



Good-hearted people, Busca cardio-protected city: an evidence-based public access defibrillation project

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Abstract: Due to the scientific shreds of evidence, in sustain of the public access defibrillation (PAD) as an essential strategy to save the lives of those stricken by out-of-hospital cardiac arrest (OHCA), we accomplished a PAD project in Busca (CN), a small and beautiful city in the north-west of Italy. The program consists of providing several AEDs located in public places and the training of a large number of common citizens in basic life support & defibrillation (BLS) manoeuvres. Here we present data about the lay population that participated in the courses and we discuss the main issues and possible limitations to the further development of PAD projects. This project aims to be an example to other cities who could be inspired by our experience.

Keywords: Public access defibrillation (PAD); automatic external defibrillator; out-of-hospital cardiac arrest (OHCA)

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Introduction

According to the latest firefighters' annual report available in Italy, 143 people died due to a fire in a year (1,2). To cope with these accidents, the law establishes that many fire extinguishers must be located inside public and private buildings. Coming to out-of-hospital cardiac arrest (OHCA), in Italy every year 55,000 people die of OHCA: it means more than one lethal event every 10 minutes (3). Nonetheless, external automatic defibrillators (AEDs), which have proven to be effective in saving the lives of these people, do not have the same spread of fire extinguishers.

Moreover, we underline that no one has ever died using an AED, while 4% of the deaths from fires died trying to extinguish it (2). The American Heart Association states that OHCA is responsible for more deaths than colon cancer, breast cancer, prostate cancer, car crashes,

pneumonia, respiratory tract infection, HIV, firearms, and fires took together (4).

Furthermore, many of the OHCA occur in young people (5). Overall, the OHCA survival rate is about 7% (6). This percentage can and must improve, in the light of these data: 65% of OHCA is witnessed. Namely, there is someone besides the victim who could provide help, but only in the 47% of the cases, the cardiopulmonary resuscitation (CPR) is attempted by the bystanders (5). Also, up to 76% of the patients present a shockable rhythm (pulseless ventricular tachycardia or ventricular fibrillation) (7), but the use of the AED is widely below the expectations (5%) (8). The factors that might improve the survival rate for OHCA are essentially the presence of possible lay rescuers who witness the cardiac arrest (witnessed OHCA), the early-performed CPR and the equally early use of the AED. These aspects can enhance the survival rate up to 50–70%; an increase

which remains statistically significant even after weighing the data by age, sex, the arrival time of the emergency medical services (EMS) and other confounding factors (9-12). Without CPR, mortality increases by 7% every minute (8). Early resuscitation not only saves the life of people stricken with OHCA but also raises the possibility of the patient to be discharged without profoundly disabling neurological outcomes (13).

Public access defibrillation (PAD)

Considering the effectiveness of CPR and AED, if used by lay rescuers before the arrival of the EMS, since the early 2000, AEDs began to be placed in public places in order to be immediately available in case of cardiac arrest. Thus, the PAD started to be considered a strategy for saving lives in the case of OHCA. Allowing non-healthcare workers to use defibrillators proved to be a winning strategy in a series of experiences implemented in the past two decades, especially in the USA, Northern European countries and Japan. One of the first reports of PAD was set up in 2000 in the casinos of Nevada providing the security agents with training in CPR and AEDs use: in this case, the survival rate reached 74% in patients defibrillated within 3 minutes and 49% in those defibrillated later (14). A similar trial was carried out in the airports of Chicago: several AEDs were placed where they could be reached in 1 minute from any point of the terminals. In 2 years, 21 cardiac arrests occurred, of which 18 presenting with ventricular fibrillation: 11 patients received the first shock within 5 minutes, 8 patients regained consciousness before admission to hospital and 10 were alive and without neurological impairment after 1 year; therefore, this project led to a survival rate of almost 50% (15). A Dutch study assessed the effectiveness of recruiting lay rescuers using a system of text messages: trained people entered in a database received a message (indicating the position of the nearest AED) if a cardiac arrest occurred within a 1 km radius; this system allowed to reduce the time of intervention, of the delivery of CPR and the first shock significantly (16). A similar experience was also conducted in Switzerland (17). Some studies assessed the efficacy of PAD on a larger scale. A prospective multicentre trial compared the survival rates for OHCA victims who were rescued by only-CPR trained volunteers compared to those rescued by lay people trained in CPR plus the use of the AED: in the first case the survival rate reached 14%, while in the second it reached 23% (18). Victims of OHCA rescued by lay volunteers with CPR and AED showed an increase in the survival rate by

39% at hospital discharge compared to those rescued with CPR only (19). In Japan, the spread of PAD throughout the nation reduced the time of the first shock and increased the survival rate at 1 month with minimal or no neurological damage (20). Given its effectiveness, consolidated by extensive studies, PAD was included in the latest version of the most comprehensive resuscitation guidelines: PAD turned out to be a fundamental strategy to save the lives of patients with OHCA. The 2015 European Resuscitation Council (ERC) guidelines claim that OHCA victims need immediate CPR and that the use of AED increases survival when OHCA occurs in public places (10). The 2015 American Heart Association (AHA) guidelines claim that survival rates in victims of OHCA presenting with pulseless ventricular tachycardia or with ventricular fibrillation is higher if bystanders provide CPR and defibrillation within 3–5 minutes after the loss of consciousness (21).

Busca (CN), Italy, a cardio-protected city

Despite the evidence coming from abroad, in Italy, the spread of PAD programs is still poorly developed and, in any case, not adequately documented. In the attempt to fill this gap, in late 2016, we launched a PAD project in Busca (CN), a city of ten thousand inhabitants in Piedmont, north-west of Italy. We thought that such a small community could represent the proper size to introduce these new issues, in a country where the attitude to first aid is not sufficiently spread. The project is called “*Good-hearted people. Busca cardio-protected city*” (22). It calls out every citizen to get involved in order to save the lives of those stricken with OHCA. In this community, thanks to private financing, 11 AEDs were located in places reachable within 4 minutes from any point of the city; the AEDs can be used 24/7 and are placed in strategic locations (busiest streets and squares, schools, sports facilities) (*Figure 1*). Therefore, in Busca we have been able to supply an AED every 900 inhabitants; the AEDs density in this area is remarkably above the mean density of the whole region, since 1098, AEDs have been registered in Piedmont for a total population of 4,375,865, which means one AED every 4,000 inhabitants (23,24). However, the mere increase of AEDs density among the city is not enough to obtain satisfactory results unless it goes together with intensive training programs for teaching the population how to perform CPR and use AEDs themselves (25).

As a consequence, our project also involved the organisation of—so far—18 courses in less than 2 years,

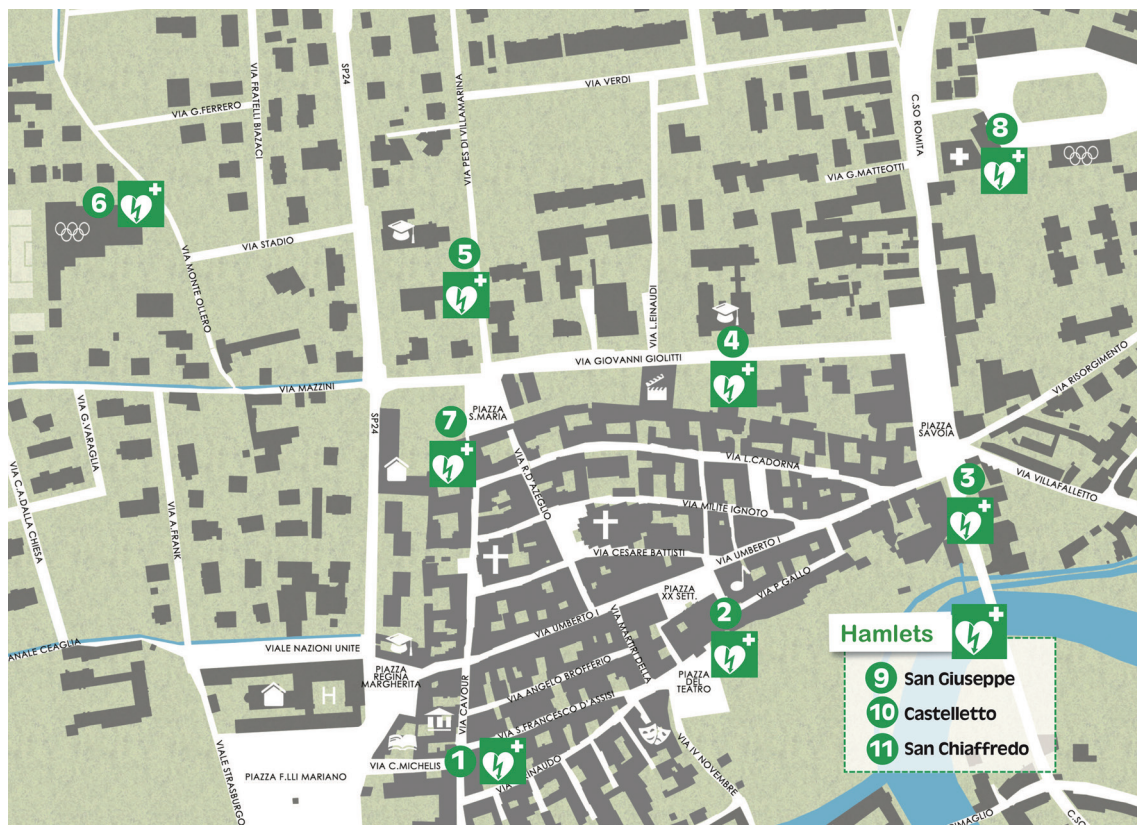


Figure 1 The AEDs networks in Busca (CN), Italy. AED, automatic defibrillator.

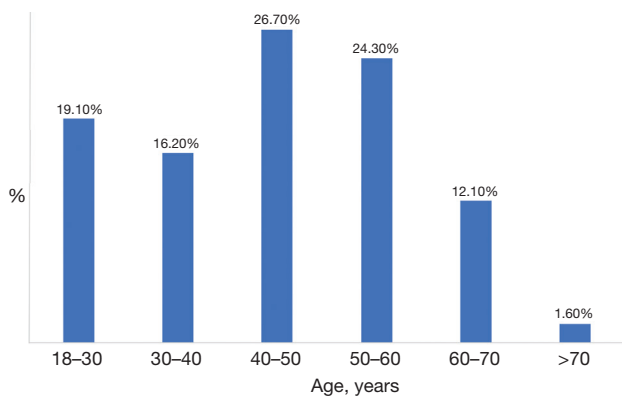


Figure 2 Age of the participants to the training courses.

which allowed to train 552 Busca citizens. During these 4-hour-lasting courses, Italian Red Cross instructors taught lay people the BLSD (basic life support & defibrillation) manoeuvres and the resolution of airways obstruction in infants, children, and adults. The achievement of our project was possible thanks to the significant commitment

of the citizens of Busca who dedicated their free time to learn how to save a life: in fact, it is the answer of the whole community that makes the difference in situations requiring such immediate intervention (10). The 552 participants to the courses represent the 5.5% of the entire population of the city (55% male, median age 46 years old, 20% under 30) (Figure 2). Our army of BLSD providers is made up of volunteers from associations, teachers, school concierges, coaches, children’s entertainers, merchants, police officers, and even common citizens, intrigued by the spread of life-saving stations around the city (Figure 3). We observed the maximum attending peoples at the courses in November and December 2016. This might reflect a more significant interest at the beginning as the project was launched thanks to a massive communication campaign carried out through official websites, local newspapers, social platforms. In the following months, the number of participants came to a stabilisation thanks to the word-of-mouth among the citizens, with higher peaks of adhesion during the second semester of the years 2017 and 2018 (Figure 4).

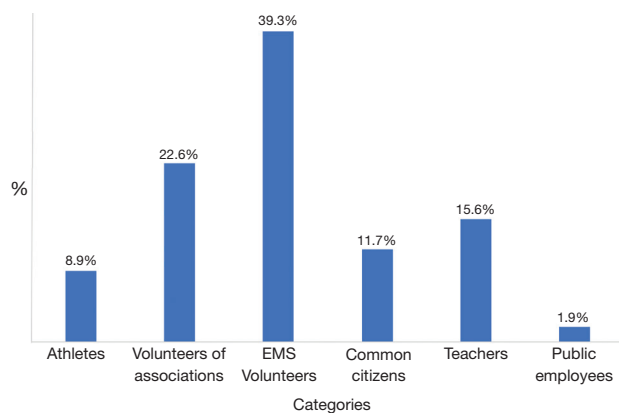


Figure 3 Categories of the participants to the training courses.

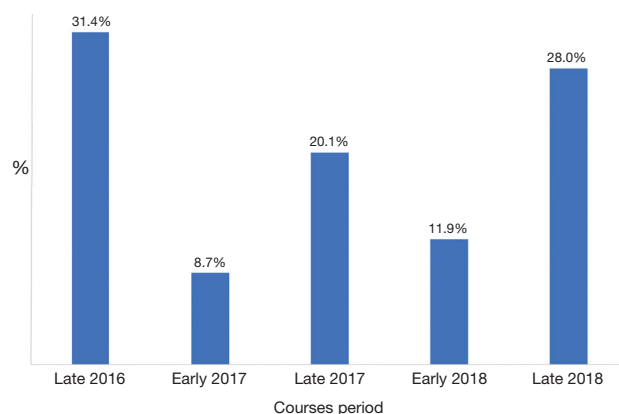


Figure 4 The trend of participation in the training courses by semester.

Nonetheless, we are expecting a new wave of participants as soon as the retraining starts, allegedly in the first months of 2019: complete retraining courses are scheduled every 2 years since the skills learned during the first session seem to decline over time (26).

The 2015 ERC guidelines state that the CPR course should be tailored to the recipients and made as simple as possible, while the question whether a specific training for the use of the AED is needed or it could be used without previous input is still unanswered. In Italy, only those who received specific training in CPR are allowed to use the AED (27). Moreover, organising courses seem to be a good strategy not only in order to comply with the legal issue but also on the practical side: who attended a training session is much more likely to undertake resuscitation manoeuvres in real life, if needed (28). Also, an introduction to first

aid is essential since childhood, as it is possible to reach significantly higher resuscitation rates by providing short courses for children from 12 years old (29,30). In Busca, since 2016, the Italian Red Cross instructors have been teaching CPR to middle school students.

Therefore, a cardio-protected city is not just a place equipped with AEDs. It is a place where, besides, there is a vision shared by the entire community, doing its best to respond to an emergency. We aim to be an example to other cities who could be inspired by our experience. For this reason, in these 2 years, we have been organising as many medical conferences in Busca giving experts (cardiologists, intensivists, emergency doctors, critical care nurses) the opportunity to discuss these themes. The first conference “*A cardio-protected city: community response saves lives*” took place in December 2017 and focused on the presentation of the project; the second one, held in November 2018, “*A cardio-protected city 2: life support*” dealt with the technical and ethical aspects related to resuscitation (Figure 5).

During the several courses held as part of our project, many concerns merged from the participants about issues already reported in the literature (10). Since they may represent a limitation to attempts of resuscitation (31), we tried to cope with them according to the evidence. Even though we focused on how to recognise a case of cardiac arrest, the participants are often afraid of the possibility of practising cardiac massage to people not in cardiac arrest. In this regard, a study reported that if this happens, the damage is minimal: patients resuscitated by mistake report at most vague pain and no one has ever reported life-threatening injuries (32). Rescuers are not at-risk performing CPR, and adverse events are exceptional (e.g., the literature reports a single case of pneumothorax) (33).

Additionally, a major concern is getting harm using the AED: even if it is necessary to instruct people to administer the shock safely, a systematic review reported only 29 adverse effects (i.e., the shock given to rescuers or bystanders). No one has ever died of these accidents, and at most, the problem has been limited to the sensation of tingling or minor burns (34). In a psychological perspective, the CPR has beneficial effects both on the rescuer (almost all of them consider their experience positively and would be ready to do it again) (35) and on the victim’s family: assisting to resuscitation attempts correlates with better psychological outcomes (36). Some people are worried about getting infected during the rescue, but, assuming that the ventilation should be performed only under safe



Figure 5 The flyers of the December 2017 and November 2018 medical conferences “A cardio-protected city: community response saves lives” and “A cardio-protected city 2: life support”.



Figure 6 A training course in Busca (CN), Italy.

conditions, the transmission of infections during CPR is episodic (37). All these drawbacks seem to be an acceptable risk, given their low incidence rate on the total of the resuscitations attempts that are estimated to have been millions since the introduction of the CPR (5,37) (Figure 6).

Saving lives: a shared goal

In conclusion, the balance is remarkably in favour of the implementation of PAD strategies. Public authorities must try to remove every possible obstacle to their spread: in the first instance, the Italian law that requires to be in possession of a certificate in order to use the AED should be reconsidered. Although this obstacle can be overcome in single cases by the state of necessity, however, it represents a psychological barrier and threatens to discourage lay bystanders from attempting resuscitation.

We believe that projects set up in small communities and based on the commitment of common people, like the one we held in Busca, are a good starting point in order to promote similar experiences on a larger scale. The most remarkable aspect of the Busca PAD program consists in the extraordinary participation of the citizens, mainly due to the sense of community that drives everyone to move towards

a common goal that, in this case, is the worthiest possible: saving lives.

Begin by doing what is necessary, then what is possible.

Suddenly, you will be surprised to do the impossible.

Francis of Assisi

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. D'Addato M. Studio sugli incendi in Italia (2011). Available online: <http://www.vigilfuoco.it/>. (last accessed: 5th December 2018).
2. Mell HK, Sayre M. Public Access Defibrillators and Fire Extinguishers: Are Comparisons Reasonable? *Prog Cardiovasc Dis* 2008;51:204-12.
3. Ministero della Salute, Arresto cardiaco in Italia (2010). Available online: <http://www.salute.gov.it/>. (last accessed: 5th December 2018).
4. Meaney PA, Bobrow B, Mancini M, et al. Cardiopulmonary resuscitation quality: improving cardiac resuscitation outcomes both inside and outside the hospital: a consensus statement from the American heart association. *Circulation* 2013;128:417-35.
5. Gräsner JT, Lefering R, Koster R et al. EuReCa ONE—27 Nations, ONE Europe, ONE Registry: A prospective one month analysis of out-of-hospital cardiac arrest outcomes in 27 countries in Europe. *Resuscitation* 2016;105:188-95.
6. Myat A, Song K, Rea T. Out-of-hospital cardiac arrest: current concepts. *Lancet* 2018;391:970-9.
7. Berdowski J, Blom M, Bardai A, et al. Impact of onsite or dispatched automated external defibrillator use on survival after out-of-hospital cardiac arrest. *Circulation* 2011;124:2225-32.
8. Bækgaard JS, Viereck S, Møller T, et al. The effects of public access defibrillation on survival after out-of-hospital cardiac arrest a systematic review of observational studies. *Circulation* 2017;136:954-65.
9. Sasson C, Rogers M, Dahl J, et al. Predictors of survival from out-of-hospital cardiac arrest a systematic review and meta-analysis. *Circ Cardiovasc Qual Outcomes* 2010;3:63-81.
10. Perkins GD, Handley A, Koster RW, et al. European Resuscitation Council Guidelines for Resuscitation 2015. Section 2. Adult basic life support and automated external defibrillation. *Resuscitation* 2015;95:81-99.
11. Weisfeldt ML, Sitlani C, Ornato J, et al. Survival After Application of Automatic External Defibrillators Before Arrival of the Emergency Medical System. Evaluation in the Resuscitation Outcomes Consortium Population of 21 Million. *J Am Coll Cardiol* 2010;55:1713-20.
12. Hasselqvist-Ax I, Riva G, Herlitz J, et al. Early Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest. *N Engl J Med* 2015;372:2307-15.
13. Holmberg MJ, Vogt M, Andersen M, et al. Bystander automated external defibrillator use and clinical outcomes after out-of-hospital cardiac arrest: a systematic review and meta-analysis. *Resuscitation* 2017;120:77-87
14. Valenzuela TD, Roe D, Nichol G, et al. Outcomes of Rapid Defibrillation by Security Officers after Cardiac Arrest in Casinos. *N Engl J Med* 2000;343:1206-9.
15. Caffrey SL, Willoughby P, Pepe P, et al. Public Use of Automated External Defibrillators. *N Engl J Med* 2002;347:1242-7.
16. Zijlstra JA, Stieglis R, Riedijk F, et al. Local lay rescuers with AEDs, alerted by text messages, contribute to early defibrillation in a Dutch out-of-hospital cardiac arrest dispatch system. *Resuscitation* 2014;85:1444-9.
17. Mauri R, Burkart R, Benvenuti C, et al. Better management of out-of-hospital cardiac arrest increases survival rate and improves neurological outcome in the Swiss Canton Ticino. *Europace* 2016;18:398-404.
18. Hallstrom AP, Ornato J, Weisfeldt M, et al. Public access defibrillation and survival after out of hospital cardiac arrest. *N Engl J Med* 2004;351:637-46.
19. Sanna T, La Torre G, De Waure C, et al. Cardiopulmonary resuscitation alone vs. cardiopulmonary resuscitation plus automated external defibrillator use by non-healthcare professionals: a meta-analysis on 1583 cases of out-of-hospital cardiac arrest. *Resuscitation* 2008;76:226-32.
20. Kitamura T, Iwami T, Kawamura T, et al, Nationwide Public-Access Defibrillation in Japan. *N Engl J Med* 2010;362:994-1004.
21. Kleinman ME, Brennan E, Goldberger Z, et al. Part 5: Adult Basic Life Support and Cardiopulmonary Resuscitation Quality. *Circulation* 2015;132:S414-35.
22. Giamello JD, Bertolaccini L, Gallo M. Good-hearted people, Busca cardio protected city: a community of a

- city in the north-west of Italy involved in a public access defibrillation project. *Shanghai Chest* 2018;2:11.
23. Regione Piemonte, portale DAE (2018). Available online: www.portaledae.sanita.regione.piemonte.it. (last accessed: 18th December 2018).
 24. Istituto Nazionale di Statistica, Popolazione residente in Piemonte, 2018. Available online www.dat.istat.it. (last accessed: 18th December 2018).
 25. Karam N, Naranayan K, Bougouin W, et al. Major regional differences in Automated External Defibrillator placement and Basic Life Support training in France: Further needs for coordinated implementation. *Resuscitation* 2017;118:49-54.
 26. Greif R, Lockey A, Conaghan P, et al. European Resuscitation Council Guidelines for Resuscitation 2015. Section 10. Education and implementation of resuscitation. *Resuscitation* 2015;95:288-301.
 27. Repubblica Italiana, Legge 3 aprile 2001, n. 120. (2001). Available online: www.gazzettaufficiale.it. (last accessed: 7th December 2018).
 28. Tanigawa K, Iwami T, Nishiyama C, et al. Are trained individuals more likely to perform bystander CPR? An observational study. *Resuscitation* 2011;82:523-8.
 29. Wissenberg M, Lippert F, Folke F, et al. Association of national initiatives to improve cardiac arrest management with rates of bystander intervention and patient survival after out-of-hospital cardiac arrest. *JAMA* 2013;310:1377-84.
 30. Plant N, Taylor K. How best to teach CPR to schoolchildren: A systematic review. *Resuscitation* 2013;84:415-21.
 31. Smith CM, Lim Choi Keung S, Khan M, et al. Barriers and facilitators to public access defibrillation in out-of-hospital cardiac arrest: a systematic review. *Eur Heart J Qual Care Clin Outcomes* 2017;3:264-73.
 32. White L, Rogers J, Bloomingdale M, et al. Dispatcher-assisted cardiopulmonary resuscitation: Risks for patients not in cardiac arrest. *Circulation* 2010;121:91-7.
 33. Sullivan F, Avstreich D. Pneumothorax during CPR training: case report and review of the CPR literature. *Prehosp Disaster Med* 2000;15:64-9.
 34. Hoke RS, Heinroth K, Trappe H, et al. Is external defibrillation an electric threat for bystanders? *Resuscitation* 2009;80:395-401.
 35. Axelsson A, Herlitz J, Ekström L, et al. Bystander-initiated cardiopulmonary resuscitation out-of-hospital. A first description of the bystanders and their experiences. *Resuscitation* 1996;33:3-11.
 36. Colbert JA, Adler J. Family Presence during Cardiopulmonary Resuscitation — Polling Results. *N Engl J Med* 2013;368:e38.
 37. Mejicano GC, Maki D. Infections acquired during cardiopulmonary resuscitation: Estimating the risk and defining strategies for prevention. *Ann Int Med* 1998;129:813-28.

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