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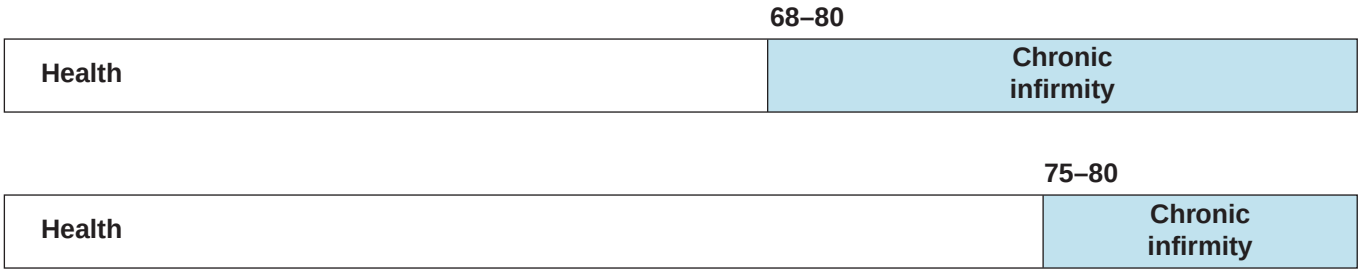
Compression of Morbidity:
In Retrospect and in Prospect

Introduction

In 1980, I proposed the Compression of Morbidity hypothesis: By postponing the age at which chronic infirmity begins, disability and morbidity could be compressed into a shorter period of the average human life span.[1] I foresaw a society in which the active and vital years of life would increase in length, the disabilities and frailties of ageing would be postponed, and the total amount of lifetime disability and morbidity would decrease.

I predicted a society in which the majority of people could enjoy a long and vigorous life, with a relatively brief terminal collapse at the end. Members of this society would maintain healthy lifestyles. There would be few smokers, many who exercised, many with good dietary habits, and few with obesity. People would understand prevention as postponement and would value the quality of life at least as much as its quantity.

Figure 1: Compression of Morbidity
Postponement of age of onset of chronic infirmity could lead to expanded total period of health.



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Compression of Morbidity:
In Retrospect and in Prospect

By James F. Fries, M.D.

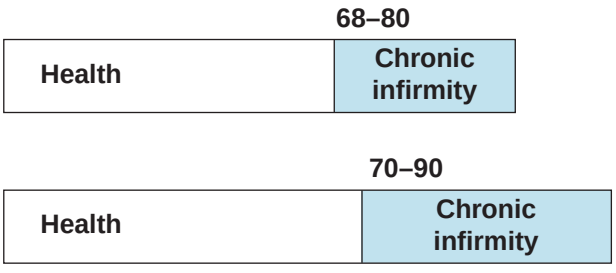
The Conventional Wisdom: "Failures of Success"

When I first proposed my hypothesis, conventional wisdom of the time maintained that the more medicine advanced, the poorer would be the health of the population.[2] Proponents of this view reasoned that the acute infectious diseases of the early twentieth century had been nearly vanquished. Taking their place were the chronic illnesses of heart disease, cancer, and stroke, which actually increased the total disability and morbidity in the average life. Life expectancy was steadily rising, and the future was envisioned as a world peopled by ever larger numbers of ever more fragile persons, consuming ever larger amounts of medical care. This scenario was termed the "failures of success".

The conventional wisdom took the discouraging view that any measure which improved health would be likely also to improve longevity and ultimately to expand the period of morbidity. For the Compression of Morbidity to occur, increases in the age of onset of chronic infirmity would have to be more rapid than increases in life expectancy. However, the opposite situation seemed to be in store, as the rapid pace of scientific medical advances promised even more rapid rates of increase in life expectancy in the future.

Figure 2: Postponement of Chronic Infirmity vs. Rising Life Expectancy

Slow postponement of age of onset of chronic infirmity, combined with rapidly increasing longevity, could lead to expanded total period of chronic infirmity.



Controversies Arising from the Compression of Morbidity Hypothesis

Initially, the Compression of Morbidity hypothesis was controversial. Curiously, it was faulted most often for being too optimistic—a societal ideal, to be sure, but unattainable. In addition, some feared that this view might foster complacency in the face of social challenges that would arise from the increasing numbers of older persons. Others worried that it might divert funds from scientific research into the study of preventive measures that might postpone illness.

Evidence for the Compression of Morbidity

The Compression of Morbidity hypothesis was based on a number of emerging observations:

- As chronic diseases increasingly dominated the burden of illness, there were fewer and fewer acute diseases to be replaced. It was thus reasonable to suggest that trends toward greater lifetime disability might slow.
- Epidemiological principles, such as Gompertz' Law, suggested that longevity gains might be slowed by the increase in competing risks from other diseases and from the frailty of ageing itself. Thus, a cardiac arrest successfully treated would not lead to as much additional longevity as expected.
- Prevention, the most obvious route to postponement of illness, had simply not been tried.

Today's Paradigm for Healthy Ageing

Over the past 24 years, the Compression of Morbidity hypothesis has grown to the status of a paradigm underlying individual and policy approaches to healthy ageing.

Three lines of evidence have led to this dramatic shift in the conventional wisdom:

- Epidemiological studies have provided proof of concept.
- Randomised controlled trials of prevention programs have proven that morbidity compression can be achieved, under certain circumstances.
- National data from several sources have shown that Compression of Morbidity is already occurring in the United States.

Proof of Concept: Postponement of the Onset of Disability by 8 to 12 Years with Healthier Lifestyles

It is abundantly clear that both mortality and morbidity are strongly associated with poor health habits.[3] Epidemiological studies of risk factors for illness and for death have evolved since the original Framingham Heart Study[4] was begun more than 50 years ago. Multiple studies have shown the adverse impacts on health from cigarette smoking, obesity, poor diet, lack of exercise, irregular seat-belt use, and other lifestyle risks.

But what have been the relative effects of better health habits upon morbidity and mortality? Recent studies have begun to address this question. Longitudinal studies of the same individuals over many years have allowed measurement of the length of time that disability has been postponed by more healthy lifestyles. Our research group in the United States is conducting two such ongoing studies:

- A study of 1,700 University of Pennsylvania alumni since 1986, at which time they averaged 68 years of age
- A study of 1,000 fitness club members and community controls begun in 1984, at which time they averaged 58 years of age

These and similar studies have been published in respected medical journals, and the results are positive and dramatic. There are no studies to the contrary.

Results of the Alumni Longitudinal Study

In the alumni study, the cumulative disability was four times as great in those who smoked, were obese, and did not exercise as in those who were lean, who exercised, and did not smoke. The onset of measurable disability was postponed by nearly eight years in the lowest-risk third of subjects, compared with the highest-risk third.[5] Moreover, in the 418 subjects who died and whose total lifetime disability thus could be computed, those with lower health risks at one and two years before death had much less disability than those with higher risks. Persons with higher health risks not only had more disability throughout their lives, but also had a surge to even higher disability levels in the two years before death.[6] This rapid terminal increase in disability did not occur in the low-risk group.

Results of the Fitness Club Longitudinal Study

In the other study, the fitness club group had postponement of disability by more than 12 years, compared with the more sedentary controls.[7] This postponement of disability far exceeded any increase in life expectancy from better health habits. Thus, it is not only true that disability is least in those with healthy habits, but also that the onset of disability is very greatly postponed.

Randomised Scientific Trials: Health Enhancement Programs in Older Adults Can Work

Many questions arise regarding health enhancement interventions:

- Is it possible to intervene in the ageing population, improve risk-factor profiles, and observe improved health and reduced medical care costs? Or, would such interventions be too little, too late?
- Are older adults intractable to change?
- Can preventive measures be effective later in life?

Studies show that improvement in health is possible at any age. Large randomised controlled trials of health promotion programs in older adults have shown very substantial health improvement in participants, compared with controls. Results have been particularly good for programs using tailored print interventions, which customize the printed material a patient receives based on specific information relating to that individual. Risk reduction has approximated 10 percent per year of participation. Improved self-reported health, decreased disability and pain, and reduction in medical claims costs have also approximated 10 percent per year.[8,9]

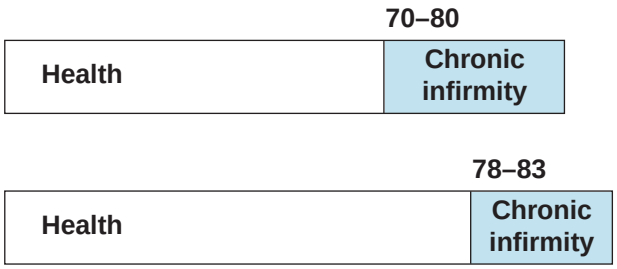
U.S. National Data: Morbidity Is Currently Decreasing More Rapidly than Mortality

For Compression of Morbidity to occur, morbidity rates must be falling more rapidly than mortality rates in ageing populations. And indeed, mortality rates among those over 65, both currently and historically, are falling at a rate of about 1 percent each year. At the same time, U.S. studies show a decline in disability of about 2 percent per year—twice the rate of decline as mortality.

Indisputably, Compression of Morbidity is currently occurring in the United States. Changes in morbidity are usually expressed as changes in disability; although morbidity and disability are not precisely the same concept, the latter is easier to define and to measure. Since 1982, disability data over the entire U.S. population have been carefully moni-

Figure 3: Morbidity Rates Falling More Rapidly than Mortality Rates

Morbidity rates falling more rapidly than mortality rates leads to Compression of Morbidity.



tored by the government, using a number of studies, most importantly the National Health Interview Study and the National Long-Term Care Study. Both of these studies show disability declining at about 2 percent per year. A number of smaller studies document similar declines.[10] No studies have shown disability to be increasing or even remaining stable. Note also that in the United States the national decline in disability has been most rapid since 1994, at about 2.6 percent per year, and is now seen in minority populations as well as in Caucasians.[11,12]

The reasons for this spectacular decline in disability are not fully understood.

- Certainly, there has been a positive effect from decreases in cigarette smoking and probably a debit from our increasingly obese population.
- A number of medical advances have probably had a greater effect on morbidity than on mortality. These include joint replacement surgery, better treatment of diabetes and hypertension, and the use of statin drugs to postpone heart disease.
- Increasing use of low-dose aspirin to postpone heart attacks, vaccines to prevent pneumonia in older adults, and colon cancer screening also may have played a role.

Each of these measures has been used more frequently in recent years.

Future Prospects for Compression of Morbidity

Solving Two Massive Social Problems

Solutions to two massive social problems will require continued and accelerated Compression of Morbidity.

- The health of older adults is a major health problem, with the majority of all morbidity and mortality concentrated in later years.
- It is also a major economic problem. In the United States, medical care for older adults threatens the very core of the Social Security system.

Current Trends

The current trends in morbidity and mortality suggest that we must be doing something right. Medical advances as well as prevention may be responsible for these improvements. The surprise is that some Compression of Morbidity has occurred even though we have not systematically implemented the most promising approach, which would be postponement of disability through reduction in lifestyle health risks.

Implementing Solutions

At the same time, there is an urgency to refine and implement solutions.

- We know that disability may be postponed an additional 8 to 12 years, at a minimum, through lifestyle changes in older adults.
- We know how to accomplish these changes at a population level through tailored print programs.
- We know how to monitor the effects of such programs at the national level.

Prevention Programs: A 4-to-1 Return on Investment

In 2001, the RAND Corporation was commissioned by Medicare to perform an evidence-based review of health promotion programs for older adults to determine whether additional research should be performed. The goal was to fund effective prevention programs that would improve the health of older adults and to provide these programs as a Medicare benefit. The resulting RAND report[13] was a strong recommendation to go forward. They found programs which convincingly improved the health of older adults while decreasing Medicare-claims costs substantially. Medicare's projected return on investment was $4 for every $1 spent.

Healthier older adults are in everybody's interest.[14] Health policy initiatives now being undertaken promise to increase and consolidate health gains for older adults.

Recommendations

The future research agenda is straightforward and must inform health policy. We must:

- Monitor trends in morbidity and mortality so that we can tell how well we are doing.
- More precisely define the causes of these trends so that we may extend them.

- Continually refine and improve programs for postponement of illness and frailty so that we can identify the most effective and most cost-efficient approaches to morbidity compression.

Conclusion

The Compression of Morbidity paradigm must direct the future of health care policy for older persons. It has been personally gratifying for me to see the gradual acceptance of a positive, practical, and even optimistic vision of the future. Far too often we have been bombarded by approaches to health care reform that are not in any way directed toward better health. We know how to do better.

James F. Fries, M.D., is professor of medicine at Stanford University School of Medicine.

Afterword

By Robert N. Butler, M.D.

The theory of the Compression of Morbidity, developed by James Fries, conveys the optimistic concept that, through lifestyle improvements and research, dependency will be reduced in intensity and duration and costs lessened.

The maintenance and improvements in one's health are vital to a productive and active lifestyle at any age, and this is critical not only from an individual perspective, but also from a social perspective. For example, in order to combat projected increases in pension and health costs, as well as labour shortages, many European governments are working to revise outdated retirement laws that terminate employment prematurely. However, in order to sustain productive and efficient workforces of all ages, individuals need to be proactive in engaging in healthy lifestyle choices and activities.

With this in mind, the Alliance for Health & the Future addresses the concerns associated with population ageing, highlights the importance of individual lifestyle improvements, and recommends strategies to promote healthy and productive ageing. The Alliance works to empower individuals with sound medical knowledge about their health; to offer simple, inexpensive, and effective steps they can begin and perform at any age; and to stress that we all must be proactive in seeking proper medical care.

Unless we change both our lifestyle and the toxic environment in which we exist, I fear that Compression of Morbidity will not be fully realized and may actually be reversed. However, by supporting a future where disease and disability are pushed to the very end of life, we can maximise the potential of our citizenry to continue to create and contribute to society into great old age.

Robert N. Butler, M.D., is co-chair of the Alliance for Health & the Future and president and CEO of the International Longevity Center-USA.

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The Alliance for Health & the Future was organized in 2003 to combine research, education, and policy efforts to promote good health and productivity throughout the life course. Operating as a division of the International Longevity Center, the Alliance secretariat is in Paris with additional offices in London and New York. The aim of the Alliance is to advance knowledge and provide training, skills, and systems to help individuals and society realize a healthy future.

Alliance publications are available online at www.healthandfuture.org.

The International Longevity Center–USA (ILC–USA) is a not-for-profit, nonpartisan research, education, and policy organization whose mission is to help individuals and societies address longevity and population aging in positive and productive ways, and highlight older people's productivity and contributions to their families and society as a whole.

The organization is part of a multinational research and education consortium, which includes centers in the United States, Japan, Great Britain, France, the Dominican Republic, and India. These centers work both autonomously and collaboratively to study how greater life expectancy and increased proportions of older people impact nations around the world.

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