

# From Framingham and Bethesda to North Karelia and Back



## Turning Prevention and Population Science Discoveries into Heart Health

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### THE FRAMINGHAM HEART STUDY

The Framingham Heart Study is a major landmark contribution to epidemiological research and a jewel among investments made in prevention and population science studies. Established in 1948 to investigate the extent and development of cardiovascular disease (CVD) in a cross-section of the population of the town of Framingham, Massachusetts [1], the Framingham Heart Study was the first to produce compelling evidence of the strong association between certain “factors of risk” and the development of coronary heart disease [2,3]. For example, in the report of the first 6-year follow-up experience, Kannel et al. [3] demonstrated that the presence of hypertension increased the risk of incident coronary heart disease by 2.6-fold in men aged 40 to 59 years while in women of the same age, the risk increased 6-fold [3]. Importantly, the presence of 3 risk factors (hypertension, elevated serum cholesterol level, and left ventricular hypertrophy by electrocardiogram) increased coronary heart disease risk nearly 14-fold in men [3].

Another seminal contribution from the Framingham Heart Study was the realization that while these risk factors were important in the clinical management of individuals for the prevention and control of coronary heart disease, the risk factors occurred with “sufficient frequency in the population” to warrant a population approach to their prevention and control [3]. For example, 40% of the Framingham Heart Study population aged 30 to 59 years had at least 1 of the coronary risk factors, and about 8% of men and 11% of women had 2 or more risk factors [3]. These findings would prove crucial, especially at a time when the coronary heart disease mortality rate was still on the rise in the United States. It was not until after 1968 that the first signs of a decline in coronary mortality rate were reported in the United States [4] and Australia [5]. In fact, there was considerable doubt as to whether the decline was even real. Writing in the *British Medical Journal* in 1976, an editorialist questioned “whether the decline, which is far from dramatic, may be considered real” and lamented that “at present the prospects of an appreciable improvement in coronary mortality rates do not seem bright” [6].

### THE BETHESDA CONFERENCE ON THE DECLINE IN CORONARY HEART DISEASE MORTALITY

In October 1978, in Bethesda, Maryland, the National Heart, Lung, and Blood Institute (NHLBI) convened a wide range of international experts in epidemiology, clinical cardiology, and public health, to explore the previously unappreciated decline of coronary mortality [7]. The primary objectives included the need to estimate the quantitative effect of the various risk factors on the mortality decline and assess the validity and limitations of the estimates; propose future studies that might add more information about the decline; suggest new strategies for monitoring national and international mortality and morbidity trends; and identify other cardiovascular risk factors [7]. At that time, few if any of the conference participants could have foreseen how dramatic and sustained the trends in coronary mortality decline would be or how closely they would be associated with declines in risk factor levels.

### THE FINNISH NORTH KARELIA PROJECT

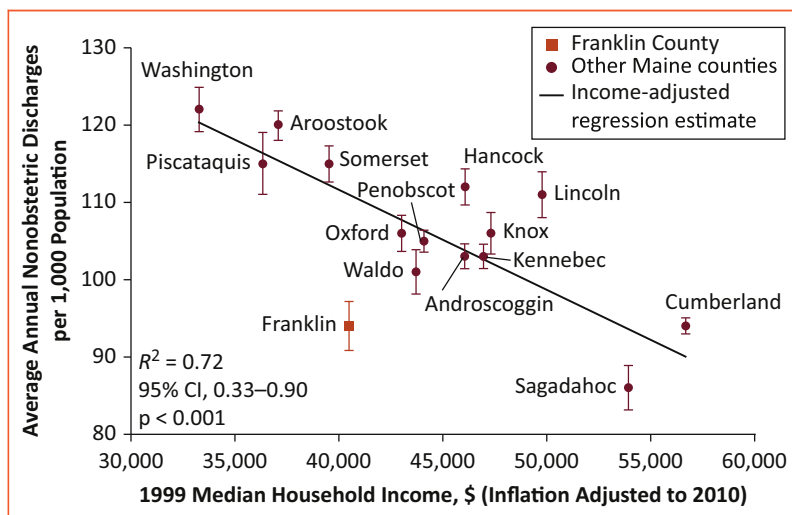
The North Karelia Project was planned in 1971 as a community-based approach for CVD prevention with a primary focus on reducing the prevalence of smoking, elevated serum cholesterol concentration, and raised blood pressure in representative population samples in the county of North Karelia and a matched control county [8]. At the time of the 1978 Bethesda Conference, the North Karelia Project was examining the changes in risk factors after only 5 years of the program. Assessment after 5 years of the program demonstrated an overall mean net reduction of 17% and 12% in men and women, respectively, in the estimated risk for coronary heart disease in North Karelia, leading the investigators to predict a subsequent decline in coronary heart disease mortality and morbidity. The 85% reduction in mortality from ischemic heart disease now seen among men aged 35 to 64 years in North Karelia from the 1969 to 1971 period to 2006 confirms the investigators’ predictions. The collection of articles in this special issue of *Global Heart* paints a remarkable picture of the power of prevention and population science research and the impact it had on reducing cardiovascular morbidity and mortality in North Karelia and Finland over more than 4 decades.

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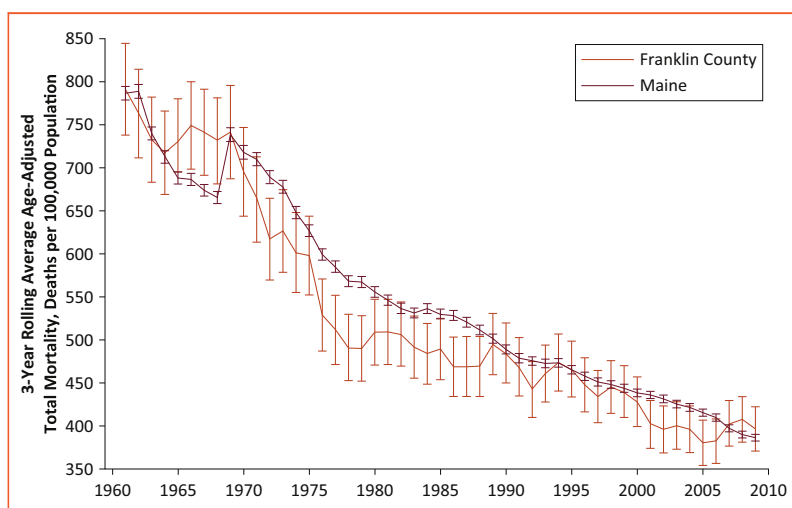
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**FIGURE 1. Maine County hospitalization rates versus income, 1994 to 2006.** Reproduced from Record et al. [15] with permission from the American Medical Association.

### COMMUNITY-WIDE CARDIOVASCULAR PREVENTION PROGRAMS IN THE UNITED STATES

Back in the United States, 3 major comprehensive community-based CVD prevention trials started in the early 1970s and 1980s (the Stanford Five-City Project [9,10], Minnesota Heart Health Program [11], and Pawtucket Heart Health Program [12,13]) failed to show significant reductions in cardiovascular morbidity or mortality in the intervention cities. All 3 programs had significantly shorter study durations (6 to 8 years) than the North Karelia project (>40 years), and a joint analysis pointed to smaller than expected net differences between intervention and control cities [11,14].



**FIGURE 2. Mortality Rates for Franklin County and Maine, 1960 to 2010.** Reproduced from Record et al. [15] with permission from the American Medical Association.

In contrast to the Stanford Five-City Project, Minnesota Heart Health Program, and Pawtucket Heart Health Program, the Franklin Cardiovascular Health Program (FCHP) has now reported very encouraging results [15]. The FCHP, a community-wide cardiovascular prevention program in a rural United States county, started at about the same time as the North Karelia project and had been running continuously since 1974 [15]. The 40-year follow-up report demonstrated absolute increases of 25% in hypertension control rate and 29% in elevated serum cholesterol control [15]. Smoking cessation rates also improved from 49% to 70% in Franklin County, substantially better than average cessation rates observed for the rest of Maine [15]. These risk factor reductions were associated with lower than expected per capita hospitalization rates (Fig. 1) and adjusted mortality rates (Fig. 2) [15]. In fact, as the investigators reported, Franklin was the only Maine county “with consistently lower adjusted mortality than predicted over the time periods 1970-1989 and 1990-2010” [15].

### A ROLE FOR DISSEMINATION AND IMPLEMENTATION RESEARCH

Taken collectively, the observational research findings from Framingham, the community-wide interventional research findings from North Karelia and Franklin County, and the prevention and population science insights from the 1978 Bethesda Conference all point in 1 direction: long-term, sustained, community-wide prevention programs that target the major cardiovascular risk factors are associated with substantial reductions in cardiovascular morbidity and mortality. The compelling question that remains now is how do we implement, with high fidelity, affordable community-wide prevention strategies for achieving sustained declines in the prevalence of major risk factors and the associated dramatic declines in cardiovascular morbidity and mortality?

The time has come to embrace active diffusion, dissemination, and implementation research with appropriate rigor in methodology and development of metrics to monitor health impact. Several frameworks are now available to enhance the value and accelerate the impact of dissemination and implementation research [16,17]. Other frameworks, built on constructs that most strongly influence dissemination and implementation effectiveness, are also available to guide data collection and analysis [18]. Finally, several resources are available to support strategic scale-up and spread of effective interventions [19].

### TURNING DISCOVERIES INTO HEART HEALTH WORLDWIDE

As the Victoria Declaration stated nearly a quarter century ago, we know enough to eliminate most CVDs [20]. Knowing is not enough, however; we must also act to adopt, adapt, sustainably scale-up, and spread affordable proven-effective interventions through rigorous dissemination and implementation research. Through this research, we also have the opportunity to address marked

variations in health and the pervasive disparities in cardiovascular health by sex, race, ethnicity, income, socioeconomic status, and geography [21,22]. There can be no better time than now to turn prevention and population science discoveries into heart health worldwide!

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