ORIGINAL ARTICLE

Relationship between knowledge of cardiovascular disease risk factors and watching educational television materials

Małopolska CArdiovascular PReventive Intervention Study (M-CAPRI)

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KEY WORDS

cardiovascular disease prevention, media education, population-based approaches, risk factors, television campaign

ABSTRACT

INTRODUCTION The current guidelines on cardiovascular disease (CVD) prevention in clinical practice emphasizes the importance of education in the media for population-based approaches.

OBJECTIVES The aim of the study was to assess the relationship between knowledge of CVD risk factors and watching educational television materials in the adult population.

PATIENTS AND METHODS After 22 months of repeated broadcasting of educational television materials, which addressed problems related to CVD, a postal survey was conducted on a random sample of 5000 persons aged 18 years or older. The questionnaire included information on demographics, personal and family history of CVD, educational materials, and knowledge of the risk factors. A multivariate logistic regression was used to assess the relationship between the knowledge of each risk factor and watching educational materials.

RESULTS A total of 1129 questionnaires were sent back and used for the analysis. There were 208 participants (18%) who watched the educational materials. The median number of the risk factors listed was 4 (interquartile range, 2–5) for persons who watched the materials and 2 (interquartile range, 0–4) for those who did not watch them. After adjustment for age, sex, education, place of residence, and personal and family history of CVD, the participants who watched the educational materials were 2 to 5 times more likely to have knowledge on particular risk factors, with the exception of hypercholesterolemia for which the relationship was not significant.

CONCLUSIONS A strong, plausible relationship revealed by our study supports the idea that in the adult population, better knowledge of CVD risk factors was the effect of watching educational materials.

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INTRODUCTION Cardiovascular disease (CVD) prevention is defined as a coordinated set of actions, both at the public and individual levels, aiming at eliminating or minimizing the impact of CVD and the related disability.[1] There are 2 main strategies of prevention. The first is a high-risk strategy that aims at the detection of all high-risk individuals and reducing their exposure to the major risk factors. The second one is the population strategy that aims at reducing the incidence of CVD at the population level through lifestyle and environmental changes targeted at the population at large. The latter follows the Geoffrey Rose's paradigm: small shifts in the risk of a disease (or a risk factor) across a whole population lead to a greater reduction in the disease burden than a large shift only in high-risk individuals. Indeed, the majority

of cardiovascular events occur in a group of people at modest cardiovascular risk. Consequently, the impact of the population approach on the total number of cardiovascular events is likely to be more effective than focusing on high-risk individuals.[1,2]

Health education is a key element of both the high-risk strategy and the population strategy. It aims to provide cardiovascular knowledge and motivate people to change their lifestyles and follow medical recommendations. In earlier studies, a low educational level was related to higher exposure to CVD risk factors and the knowledge of these factors was related to a lower risk of death.[3,4] Besides the traditional recommendations for the education of patients and high-risk persons addressed to general practitioners, the recent European guidelines on CVD prevention emphasizes the importance of education in the media for population-based approaches to smoking, physical activity, diet, and alcohol abuse.[1]

Małopolska is a region in Poland characterized by average mortality due to the diseases of the circulatory system, and by less prevalent smoking and hypercholesterolemia, but at the same time, by a similar prevalence of obesity and hypertension as the rates for the whole country.[5-8] In 2012, a program for the prevention and detection of CVD in the population of the Małopolska Voivodeship was started; its goal was to reduce the mortality from and incidence of CVD and to improve the health and quality of life of the residents of the voivodeship. The program was commissioned by the Marshal's Office of the Małopolska Voivodeship and has been coordinated by the staff from John Paul II Hospital in Kraków. An important part of this program was the development of educational materials for television (TV), with participation of known experts from the field of CVD prevention, as well as short promotional spots that were broadcast by a local TV station (TVP Kraków).[9] It seems obvious that evaluation measures are needed to document the successful implementation of every prevention program. However, in general, little is known about the effectiveness of health education in the mass media in the Polish population. Therefore, the aim of this study was to assess the relationship between knowledge of CVD risk factors and watching educational materials on TV in the adult population.

PATIENTS AND METHODS The study was conducted as part of the Małopolska CArdiovascular PReventive Intervention Study (M-CAPRI) program. The methods of the program were described previously.[9,10] Briefly, from November 2012 to May 2013 and from January 2014 to November 2014, educational materials were broadcast on TVP Kraków. The materials consisted of 13 short promotional spots, lasting 30 seconds each, and 9 episodes (15 minutes each) for a regular cycle of TV programs called *Magazyn Medyczny* (Medical Magazine). The spots featured Justyna Kowalczyk, a popular cross-country skier, who was voted the Polish Sports Personality of the Year 5 times in a row (2009–2013) by the magazine *Przegląd Sportowy* (Sports Review) and the Polish public broadcasting TV. They addressed problems related to myocardial infarction, stroke, hypertension, diabetes, alcohol use, smoking, stress, low physical activity, obesity, high blood cholesterol levels, CVD risk related to influenza, unhealthy diet, and prevention in children and adolescents. The episodes of *Magazyn Medyczny* featured interviews with experts who debated the same problems in greater depth.[9] The spots were broadcast during *Magazyn Medyczny* or separately.

After 22 months of repeated broadcast of the educational materials (short spots aired 509 times, and the episodes of *Magazyn Medyczny*, 36 times), a postal survey was conducted on 5000 residents of the Małopolska Voivodeship, aged 18 years or older. The sample selection method was simple random sampling. The sampling frame was the registry of residents of the Małopolska Voivodeship. The methods of data collection were the same as in the 2012 survey, namely, a standard questionnaire was sent to the participants by post.[10] The shipment included a letter from the voivodeship consultant in cardiology, in which the rationale for the study was explained and the participants were asked to complete the questionnaire anonymously and to send it back in the attached return envelope. Participants did not have to bear the cost of shipment. The questionnaire included questions on sex, age, level of education (primary, vocational, secondary, or university degree), place of residence (Kraków, other town, or village), personal history of CVD (coronary artery disease or myocardial infarction or stroke) and family history of CVD, TV programs watched by respondents, recognition of promotional materials, and knowledge of CVD risk factors. The latter was assessed using 2 questions, which were a modification of the questionnaire used in a study on the effectiveness of the National Program of Primary Prevention.[11] The first question allowed us to assess whether a respondent was familiar with the term "risk factor," and the second one was an open question in which participants were asked to list all the known risk factors. The answers were coded using a standard coding system.[10] The M-CAPRI Program was approved by the local ethics committee (116/KBL/OIL/2012).

The differences between the groups were tested using the χ^2 test, *t* test, and Mann–Whitney test. The results were presented as percentages of persons aware of CVD risk factors in a group of participants who watched and who did not watch the educational materials. The Mantel–Haenszel procedure was used to assess the inequality of the relations between the knowledge of CVD risk factors and watching education materials after stratification by covariate classes (Supplementary material online, *Table S1*). To adjust for the potential confounders, 2 main models of multivariate

TABLE 1 Sex, age, education, place of residence, and family and personal history of cardiovascular disease in the total study sample and in persons who watched and who did not watch educational materials

Parameter		Total sample	Watching educational materials		*P* value
			No	Yes	
Men, n (%)		439 (39.3)	377 (41.4)	62 (30.2)	<0.01
Age, y, mean (SD)		49.4 (16.23)	48.6 (16.12)	52.7 (16.33)	<0.001
Education, n (%)	Primary or vocational	279 (24.9)	209 (22.8)	70 (33.8)	<0.01
	Secondary	437 (39.0)	362 (39.6)	75 (36.2)	
	University	406 (36.2)	344 (37.6)	62 (30.0)	
Place of residence, n (%)	Rural	452 (40.3)	384 (42.0)	68 (32.7)	<0.05
	Small town	380 (33.8)	302 (33.0)	78 (37.5)	
	Kraków	291 (25.9)	229 (25.0)	62 (29.8)	
Family history of CVD, n (%)		565 (51.5)	430 (48.3)	135 (65.5)	<0.001
Personal history of CVD, n (%)		149 (14.8)	107 (13.0)	42 (22.7)	<0.001
Personal history of CVD, n (%)	Myocardial infarction	43 (4.3)	32 (3.9)	11 (6.2)	<0.01
	Stroke	28 (2.9)	19 (2.4)	9 (5.1)	<0.05
	Coronary artery disease	126 (12.2)	90 (10.7)	36 (18.9)	<0.001

Abbreviations: CVD, cardiovascular disease

TABLE 2 Percentage of persons with the knowledge of cardiovascular disease risk factors in the total study sample and in persons who watched and who did not watch educational materials

Risk factor	Total sample	Watching educational materials		*P* value
		No	Yes	
Hypertension	330 (29.2)	229 (24.9)	101 (48.6)	<0.001
High blood cholesterol levels	122 (10.8)	92 (10.0)	30 (14.4)	NS
Diabetes	154 (13.6)	86 (9.3)	68 (32.7)	<0.001
Obesity	395 (35.0)	291 (31.6)	104 (50.0)	<0.001
Unhealthy diet	294 (26.0)	217 (23.6)	77 (37.0)	<0.001
Alcohol	77 (6.8)	67 (7.3)	10 (4.8)	NS
Smoking	502 (44.5)	384 (41.7)	118 (56.7)	<0.001
Low physical activity	461 (40.8)	355 (38.6)	106 (51.0)	<0.01
Stress	481 (42.6)	370 (40.2)	111 (53.4)	<0.001
Family history of CVD	58 (5.1)	44 (4.8)	14 (6.7)	NS

Data are presented as number (percentage) of participants.

Abbreviations: NS, not significant; others, see TABLE 1

logistic regression were constructed. The first included only age and sex, and the second included age, sex, education, place of residence, and personal and family history of CVD (full adjustment). In addition, a sensitivity analysis using the models with a variety of combinations of the characteristics listed above and different definitions of personal history of CVD was performed. Statistical significance was accepted at a *P* level of less than 0.05. The analysis was performed using the statistical package Statistica PL ver. 12 (StatSoft Inc.; Tulsa, Oklahoma, United States).

RESULTS Of the 5000 questionnaires that were sent out, 1129 were returned and used for the analysis (22.6% of the initial sample). There were 99 participants (9%) who reported watching *Magazyn Medyczny* and 144 participants (13%) who recalled Justyna Kowalczyk from the promotional spots on CVD risk factors. In combination, 208 participants (18%) were defined as persons who watched educational materials, that is, either watched *Magazyn Medyczny* or recalled Justyna Kowalczyk from the promotional spots.

There were more women, older people, persons with low educational level, urban residents, and persons with personal or family history of CVD among persons who watched the educational materials, as compared with those who had not watched the materials (TABLE 1).

With the exception of alcohol, knowledge about all CVD risk factors was more prevalent among participants who watched the educational materials. The differences were statistically significant for hypertension (48.6% vs 24.9%), diabetes (32.7% vs 9.3%), obesity (50% vs 31.6%), unhealthy diet (37.0% vs 23.6%), smoking (56.7% vs 41.7%), low physical activity (51% vs 38.6%), and chronic stress (53.4% vs 40.2%) (TABLE 2).

In general, participants who watched the educational materials could list more risk factors than participants who did not watch those materials. The median number of risk factors listed was 4 (interquartile range, 2–5) for persons who watched the materials and 2 (interquartile range, 0–4) for those who did not watch them (FIGURE 1).

The relation between watching educational materials and knowledge of CVD risk factors varied by age, sex, education, place of residence, and personal and family history of CVD, although the results were not stable and were frequently nonsignificant (Supplementary material, *Table S1*). After adjustment for age and sex, participants who watched the educational materials were 2- to 5-fold more likely to have knowledge about particular risk factors, with the exception of high blood cholesterol levels, for which the difference was not significant. Further adjustment for educational level, place of residence, and personal and family history of CVD did not attenuate the relationship (TABLE 3). The sensitivity analysis using models with combinations of the above characteristics and different definitions of personal history of CVD did not appear to change the results.

DISCUSSION The main finding of our study was that the knowledge of CVD risk factors is related to watching educational materials on TV. However, these results are slightly less optimistic if we consider the fact that in the total study sample, the level of knowledge was not different from the findings of the first M-CAPRI survey in 2012, which was conducted prior to the broadcast of the educational materials.[10] The latter observation

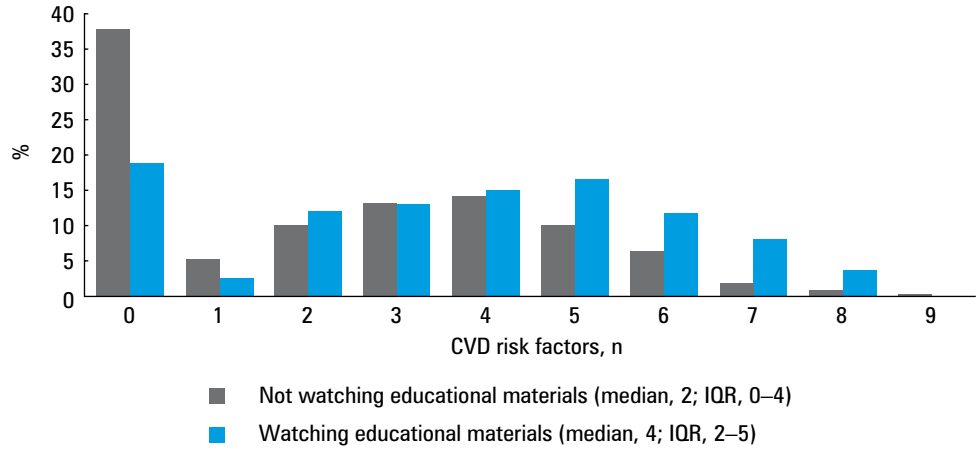

FIGURE 1 Distribution of the number of listed cardiovascular disease risk factors in persons who watched and who did not watch educational television materials
Abbreviations: IQR, interquartile range; others, see TABLE 1

TABLE 3 Relationship between knowledge of cardiovascular disease risk factors and watching educational television materials (reference group: people who did not watch educational television materials)

Knowledge of CVD risk factors	OR (95% CI)	
	Adjusted for age and sex	Fully adjusted[a]
Hypertension	2.82 (2.05–3.89)	2.80 (1.97–3.98)
High level of blood cholesterol	1.41 (0.90–2.23)	1.35 (0.82–2.22)
Diabetes	5.03 (3.44–7.36)	5.01 (3.31–7.60)
Obesity	2.28 (1.66–3.13)	2.60 (1.84–3.74)
Unhealthy diet	2.07 (1.49–2.88)	2.03 (1.41–2.91)
Smoking	2.06 (1.51–2.83)	2.14 (1.50–3.04)
Low physical activity	1.80 (1.32–2.46)	1.84 (1.30–2.61)
Chronic stress	1.90 (1.39–2.61)	1.90 (1.34–2.69)

a Adjusted for age, sex, education, place of residence, and personal and family history of CVD

Abbreviations: CI, confidence interval; OR, odds ratio; others, see TABLE 1

could be explained by the insufficient intensity of the education campaign.

The American Heart Association stated that media and education campaigns are the most effective when combined with other community, school, and health care system-based strategies.[12] Furthermore, a report by the Centers for Disease Control and Prevention suggested that in order to maximize success, such approaches must have sufficient frequency and duration to reach from 75% to 85% of the target audience and run for at least 6 months to increase awareness, 12 to 18 months to have an impact on attitudes, and 18 to 24 months to influence behavior.[12,13] In our study, less than 20% of the study respondents reported that they had watched the educational materials on TV. However, considering the low participation rate in the study, even this percentage might have been overestimated. Probably, the most important factor that contributed to insufficient effectiveness of the M-CAPRI campaign was that the educational materials were broadcast only on the local TV channel (TVP Kraków). The estimated audience of this channel varies from 50 000 to 500 000 people, which corresponds roughly to a maximum of 1.5% to 15% of the total population of the Małopolska Voivodeship.[14,15] The percentage of the target audience exposed to the M-CAPRI materials was probably far smaller than that in all other studies in which the respondents reported a greater awareness of the education campaign.[16-19] For example, in the BBC's campaign for obesity prevention, 29% of the respondents (corresponding to around 13 million adults) recalled seeing at least one of the educational programs.[16] In the Stanford Five-City Project, which was successful in providing knowledge about CVD and achieved a decrease in the CVD risk, the total exposure during the 5 years of education was calculated to be 26 hours per adult, and approximately 34% of this time was provided by TV and radio (on average, each adult was exposed to 527 educational episodes distributed fairly evenly over 5 years).[20]

The M-CAPRI short spots were broadcast 5 to 6 times a week in the years 2012 and 2013, and 9 to 10 times a week in 2014. *Magazyn Medyczny* was broadcast less than once a week in the years 2012 and 2013 and once in 3 weeks in 2014. During the 22 months of the campaign, the spots were broadcast 509 times and the episodes of *Magazyn Medyczny*, which were focused on CVD prevention, were broadcast 36 times. Altogether, the M-CAPRI materials took approximately 9 emission hours of *Magazyn Medyczny* and nearly 4.5 emission hours of promotional spots. It seems that the proportion of the target population who watched the materials was too small and the time of exposure was too short to influence the total population of Małopolska. However, it is possible that the M-CAPRI program could increase the knowledge of people who watched the educational materials on TV. Still, the question about the causality of the observed relationship remains open. The cross-sectional design of the study does not allow for any firm conclusion in this respect. Several other explanations are also possible, such as reversed causality (people who are aware of the CVD risk may seek more information on TV), nonrespondent bias, or confounding by social factors that are independent of formal education. The M-CAPRI educational

materials were more often watched by older people, women, less-educated participants, town residents, and by people with personal or family history of CVD. However, adjustment for age, sex, education, place of residence, personal and family history of CVD did not attenuate the relationship between watching education materials and the knowledge of CVD risk factors.

Our results are consistent with the results of other studies that investigated the association between watching advertisements or educational programs on TV and knowledge, attitudes, or health behaviors.[16,18,19] Furthermore, there is evidence that multiple-strategy programs that include health promotion by the media teach and even achieve a decrease in the CVD risk factors.[20-23] Media and education components, as a part of the multi-component strategies, have been estimated to account for at least 20% of the decline in tobacco use.[12,13] Our findings are also in accordance with the current guidelines for CVD prevention that call for action through the mass media for the population-based approach.[1]

Our study has several strengths including random sampling and an assessment of knowledge at a high level of operability by using standardized methods. However, besides the cross-sectional design, some other limitations of the interpretation of the results should be considered. The main weakness of the study is the low participation rate, which is related to a method used for the assessment of knowledge (anonymous postal questionnaire). A possible subsequent influence on the assessment of the percentage of population exposed to the educational materials on TV was mentioned above, and the other implications were discussed earlier.[10]

In conclusion, despite the limitations related to the interpretation of the results, finding a strong, plausible relationship supports the idea that in the adult population, better knowledge of the CVD risk factors was the effect of watching the educational materials on the local TV channel. Intensification of the TV campaign might be worth considering to achieve broader publicity and a greater effect on the awareness and to potentially decrease the exposure to known CVD risk factors.

Supplementary material Supplementary material is available with the article at www.pamw.pl.

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Contribution statement AW contributed to the design of the study, was involved in the data collection and in the data analysis, and wrote the paper. GK, JP, AS and KK participated in the M-CAPRI program and critically reviewed the paper. MK and KSz participated in the data analysis and critically reviewed the paper; AP conceived the idea of the study, participated in the design of the analysis, and critically reviewed the paper; and PP conceived the idea of the M-CAPRI program, assured and coordinated funding for the project, and critically reviewed the paper. All authors accepted the final version of the paper.

REFERENCES

1 Piepoli M, Hoes A, Agewall S, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice. (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). Eur Heart J. 2016; 37: 2315-2381. doi:10.1093/eurheartj/ehw106

2 Rose G. The strategies of preventive medicine. New York, NY: Oxford University Press; 1992.

3 Kozakiewicz K, Podolecka E, Syzdół M, et al. Relationship between education and cardiovascular risk score. Pol Arch Med Wewn. 2016; 126: 369-371. doi:10.20 452/pamw.3414

4 Waśniowska A, Kozela M, Podolec P, Pająk A. Knowledge of cardiovascular disease risk factors and the risk of death in middle-aged residents of Krakow. Kardiol Pol. 2017; 75: 386-394. doi:10.5603/KP.a2016.0180

5 Demographic Yearbook of Poland 2016. Central Statistical Office of Poland. Warsaw, Poland. 2016.

6 Drygas W, Bielecki W, Kozakiewicz K, et al. [The Multi-center National Population Health Examination Survey – WOBASZ]. In: Kopeć G, Jankowski P, Pajak A, Drygas W. [Epidemiology and prevention of cardiovascular diseases]. Kraków, Poland: Medycyna Praktyczna; 2015: 41–56. Polish.

7 Pająk A, Szafraniec K, Polak M, et al. Changes in the prevalence, treatment, and control of hypercholesterolemia and other dyslipidemias over 10 years in Poland: the WOBASZ study. Pol Arch Med Wewn. 2016; 126: 642-652. doi:10.20 452/pamw.3464

8 Stepaniak U, Micek A, Waśkiewicz A, et al. Prevalence of general and abdominal obesity and overweight among adults in Poland. Results of the WOBASZ II study (2013–2014) and comparison with the WOBASZ study (2003–2005). Pol Arch Med Wewn. 2016; 126: 662-671. doi:10.20 452/pamw.3499

9 Podolec P, Sarnecka A, Waśniowska A, Kopeć G. [The health program in the field of prevention and detection of cardiovascular disease in the population of the Malopolska Voivodeship for the years 2012–2018 M-CAPRI]. In: Kopeć G, Jankowski P, Pająk A, Drygas W. [Epidemiology and prevention of cardiovascular diseases]. Kraków, Poland: Medycyna Praktyczna; 2015: 179-196.

10 10 Waśniowska A, Kopeć G, Szafraniec K, et al. Assessment of knowledge on cardiovascular disease risk factors by postal survey in residents of Małopolska Voivodeship. Małopolska Cardiovascular Preventive Intervention Study (M-CAPRI). Ann Agr Env Med. 2017. doi:10.5604/12 321 966.1 228 40 0

11 Pająk A, Szafraniec K, Janion M, et al. for a POLKARD study. The impact of the Polish national Programme of Cardiovascular Disease Prevention on the quality of primary cardiovascular disease prevention in clinical practice. Kardiol Pol. 2010; 68: 1332-1340.

12 Mozaffarian D, Afshin A, Benowitz NL, et al. Population approaches to improve diet, physical activity, and smoking habits: a scientific statement from the American Heart Association. Circulation. 2012; 126: 1514-1563.

13 US Dept of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Best Practices for Comprehensive Tobacco Control Programs-2007. Atlanta, GA: US Dept of Health and Human Services; 2007.

14 [Ranking of television information programs of regional branches of TVP]. http://www.press.pl/tresc/26 773,ranking-programow-informacyjnych--regionalnych-oddzialow-tvp. Accessed January 8, 2017. Polish.

15 [*Kronika Krakowska* is 45 years old]. http://malopolskie-media.info/tv-news/113-kronice-tvp-krakow-stuknelo-45-lat.html. Accessed January 2017. Polish.

16 Wardle J, Rapoport L, Afuape T, Duman M. Mass education for obesity prevention: the penetration of the BBC's "Fighting Fat, Fighting Fit" campaign. Health Educ Res. 2001; 16: 343-355.

17 Dixon H, Borland R, Segan C, et al. Public reaction to Victoria's "2 Fruit 'n' 5 Veg Every Day" campaign and reported consumption of fruit and vegetables. Prev Med. 1998; 27: 572-582.

18 Huhman M, Potter L, Duke J, et al. Evaluation of a national physical activity intervention for children: VERB campaign, 2002–2004. Am J Prev Med. 2007; 32: 38-43.

19 Reger B, Wootan MG, Booth-Butterfield S, Smith H. 1% or less: a community-based nutrition campaign. Public Health Rep. 1998; 113: 410-419.

20 Farquhar JW, Fortmann SP, Flora JA, et al. Effects of communitywide education on cardiovascular disease risk factors. The Stanford Five-City Project. JAMA. 1990; 264: 359-365.

21 Puska P, Pietinen P, Uusitalo U. Influencing public nutrition for non-communicable disease prevention: from community intervention to national programme – experiences from Finland. Public Health Nutr. 2002; 5: 245-251. doi:10.1079/PHN2001300

22 Bhalla V, Fong CW, Chew SK, Satku K. Changes in levels of major cardiovascular risk factors in the multi-ethnic population in Singapore after 12 years of a national noncommunicable disease intervention programme. Singapore Med J. 2006; 47: 841-850.

23 Dowse GK, Gareeboo H, Alberti KG, et al. Changes in population cholesterol concentrations and other cardiovascular risk factor levels after five years of the non-communicable disease intervention programme in Mauritius. Mauritius Non-communicable Disease Study Group. BMJ. 1995; 311: 1255-1259.