mean PM_{2.5} level was higher during evening hours vs. daytime. Moreover, *Schoj et al. (2010a)* assessed the impact of the 100% smoke-free legislation on hotel and pub workers in the city of Neuquén. In this province, a banning to smoke in bars and restaurants has been in force since 2004. The evaluation consisted of a questionnaire administered to workers in these places before and 3 months after the legislation implementation. The study showed significant changes in smoke exposure before and after the ban, and some positive changes in spirometry parameters. On the other hand, the National Program for Tobacco Control of Argentina's Ministry of Health undertook in 2006–07 an assessment on the reduction in hospital admissions due to acute coronary syndromes after the successful implementation of the legislation '100%' smoke-free in the provinces of Santa Fe and Buenos Aires (*Ministerio de Salud de la Nación Argentina, 2009*). An interrupted time series design was selected, using the ARIMA statistical model. The authors reported that the number of hospitalizations for acute coronary syndrome in the province of Santa Fe pre- and post-intervention showed a significant reduction. A marked decrease in hospitalizations after implementation of the law was evident (*Ferrante et al., 2012b*). Besides, in 2009, more smokers attempted to quit in the year prior to the survey in Santa Fe than in Buenos Aires (53.2%, 95% CI 42.5–63.6% vs. 44.4%, 95% CI 34.3–55.0%, $p = 0.045$). No changes were observed in the proportion of daily smokers or cigarettes consumed per day in both provinces, both in 2005 and in 2009. In 2010, the Ministry of Health conducted a cross sectional study in 15 jurisdictions to evaluate the compliance with legislations implemented at subnational levels (*Ministerio de Salud de la Nación, 2011*). The study included direct observation in 483 buildings, key informant interviews and a survey to characterize the type of legislation. The report concluded that compliance was low at that time, but they identified some characteristics that were associated with higher compliance. One hundred percent smoke-free legislation, active compliance monitoring, penalizing infringers and a specific budget to control tobacco were significantly associated with better compliance with legislation.

Alecio et al. (2004) carried out the 'Madryn no Pares' program, in the province of Chubut in force from 2004 to 2010. It involved workshops on capacity building on preventive practices delivered at secondary schools of the city of Puerto Madryn. It also utilized mass-media communication campaigns in local newspapers and magazines, radio and TV spots. It was estimated that more than 3200 people participated, and detailed process information is available.

DISCUSSION

We systematically collected published and unpublished information on experiences in health promotion and primary cardiovascular prevention in Argentina in the past 17 years, focusing on population-based interventions which included a proper assessment of their implementation and impact on population health.

Of the many experiences that emerged after the search, only a small number of them met the proposed inclusion criteria. Most of the selected projects were conducted in different cities of the Province of Buenos Aires, the most densely populated province in Argentina. Other important provinces have also reported studies with evaluations of adequate methodological quality, like Santa Fe and Mendoza. All included studies found measurable benefits after the implementation of the programs or policies. Mostly, the results reported were about process evaluation, with few reported measurements on health outcomes. We identified other relevant 76 experiences that did not match the inclusion criteria.

Several national Ministry programs ('Municipios y Comunidades Saludables', 'Argentina Saludable', 'Sports and Health' 'Tobacco Control National Program [TCNP]', 'Essential Functions on Public Health') and campaigns ('100 000 hearts', 'National campaign for increasing the consumption of fruits and vegetables', 'Argentina 2014 Free of Trans Fat') relevant to this review were evaluated. Regarding CVD and diabetes policies, except for those of the TCNP, for which the four studies evaluating public policies were described, no published study or report evaluating implementation or impact was identified.

Several experiences with community health workers specific training in CVD prevention have been identified in the cities of Mar del Plata, Marcos Paz, Ensenada, Boulogne, La Plata, Brandsen, Neuquén and Córdoba, although no published formal evaluation of them was identified.

Regarding policy modeling, an economic evaluation of several potential risk factor control policies found

Table 3: Methodological quality appraisal of included studies

Study (year)	Participant's selection ^a	Definition, and measurement of key variables ^a	Control of confounders ^a	Comparability among groups ^a	Statistical methods excluding confounding ^a	Conflicts of interest	Global risk of bias
Alecio (2010) (Alecio <i>et al.</i> , 2004) ^b	No	Partially	NA	NA	Yes	No	High
Antún <i>et al.</i> (2014)	No	Yes	No	NA	No	Yes	High
Antun <i>et al.</i> (2015)	No	Yes	No	NA	No	No	High
Calandrelli <i>et al.</i> (2002)	No	No	NA	NA	Yes	No	High
Ferrante <i>et al.</i> (2011)	No	Yes	No	No	Yes	No	Moderate ^c
Ferrante and Macchia (2012)	No	Yes	No	No	Yes	No	Moderate
Ferrante <i>et al.</i> (2012b)	No	Yes	Yes	Yes	Yes	No	Moderate
González <i>et al.</i> (2016)	No	Yes	No	NA	No	No	High
Marin <i>et al.</i> (2009)	No	Partially	NA	NA	Yes	No	High
Marin <i>et al.</i> (2009)	No	Partially	NA	NA	Yes	No	High
Ministerio de Salud de la Nación Argentina (2009)	Partially	Yes	NA	NA	Yes	No	Low
Ministerio de Salud de la Nación Dirección de Promoción de la Salud y Control de Enfermedades No Transmisibles (2011)	No	Yes	No	NA	Yes	No	Moderate
Municipalidad de Rosario (2008)	NA	Yes	NA	NA	SI	No	Moderate
National University of La Plata, DEMOBAL	No	Yes	No	No	Yes	No	High
Project (Tavelia <i>et al.</i> , 2000; Bardach <i>et al.</i> , 2001, 2005)	Yes	Yes	Yes	Yes	Yes	No	Low
Rubinstein <i>et al.</i> (2016)	Yes	Yes	NA	NA	Yes	NA	Moderate
Salazar <i>et al.</i> (2005, 2014)	Yes	Yes	NA	NA	Yes	NA	Moderate
Schoj <i>et al.</i> (2010a)	Yes	Yes	NA	NA	Yes	No	Low
Schoj <i>et al.</i> (2010b)	No	Yes	No	Yes	Yes	No	Moderate
Testasecca <i>et al.</i> (2004)	No	Yes	NA	NA	Yes	No	High

NA, not applicable.

^aYes= fulfilled the criteria.

^bMethodological appraisal done with the Cochrane Collaboration checklist for RCTs (see Methods section).

that salt reductions in bread and a multidrug therapy oriented to persons with high absolute risk would be cost-saving for Argentina (Rubinstein *et al.*, 2010). Another salt in food model carried out by the Ministry of Health reported similar results (Ministerio de Salud de la Nacion Argentina, 2011). Another study showed that a health education through mass media campaigns would also be cost-effective (Rubinstein *et al.*, 2009). Konfino *et al.* (2012) published recently a study using the WHO Coronary Heart Disease (CHD) Policy Model to project future CV events. They estimated that the annual percent reduction would be 3% for CHD deaths, 3% for myocardial infarctions and 1% for stroke if tobacco law were fully implemented. Other study, evaluating the impact of Argentine policies to reduce trans fatty acids on coronary heart disease, established that more than 1500 deaths and 5000 CHD events could be averted annually by achieving the reduction of intake (Rubinstein *et al.*, 2015). Strategies to reduce salt intake in Argentina would also lead to positive health impacts (Ferrante *et al.*, 2012a; Konfino *et al.*, 2013).

In Latin America, some studies have been published in the field of CVD health promotion, such as the ‘Agita Sao Paulo’ program (Matsudo, 2002; Matsudo *et al.*, 2003) in Brazil and the ‘Vida Chile’ study (Vio, 2005; Salinas *et al.*, 2007). These two studies constitute useful models for promoting physical activity in the general population. Other experiences related with risk factor prevention were done in Mexico (Córdova-Villalobos *et al.*, 2008).

We can see that in Argentina, there is a growing interest in promoting and protecting cardiovascular health addressing significant risk factors. A large and growing number of initiatives to prevent them were implemented. However, proper process and outcome evaluations—which are of outmost importance in order to plan the appropriate resource use—were not usually planned or reported with detail. In those studies that met our inclusion criteria, the most frequent strategies used for achieving changes were media interventions (printed, radio broadcasting), workshop for group education, individual counseling sessions, healthy stations at public squares and parks, recreational and social physical activity groups and community health workers strategies. Many of these interventions were effective (Table 1), although the degree of implementation varied widely and was not high enough to reach all the population (e.g. interventions described for the programs in Balcarce or in Rosario). Some of other reasons for exclusion included interventions targeted to secondary prevention of CHD or diabetes, having been carried out only in children, or not being a community-based program or policy.

Regarding the risk of bias, we observed that the majority of experiences were deemed to entail moderate or high risk of bias, while only three had low risk of bias. The main domains which lowered methodological quality were lack of representativeness (selection bias), and information bias of key variables. This suggests that the overall quality of the evidence found on the effectiveness is community-based CVD programs in Argentina is low to moderate which could limit the replicability of interventions. Future studies should increase research value by using solid epidemiological designs and to ensure replicability of interventions.

As a shortcoming of this systematic review, the information identified may represent only a very small percentage of what was actually done in cardiovascular health promotion in the country. Many valuable and adaptable experiences undoubtedly existed, but may have not been published. On the other hand, the main strengths of the present review are the use of reproducible search strategies and predefined replicable inclusion and exclusion criteria, and the incorporation of a manual search of references, gray literature and contact with key informants.

The main challenges for prevention and control of NCDs are clearly described in the Global Strategy and Plan of Action of the WHO. Argentina’s Ministry of Health issued in 2009 the National Strategy for Prevention and Control of NCDs, which assimilates various components of the WHO Global Strategy on Diet and Physical Activity. In addition to government action, it will be important that various sectors and initiatives get involved, including integrated community programs, the strategy of community health workers and the incorporation of new technologies.

During the last decade, many countries in Latin America have experienced a large economic growth. However, the increasing burden of NCDs in the region threatens the economic development, as a result of rapidly growing and aging populations. These conditions also drive inequity and create significant challenges to development, as it was acknowledged in the Sustainable Development Goals (SDGs), recently launched by the UN, which include in its third goal to ensure healthy lives and promote well-being, a target for a one-third reduction in premature mortality from NCDs by 2030 (United Nations). In this regard, our report can give a valuable country perspective on how LMIC, which are disproportionately suffering the burden of CVD, are implementing effective strategies to counter this increasingly larger burden of disease. It is highly important to have information about which strategies show greater population impact. Although the transferability of

experiences between countries may be difficult, in the absence of information on the most effective strategies for one specific country, having information from other countries allows an initial screening of the type of interventions that are generally more successful (Barnes *et al.*, 2012). This helps to optimize the use of resources and also identifies potential barriers and facilitators for implementation.

To conclude, we summarized the findings and characteristics of important population-based studies and public policies relevant to CVD health promotion and primary prevention in Argentina. This represents the first systematic review of interventions, programs and policies in primary prevention and cardiovascular health promotion in Argentina.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Health Promotion International* online.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest.

ETHICAL ASPECTS

This work was approved by the Institutional Review Board of the 'Hospital Italiano de Buenos Aires', under protocol number #1406 in April 2009.

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