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A Conceptual Framework for Community Interventions in Successful Aging

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A Conceptual Framework for Community Interventions in Successful Aging

by

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Abstract:

As the number and percentage of elderly Canadians increase, it becomes imperative to understand successful aging in order to keep this growing segment of our population healthy and productive. Conceptual models of successful aging have been proposed in a number of disciplines (biology, psychology, sociology, epidemiology), but these have yet to be integrated. There is not even agreement on how to define successful aging, or on whether it is a state of being or an adaptive process.

To date, there have been relatively few interventions to promote successful aging, and the lack of a theoretical approach makes it more difficult to design them and to assess the results of any interventions that have been attempted.

In this thesis, I build upon the insights from existing literatures, and I propose a conceptual model for successful aging. I then discuss the application of this model to guide community interventions for Successful Aging Ottawa.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE:

This thesis grew out of my work as a member of the Successful Aging Ottawa Initiative. SAO is a community coalition, whose mission is to improve the lives of all older citizens in this city. In order to guide this initiative, SAO requires a conceptual model that depicts Successful Aging within a community context, and which helps us to understand the impact of various determinants of health upon elderly individuals. Because there was no one model in the literature that illustrated successful aging as a dynamic process within a community context, our committee took upon the task of designing our own model. In order to assist with this process, I conducted a literature search. Because successful aging is a broad topic that has been approached in various ways by many different researchers from a number of disciplines over the years, I found it necessary to review the literature from epidemiology, psychology, sociology and biology. Accordingly, Part I of the thesis consists of an overview of the literature which traces the progression of ideas on successful aging in each of these disciplines and discusses how these ideas might inform a conceptual model. In the second Part of the thesis, I collate the many definitions of successful aging in the literature and discuss their similarities and differences, and link them to various concepts behind our understanding of successful aging. I then discuss theories of successful aging and the difference between models and theories. Next I trace the development of models of successful aging, identifying previous attempts to integrate the biological, sociological and psychological points of view. In Chapter 5, I then review some of the intervention literature on promotion of successful aging and health promotion in general, and point out the lack of conceptual model development to guide the process. Part III of the thesis represents my field work. In this section, I explain the development of the Successful Aging Ottawa working conceptual model as it evolved through the ongoing work of the committees on which I am an active participant. I then go beyond

the work done at SAO to propose my own conceptual model, and then speculate as to how my model might be useful in the future, in guiding approaches to treating older age not simply as a time to avoid sickness and disease, but as a time to live life as fully as possible.

PART ONE: Conceptions of Successful Aging

Chapter One: The epidemiology of aging

There seems to be general agreement that the number and proportion of Canadians over the age of 65 is increasing and will likely continue to increase well into this century. A question that remains largely unanswered concerns how healthy these elderly will be, how to keep them healthy, and what will be their impact on the productivity and economic well-being of the country.

Three very different scenarios have been proposed. Gruenberg predicted a disability pandemic, resulting from the expansion of morbidity as technology keeps sicker people alive for longer (1). This represented a rectangularization of length of life, without a corresponding rectangularization of the quality of life. By contrast, Fries predicted compression of morbidity (2), working from the assumption that although the human life span is fixed, it is nonetheless possible to delay disability until shortly before death. Manton takes a position midway between these two extremes. He has shown a reduction in age-specific disability rates, and postulated that a reduction in the morbidity associated with chronic diseases will balance out an increase in the prevalence of chronic disease (3).

Demographic determinants

I will first review the demographic changes that have occurred in our population over the past 100 years, and examine the demographic forces that have produced these changes. I will then examine the evidence to support each of the three previous scenarios.

Three demographic factors determine a population's age and size structure: fertility, mortality and migration. Potentially the most important of these is fertility, except in

extremely high-mortality populations (4). If children survive to maturity to have children of their own, there is potentially an exponential increase in the population. Initially, this produces an increase in the young, as we saw in Canada in the 1960s, the so-called "Youthquake", but as these children age they contribute to the aging of the population as fertility rates fall. The permanent shift to an older age structure as a consequence of long-term declines in fertility rates is referred to as the "demographic transition (5)." The faster the decline in fertility rates, the more rapidly the mean age of the population rises. In Belgium, the proportion of people over 60 doubled in 100 years. In China, these changes are predicted to occur in 34 years, and in 20 years in Singapore (6).

Mortality rates also contribute to the population structure. As populations have moved from relatively high to relatively low mortality rates, the age structure at death and the causes of death in the population have changed. The reduction in maternal mortality has resulted in an increase in the proportion of females to males, which continues to increase as the population ages. These processes have been described by Omran as the "epidemiological transition"(7). Marked reductions in infant mortality rates over the past 100 years have led to increases in life expectancy at birth. For example, in England and Wales, in 1901, 37% of all deaths occurred in the 0-4 year age group, and only 12% of deaths occurred in those people over the age of 75. In 1999, 0.8% of all deaths occurred in the 0-4 year age group, while 64% occurred in the over 75 age group. Life expectancy at birth was 44.8 for men and 48.7 for women in 1901, and 74.4 and 79.6 for men and women respectively in 1995 (8).

Because infant and child mortality in industrialized countries is now so low, it is unlikely that any further gains in life expectancy will directly result from improvements in child mortality. However, reductions in the mortality rates of the elderly may result in improved life expectancy at age 65. In Japan from 1985-1990, 48% of the female and 31% of the male gain

in life expectancy was due to falls in mortality among those aged 75 or over. The proportion of Japanese women surviving to 90 increased to 40.1% in the mortality conditions of 2001 (9). In contrast, in 1955-60, changes in the mortality rate of the group aged 65 and over had a negative effect on the life expectancy of the population, even as mortality rates fell overall and overall life expectancy increased.(10) As epidemiologist Emily Grundy states, "Not only have changes in late-life mortality come to play a much more dominant role in determining the overall level and pace of change in morbidity, but in a low-fertility, low-mortality population with already relatively high proportions of elderly people, mortality changes are now the major determinant of further population aging (8)." Furthermore, unlike the demographic and epidemiologic transitions, which take years to age the population, the fall of mortality in the elderly immediately ages the population by directly increasing the number and proportion of the oldest-old.

Migration is another factor that contributes to the age structure of the population. In general, migrants are young and serve to decrease the average age of the population. However, in Canada because of the current government policies limiting immigration, the numbers have not been sufficient to counteract the aging of the indigenous population. If a war or famine necessitated Canada taking a very large number of refugees, the proportion of elderly in the population could be reduced, although the absolute number would not.

Over the past 160 years, average life expectancy has risen steadily and continuously by about 3 months per year (11). There is great debate about whether or not we can sustain this pace indefinitely. As we have seen in the former Soviet Union, collapse of the social infrastructure, combined with an increase in risky behaviour, especially alcohol use, resulted in a precipitous fall in life expectancy, particularly for males (12). There has been speculation that the re-emergence of infectious diseases such as smallpox, increasing antibiotic resistance in

bacteria and climate changes associated with global warming resulting in an increase in natural disasters may negatively affect life expectancy in the future. It has also been proposed that the epidemic of childhood obesity in the United States may reduce life expectancy in that country. However, improvements in biotechnology and genetic engineering could potentially cause a more rapid than currently predicted increase in life expectancy.

Having acknowledged that there are potential pitfalls, it seems reasonable to assume for now that present trends will continue and that the proportion of elderly people in the Canadian population will rise from the current 13% to 22% by 2031 (13). The interesting question is, what will the health status of these elderly people be?

Expansion or compression of morbidity?

Gruenberg, in 1977, in his classic essay, "The failures of success", predicted that technology would save people from dying without curing them, thus prolonging the process of dying rather than extending healthy life. The net effect would be to produce a pandemic of old age disability and to exponentially increase the burden of health care services and costs. So far, at least in Europe and North America, this has not occurred. The work of Manton and Gu (14) has shown that disability in the United States declined from 1982 to 1999, and that the rate of decline was greater in the 1990s than the 1980s. From 1982 until 1989, disability declined by an absolute rate of 0.26% per year and a relative rate of 1.0% per year. From 1989 to 1994 it declined by an absolute rate of 0.38% per year (a relative rate of 1.6%), and from 1994 to 1999 by and absolute rate of 0.56% per year (a relative rate of 2.6%). Disability, however, is a functional construct. One definition states that, "disability exists when the demands of a particular context do not match an individual's physical, cognitive and psychological capacity (15)." Thus, with the use of adaptive aids, one might not be considered disabled even if one is

impaired. Someone who cannot climb into a bathtub will still be able to cleanse himself if he has a walk-in shower, and hence will not be considered disabled for personal care. Similarly, someone who may not be able to prepare elaborate meals, but can use a microwave, may not be considered disabled for meal preparation. The WHO recognized the importance of understanding the nature of a limitation, and hence distinguished between impairment, disability and handicap (16). According to the WHO, impairment is "any loss or abnormality of psychological, physiological, or anatomical structure or function." Disability is defined as "any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being" and handicap is defined as "disadvantage for a given individual, resulting from an impairment or disability that limits or prevents the fulfillment of a role that is normal (depending on age, sex, and social and cultural factors) for that individual." Disability is therefore determined not only by impairment, but by rehabilitation and adaptation. Handicap depends not only on the individual, but also on the physical and social environment in which the individual lives. Thus for the purposes of successful aging, the concept of handicap becomes vitally important.

Although the widespread use of modern conveniences may decrease the level of functional disability for a given level of impairment in the population, we do need to distinguish between disability and morbidity. Declines in disability may be due to a reduction in the level of morbidity from chronic diseases because of better medical treatment. For example, improvements in cardiovascular treatment may have resulted in better overall health status of cardiac patients. On the other hand, declines in disability may occur in spite of an increase in morbidity because of diagnoses of chronic diseases at an earlier age, as well as prolonged survival because of better treatment. Robine in France, in contrast to Manton and Gu in America who reported a decline in the prevalence of chronic disease, found that, ". . .

the prevalence of chronic disease increased, but these diseases were on average less severe and induced less disability (17)."

Or, with earlier detection and better treatment, some chronic diseases may be significantly reduced or eliminated. Take the example of type 2 diabetes. We now have evidence that by detecting impaired glucose tolerance (IGT) and treating it with aggressive lifestyle modification or drugs, we can prevent some patients from progressing to type 2 diabetes and its inherent complications. One Finnish study showed that progression from IGT to type 2 diabetes could be reduced by 58% (18) with intensive diet and exercise programs, while another study showed that treatment with the oral anti-diabetic medication metformin could reduce progression to overt diabetes by 31% (19). One should also consider osteoporosis. By identifying and treating those persons with osteopenia with exercise programs and bisphosphonates, progression to osteoporosis may be prevented. Potentially, with appropriate screening and treatment, this disabling disease, with its attendant severe morbidity and mortality, could be eliminated.

Another factor to consider is that the cohort entering the category of elderly today may be healthier than the elderly of 20 years ago. They are certainly better educated, and there is a positive correlation between health and education levels (20), although the precise causal status of this association remains unproven. Some mechanisms by which education might influence health have been proposed (21): (i) Better educated persons more readily adopt healthy behaviours, such as exercising and refraining from smoking. (ii) Better educated persons are more likely to have had better medical care both early in life and up to age 65. (iii) Better educated persons are more likely to be able to comply with complex medical regimes and treatments, which may be required for control of chronic diseases such as diabetes or rheumatoid arthritis. Thus, the better educated tend to have fewer disabilities even when a

chronic condition is present. The debate over whether education or socioeconomic status is the essential causal factor is arcane and unhelpful, for they are intertwined. People in higher socioeconomic positions can afford more education, and education in turn permits access to higher-status positions in society. It may be that only a select portion of the population attained higher levels of education in the past. It is clear, though, that the education levels of the elderly are rising. In 1980, more than 60% of the population aged 85 to 89 had 0 to 7 years of education. In 2015, this proportion is expected to decline to between 10 and 15% (22). We may find that as a greater proportion of the population becomes more highly educated, the association between education and health becomes less apparent.

In 1984, the World Health Organization (WHO), proposed to look at "health transitions", that is, to study the effects of increase in survival on health status (23). From this conceptual work came the concepts of disease-free life expectancy and disability-free life expectancy as well as a new measurement, the "Healthy Active Life Expectancy" or HALE, which facilitated monitoring the health effects of decreased mortality in the oldest-old. Calculations done for the WHO, using data from 50 countries collected over 40 years from 1958 to 1998 (24-27), showed (i) a steady increase in life expectancy at age 65 in low-mortality countries since 1970, (ii) no increase in disability-free life expectancy over the same time period, (iii) "severe" disability-free life expectancy increased in parallel with life expectancy in those countries for which data was available (Australia, Canada, France, Japan, the UK and the US). This data supports Manton's theory that an increase in life expectancy is in part due to a slowing down in the rate of progression of chronic diseases. Robine, in interpreting this data, stated that, "In the low-mortality countries, the decline in mortality among the oldest-old during the 1980s and 1990s was accompanied by an increase in the reported prevalence of chronic diseases and perhaps by an increase in the total prevalence of reported disability. But

these diseases were on average less severe and led less often to severe levels of reported disability. The results indicated that, at worst, the increase in life expectancy is accompanied by a pandemic of light and moderate but not of severe disabilities (28)." In other countries such as Taiwan, however, morbidity and disability have been shown to be increasing (29). Furthermore, severe disability increased in Australia during 1993 to 1998 at the same time as it declined in the UK, Finland, Switzerland and France (27).

Robine and Michel have proposed a model which seeks to explain these disparate results by viewing the expansion of morbidity, the compression of morbidity and Manton's theory of dynamic equilibrium as different stages in the same transition. Succinctly stated, their theory proposes that, through time, "there may be a circling back, where, first sicker people survive into old age and disability rises, then the number of years lived with disability decreases as new cohorts of healthier people enter old age, but finally, the number of years lived with disability rises again when the average age of death goes so high that many people spend their last years at advanced old age burdened by multiple chronic diseases and frailty (30)." In a low-mortality country such as the United States, the expansion of morbidity, as observed by Gruenberg and reported by Verbrugge (31) in the1960s and 1970s, followed by the compression of morbidity as reported by Manton, seems to have already occurred. A developing country such as Taiwan, which underwent its demographic and epidemiologic transitions later than Western countries, may be in the expansion of morbidity phase.

It is the last stage, the predicted expansion of morbidity, which is the most controversial part of the theory. Although Robine and Michel have suggested that expansion of morbidity might already be occurring in Australia, Australian researchers disagree. Caplan and Harper (32) state that the expansion of the definition of disability as well as decreased stigma associated with mental illness have resulted in increased reporting of disability in

Australia. James Fries makes the point that ". . . disability is not a present or absent variable, it is a continuous variable and must be measured as such (33)." Improvements in measurement of disability will be necessary in order to determine whether or not Robine and Michel's last stage of expansion is actually occurring.

But we should not regard these processes as being mechanical or inevitable processes. Mor and Perls point out that when considering the extreme old, we must consider such factors as resistance and resilience. They have observed that, "There is certainly a broad range of variability in how people respond to illness both physically and psychologically. Two individuals can sustain an equally dramatic myocardial infarction or stroke and yet incur widely different levels of functional impairment and mortality risk (34)." They classified centenarians into three groups: survivors (who were coping well with chronic disease, delayers (who were not yet suffering the manifestations of chronic disease) and escapers of age-related diseases. All of these groups were highly functional. They suggested that these centenarians, having demonstrated an ability to survive for a long period of time, had a component they called resilience, which allowed for a compression of disability even in the face of expanded morbidity. They felt that this factor could modify the impact of the expansion of morbidity, and therefore needed to be included in the model. However, even if there is a compression of morbidity and rates of morbidity continue to decline in the elderly, because of the sheer numbers of people achieving extreme old age the levels of disability in the population will increase. That is, the total number of years spent with disability over the whole population will increase.

Economic effects of shifting demographics

But do we need to answer the question of whether or not morbidity will expand or contract in order to predict future health care expenditures? Evans et al argue in their paper, "Apocalypse No", that demography plays only a minor role in determining health care expenditures (35). In the US, Gruber and Wise, who conducted a cross-national survey of the effect of aging on social spending, concluded that there is no statistically significant relationship between the percentage of a nation's population that is aged 65 or over and total health spending as a percentage of Gross Domestic Product (GDP) (36).

From an economic viewpoint, what may be more important is increasing the retirement age to realistically reflect the capacity for seniors to continue to be productive at the age of 65 and beyond. In the US, the age at which one may collect full social security pension benefits is gradually rising from age 65, and will be at 67 by the year 2027 (37). In Canada, Canada Pension Plan (CPP) officials assure us that because the CPP has a very large reserve, the result of a 73% increase in CPP contributions since 1997, the age for CPP eligibility can comfortably remain at 65. Whether or not the income from CPP is enough to sustain an adequate standard of living is another discussion. In 2001 for men at age 65, the CPP payment represented about 41% of their pre-retirement income (38). It is designed to replace about 25% of working income. Furthermore, given the improved health of the elders, their capacity to continue working and the increased proportion of seniors in the population, one wonders about the cost to our society, both in money and in loss of skills, of keeping the retirement age fixed at 65 years.

European countries and Japan, because they did not experience as dramatic a post-war baby boom as occurred in North America, have populations whose average age is older than ours. For example, in Italy in 2000, 24.4% of the population was over 60, as compared to 17%

of the Canadian population (39). These European countries have been developing some strategies for dealing with the aging of the work-force. In Germany, for example, unions and employers established a plan whereby 55 year old workers could opt to work half-time while collecting 82% of their salaries and while still maintaining their pension contributions at 95% of the full-time rate (37). In Japan, the government is promoting the retention of older workers by providing financial incentives to employers. For example, those businesses who maintain more than 10% of older workers in their workforce or who have eliminated mandatory retirement receive subsidies. The government also partly covers the cost of adaptations made to the workplace to make it more hospitable to the needs of older workers. Over 37% of Japanese men continue to work past age 60, while only 10% of American men do so (37). In the United States as well, there has been some effort to retain older workers. Recently, companies have been experimenting with flexible hours in a bid to retain older workers. This has translated into increased productivity. The American company Watson Wyatt Worldwide states that, "As the workforce ages and interest in phased retirement grows, employers that do not facilitate phased retirement could face a significant competitive risk (40)."

All of these policies could increase the labour supply as well as decreasing the number of people dependent on the working population. Projections from the Organization for Economic and Cooperative Development (OECD) show that if Germany, Italy, Austria and the UK can increase their rate of labour force participation, by attracting more women and younger workers into the work force as well as by delaying retirement for older workers, that they can actually increase their standard of living growth over the next 30 years (41). Growth in productivity could offset some of the increased costs required to support the growing elderly population. Of course, it is important that the increased wealth generated by the elderly

remaining in the workforce should be equitably distributed. The present tax structure tends to punish rather than reward those elders who wish to remain in the workforce. According to OECD figures (41), the change in pension wealth in Canada for a person who postpones retirement from age 55 to 69 is -1.6 times average annual earnings. That is, the worker pays a penalty of 1.6 times average annual earnings for retiring later, which translates into an average tax rate of about 16% in addition to all other taxes and work-related expenses the worker would have to pay. Having said that, the Canadian worker is still in a relatively good position compared to the rest of the developed world, with only Switzerland and the UK being less punitive. Both of these countries impose a penalty of -1.5 times average annual earnings. Italy currently presents the worst pension environment for the older worker, with a penalty of -11.8, or an average tax rate of 118% for those who delay retirement to age 69.

There seems to be general agreement among economists that increasing the productivity by retaining older workers in the workforce will help to ameliorate the economic effects of population aging. The degree to which they will do so is in question, because projections for the burden that will be imposed by the aging population are wildly different. First of all, although everyone agrees that the proportion of elderly people will increase, there is great disagreement about the absolute numbers of elderly people that we may expect in the future. Because population projections are based on assumptions about fertility rates, mortality rates and immigration rates, demographers usually calculate three projections: high, medium and low variants. For the United States population, the official projections for the number of people over the age of 65 in 2040 range from a high variant of 92 million to a low variant of 59 million, a difference of 33 million people (42). Projections for the number of people over 85 in 2040 range from a high variant of 20.9 million to a low variant of 8.3 million. And these are just the official statistics. Estimates for the number of people over 85 in 2050

range from 14.6 million predicted by the US Social Security Administration, to 18.2 million predicted by the US Census Bureau, to 39.0 million forecasted by James Vaupel, to 48.7 million projected by Kenneth Manton (43). As Ellen Gee points out, even using the medium variant assumptions, different agencies can come up with differing projections (44). For example, the US Bureau of the Census estimates the population aged 65 and over in 2030 to be 69.3 million while the Urban Institute projects it to be 64.3 million. This difference of 5 million people translates into a discrepancy of 76 billion dollars in Social Security Benefits (in 1998 US dollars) (45).

Dependency ratios

Obviously there is huge uncertainty about the numbers of elderly people we will be expecting as the century unfolds. There is even greater uncertainty as to how much they will cost. One figure that has been used to try to assess the impact of aging on the population is the dependency ratio. Dependency ratios are calculated by measuring the ratio of people in the dependent age groups to the number of people in the working age groups. These are somewhat arbitrarily defined, as some researchers use 0-15 years for calculating the youth dependency ratio, while others use 0-18 years or even 0-20 years. Similarly, on the other end of the scale, some researchers define those in the aged dependency group as 60 and above, while others use 64 and above. Some demographers also make the assumption that if one spouse is in the aged dependency group then the other spouse is as well, even if the younger spouse has not yet attained the specified age (39). Adding together the youth dependency ratio and the aged dependency ratio produces the total dependency ratio. If the number of young

people falls while the number of aged people rises, the total dependency ratio remains constant. For example, in Canada in 1951, the total dependency ratio was 0.83, which means that there were 83 non-working people for every 100 working people in Canada. In 2001, because of the fall in fertility, the total dependency ratio was 0.62. In 2041, the total dependency ratio is projected to be 0.82, because the youth dependency ratio is expected to fall from 0.69 to 0.36 while the aged dependency ratio rises from 0.14 to 0.46 (46). If society spends the same amount on social programs for children as for the elderly, then total social expenditures would not be expected to increase. However, we do spend more on the elderly, but how much more is, again, a huge area of controversy.

In Canada, it has been estimated that public expenditures are two to three times higher for the aged as for the young (47). The elderly do make private economic contributions which are not included in this calculation, and so Canadian estimates are that the public expenditures on the elderly are less than three times as high for the aged as for the young. Denton et al have calculated that in order for Canada's total dependency burden to increase that we would have to spend greater than three times the amount on elderly than on youth (48). From these figures one can conclude that Canada does not face much of a dependency problem based on the aging of the population. However, estimates of public expenditure on the elderly do vary substantially. American economists estimate that per capita public spending on the elderly in the US is eleven times that spent on the non-elderly. The same economists place Canada's public spending at five times greater for the elderly (49). Of course it may be argued that the reason for the huge difference in the US is under-spending on youth. However, if they are correct and Canada does spend five times rather than somewhat less than three times the amount of money on elderly than on young people, than we could be facing a substantial problem in the future. There are some inherent difficulties with dependency ratios that limit

their usefulness as a tool to assess the impact of aging on our society. As mentioned previously, the age limits at both ends are arbitrary. Also, many people in the "working age" group may be dependent for a number of reasons, leading to an under-estimate of dependency ratios, but this may be balanced by some in the elderly group who are in paid employment (and the number will likely increase as we have seen previously), or may be doing unpaid work such as looking after grandchildren or an elderly spouse, and thus contributing substantially to the economy.

Projections of economic growth

Another factor that needs to be considered is economic growth. Depending on predictions of the growth rate of the economy, the ability to pay for social programs in the future is either well assured or is in question. The US economy has grown by an average rate of 3.2% per year since 1950 (50). In the recession of the 1990s, growth was only 1.9%, the worst since the Depression. Again, there are varying predictions as to what will happen to the economy over the next three decades. The Clinton administration predicted a growth rate of 2.3% per year on average. The Congressional Budget office more conservatively assumes the rate to be 1.5% per year. Small differences in the growth rate produce astronomical differences in the GDP. For example, if the rate of average economic growth over the next 30 years is 1%, the US GDP will be $10 trillion (in 1992 US dollars). If the growth rate is 3%, the GDP will be $19.3 trillion (also in 1992 US dollars). Given a margin of error of 9.3 trillion dollars based on this calculation alone, it is easy to see why predictions about the ability of our governments to pay for social programs in the future are all over the map. In the US in 1997, total government expenditures were about 34% of GDP. If the 1% growth rate figure is correct, then spending will rise to 61% of GDP to maintain the same level of service. If the 3% growth rate is

accurate, then spending will decline to 32% of GDP. It is easy to see how different policy makers interpreting the same data can come to very different conclusions. Those who wish to reduce spending will cite the less favourable scenarios in order to justify cuts to services, while those who wish to increase social spending will quote the more optimistic figures. Whether or not the aging of the population will lead to economic instability in the future remains an open question.

Given all the uncertainty about the future economic environment, and the reality that many of the factors affecting the economy are under federal and provincial controls, we need to return to the question of what can a modern Canadian city do to promote healthy aging.

Conceivably, the city could have some influence in promoting work environments suited to the needs of older workers, thus helping to boost overall productivity. For example, encouragement of zoning decisions that support mixed-use environments with work, housing and shopping close-by, development of accessible workspaces, and reliable and safe transportation would facilitate older people remaining in the workforce.

However, in order for older people to remain in the workforce, they do need to remain healthy. As I have discussed, there is some evidence that the level of disability in the elderly population is decreasing, but it is still of concern. In the next few chapters, I will review evidence from psychology, biological science and sociology, in order to elucidate some of the factors that contribute to mental, physical and social health of the elderly.

Chapter Two: The Psychology of Aging

The psychology of aging is a topic area of significant breadth, as psychologists have looked at aging from many different perspectives. Psychology encompasses both mental health and cognitive functioning, which may be but are not necessarily related. Both are relevant to successful aging, as are the development of personality and coping strategies, which may influence mental health but are also a field of study in their own right. Each of these fields of study could fit under different categories in a model describing successful aging. In order to understand how each of these areas of psychology can help us to understand successful aging, I am going to describe the developments in the field to date and then discuss how each area could be integrated into a conceptual model.

Definition of mental health

Different approaches start with different sets of assumptions. For example, there is in the literature disagreement about what constitutes mental health. There are those researchers who would define mental health as the absence of disease, whereas there are others who favour a wellness based approach, consistent with the WHO definition of health as "a complete state of physical and mental well-being". Jahoda (51) in 1958 proposed six criteria for positive mental health: (1) sense of identity, including self-acceptance, self-esteem and self-reliance; (2) investment in living and in realizing one's potential; (3) unifying outlook and sense of meaning and purpose to life; (4) autonomy, including self-determination with respect to demands from society; (5) accurate perception of reality and sensitivity to situations of others; and (6) mastery of the environment, manifested in interpersonal relationships, engagement in work and play, and ability to solve problems. Although these criteria were not intended to be specific to the

elderly, they work rather nicely as a model for emotional health in old age. Ryff (52) used these criteria as a basis for identifying dimensions of well-being, which she proposed as: (1) self-acceptance, (2) positive relations with others, (3) autonomy, (4) environmental mastery, (5) purpose in life and (6) personal growth. These dimensions have been measured as an attempt to quantify life-satisfaction, which in some of the psychology and social work literature is synonymous with successful aging.

Depression

In some of the literature, this broader, more inclusive, positive approach is named emotional well-being, rather than mental health. The term "mental health" more usually refers to the presence or absence of mental illness, which is often included in rating scales as an indicator of absence of well-being. Although mental illnesses such as schizophrenia or bipolar affective disorder are important, depression is by far the most common mental illness in the population. It is important that we consider depression in the context of successful aging because it is such common treatable cause of morbidity in the elderly, and because it affects physical and social functioning. In the community, rates of prevalence of major depression are about the same in the elderly as in the rest of the population, running at between 1 to 4% (53). Peak incidence of depression is in the 50 to 60 yr age group. However, rates of prevalence of depression are significantly higher among institutionalized elderly. In one study, the overall estimate of prevalence of major depression among residents of a veteran's hospital in the US was 11.5% (54), while in another study in a long-term care facility in the US the prevalence of major depression was found to be 12.4% (55). The residents of long-term care facilities have greater medical co-morbidities than elderly who are resident in the community, which accounts for their placement in such facilities. There is an association between physical infirmity and

depression. Certain severe and chronic diseases are associated with significant increases in the prevalence of depression. For example, between 30 to 50% of stroke patients, 8 to 44% of ischemic heart disease patients, 1 to 40% of cancer patients, 40% of Parkinson's patients, 20 to 40% of those with Alzheimer's and 17 to 31% of dementia patients become depressed (56). Worldwide, depression was ranked as the fourth largest disease burden by the Global Burden of Disease Project (57). These same researchers have projected that depression will become the second largest cause of morbidity, after ischemic heart disease, by 2020. Part of the reason for this change is the expected decline of the current top three causes of morbidity, lower respiratory infections, diarrhoeal diseases and conditions arising from the perinatal period. Another reason is an anticipated increase in neuro-psychiatric conditions, particularly in Third World countries, as a result of ischemic changes due to tobacco abuse.

As depression is considered to be a disease which may be caused directly by physical factors, a model of successful aging should show mental health tied closely to physical health. Moreover, the relationship between physical and mental health is reciprocal, in that depression can cause physical infirmity and disability. Depression can lead to disability because depression itself is a disabling state (58). Depressed elderly are less likely to be able to perform executive-type cognitive functions, which renders them disabled for activities of daily living. Increased disability can then contribute to increased depression, by leading to higher numbers of negative life events or by leading to restriction of valued social or leisure activities, isolation, and reduced quality of social support. Depression is one area that lends itself to a continuum approach, with absence of depressive symptoms on one end of the spectrum and severe depressive symptoms on the other. In the middle is less severe symptoms, which have been termed "minor depression" by some researchers. There is evidence that a very large number of elderly people suffer from some depressive symptoms, up to 58% of women and 34% of

men in one Italian study (59). Depending upon one's point of view, this could be taken as an indication that there is a significant burden of biological disease that needs to be treated or a concern that the sociocultural environment produces a poor quality of life for elders (60). Thus even though we need to show the close relationship between physical and mental health in the model, we also need to show how the sociocultural context influences both physical and mental well-being. For example, the social environment may be a factor in rehabilitation treatment of stroke patients. Although we believe that stroke causes depression directly putatively by effecting changes in neurotransmitter activity (61), we have evidence that physical rehabilitation effectively treats these patients' depressive symptoms (62;63). It is possible that the improvement in physical well-being brought about by rehabilitation directly causes an improvement in mental health, but it is also possible that the supportive environment of a rehabilitation facility is of great importance in improving depressive symptoms.

Cognitive function

Cognitive function is another entity which is affected by depression, but which has a number of predictable age-related changes that must be considered separately. Sometimes in elderly people, depression can present as cognitive deficits (64). Diseases such as Alzheimer's, which result in a decline in cognitive function, have a very high associated incidence of depression. Other diseases such as atherosclerosis can negatively affect cognitive function, as can biological assaults such as prolonged tobacco or alcohol abuse. Cognitive function is to a large extent a reflection of the overall health of the organism and thus in Rowe and Kahn's model of successful aging one of their three components contributing to successful aging is "high cognitive and physical function" (65). In an individual who is not burdened by biological disease that can cause decreased cognition, there are some predictable changes in cognitive

function that occur with age, as measured by standardized intelligence tests (66). Fluid intelligence declines with age, while crystallized intelligence increases. Fluid intelligence is the native ability to reason, problem solve and remember, and is unrelated to education. Crystallized intelligence reflects experience both from formal education and from everyday life. It reflects knowledge of the world as well as wisdom. Baltes refers to fluid intelligence as "knowledge-free, fluid mechanics" and crystallized intelligence as "knowledge-rich crystallized pragmatics" (67). He likens fluid intelligence to hardware on a computer, and crystallized intelligence to software. Fluid intelligence, because it is mechanical and reflects functions such as processing speed and efficiency, is more vulnerable to biological aging related changes, while crystallized intelligence is less affected. Because of the increase in crystallized intelligence, in longitudinal studies verbal performance on IQ tests peaks at about age 55. Society has long recognized that in many although not all individuals, wisdom increases with age. Thus, there are very few world leaders or Supreme Court judges below the age of 50 years. Older adults tend to do better on tests of moral reasoning than do younger adults. As one colleague put it, "The light of reason is no longer dimmed by the fog of fashion."

Gain – loss theory

Paul Baltes has proposed that as one ages, the increase in knowledge-based pragmatics offsets the age-related declines in cognitive mechanics. That is, because of their superior knowledge, older workers can perform at a level equal to or better than younger workers, in spite of age-related problems. In other words, they can compensate for their losses. One example of compensation was found in Timothy Salthouse's classic study examining the performance of older and younger good typists (68). Salthouse found that tapping speed was significantly slower in the older typists, but that some older typists exhibited superior typing performance in

spite of this limitation. He suspected that older typists likely compensated for the decline in tapping speed by reading farther ahead in the text to be typed, an example of the development of a strategy based on procedural and declarative knowledge (69). This ability to use knowledge acquired over the course of a lifetime to compensate for physical declines associated with aging provides an illustration of Baltes' gain/loss theory.

Whereas Rowe and Kahn provided a description of what constitutes a successful ager, Baltes attempted to explain how some people are able to age successfully. He argued that successful aging is achieved by a process of successful adaptation. He proposed that development at any life period reflects a dynamic interplay between gains and losses (70). For example, as one develops in one's career, one tends to become more and more specialized, decreasing the probability of moving to alternate career paths. As we adapt in a more specialized manner, we lose our pluripotentiality. As we age, Baltes proposed, the balance between gains and losses becomes less and less positive. He attributes these changes to a loss in reserve capacity of the aging person. He suggests that one way to mitigate age-related losses is to employ a strategy of "selective optimization with compensation". This adaptive strategy comprises three components. The first is selection, which refers to "an increasing restriction of one's life world to fewer domains of functioning because of an aging loss in the range of adaptive potential." The second component is optimization, which refers to people engaging in behaviours to enrich and augment their general reserves. The third component, compensation, refers to behaviours invoked when functional capacities are lost or reduced, in order to maintain adequate function. A good example of selective optimization and compensation is provided by the concert pianist Arthur Rubinstein, who continued to perform into his 90s. In order to continue to perform, he reduced his repertoire of pieces (selection), practiced them more often (optimization), and played a bit more slowly before the fast parts in

order to create a contrast to make the fast parts sound faster than they actually were (compensation). The adaptive strategy of selective optimization and compensation can be applied on an individual level but also at a municipal level. Selection could be expressed by provision of a less demanding physical environment. For example, provision of adequate lighting, well-shoveled sidewalks and accessible buildings could enhance the well-being of the elderly. Optimization could be expressed as the provision of opportunities for practice in domains targets for further growth. This could include access to libraries and to post-secondary education. Compensation would be achieved by the ability of medical and technological systems to support diminished reserve capacities. For example, good access to adaptive aids such as hearing aids, mobility aids or prostheses as needed would allow elders to continue to function independently.

The Baltes' research is grounded in a life course perspective. That is, it explains an adaptive process that occurs throughout the lifespan, not only in old age. For this reason, it is unique in aging research. Much of the work that takes a developmental approach is concerned with only the second half of the life course, and is not integrated with infant and child development. It does stand to reason, however, that those who are successful children or young adults are more likely to be successful agers, as aging is a culmination of a series of life-long choices.

Branching theory of aging

One theory that attempts to show how choices at all stages in the life-span may affect successful aging is Birren and Schroots "branching theory of aging" (71;72), which they derive from their more general theory of "gerodynamics". Their theory of gerodynamics, briefly stated, depends on three propositions: (i) Living systems conform to the constraints of the

Second Law of Thermodynamics. That is, entropy in living systems will increase over time. (ii) Order can arise out of disorder in living systems by way of self-organization. (iii) The dynamics of living systems is represented in nonlinear series of transformations into higher and/or lower order structures (or processes), showing a progressive trend toward more disorder than order over the life span. Lower-order structures contribute to increased entropy, which leads to the senescence and death of the organism, while higher order structures lead to greater organization. These authors describe psychological aging in gerodynamic terms as "the processes of optimizing self-regulation and independence of environmental variations (order) in the presence of some decreasing capacities and resources (disorder) which the aging individual may experience." They go on to discuss life choices in terms of branches or bifurcations. They argue that, "Branching points – or bifurcation/choice/transformation/turning points, as they are called alternately – may be defined as those changes in the life of the individual, which direct the life-path distinctly, for better (higher order) or for worse (lower order). As individuals age, the probability of lower order transformations increases, leading to their disability and death. The limitations of this theory are that the bifurcation points are only observable in retrospect, some changes that might seem to be for the worse, such as divorce, may lead to better rather than worse psychological health, and that this model is only useful for describing the life trajectory in individuals to whom it is applied. One can perhaps use this model to compare the lives of two individuals, but it is quite unhelpful in eliciting the factors that can contribute to successful aging in the population.

Erikson's theory of human development

Another psychological approach that looks at aging as part of the lifespan is Erik Erikson's theory of human development. Erikson proposed that human beings must overcome a series of eight developmental challenges in order to achieve wisdom and maturity in old age (73). According to his theory, the successful resolution of each challenge is necessary in order to move on to the next developmental task. That is, only when each developmental crisis is resolved and one's personality has accommodated to the newly-met challenge, will the individual have enough strength to deal with subsequent stages of development. If an individual is unable to resolve a conflict at a particular stage, that individual will be compelled to continue to struggle with that conflict later in life. Observing her own personality growth in her 80s and 90s, Joan Erikson felt it was necessary to add a ninth stage to her husband's eight stages of human development. She used the term gerotranscendence, after the work of Lars Tornstam, in order to describe the final stage of human development in the very old. She felt that very old individuals wish to transcend the ordinary limitations of human knowledge and experience, and concentrate on a more universal understanding of life as well as focus on their own impending deaths. She argued that in order to achieve gerotranscendence, one must revisit the eight previous developmental challenges to resolve completely any previously unaddressed issues.

Gerotranscendence

Tornstam defined gerotranscendence as, ". . . a shift in meta-perspective, from a material and rational vision to a more cosmic and transcendent one, normally followed by an increase in life satisfaction (74)" Like Joan Erikson, he felt that gerotranscendent individuals were less

concerned with the mundane details of everyday life, and more concerned with universal values. Unlike Joan Erikson, however, Tornstam did not theorize that it is necessary to resolve outstanding developmental challenges in order to achieve gerotranscendence. Rather, he regarded gerotranscendence as the normal outcome of a long life if one has attained the necessary and sufficient personal qualities to make a positive examination of one's past. Development of a gerotranscendent perspective would allow an individual to maintain a high level of life satisfaction even in the face of significant physical deterioration. Theories such as Tornstam and Erikson's have been criticized as being attractive ideals which do not specify any practical means for their achievement. Consequently, they run the risk of "becoming merely idealized or sentimental projections of human fulfillment, where the highest stage of consciousness turns out to coincide with the last stage of life." (75) Except for one conceptual model put forward by the epidemiologist Thomas Glass (67;76), these theories have not been integrated into models of successful aging. One of the great challenges is to somehow link the body of work, such as that of the Eriksons and Tornstam, which considers successful aging to be a state of being, with that of researchers such as the Baltes who consider successful aging to be a process of adaptation. We will explore this theme in detail in the Definitions and Models chapter which follows later in the thesis.

Chapter Three: The Sociology of Aging

In order to understand the contribution of sociology to the study of aging, it is necessary to review the various schools of sociologic thought and discuss how they have contributed to our understanding of successful aging. We will review the various theories of successful aging in chronological order and discuss from which sociologic tradition they have arisen.

Disengagement theory

The first formal sociological theory of aging to appear in the literature was Cumming and Henry's disengagement theory (77) (1961), which described how elderly people withdraw from the roles characteristic of middle age. They argued that this process is functional to both society and the individual; it enables society to make room for more efficient young people while, at the same time, allowing the elderly time to prepare for their final withdrawal from social life – death. This theory is rooted in the sociologic tradition of structural functionalism. Structural functionalist theory states that social behaviour is best understood from the perspective of the processes within society that maintain social equilibrium. The approach views social behaviour in terms of its function within the structure of society. In the functionalist perspective, consensus and conformity, rather than conflict, are the driving forces within the social order. Disengagement theory was heavily criticized and fell out of favour because the empirical data did not support it. Even Cumming and Henry's own data showed that a substantial portion of elderly people did not withdraw from social activity. These people were referred to by Cummings and Henry as "unsuccessful agers", "off time disengagers" (i.e. people who had not yet disengaged), or members of a biological or psychological elite.

Activity theory

In opposition to the disengagement theory is activity theory. Prior to the development of disengagement theory, an implicit activity theory had been the dominant perspective in the study of aging. Early researchers such as Havighurst, in 1943, had stated that the more active elderly people were, the greater their life satisfaction (78). After the formulation of disengagement theory, critics of that approach developed activity theory in a more formalized fashion, starting with Cavan in 1962 (79). Activity theory is rooted in a different sociologic tradition, called symbolic interactionism, which emphasizes the dynamic and meaningful processes of social interaction. According to this perspective, individuals develop a sense of self by interpreting other people's responses to their behaviour; for example, someone who becomes a grandparent must learn to take on that role in part by assessing how the grandchild responds to him or her.

The role evolves out of an interaction between the players. Individuals attempt to understand how other people see them by taking on the role of the other. Social order depends upon the shared meanings that develop in interactions between individuals. Activity theory states that an individual's self-concept is related to the roles that he holds, and that successful agers are able to develop new roles to compensate for the roles lost with age. In this model, life satisfaction arises from increased activity in these new roles. One of the major criticisms of activity theory is that it assumes that all older people need and desire high levels of activity to maintain life satisfaction in old age, when findings from studies of older people's attitudes toward successful aging show that this is clearly not the case.

Subculture theory

Another theory based on symbolic interactionism, was Rose's 1964 subculture theory of aging (80). This theory postulated that elderly people are developing their own subculture in American society. The creation of a unique subculture "results from (1) older people's exclusion from interactions with other age groups, (2) their increased interaction with each other as a result of age-segregation policies (e.g., retirement, age-homogeneous housing), and (3) their common beliefs and interests (e.g., health care). As a subculture, the elderly create their own norms and values specific to their group. The aged subculture cuts across other status distinctions – gender, race, social class – so that the elderly develop a group identity." This theory has been discounted by research that shows that the elderly have not developed a strong group consciousness, at least inasmuch as these are reflected in voting patterns or attitudes and values. In fact, the elderly may be more heterogeneous than other age groups.

Continuity theory

A third theoretical construct which arose out of the symbolic interactionist perspective was continuity theory, first elaborated by Atchley in 1971(81). He theorized that older adults cope with the changes of aging by applying familiar strategies in familiar arenas of life in order to "preserve and maintain existing internal and external structures." For example, a person may retire from an occupation, but keep the occupational role. Instead of being a professor, one can become a professor emeritus, retaining status but decreasing workload. Atchley theorized that there are two types of continuity, external and internal continuity, and that when one was no longer able to maintain external continuity, one could compensate by increasing internal continuity. For example, a person who loses the ability to live independently can retain his

self-esteem by gradually reframing his perception of himself in order to absorb the new reality. Those who fail to absorb the new reality will experience discontinuity, or identity crises. Internal continuity is thought to be a prerequisite for mental health. There are some similarities between this theory and some of the psychological theories discussed in Chapter 3, particularly Schulz and Heckhausen's theory of primary and secondary control (82), which would roughly correspond to external and internal continuity. Continuity theory has been criticized for being too abstract, difficult to measure and impossible to operationalize (83).

Age stratification theory

The next influential theory to be elaborated in the literature was Riley's 1971 age stratification theory (84), which is rooted in structural functionalism. This is one of the most cited theories in the sociological literature. There are three main components to this theory: (1) studying the movement of age cohorts across time in order to identify similarities and differences between them; (2) examining the asynchrony between structural and individual change over time; and (3) exploring the interdependence of age cohorts and social structures. In this approach, aging is conceptualized as both a process and a structure. This theory argues that a individuals are organized into a hierarchy by age, and that people are restricted in the roles they are allowed to take on by their age. Thus, younger people may be excluded from certain jobs because of educational requirements which they have not yet been able to fulfill, whereas older people may be excluded from occupations because of mandatory retirement. Implied in this world view is an unequal distribution of resources and power. The theory attempts to understand the interdependence between age cohorts, social structures and individual aging processes. One of the major criticisms of age stratification theory is that because it involves the study of cohorts, usually in arbitrarily defined 1-year and 5-year age groups, it puts an inordinate

emphasis on chronological age. This can lead to an exaggeration of homogeneity. Critics note that the theory neglects diversity on the basis of other structures such as gender, class, or ethnicity. When gender, class or race are mentioned in this research, they are treated as separate systems of inequality that are independent of one another and of aging.

Modernization theory

Cowgill's theory of modernization (85) appeared in the literature in 1972, shortly after the first iteration of age stratification theory. Like age stratification theory, this theory is rooted in the structural functionalist perspective. Modernization theory suggested that "the status of the elderly derives from their relationship to evolving systems of social roles which vary across societies depending on the degree of industrialization (or modernization)." This theory attempted to explain the shifting status of the aged across cultural and historical contexts. Briefly stated, it argued that the status of the aged is inversely related to the level of societal industrialization. The evidence for this theory was based on 20th century pre-industrial societies, which were intended to represent past societies. Critics of this theory claim that modernization theory describes a "golden age of aging", with the elderly as powerful heads of multi-generational families living under one roof, which never really existed.

Social competence and breakdown theory

In 1973, the social competence and breakdown theory (86), which has its roots in symbolic interactionism, environmental press theory in psychology, and general systems theory, appeared in the literature. This theory describes how depletions in social competence, or breakdown, can occur as a result of crises (such as the loss of a spouse or an illness) in the life of an elderly person. The mechanism is described as follows: "(1) An elderly individual,

whose self-concept may already be vulnerable because of role loss or negative stereotypes concerning aging, experiences a health-related crisis; this leads to (2) labeling of the older person as dependent by the social environment – health professionals or family; (3) atrophy of previous competency skills occurs; and (4) the individual adopts the self-concept of sick, inadequate, or incompetent. This leads to further vulnerability; and the negative cycle occurs again, with further consequences to social and psychological competence."

The authors suggested that the spiraling breakdown of confidence in the elderly could be reversed by what they termed the "social reconstruction syndrome", by which they meant offering environmental and emotional support in order to help the elderly retain their perception of competence. Although the approach may have some merit, it has not been empirically tested. We do not know if in practice the elderly are able or even willing to muster the support needed to protect their sense of competence.

Social exchange theory

Another theory that appeared soon after the modernization theory was Dowd's 1975 social exchange theory of aging (87), which was based on the application of a rational, economic model to the study of social behaviour. Exchange theory states that "social life consists of a collection of individuals involved in ongoing social exchanges. Individuals' reasons for interacting with others depends on their calculations of the costs and benefits they derive from continued social interaction. That is, individuals engage in interactions that are rewarding to them and, conversely, withdraw from interactions that are costly. As such, social order exists as a by-product of "profit-maximizing" individuals." As applied to the aging, the theory postulates that the elderly possess fewer resources than the young, and for this reason, continued interaction with the elderly becomes prohibitively costly for the young. For

example, if an elderly person becomes hearing impaired he may become increasingly difficult to engage in conversation. A younger person interacting with the older person may become increasingly frustrated at attempting to hold a conversation. Therefore, the interactions between the young and the elderly decrease and the elderly gradually withdraw from social life. The model has been criticized for the fact that it looks only at the quantity of social interactions and not at their quality. It also attempts to define qualities such as love purely in economic and behavioural terms. Most people would agree that one could not capture the meaning or effect of love in such terms.

Life course perspective

The life course perspective, which is not a theory of aging per se, but is rather a conceptual framework rooted in the age stratification theory, was popularized by Neugarten (88) in 1976. Researchers using this approach acknowledge that (1) aging occurs from birth to death; (2) aging involves social, psychological and biological processes, and (3) aging experiences are shaped by cohort-historical factors. The life course perspective has the potential to link personal and societal aspects of aging. It also links psychological and sociological perspectives. One of the problems with the term, life course, however, is that it has been used somewhat loosely in the literature and so has been applied to just about any research on adulthood and aging.

Political economy theory

More recently, a political economy approach has been used to try to understand successful aging. The political economy approach is rooted in Karl Marx's theories of capitalist development (89). Marx argued that "the social distribution of power and resources in a

capitalist society is embedded within the context of the social relations of production (90)." Thus, individuals are born into societies in which their relationship to the means of production has been largely determined by birth, giving rise to different class positions: a miner's son has a strong chance of becoming a miner in his turn. Furthermore, power rests with those who own the means of production. It is the fundamental antagonism of the classes which produces the class struggle that is ultimately required to change sociocultural systems. In contrast to structural functionalism which emphasizes consensus and conformity, Marxism views tension and conflict as the key features characterizing the social order. The political economy perspective holds that the economic structure of the capitalist state to helps to explain the social problems of the elderly. This perspective argues that effects of "social programs created for the elderly have been much more beneficial to capitalist interests than to the elderly themselves, often having adverse effects on older people." For example, the development of institutional care for elderly people who were formerly cared for at home responded to economic pressures from industry to maintain working families as free as possible from obligations that conflicted with their employment. Estes (91) in 1979 theorized that the primary benefit of development of government welfare programs for the elderly in the US has been to create service jobs, thereby benefiting the capitalist economy, while failing to provide for the needs of the elderly they purport to serve. That is, social programs, like everything else in the society, serve the state, which is the repository of the power. The elderly are treated as another commodity. This approach has been criticized for overestimating the plight of the elderly, while also failing to account for individual experiences.

Feminist theory

The underlying conflict orientation of political economy theory forms the basis for much of feminist theory of aging, which views gender together with class and race in a "paradigm of domination" reflecting an "interlocking system of oppression" (92). This approach maintains that it is impossible to discuss inequality without considering all the factors that contribute to that inequality, and viewing them as inextricably linked. "It starts from the assumption that social relations are constituted through processes in which the linkages are inbuilt . . . Looking at them from one angle we see class, from another we see gender, neither is complete without the other (93)." This approach stresses that in the elderly, disadvantage results from the accumulation of discrimination throughout the life course. Feminist theory has been criticized for emphasizing gender, class and race while paying less attention to aging itself and the power imbalances inherent in relations between the generations.

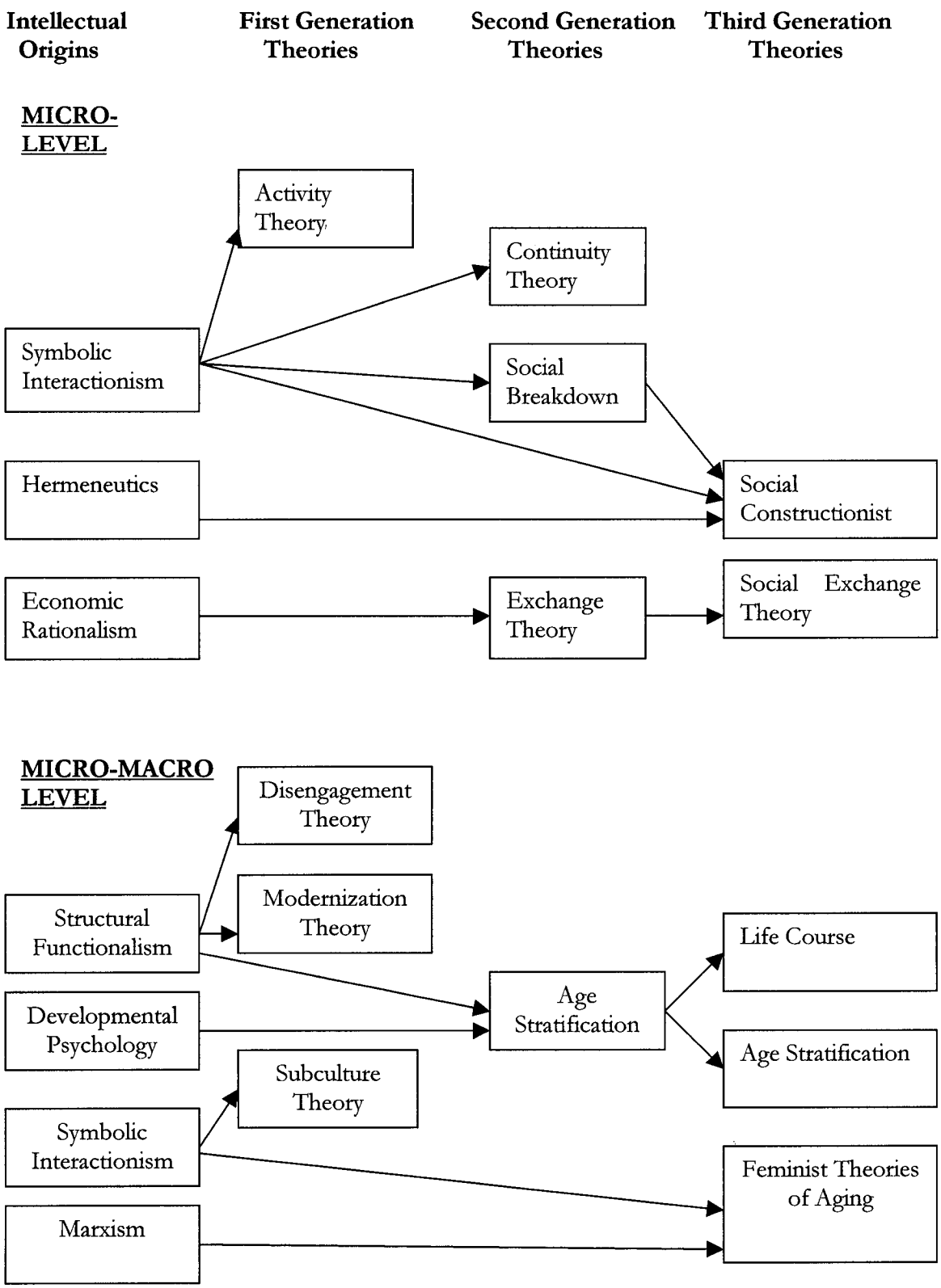
Hermeneutics

There is another branch of feminist theory in aging that looks less at the power structure of society, and more at the effect of gender upon individual interactions. This approach is rooted in a sociological approach called social constructivism, which in turn springs from a sociological perspective called hermeneutics. Hermeneutics comes from the Greek *hermeneuo* "to interpret or translate". Hermeneutics refers to the idea that we all bring preconceptions from our own culture to our study of any subject. Thus, whenever we study another culture we inevitably end up with an interpretation that blends our own cultural orientation with the culture that we are studying: perhaps we think that elderly people ought to remain active, for example. Hermeneutics is helpful because it challenges us to be aware of our own biases. It

has been criticized because it implies that all truth is relative. At a micro level, sociologists have applied hermeneutics in the development of social construction theory. Social constructionists attempt "to understand individual processes of aging as influenced by social definitions and social structures (94)." Their approaches may include studying attitudes toward aging and stereotypes of the aged, examining how social meanings of age and self-conceptions of age arise through negotiation and discourse, and studying how social reality shifts over time. Individuals are seen as active participants in their daily lives, and their interactions with others create their social realities. While this view is useful in looking at individual lives, it is not helpful in looking at macro-level effects, and it ignores the effects of structure. It can then lead to a "blaming the victim" mentality where individuals are seen as solely responsible for the quality of their own lives.

A relativist or hermeneutic perspective can also be applied at a macro level. At this level it takes the form of "Critical theory" which is basically taking a critical look at the assumptions behind the other gerontologic theories that have been proposed. Harold Moody (75) has argued that in theories of aging there are three levels of interpretation, or "triple hermeneutics". These are (i) the interpretation of empirical data which is already heavily theory-laden by theories of aging, (ii) societal preconceptions about aging, and (iii) our own subjective experiences of aging, which are occurring as we are studying the theories. Tornstam (95) has applied critical theory to gerontology itself. He raises the issue that the preponderance of work in gerontology has been done by middle-aged, middle-class white academics, who have imposed their own value system upon the elderly. Critical theory tends to be poorly understood. Moreover (and like so many of the sociological insights), it has been criticized for merely pointing out problems with mainstream theories while not proposing appropriate alternatives.

In the sociological literature, no one theoretical approach explains successful aging at a micro and a macro level. There are many approaches, each of which plays some part in understanding successful aging. Except for activity theory, which has been incorporated into the Rowe and Kahn model (96), sociological theory has not been incorporated into models of successful aging, as we will see in Chapter 5. Sociological theory is perhaps more useful as multiple lenses through which to view models of successful aging. For example, it is useful to consider how interactions between individuals might affect an individual's ability to age successfully (social constructivism), and also to consider how existing power structures might affect successful aging (feminist theory). Rather than developing a synthesis of the current approaches, we might want to consider how a model of successful aging might be viewed using each of these different approaches in order to more fully understand how one ages successfully.


Intellectual Origins
First Generation Theories
Second Generation Theories
Third Generation Theories
MICRO-LEVEL
Activity Theory
Continuity Theory
Symbolic Interactionism
Social Breakdown
Hermeneutics
Social Constructionist
Economic Rationalism
Exchange Theory
Social Exchange Theory
MICRO-MACRO LEVEL
Disengagement Theory
Modernization Theory
Structural Functionalism
Life Course
Age Stratification
Developmental Psychology
Age Stratification
Subculture Theory
Symbolic Interactionism
Feminist Theories of Aging
Marxism

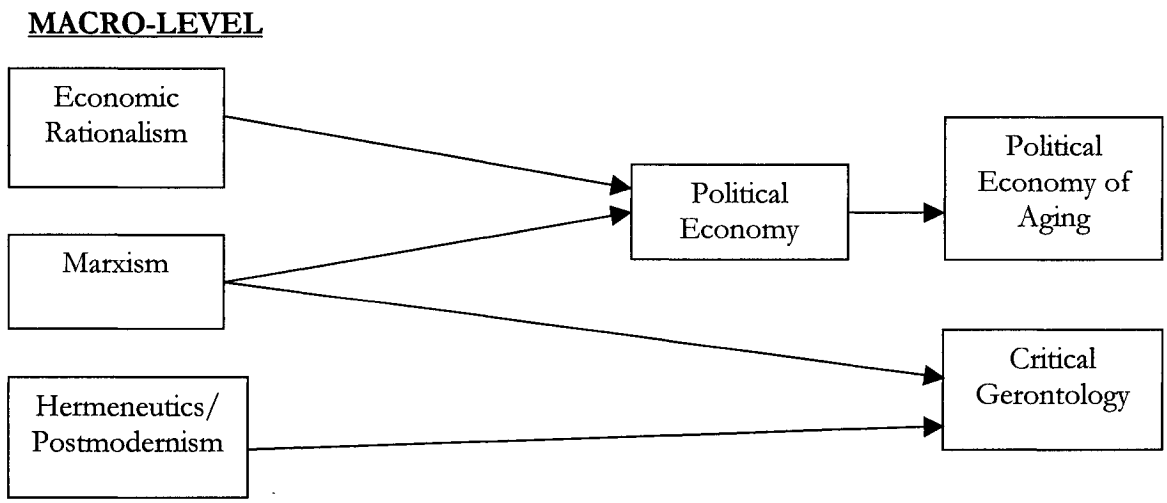


Figure 1: The generation of theories in social gerontology.
From Bengston VL, Burgess EO, Parrot TM. Theory, Explanation, and a Third Generation of Theoretical Development in Social Gerontology. Journal of Gerontology: Social Sciences 1997, 52B;2:S72-S88.

Chapter Four: The Biology of Aging

The prevailing view of the duties of government in caring for elderly people is that it should provide curative services: hospitals, clinics and medical services. But to answer our question "What should a 21st century Canadian city do to promote healthy aging in its citizens?", we need to examine more closely the relationship between aging and disease.

There are authors who argue that aging and disease are separate entities, while another faction considers aging to be the cumulative result of various diseases processes. Obviously, diseases become more common in elderly people, but this does not necessarily mean that the diseases are a consequence of aging; they may merely be age-associated. The majority of researchers consider aging and disease to be a continuum, but there is debate about where aging and disease intersect on the continuum. These differing viewpoints have different implications for the health of the population overall, and would mandate differing approaches to intervention. If aging is considered as a process quite separate from disease, a population health approach would be desirable. On the other hand, if aging is considered to be the result of accumulated diseases, then a disease-specific approach would be more useful in improving the health of the population.

Rowe and Kahn's landmark paper on successful aging (97) promoted the idea of the aging/disease continuum and shifted the emphasis in aging research towards disease intervention. In the past 20 years, there has been a reduction in the severity of disability associated with chronic disease in the older population, which may be a result of disease-specific interventions, or may be because of the improved health of the cohort entering this age group. In order to help determine whether the City of Ottawa should pursue a more population-based approach or should target specific diseases, in this chapter I will examine the

arguments for aging as a result of disease, as opposed to a process that is independent of disease. I shall then discuss some aging changes that occur at a cellular level and at an organismal level, and whether or not these fit into a disease model. Next, I will discuss interventions that would target these age changes, and determine if these support a more population based or disease specific approach to intervention. Finally, wI will discuss the promotion of longevity versus reduction in morbidity as health goals for the city.

Is aging a disease?

The relationship between aging and disease has been pondered for millennia. Cicero in *De Senectude* in 44 BC wrote, "Old age contains many opportunities for positive change and should not be confused with illness." He also wrote, "Yet it may be urged, many old men are so feeble that they can perform no function that duty or indeed any position in life demands. True, but that is not peculiar to old age: generally it is characteristic of ill health. . . Old age is an incurable disease." Clearly he was of two minds about this matter, although the first part of the quote has been used subsequently by the "aging is not a disease" camp, while the latter part has been used to bolster the argument of those who believe the two entities cannot be separated.

The view that aging is separate from disease has been most eloquently expressed by Leonard Hayflick (98). He states that pathological changes can be distinguished from aging changes and offers six arguments. Unlike any known disease,

(i) age changes occur in every human given sufficient time

(ii) age changes occur across virtually all species

(iii) no disease afflicts all members of a species only after the age of reproductive success

(iv) aging occurs in all wild animals subsequently protected by humans, even when that species has probably not experienced aging for thousands or millions of years

(v) aging occurs in virtually all animate and inanimate matter

(vi) aging changes have the same universal molecular etiology, that is, thermodynamic instability.

He argues that if we were to resolve today's leading causes of death, we would be able to increase human life span by only about 15 years. By focusing on age-associated diseases, we can affect morbidity but not longevity. He states that only by studying the underlying processes involved in aging, rather than their manifestations, can we affect aging itself. Of course, this raises the questions of whether or not our goal should be to slow the aging process itself, whether society as a whole benefits by increasing longevity, and whether or not the increase would be spread equitably across the population.

In approaching the debate about aging versus disease, we should consider Hayflick's assertion that, "All theories of aging are derivative of one fundamental idea, and that is that aging is simply an increase in molecular disorder." Without perfect mechanisms for repair, molecular disorder increases. Increased molecular disorder results in decreased physiologic capacity of the organism. Vulnerability to disease increases at both the molecular level, making the organism more susceptible to diseases such as cancer, and at the organismal level making it more susceptible to diseases such as pneumonia, thereby increasing the probability of death. Hayflick argues that some molecular disorder causes changes of aging that we would not consider to be pathological, such as an increase in grey hairs, while others that affect vital organs would be pathological, such as accumulation of plaque in the coronary arteries. Because some aspects of the aging process are pathological while others are not, he argues that the phenomena of aging may be distinguished from age-associated diseases. He goes on to

state that resolving age associated diseases will not advance our understanding of the aging process, just as the elimination of childhood diseases such as polio did not advance our understanding of child development. He further argues that while huge resources are committed to Alzheimer's disease research, elimination of Alzheimer's disease would increase the average life expectancy by only 19 days, and would not contribute to our understanding of the fundamental biology of aging.

Aging as a continuum

From a societal viewpoint, however, reduction of morbidity associated with Alzheimer's would be a tremendous accomplishment, regardless of whether or not knowledge of the fundamentals of aging was increased. Perhaps enhanced quality of life, rather than duration, should be the goal. Rowe and Kahn proposed that we should strive for "successful aging", which they defined as the limitation of the morbidity associated with "normal aging" (99). Their central tenet was that the role of age per se in age-related changes was overstated, and that in fact "a major component of age-related declines can be explained in terms of life style, habits, diet, and an array of psychosocial factors extrinsic to the aging process." They separated aging into three categories, successful, usual and pathological. Pathological aging referred to aspects of diseases that occur either solely or disproportionately in the elderly, such as osteoporosis, cardiac disease and falling. Normal aging referred to the physiologic and biochemical changes that occur with aging in the absence of disease. These normal physiologic changes were recognized to influence the presentation of disease, its response to treatment, and any ensuing complications. Recognizing the tremendous variation in the elderly population, they introduced the concept that what we had perceived as normal changes were in fact usual changes, in that although they occurred more often than not in the elderly

population, that they were modifiable and not inevitable. Thus, extrinsic age-associated factors became more important than the intrinsic age-determined changes stressed by Hayflick. In the biomedical approach promoted by Rowe and Kahn and others, disease is seen to contribute to what we consider to be "usual aging", which opens the door for interventions to treat those aspects that are caused by disease and therefore influence the aging process.

In this model, disease is defined as a reduction in function to below an (arbitrary) threshold, which is usually set at the level of middle-age functioning. In this way, the authors are promoting the idea that successful aging is preservation of middle age functioning, or de-facto prolonging of middle age. This model was enthusiastically adopted for several reasons. First, it helped to account for the marked heterogeneity which characterizes the older population. Secondly, it allowed researchers to think of aging as a dynamic process rather than as an unremitting decline, and to look at what might be possible, rather than what is usual. By visualizing a continuum with minimal decline at one end versus severe pathology at the other, one imagines that it might be possible to shift an individual's place on the continuum.

Analyses of bone mineral density (BMD) provide a helpful illustration of this concept of the spectrum of age-related changes. There is a steady loss of bone density in older adults, starting in the mid 30s and accelerating in the sixth and seventh decades (100). Mechanisms of bone loss are thought to include estrogen deficiency in males and females (101), calcium malabsorption, and decline in growth factors at both the endocrine and local tissue levels (102). A BMD within 1 standard deviation of the young adult reference mean is defined as normal, a BMD between 1 and 2.5 SD below this value is defined as osteopenia, and a BMD >2.5 SD below the young adult mean is defined as osteoporosis (100). Those people who have osteoporosis are considered at risk of fragility fractures, defined as fractures sustained from minimal trauma, such as a fall from a standing height or less (100). People with BMD in the

osteopenic range are considered at risk of developing osteoporosis (103). Possible interventions could be directed at trying to prevent further bone loss, or at increasing bone mass. Those with osteoporosis could be started on medication and exercise to try to slow or reverse the rate of bone loss and given hip protectors to try to mechanically reduce fractures. Those with osteopenia could be treated with medication and exercise prescriptions, and those with normal BMD could be encouraged to take adequate calcium, vitamin D and exercise.

Although the Rowe and Kahn model has been criticized for encouraging a disease-specific approach, from the preceding example we can see that it does also lend itself to a population health approach in that by promoting a healthy lifestyle in people who have not yet developed a low BMD, perhaps we can decrease the incidence of oseoporosis. It becomes a question of how our society chooses to allocate its resources. The decision is often difficult, as on an individual basis we know that the expensive bisphosphonate medications are effective. Diet and exercise may be beneficial for the population as a whole, but may be ineffective for individuals because of underlying risk factors (e.g. small stature). One of the problems with this approach lies in the identifying of preventable and unpreventable risk factors. A heavy emphasis on preventable risk factors, such as heavy alcohol intake, smoking, or inadequate calcium intake, while encouraging action on these fronts, can lead to a "blame the victim" mentality. It has been argued that this approach reduces the problems of aging to an individual level and "shifts any onus of responsibility from the state to the individual. . . [thus] inequities in resource distribution and access can be ignored."(104) By combining case-finding with a wider, public-health approach and trying to shift the curve so that the mean BMD of the whole population increases, we can avoid some of these pitfalls.

Another illustration of the concept of an age-related change expressed as a continuum encompassing both preservation of function and disease is carbohydrate metabolism.

Advancing age is associated with impaired capacity to metabolize glucose (105). However, a study done in Italy showed that when the effects of exercise, diet and drugs were taken into account, the correlation between age and postprandial glucose was extremely weak and the correlation between age and insulin levels was non-existent (106). From this study, Rowe and Kahn concluded that "much of the observed carbohydrate intolerance of older people may be caused by factors other than biological aging per se, and that dietary or exercise modifications may substantially blunt the emergence with age of carbohydrate intolerance and insulin resistance (107)."

The example cited by Rowe and Kahn would actually support the adoption of both population-based and disease specific interventions. For example, healthy diet and adequate exercise could be promoted for the entire population, while early intervention could be targeted for those with risk factors such as a family history of diabetes or obesity.

Inevitable changes of aging

There are other cases where the distinction between aging changes and disease is less of a continuum. Take the example of "sarcopenia". Universally there is a decrease in the number of muscle fibres in individuals as they age, which is thought to be as a result of gradual loss of motor neurons. By age 80, one loses approximately half of one's muscle fibres (108), which causes a significant reduction in muscle strength and power. When power is decreased below a threshold level, it can cause reduction in function and increased fatigue. This change is particularly apparent in elderly women, who have less muscle mass than men to begin with. Some elderly women are so reduced in capacity that even the work of breathing becomes exhausting. With training and activity however, the remaining muscle fibres will undergo compensatory hypertrophy (109), which will result in a regain of some of the lost power.

Thus there may be a return to normal function but not to normal physiology. Because of the absolute loss of muscle fibres, elderly people will have decreased reserve, in that they will more quickly become deconditioned and recover more slowly than younger people after suffering an insult that might make them take to their beds for several days.

The illustration of sarcopenia differs from the previous two examples in that it is a universal change resulting in incapacity or at least a significant loss of reserve in most people. Thus the distinction between biological and pathological aging is blurred. Another case where aging changes seem to lead to disease is the phenomenon of senile amyloidosis. Amyloidosis, which is recognized as a disease, is thought to be attributable to a post-translational misfolding of proteins (110). It results in deposits of amyloid in human brains with an incidence of between 80 to 100% in elderly autopsy subjects (111), and has been postulated as a cause of Alzheimer's disease (112). However, the Nun Study (113) showed that there is not a linear relationship between decline in cognitive function and pathologic brain changes, and that education may have a protective effect on cognitive function even in the presence of severe brain pathology.

The role of the city

This assertion leads us back to Rowe and Kahn's functional approach to age-associated changes. We must ask the question, however: if we are preserving function by increasing reserve capacity, this is to what end? Are we decreasing morbidity or merely postponing it? Are we aiming to increase longevity? As we discussed in Chapter 1, human life expectancy appears to be steadily increasing. Fries had proposed that human life span is fixed at about 85 years (114), but average life expectancy for women in Japan has already exceeded that limit and is now approaching 90 (115). There appear to be dynamic competing forces favouring

expansion and compression of morbidity, so it remains to be seen what will happen over the course of the 21st century. It does seem intuitively obvious that the better care one takes of anything, the longer it lasts. Baltes and Baltes have introduced the term optimal aging, which they describe as "a kind of utopia, namely aging under development-enhancing and age friendly environmental conditions (70)." Given the previous discussion about the continuum encompassing aging changes, health and pathology, it seems to me that the role of the city is to provide "age-friendly environmental conditions" which would promote a shift in the population curve towards the healthier end of the spectrum. For example, providing exercise programs for all age groups could help to reduce obesity, improve carbohydrate metabolism and lower the rates of diabetes. Exercise programs aimed at younger people could facilitate the development of healthy bone mass, while programs aimed at older people could help with the retention of bone mass. Strengthening programs aimed at the elderly could help them to develop compensatory muscle fibre hypertrophy, preserving their strength and functional capacity. Longevity may be seen as a by-product of morbidity reduction.

The role of the city is incorporated in the conceptual model that is discussed in Part II of this thesis. Further discussion of policy implications will take place in the last chapter of this thesis.

PART TWO: Existing Conceptual Models of Successful Aging

Chapter Five: Definitions and Models of Successful Aging

"Successful Aging" is a term frequently mentioned in the literature, but there is little agreement upon its meaning. Thomas Glass calls the term "a conceptual ink blot onto which a wide variety of ideas have been projected (116)." In this chapter, I will review the various definitions of successful aging used in the literature and then describe how conceptual models have been constructed based on these definitions.

Healthy versus successful aging

Before discussing the meaning of successful aging, it is necessary to first review a related term, "healthy aging". Some authors have used healthy aging as a synonym for successful aging. Others contend that healthy aging and successful aging are conceptually separate, although their reasons for making the distinction may be very different. One approach, represented by Vaillant (117), argues that healthy aging is a necessary part of successful aging, but that successful aging is more than just healthy aging. That is, "Successful aging seems to refer to a broad set of circumstances that include but transcend healthy aging (118)." Other researchers, such as Roos and Havens (119), who chose to use the term successful aging, stated that they deliberately did not use healthy aging, because "healthy" implies absence of disease. They felt that individuals with chronic disease could still be said to be aging successfully as long as they were functioning independently, so they separated healthy and successful aging. Finally, some authors avoid the term healthy aging because it would require them to define "health", which in itself is problematic. For these reasons, the term successful aging appears more frequently

in the literature. On occasion, the term "positive aging" also appears as a synonym for successful aging (120).

Successful aging and life satisfaction

The term successful aging was introduced in 1963 by the sociologist Robert Havighurst. He defined successful aging as the conditions under which a person gets "a maximum of satisfaction and happiness" (121). In the early research on successful aging, conducted primarily by social scientists, successful aging was equated with life satisfaction, and so considerable energy was devoted to developing tools to measure the components of life satisfaction, such as Neugarten and Havighurst's Life Satisfaction Index (122). By the mid-1970s, life satisfaction was the most frequently studied variable in American gerontology (123). In more recent work, life satisfaction has been treated as a component of successful aging. Fisher (124) maintains that life satisfaction is a precursor to successful aging, but that they are not interchangeable concepts. That is, Fisher considers life satisfaction to be a predictor of the outcome variable, successful aging, while other researchers consider life satisfaction to be the outcome variable that may be predicted by successful aging. One group of researchers in the Netherlands has constructed two models of successful aging, a qualitative model in which well-being (or life satisfaction) is synonymous with successful aging, and a quantitative model in which well-being is contributor to successful aging as the outcome variable (125). To confuse matters even more, Fisher refers to both life satisfaction and successful aging as components of well-being, although most of the time in the literature well-being and life satisfaction are used synonymously.

Life satisfaction, although a key component of many definitions of successful aging as we have just seen, does not appear in every definition used in the literature. Elizabeth Phelan

identified seven major elements included in definitions of successful aging (126). These included life satisfaction, longevity, freedom from disability, mastery or growth, active engagement with life, independent functioning and positive adaptation. Different researchers include in their definitions of successful aging anywhere from one to four of these elements. Basically, there is no agreement on any one element being necessary for the definition of successful aging. The next section gives a list of definitions of successful aging in the literature, while Table 1 summarizes the major elements included in these definitions.

Definitions of Successful Aging:

Baltes and Baltes: "an adaptive process involving selection, optimization and compensation" (70)

Butt and Beiser: "positive adaptation as reflected in contentment and satisfaction with quality of life as perceived by people in their advanced years" (127)

Cassel: uses it as her title, but doesn't define it. Does refer to longevity and freedom from disability (128).

Day: quality of life as described by "psychological well-being, capacity for self-management, and a private safety net of social supports" (129)

Erikson, J: gerotranscendence, achieved by mastery of E. Erikson's seven stages of development (130)

Fries: optimizing life expectancy while simultaneously minimizing physical, psychological and social morbidity (131)

Fisher: "strategies for coping in later life and maintaining a positive outlook on life" (132)

Gibson: successful aging "refers to reaching one's potential and arriving at a level of physical, social, and psychological well-being in old age that is pleasing to both self and others." (133)

Glass: Gives no consensus on the definition, but areas of agreement are important. "First, successful aging means something beyond health and longevity; it is rooted in a broader definition of "the good life" in late life. It refers to the capacity to function across many domains, including the cognitive, social and emotional. Second, successful aging is in large part what older adults value in the quality of their life and their death. . . Third, successful aging, as observed by Rowe and Kahn, implies aging that is better than "usual aging", which

many envision as lock-step declines in capacity and health. Herein lies both the promise and the danger of the concept. The promise comes from envisioning exceptional functioning as possible; the danger is that taking what is possible as a benchmark leads us to conclude that sickness and dependency constitute a "failure" in aging. Successful aging prompts the question of what we mean by "unsuccessful" aging. To the extent that we conceptualize successful aging as *not* aging, as only disease-free aging, our concept (and our policies) will be diminished." (134)

Havighurst: conditions under which a person gets a "maximum of satisfaction and happiness" (121)

Inui: "Successful aging is defined not by longevity alone but also by sufficient well-being (in multiple domains) to sustain a capacity for functioning adequately in changing circumstances." (135)

Lawton: "any conception of the 'good life' for the aged should include four major sectors, each with multiple domains: behavioural competence, psychological well-being, perceived quality of life and objective environment" (136)

Palmore: "Successful aging was defined as survival to age 75 with good health and happiness." ie, includes survival (longevity), health (lack of disability) and life satisfaction (happiness) (137)

Perls/Silver: "living to 100" (138)

Roos/Havens: live a long life and live independently in the community (139)

Rowe and Kahn: "We define successful aging as including three main components: low probability of disease and disease-related disability, high cognitive and physical functional capacity, and active engagement with life."(140)

Ryff: "growth-oriented developmental changes". Identified six features of successful aging: (1) sense of purpose, (2) autonomy, (3) environmental mastery, (4) interactions with others, (5) personal growth and (6) self-acceptance (141)

Schulz/Heckhausen: "successful aging includes the development and maintenance of primary control throughout the life course. Put another way, individuals who are able to engage and impact the environments around them for the longest period of time would be judged most successful" (142)

Strawbridge: "minimal interruption of usual function, although minimal signs of chronic disease may be present" (143)

Tornstam: gerotranscendence (144)

Vaillant: defined successful aging as "well-being in old age". This was represented by six domains: (1) objective physical health and absence of irreversible disability,
(2) subjective physical health, (3) length of active life, (4) objective mental health,
(5) subjective life satisfaction, (6) social supports (145)

Von Faber: (1) an optimal state of overall functioning and well-being
(2) the successful adaptation to physical limitation; successful in the sense of satisfactory to the person concerned (146)

Williams and Wirth: "a balanced exchange of energy between the individual and the social system, and a balanced social system" (147)

Elements of Successful Aging

The table which follows shows the classification of the existing definitions of successful aging in the literature, using the seven elements identified by Phelan (148). I have identified each of the definitions with a "B" for biological or a "P" for psychological, in order to designate whether the researcher looks at successful aging from either a biological or a psychological point of view.

Another way of classifying the definitions of successful aging to consider whether the author considers successful aging to be a state of being or an adaptive process. This distinction becomes particularly important when we consider models later in this chapter. I have designated those who consider it to be a state with an "S", while those who consider it to be an adaptive process have been identified by an "A".

Table 1: Major Element(s) identified by Phelan included in definition of successful aging

Researcher	Longevity	Freedom from Disability	High/ Independent Functioning	Active Engagement with Life	Positive Adaptation	Mastery or Growth	Life Satisfaction
Baltes/Baltes (P) (A)				x	x	x	
Butt/Beiser (P) (A)					x		x
Day (P) (S)			x	x			x
Erikson (P) (A)						x	
Fisher (P) (A)						x	
Gibson (P) (S&A)						x	x
Glass (P) (S)			x	x		x	
Havighurst (P) (S)				x			x
Palmore (P) (S)	x	x					x
Ryff (P) (A)						x	
Schulz/ Heckhausen (P) (A)					x	x	
Steverink (P) (A)					x		
Tornstam (P) (A)						x	
Von Faber (P&B) (S&A)			x				x
Cassel (B) (S)	x	x	x				
Inui (B) (S&A)	x		x		x		
Perls/Silver (B) (S)	x						
Roos/Havens (B) (S)	x		x				
Rowe/Kahn (B) (S)		x	x	x			
Strawbridge (B) (S)			x				
Vaillant (B) (S)		x				x	
Williams (B) (A)			x				

A quick inspection shows that the elements of the definition of successful aging are literally all over the chart. However, if we look at the biological researchers (B) versus the social science researchers (P), we can see that the majority of the biological researchers do at least agree on high or independent functioning as being a necessary component for successful aging. However, their definitions of high/ independent functioning are not necessarily the same. For example, Rowe and Kahn specify that high physical, cognitive and social functioning are required. Roos and Havens refer to high physical and cognitve functioning, Strawbridge requires high physical functioning with a lack of dependency, while Williams specifies only a lack of dependency. Thomas Perl is the one biological researcher who defines successful aging as longevity, but his premise is that "the longer you live, the healthier you have been." Rowe and Kahn are slightly more inclusive in their definition than the other biological researchers, in that they also consider active engagement with life to be a necessary element for successful aging. In this respect, there is an overlap with some of the psychosocial researchers, Havighurst, Alice Day and the Baltes, who also consider active engagement with life to be a necessary element for successful aging. Von Faber et al, a Dutch research group composed of geriatricians and anthropologists, chose to define successful aging in terms of life satisfaction in addition to high or independent functioning, thus providing another overlap with the psychosocial researchers. Amongst those researchers of the psychosocial persuasion, successful aging is defined in terms of either life satisfaction or mastery/ growth, with the Baltes, Butt/Beiser, Schulz/Heckhausen and Steverink et al (149) considering adaptation to be an essential feature.

With respect to the distinction of successful aging as a state versus an adaptive process, one can see that in general the psychosocial researchers tend to look at it from an adaptive process, whereas successful aging as a state is a more prevalent view amongst the biological

researchers. Interestingly, Thomas Glass has proposed a state model of successful aging which incorporates psychological theory in order to try to unite the psychosocial and biological perspectives. State and adaptive models of successful aging will be discussed later in this chapter.

Theories versus models

Before moving from discussion of the definitions of successful aging to looking at models of successful aging that incorporate these definitions, we should first briefly discuss theory. Much of the theory development in the study of successful aging has been done in the field of sociology, and was discussed in the previous chapter. In his paper, "Successful Aging" (150), Robert Havighurst stated that, "A theory of successful aging is a statement of the conditions of individual and social life under which the individual person gets a maximum of satisfaction and happiness and society maintains an appropriate balance among satisfactions for the various groups which make it up – old, middle-aged, and young, men and women, etc." So what is the difference between a theory and a model, and how does theory contribute to the construction of a model? According to Dr. John Last's Dictionary of Public health(190), a theory is "a belief system based on observation and supposition; cf axiom, canon, hypothesis." A model is defined as a "theoretical (usually mathematical, often computerized) equation or simulation, abstract representation, or the formal expression of a theory." A model is descriptive and will show for example, that there is a link between stroke and depression. A theory will attempt to explain the nature of the linkage. For example, depression in stroke patients may be attributed to reductions in the levels of neurotransmitters in the brain, or it might be attributed to changes in activity levels associated with the stroke. A model will show arrows connecting stroke with depression, and may even include numeric path coefficients in order to quantify

the magnitude of the effect, but does not explain why the effect occurs. A model may incorporate many different theories, in that every arrow in the model may have a theory behind it to explain how and why the interaction occurs. A model may also be an attempt to illustrate in more concrete terms an overarching theory, as we will see with the Schulz/Heckhausen model describing the role of primary control later in this chapter. Models illustrate the relationships of variables to one another, indicating the direction of the relationship and perhaps how they may form a hierarchy. Models may be constructed purely from empirical data, and they may postulate relationships that need to be explored further from a theoretical standpoint. In a sense, models help us to understand what variables are important in producing a particular outcome, and how they might be related to one another. Theories explain how the interactions occur, and also help to explain why. In the context of the role of a city in promoting successful aging, a model will identify the factors that are influential and that should be addressed by interventions from the city.

The rest of this chapter will deal primarily with models of successful aging, with discussion of applicable theory as required in order to explain either the purpose of the model, or how the model may be elaborated. As the definitions of successful aging are split along disciplinary lines, it is no surprise that there is a lack of models that encompass both the psychosocial and the biological perspectives. There have been two recent attempts in the literature to create a transdisciplinary model for successful aging. Thomas Glass has attempted to merge the two approaches in his "biopsychosocial model of successful aging." In his definition, he incorporates the elements of mastery from a psychological perspective, active engagement with life in order to bring in a social perspective, and high or independent functioning in order to include a biological point of view.

Models of successful aging as an adaptive process

In order to compare the models of successful aging that exist in the literature , it is helpful to classify them into those that consider successful aging to be a state of being, versus those that consider it to be an adaptive process. We will first discuss the models of successful aging which view it as an adaptive process, since these models are all based upon Paul Baltes' gain/loss theory. Baltes characterized the aging process as a changing balance between gains and losses which becomes less positive with age. The theories which fall under the adaptation classification try to answer three key questions (149): (1) what mechanisms and processes make people age successfully? (2) under what circumstances will the process of aging be more or less optimal? and (3) by which criteria should successful aging be evaluated? Baltes' model is that of selective optimization with compensation, which was discussed in detail in Chapter 2. The model describes "a lifelong process of adaptation, reflecting the dynamic interplay between gains and losses, between development-oriented plasticity and age-related boundaries of such plasticity (70)." The process of selective optimization with compensation is considered a lifelong phenomenon, but one that takes on a new significance in old age because of the loss of biological, social and mental reserves. Baltes and Baltes call their model a "prototypical strategy of successful aging."

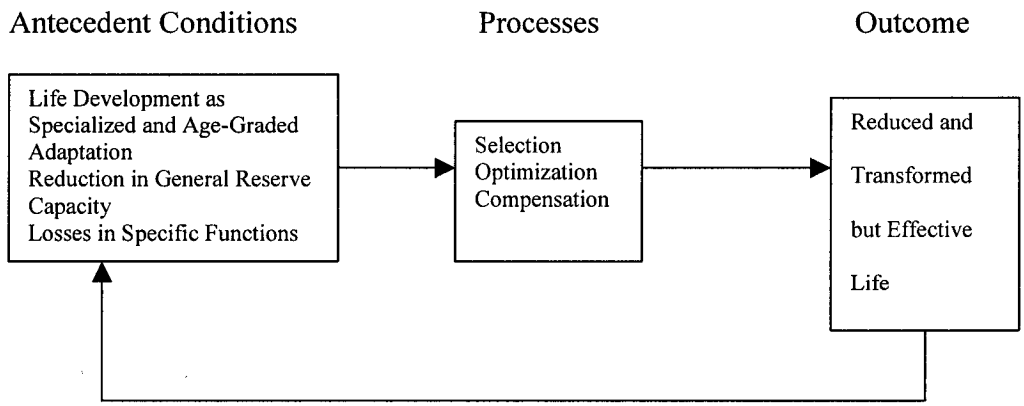


Figure 2: Baltes and Baltes. The ongoing dynamics of selective optimization with compensation. From Baltes PB and Baltes MM. Successful aging: a perspective from the behavioral sciences. New York: Cambridge University Press, 1990.

One of the criticisms of the Baltes' model is that although it describes a strategy for successful aging, success is not clearly defined. The focus is not on the outcome, but on the process or strategy. Baltes and Carstensen in later work state that success is defined as goal attainment in the SOC model (151), but the goals are individually determined. Hence successful aging is defined on an individual's own terms and comparisons become problematic.

Schulz and Heckhausen have expanded and elaborated Baltes' SOC model by integrating it with their life-span theory of control. The life-span theory of control, briefly stated, holds that individuals attempt to control their environments throughout their lifespan. There are two forms of control, primary and secondary. Primary control involves the individual modifying his environment to meet his needs. Secondary control is modification of oneself in order to fit in with the environment. Schulz and Heckhausen theorize that individuals exercise both forms of control, but that adaptation involves "shifting from one to the other depending on the challenges and obstacles encountered". Primary control is

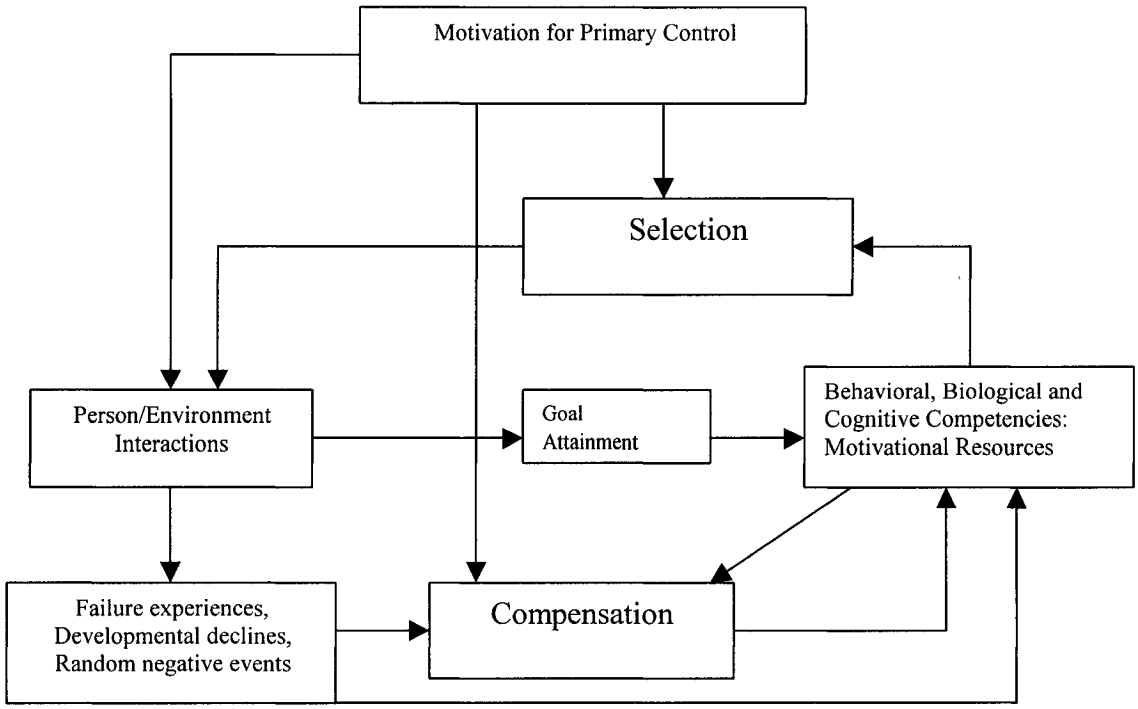


Figure 3: Schulz and Heckhausen's model showing the role of primary control in a life span model of successful development. From Schulz R, Heckhausen J. A lifespan model of successful aging. Am J of Psychology 1996;51:702-714.

presumed to be preferred and more adaptive, since it "enables individuals to explore and shape to their environment to fit their particular needs and optimize their developmental potential." Increasing age-related biological and social challenges to primary control increase the importance of secondary control to the individual as one ages. As the ratio of gains to losses in primary control becomes less and less favourable, the individual increasingly resorts to secondary control processes. Combining the control theory with SOC, Schulz and Heckhausen proposed four different control strategies which they term selective primary control, selective secondary control, compensatory primary control and compensatory secondary control.

Selective primary control refers to the focused investment of resources such as time, effort and abilities and skills required for a chosen goal, such as acquiring a Master's degree in Epidemiology. Selective secondary control effectively enhances the value of a chosen goal,

while devaluing alternatives not chosen, such as caring for one's patients. Compensatory primary control is required whenever the physical or cognitive capacities of the individual are insufficient to attain a chosen goal. To compensate for the physical declines of aging, this sort of compensatory control could include the use of wheelchairs, hearing aids or typing services. Compensatory secondary control, which Baltes and Baltes called resilience of the self, buffers the negative effects of failure or losses on the individual's motivation for primary control. For example, one can disengage from previous goals, formulate new goals or engage in strategic social comparisons with others. As with the Baltes model, goals are highly individualistic and unspecified. Successful aging is a process with no defined outcome.

Steverink, Lindenberg and Ormel have attempted to build upon the SOC model by linking it to a theory of goals. They refer to their theory as social production function theory or SPF. Their premise is that individuals have two universal goals, achieving physical and social well-being, in order to maximize overall well-being. This premise fits with the WHO definition of health as "a state of complete physical, mental, and social well-being and not merely the absence of disease and infirmity (152)." Using this theory as an underlying basis, they have developed an explanation of the adaptive processes necessary for successful aging. They consider psychological well-being to be the joint result of physical and social wellbeing. In order to attain these "universal goals", individuals must achieve "instrumental goals". That is, they need to attain the prerequisites for the universal goals. For example, in order to attain physical well-being, individuals must strive for comfort and stimulation. Comfort refers to physical comfort, such as adequate food, water, rest and warmth, the absence of pain, fatigue and other health complaints and the absence of fear. Stimulation refers to "the absence of boredom, the right amount of exposure to novelty, challenges and interesting events." According to Lindberg (153), to achieve social wellbeing individuals must strive for affection,

behavioural confirmation and status. Affection is seen as positive social confirmation of what one is, behavioural confirmation is societal approval of what one does, and status is positive social approval of what one has. Self-esteem is considered in this model to be an internalized affection, behavioural confirmation and status. The theory of SPF states that in order to achieve the universal goals, individuals engage in substitution in their resources or in their instrumental goals. For example, if an individual can no longer play tennis because of knee problems, he may concentrate on improving his dart game, thus using a different set of resources in order to preserve his sense of wellbeing. Or, an individual who retires may react to the loss of occupational status by substituting affection and behavioral confirmation, the other instrumental goals leading to social wellbeing.

This theory builds upon Baltes' gain/loss theory (70), with the process of aging characterized as a changing balance between gains and losses (in resources) in which losses will increasingly outweigh gains. "With regard to delaying and mitigating this changing balance, the *substitution* or compensation of resources and instrumental goals is considered to be the central mechanism of successful adaptive behaviour in aging individuals (149)." Thus Steverink et al have proposed the following illustration of the difficulty of goal attainment as one ages. See Figure 4:

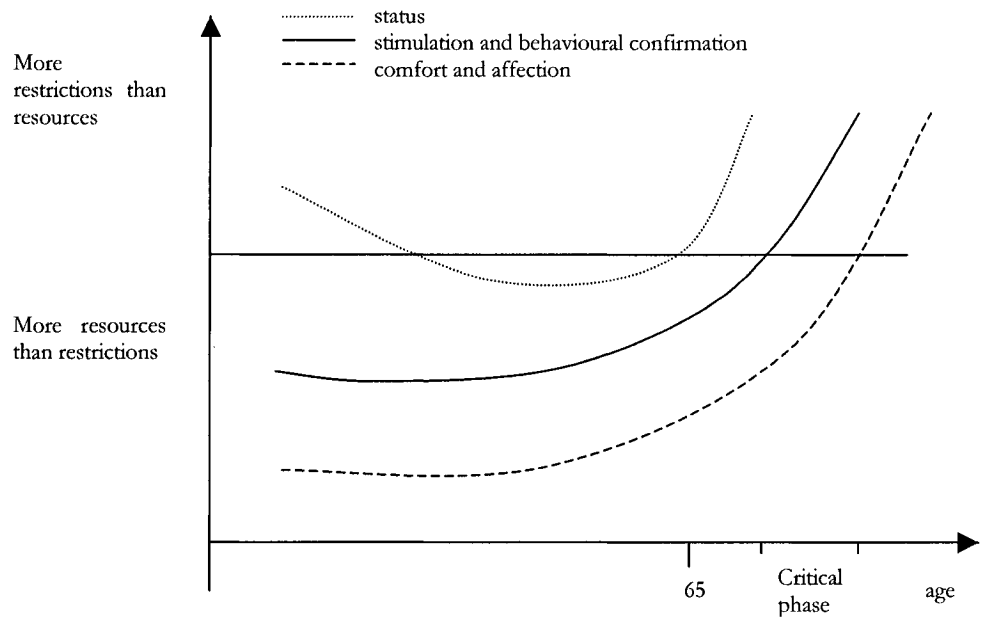


Figure 4: Hypothetical course of the relative difficulty of goal realization for status, stimulation and behavioural confirmation, and comfort and affection across the life span (in a Western society).
From Steverink N. et al. Towards understanding successful aging: patterned changes in resources and goals. Ageing and Society 1998;18: 441-467.

In their view, success is defined as the achievement of physical and social well-being. That is, the more physical and social well-being an individual achieves, the more successful he is deemed to be. How successful an individual has become should correlate with subjective measures of well-being, such as the life satisfaction index. Thus, although these authors describe a process by which individuals can adapt to the gains and losses of old age, the ultimate outcome is life satisfaction, which brings us back to Havighurst and the early social scientists.

State models of successful aging

Havighurst was interested in development throughout the life course, as well as successful aging, and like Erikson he believed that the mastery of certain developmental tasks was necessary in order to attain maturity. However, whereas Erikson was interested in the struggle

of the individual to master innate developmental conflicts, Havighurst was interested in the adjustment of adults to various sociocultural patterns and values. Havighurst and others who followed him, however, regarded successful aging as a state of being rather than as a process. Havighurst and others who followed him, however, regarded successful aging as a state of being rather than as a process. Arguably the most influential model in the literature that of Rowe and Kahn, also depicts successful aging as a state. In their 1987 article, "Human aging: Usual and successful", Rowe and Kahn defined both usual and successful aging as nonpathological states, but consider successful aging to be an optimal state of being. They defined three components required to achieve successful aging: low probability of disease and disease-related disability, high cognitive and physical functional capacity, and active engagement with life. The components are considered to be hierarchical in that absence of disease is required to achieve high cognitive and physical functioning, and high functional capacity facilitates active engagement with life. Active engagement with life comes from activity theory, so this model does incorporate biological, psychological and sociological thought to some degree. See Figure 5:

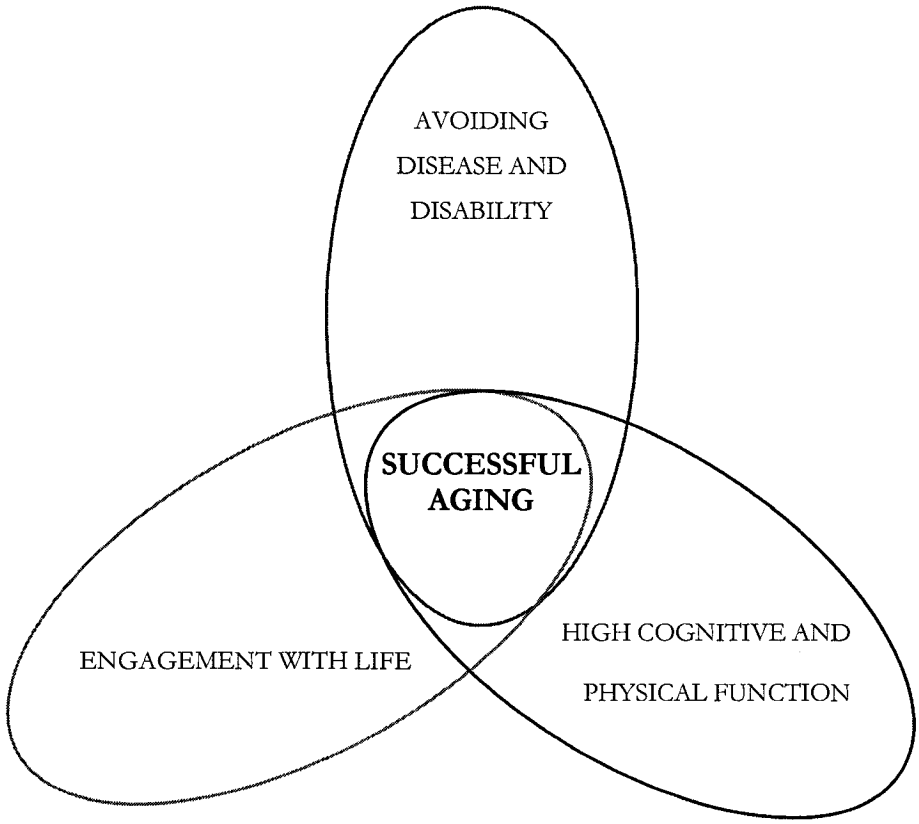


Figure 5: A model of successful aging.
From: Rowe JW and Kahn RL. Human aging: usual and successful. Science, 1987;237:143-149.

Rowe and Kahn considered active engagement with life to have two important facets - interpersonal relations and productive activity. These researchers intended that this model set the stage for "intervention studies to identify effective strategies that enhance the proportion of our older population that ages successfully." In the American context, this model has led to an emphasis on individually based risk factors and how they might be modified.

Another American model of successful aging also looks at it as a state. Alice Day (154) refers to it as "an unstable condition, identified at a moment in time and subject to unpredictable and precipitous change." She further stated that "a successful ager is a woman who does better in terms of available measures than do other women in the sample." (She studied only women). Her model was an attempt to better understand how individuals age

successfully, and then by building on that understanding to change policy in order to help more people lead rewarding lives. She identified three dimensions of successful aging: (i) subjective well-being, (ii) possession of a private safety net, (iii) capacity for independent activity. See Figure 6:

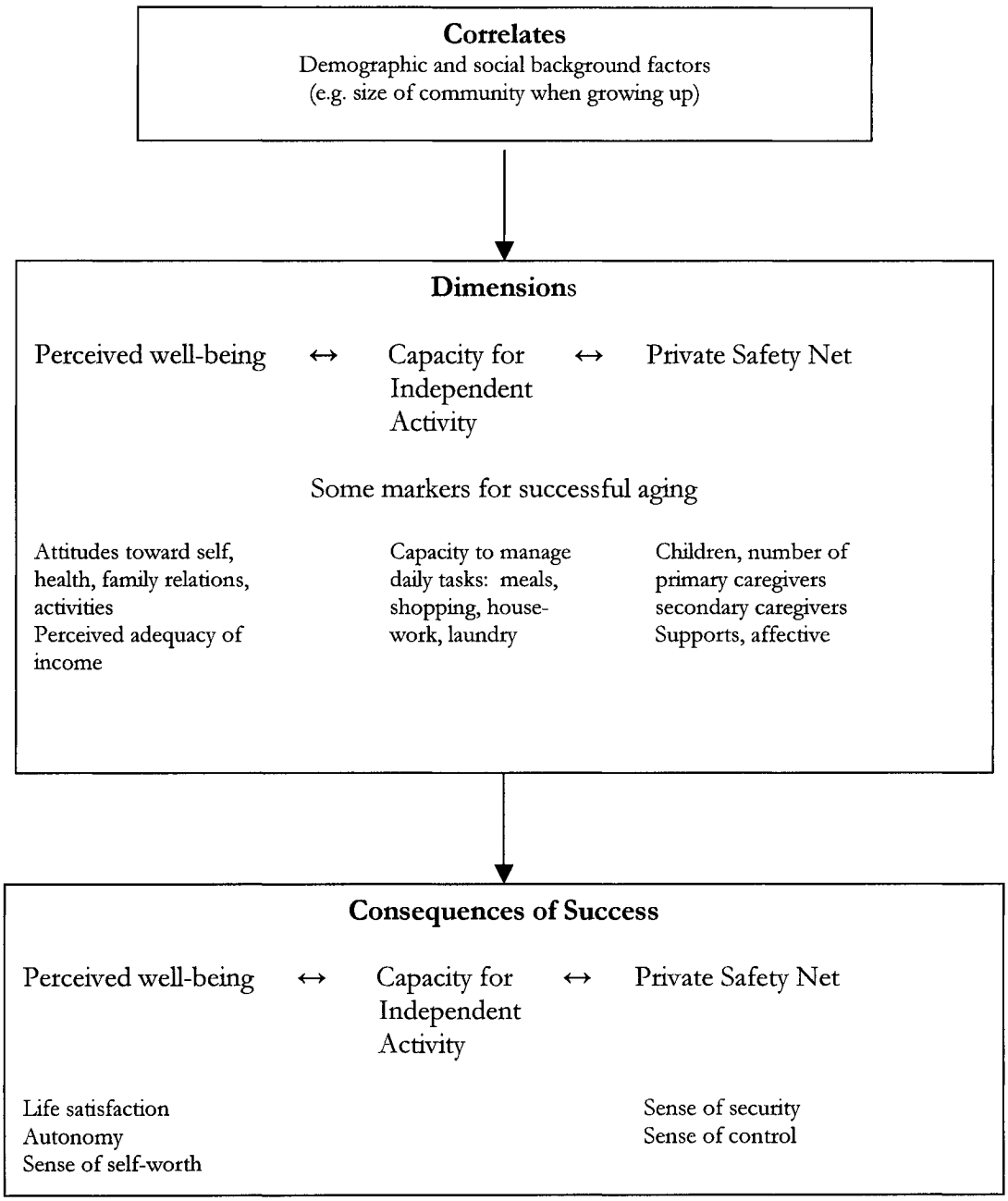


Figure 6: A model for the study of successful aging.
From Day, A. Remarkable survivors: Insights into successful aging among women. Washington, DC. Urban Institute Press, 1991.

Interestingly, although Day felt that the public safety net could be an important factor, for several reasons she did not include it in her model. First of all, her study was conducted in the US where the social safety net is less developed, and perhaps because of this, few of the participants in her study received any public assistance. She also felt that the nature of public assistance varies widely, and that the use of subsidized public transportation, for example, cannot be equated with the use of adult day care. Other American authors, such as Lynott and Lynott (155), have raised the concern that the use of public assistance implies a loss of control. They argue that systems set up to help the poor and disenfranchised, such as Medicare and Medicaid in the US, enrich the health care system while doing very little to enhance the quality of life for the intended recipients. The real effectiveness of the limited US social safety net is debatable, but their argument would seem to support the universality of social programs. If everyone receives services instead of only the disenfranchised, power is likely to remain with the population being served instead of the population providing the service. In the City of Ottawa context, the public safety net would seem to be a much more important factor, not only because there is more of a safety net already in place, but also because of a willingness to look at expanding services to improve the lives of seniors as expressed by the city. Thus, the inclusion of the public safety net is important in the context of the SAO project. However, Day's model is helpful in that the social context in which an individual lives is explicit in her model. In Steverink's theory, discussed previously, the social context is implied in that the resources available to a particular individual may vary according to one's health, presence or absence of negative life events or socioeconomic status, but it is not explicitly identified.

Thomas Glass has also attempted to create a state model linking the various aspects of successful aging. See Figure 7:

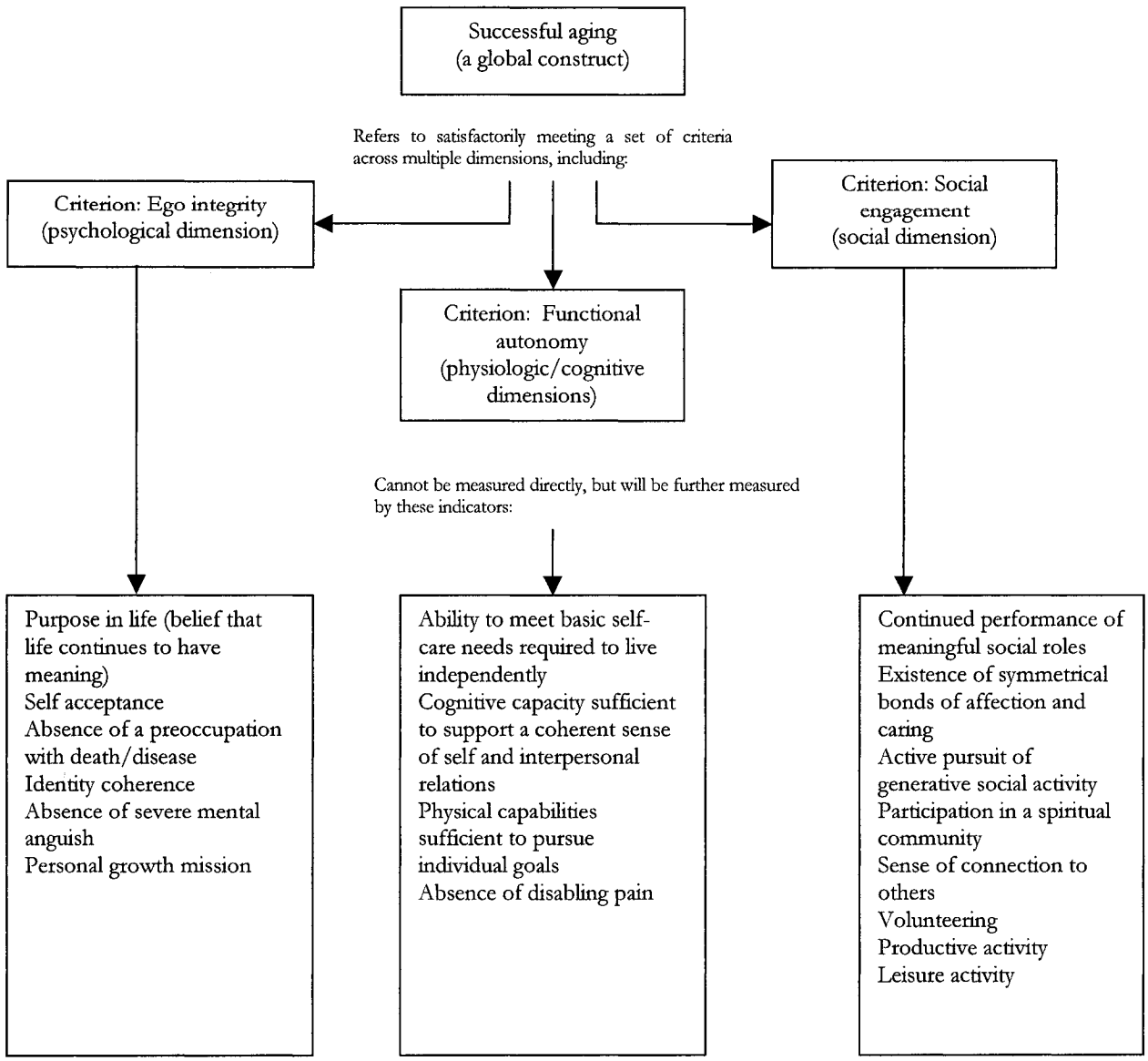


Figure 7: Conceptual model of successful aging, with emphasis on multiple sub dimensions as well as potential empirical indicators.
From Glass, TA, Successful aging in Tallit RC, Fillit HM, eds. Brocklehurst's Textbook of Geriatric Medicine and Gerontology, 6th ed.

Glass's model is in a sense similar to Rowe and Kahn's, but places more emphasis on the psychological context and less on the biomedical aspects of successful aging. In his model,

Glass maintains that as long as one functions well, one may be considered to be aging successfully in spite of the presence of disease. In this model, the criterion "social engagement" is similar to Rowe and Kahn's "engagement with life" but he has added some descriptors in order to clarify its meaning. This model differs from Rowe and Kahn's in that Glass removes the criterion "avoiding disease and disability" and replaces it with "ego integrity". By doing this, he provides a mechanism for integrating the psychological theories of Erikson, Tornstam and Ryff into a model. This is unique in that no other models have incorporated these psychological theories. Instead, the Baltes' theories of adaptation have been used as a basis for model building. In other words, this Glass model is unique because it represents a view of successful aging as a state (i.e. a condition at the moment of measurement) but incorporates psychological theories. Because psychological thinking is generally dynamic in nature, Glass's approach provides a potentially useful way of allowing biomedical and psychosocial researchers to communicate with one another.

Von Faber et al chose to look at successful aging as a state, but then to survey elderly people to see how they viewed successful aging. They found that the elderly view it more as a process of adaptation, and that when the adaptation approach is taken many more elderly qualify as successful agers. The advantage of approaching successful aging as a state is that it lends itself better to measurement. Physical, social and cognitive functioning, as well as feelings of well-being can be scored using validated quantitative instruments. Regarding successful aging as a state also corresponds nicely to the World Health Organization definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."(WHO) The investigators proposed the following model of successful aging as a state:

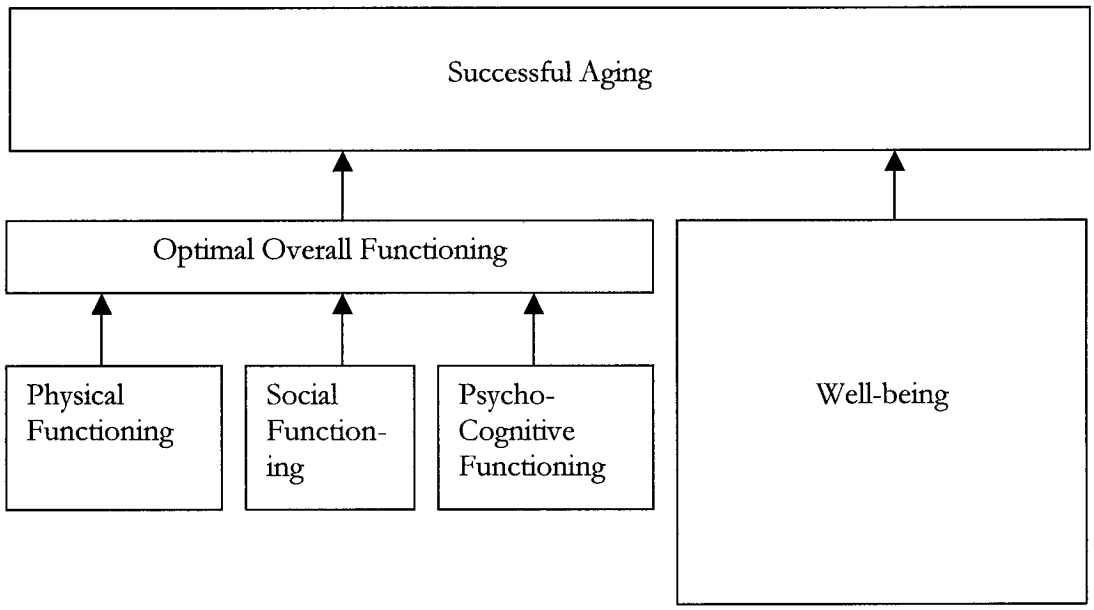


Figure 8: Quantitative model for successful aging.
From von Faber et al, Successful aging in the oldest old: Who can be characterized as successfully aged? Arch Intern Med 2001; 161(22):2694-2700.

Using this model, about 10% of the elderly in the study, which included only individuals age 85 or older, were classified as aging successfully. However, 45% had optimal scores for well-being. This finding is consistent with similar research in the US which showed that 50.3% of elderly surveyed considered themselves to be aging successfully, while only 18.3% met Rowe and Kahn's successful aging criteria (156). Using qualitative interviews, the researchers explored elderly people's perceptions of aging and created the following model for successful aging:

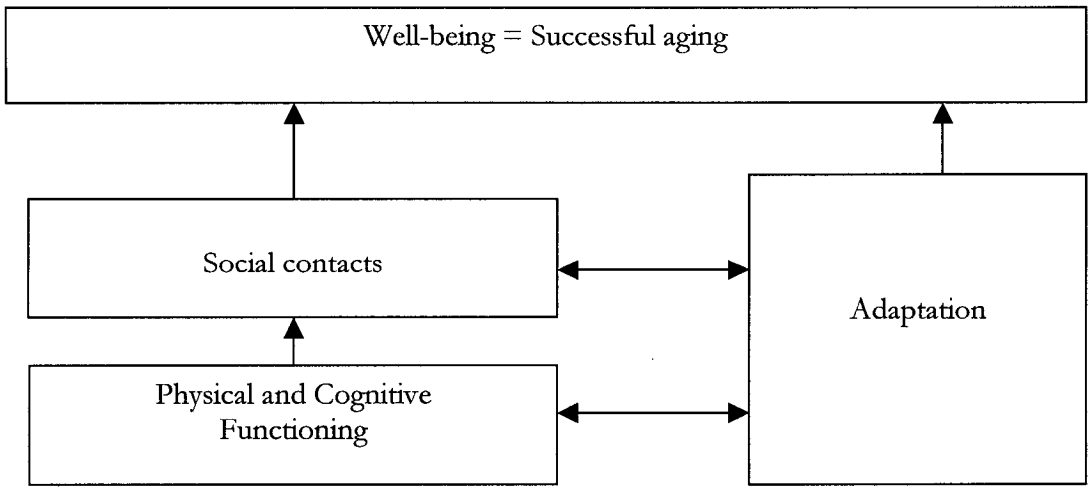


Figure 9: Qualitative model for successful aging.
From von Faber et al, Successful aging in the oldest old: Who can be characterized as successfully aged? Arch Intern Med 2001; 161(22):2694-2700.

Unlike the quantitative model, well-being is seen as equivalent to successful aging and not as a determinant of it. Also, this model is hierarchical, like the Rowe and Kahn model, in the sense that physical and cognitive functioning are seen as a means to maintaining social contacts. Adaptation provides a means for maintaining well-being in the face of loss of physical limitation. Elderly people see successful adaptation to the losses associated with aging as essential for successful aging; maintaining social contacts contribute to this adaptation.

In the next chapter, we will discuss some of the intervention for successful aging and health promotion in the literature, and will examine the use of the conceptual models described here for designing and understanding interventions.

Chapter Six: Interventions

The literature describes many intervention studies that attempted to modify the course of chronic diseases, such as hypertension, which affect the elderly predominantly but not exclusively. However, most of the literature that concerns successful aging rather than a specific disease consists of descriptive, longitudinal studies which analyze relationships between factors such as lifestyle behaviours, exercise, availability of health care, social status and income on the functional status of elderly adults. Intervention studies are rare, although a few intervention studies have looked at particular small pieces of the successful aging puzzle. For example, exercise programs have been designed to slow the rate of functional decline in the elderly (157), and a number of falls prevention initiatives exist. However, only one study attempted to intervene at multiple levels in order to postpone functional decline in the elderly. This study was conducted in Gothenburg, Sweden, in the 1980s.

The Intervention Elderly in Gothenburg (IVEG) study (158) was added to a longitudinal study of elderly people, the H-70 study (159), which compared three cohorts born in 1901/02, 1906/07 and 1911/12. The longitudinal study examined age-cohort effects on the health of the elderly individuals, and aimed to uncover relationships between such factors as previous environmental conditions, personal life-style, or availability of medical care and state of health at age 70 and above. The intervention was applied to the cohort born in 1911/12. This cohort was randomized into 3 groups of about 400 people each. The first group received a comprehensive medical and social intervention; the second received the same medical care as the first group, but no other interventions, and the third group received "usual care". The primary goals of the intervention were:

I. to maintain or improve physical and mental functioning or, alternatively, to retard the development of disablement;

II. to increase the sense of well-being;

III. to reduce the need for social services;

IV. to offer more appropriate health screening and treatment, and thereby reduce the need for medical services.

These goals were somewhat motivated by the fact that in the 1980s Sweden had the highest proportion of elderly in the world, and Swedes were concerned about the ability of the government to continue to deliver a high level of social services.

The intervention study did not use a conceptual model, but was governed by four main principles:

I. That adequate medical service, with avoidance of under- and over- diagnoses, improves vitality, quality of life, and possible also slows age-related decline in functional performance.
II. The Activity Hypothesis, which is that adequate functional loading in areas such as physical activity, intellectual performance and social integration and engagement, decreases the rate of functional decline in the elderly person.
III. The Life-Style Hypothesis, which is that personal lifestyle has consequences for functional performance and state of health. The analysis of life style is obviously a pivotal concept for the choice of intervention efforts.
IV. The Resource Perspective focuses on the capacities of the individual and how these could be developed in social interaction and productivity in the widest sense.

The intervention arm of the study used a multi-disciplinary team approach, involving architects, dentists, dieticians, economists, historians, a variety of medical disciplines, occupational therapists, physiotherapists, psychologists, sociologists, statisticians, and representatives of local authorities, government agencies, and volunteer organizations. Interventions were tailored to individual need, i.e. a particular intervention was offered if the team felt it would benefit the individual. For example, special exercise training programs were offered for people with specific challenges such as obesity or arthritis. For lonely elderly people, who were found to be more tired, to have a more negative perception of their own health, to see physicians more often and to take more medications, efforts were made to improve their physical strength, psychomotor speed, balance, and social network as well as to

look for undiagnosed medical causes for their problems. Specific "reactivation" programs were also designed for patients who had suffered episodes of curable medical problems such as hip fractures, to try to regain the performance level they had before they became ill.

In general, interventions directed towards the individual's home situation were found to be successful. That is, interventions which enabled elderly people to continue to live safely in their own homes were found to be well-received and useful. Also, improvement of safety to allow elderly people to walk through traffic to get to parks was found to be very helpful, as was organization of walking groups to encourage physical activity. Those elderly who walked at least 30 minutes per day did significantly better on tests of physical performance than those who walked less than 30 minutes.

Interventions that were directed at changing unhealthy behaviours were found to be unsuccessful. Attempts to modify tobacco and alcohol use, and to improve diet in the obese elderly were not well received. These results are consistent with other trials which have attempted to modify individual health behaviours, such as the Multiple Risk Factor Intervention Trial. (160). The authors considered the IVEG trial to be a pilot project, to illustrate "to what extent older persons would consider participating in a program interfering with their traditions and lifestyle." The sample size was insufficient to do a detailed analysis of the effects of interventions on conditions with multiple causes.

There has not to my knowledge been another trial that attempted to intervene at multiple levels to promote successful aging. Studies of this type are costly. Also, as we have seen, attempts to change individual behaviour have not produced the desired outcomes. For example, the MRFIT trial, which cost $180 million in 1980 US dollars and involved almost 13,000 highly selected, highly motivated subjects, showed that after 6 years there was no

improvement in tobacco use, blood pressure control or quality of diet in the intervention arm as opposed to the control group (162).

Because direct attempts to modify individual behaviour have not worked, there was an interest in attempting to change the communities in which people live in order to influence individual behaviour. The theory is that if community norms change, then individual behaviour will follow. An example of this is the fact that impaired driving in Canada has decreased with stricter laws and increased societal disapproval of this behaviour. There have been some planned interventions to try to change community values and norms. One example of this was the Community Intervention Trial for Smoking Cessation (COMMIT) (161) which involved 10,000 heavy smokers in 11 cities, and 11 control cities. In spite of intensive intervention which included implementation of smoke-free policies in the workplace and elsewhere, production and distribution of newsletters and training of people to become smoking cessation counselors, the quit rate for heavy smokers was the same in the intervention cities as in the control cities. One of the reasons postulated for the disappointing results of this trial is that the intervention was imposed upon the communities, rather than requested by them (162).

One community intervention that has been successful was the North Karelia project in Finland. In this case, the community asked the government to intervene to help them after it was reported that North Karelia had the highest rate of mortality from coronary artery disease in the world. Interventions were undertaken at many levels, including measures by local meat and dairy producers to decrease the fat content of their foods. Between 1970 and 1997, the rate of death from coronary artery disease declined by 60%, which was a higher rate than anywhere else in Europe (163). The majority of the decline (about 80%) was attributed to observed reductions in levels of smoking, blood pressure and serum cholesterol. This

intervention differed from COMMIT in that it was driven from the "bottom up" rather than from the top down. These results would seem to indicate that any interventions to promote successful aging should be community driven. Maybe, indeed, communities themselves have to initiate successful aging programmes. This would imply that the community is aware of its needs and concerned about its seniors, markers of a healthy community. Perhaps successful aging is most common on healthy communities.

There are some examples of successful community driven initiatives which are not well documented in the scientific literature. An example of such an initiative is the Tri-County Health Partnership (TCHP) of Pottstown, Pennsylvania (164). The community was able to mobilize its assets in order to reduce the number of unemployed persons in the city. It did so by doing a survey to identify barriers to employment, which as it turned out were a lack of day care, especially in the evening, and a lack of transportation. The area transit authority was persuaded to extend its hours of operation, and the YMCA developed and evening day care program. The school board agreed to transport the children to the YMCA after school. The parents were required to pick the children up at the end of their shifts, but many of them did not have cars. The TCHP then sought donations of used company cars, which were first lent to auto-repair students to allow them to gain experience in automobile restoration and then given to needy families. In addition, the TCHP provided workforce readiness training for prospective employees, and then organized a mentoring program where new employees were mentored by more senior employees for their first year on the job. Employers were also educated about the benefits of hiring people off the welfare rolls, and were consulted about what assistance their businesses would require in order to facilitate new hiring. This collaborative effort, while successful and admirable, was not designed as a scientific study and therefore suffers from a lack of clear evaluation criteria, which leads to lack of reporting in

peer reviewed journals. Because this type of intervention is community driven and community specific, little emphasis is put on the ability to replicate such an intervention in another locale. Furthermore, the lack of a conceptual model restricts the ability to understand the impact of the intervention, to evaluate it and to modify it in order to improve outcomes.

Recognizing that our ability to understand some important work is limited by the lack of a conceptual model, Thomas Inui has proposed that we organize the determinants of health and their corresponding indicators into a conceptual model to help understand multiple outcomes associated with successful aging. He calls this method "a heuristic for comprehensively examining the place of any particular intervention in health status while placing that intervention into a context of the whole set of potential investments in health (165)". He has proposed applying the US National Institute of Medicine's set of performance indicators for elder health to Evans and Stoddart's health field model (166). This is illustrated in Figures 10 and 11:

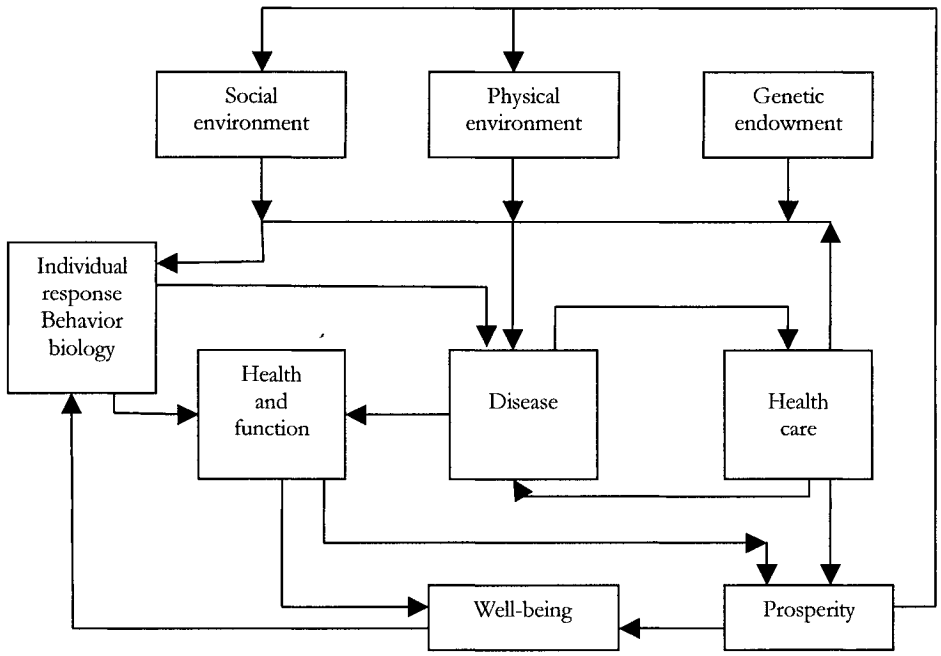


Figure 10: The Evans – Stoddart Model of the Determinants of Health.
From Evans RG, Stoddard GL. Producing health, consuming health care. Soc Sci Med 1990;31(12):1347-1363.

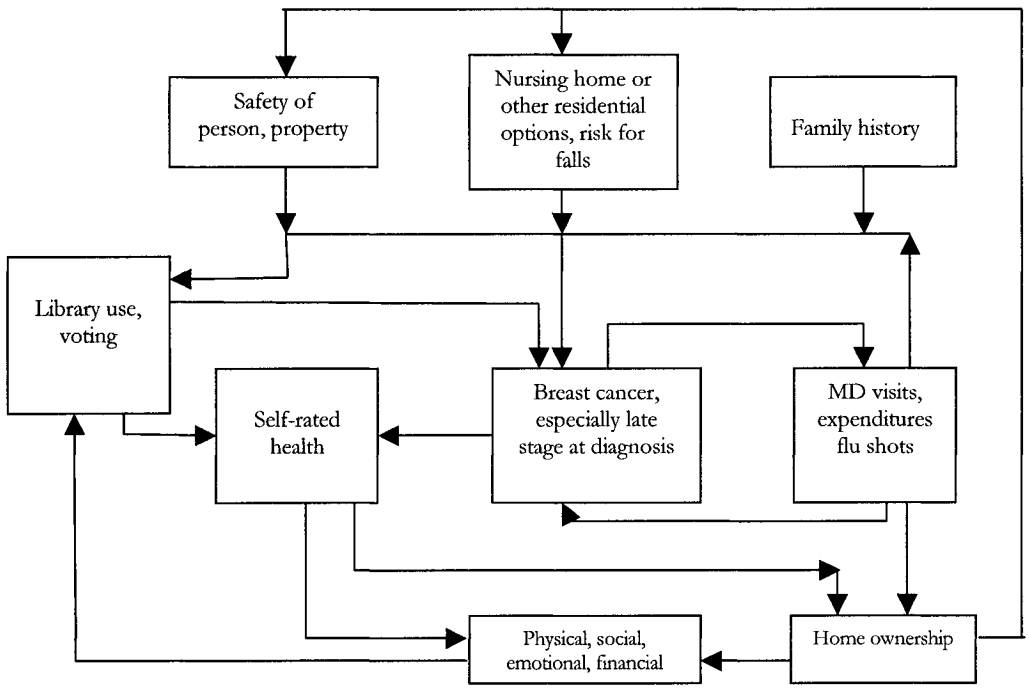


Figure 11: Use of the Determinants of Health Model in accordance with the Institute of Medicine performance indicator set for elder health.
From T. Inui. The need for an integrated biopsychosocial approach to research on successful aging. Ann Intern Med 2003; 139(5 Pt 2):391-394.

When applying the performance indicators to the model, Inui ensured that at least one indicator represents each of the determinants of health presented by Evans and Stoddart. This approach provides a framework for thinking about interventions, and how they might influence multiple outcomes. This work is one of the few attempts in the literature where a conceptual model has actually been linked to data collection. As we have seen in the previous chapter, there have been some attempts to create conceptual models to understand *what* successful aging is, but very little work has been done on *how* one might achieve it. Thomas Glass's model is unique in that he does propose some indicators that might be measured, but he does not try to explain how the indicators might be related to one another.

Inui also proposes to apply the Evans and Stoddart model to data already collected, in order to help understand the complex relationships between data gathered from longitudinal studies, again to help decide upon where interventions might be appropriate. Inui has used the model to help organize findings from the Seattle Kame study, which looked at cognitive decline and dementia among Japanese-Americans, as illustrated in Figure 12:

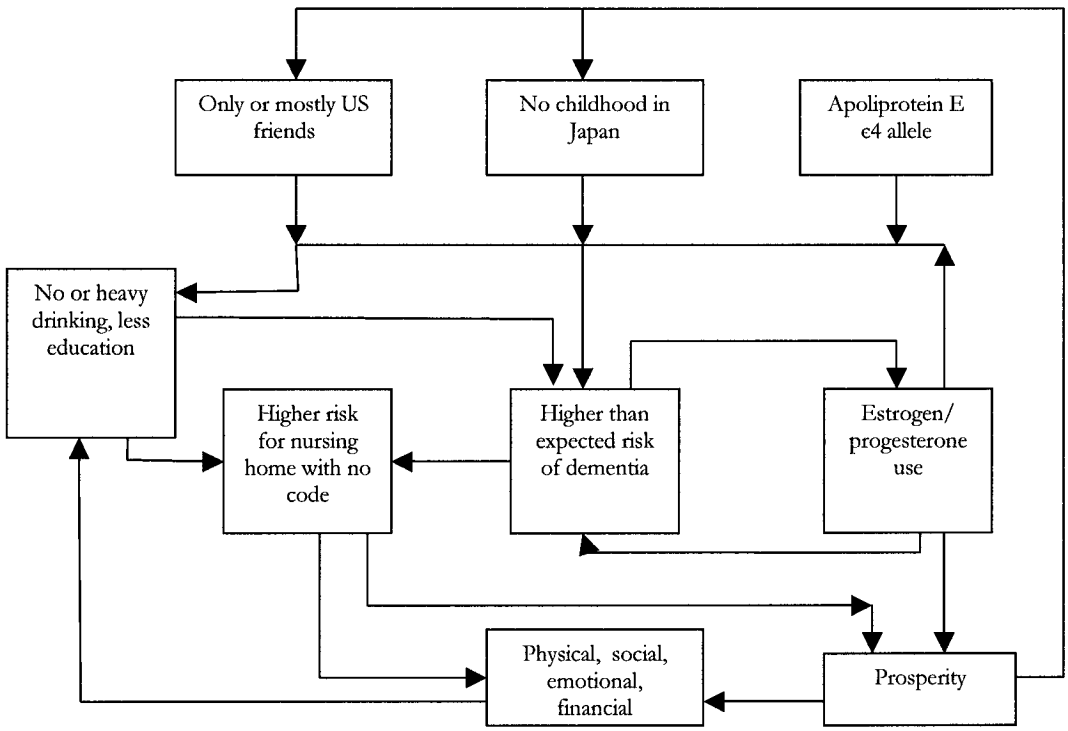


Figure 12: Cognitive decline and dementia among Japanese-Americans, organized according to the Determinants of Health Model.
From Inui, TS. The need for an integrated biopsychosocial approach to research on successful aging. Ann Intern Med 2003; 139(5 Pt 2):391-394.

This model takes the findings from a series of studies collected during the Kame project and fits them onto the template of the Evans and Stoddart model in order to better understand how various determinants of health might be related to one another. In this case, the model serves as a framework for organizing findings from multiple related studies. It helps us to theorize how multiple exposures might interact to lead to a state of disease or to wellness. While this is an interesting approach that helps us to organize our thinking around successful aging, I propose that rather than using a generic model it is even more useful to design a conceptual model that reflects our understanding of what is successful aging and how it might be achieved. We may then theorize how particular interventions may then affect

various determinants of successful aging. We should be able to create evaluation criteria that will allow us to measure the success of a particular intervention. Expensive multiple intervention trials need not be undertaken as long as we have an understanding about how one intervention might affect multiple outcomes. Therefore, interventions might be tested one at a time. This would allow us to take a reductionist approach to a specific intervention, but still maintain a holistic point of view.

In the next section of the thesis, I will discuss our attempt at Successful Aging Ottawa to create such a model, and I will also propose my own model which builds upon the work at SAO, but goes beyond it.

PART THREE: A New Conceptual Model for Successful Aging

Chapter Seven: A Conceptual Model for Successful Aging Ottawa

Background

Successful Aging Ottawa (SAO) is an initiative that originated from a retreat held in the fall of 2002, which involved the Council on Aging of Ottawa, the City of Ottawa, the Ontario Ministry of Health and Long-term Care, the Regional Geriatric Assessment Program, the Ottawa Community Care Access Centre, Sisters of Charity Health Services, the Elisabeth Bruyere Research Institute and United Way/Centraide Ottawa. I became involved with SAO in 2003 as a member of the Research Steering Committee and the Conceptual Model Working Group.

The vision of Successful Aging Ottawa is as follows:

> The Ottawa community is committed to, and recognizes and values the contributions and involvement of people of all ages. Seniors are the roots of a community, and as such, our community is enriched by its older citizens.
>
> Ottawa is committed to creating a climate where there is a sense of belonging, inclusion and connectedness; an environment which promotes the values and conditions that contribute to optimal aging, and subscribes to the idiom, 'what's good for seniors is good for the community'.

The mission statement of Successful Aging Ottawa is "to promote and foster a culture/community where there is inclusion, safety, integration, engagement, and choice for all older citizens. This will be achieved through building partnerships, educating, influencing public policy, and building on existing strengths within the community." SAO chose to define successful aging using the work of Rowe and Kahn as a basis, but adding the dimension of life

satisfaction, which was identified as important in the Canadian Study of Health and Aging (167). Successful aging was considered to consist of the following four dimensions:

I. good physical health and function

II. good psychological health and function

III. engagement with life

IV. morale and life satisfaction

SAO also felt that it was important to show that aging is an individual phenomenon that takes place in the context of a wider community, as depicted in the following model which has been adopted by the Healthy Aging Research Network (191):

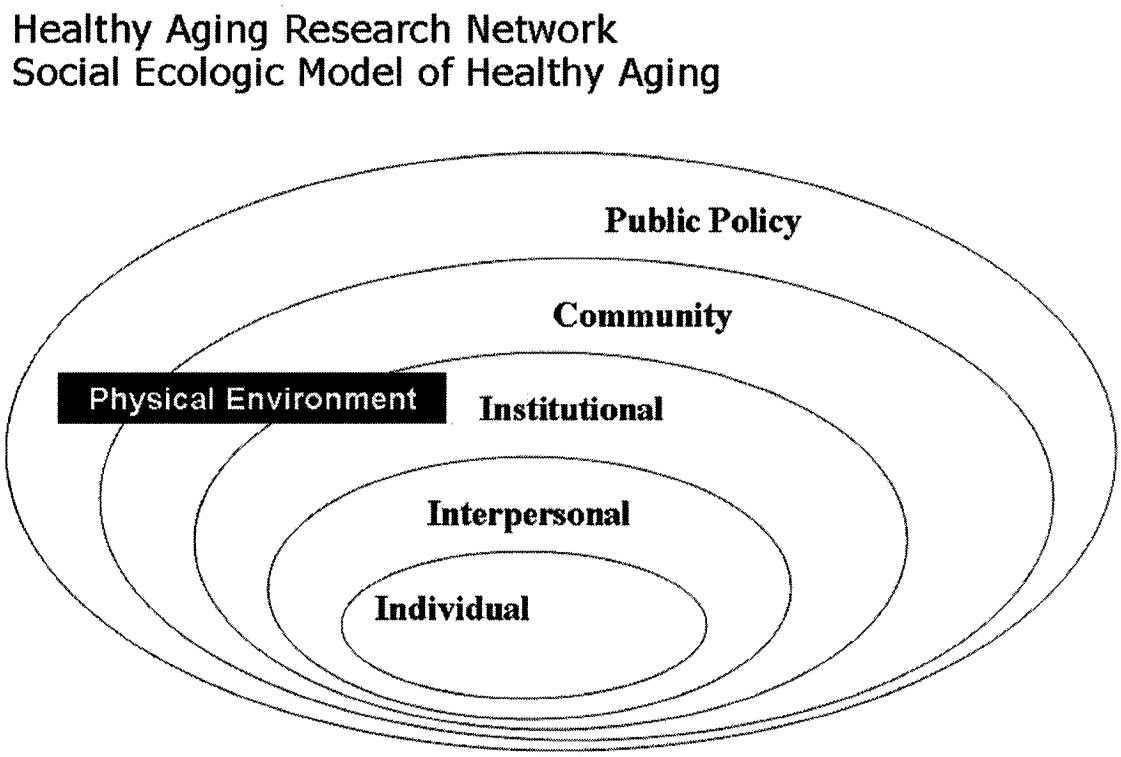


Figure 13: Healthy aging network model

Incorporating the four dimensions of successful aging into a social ecological model, Elizabeth Kristjannson et al created the following model:

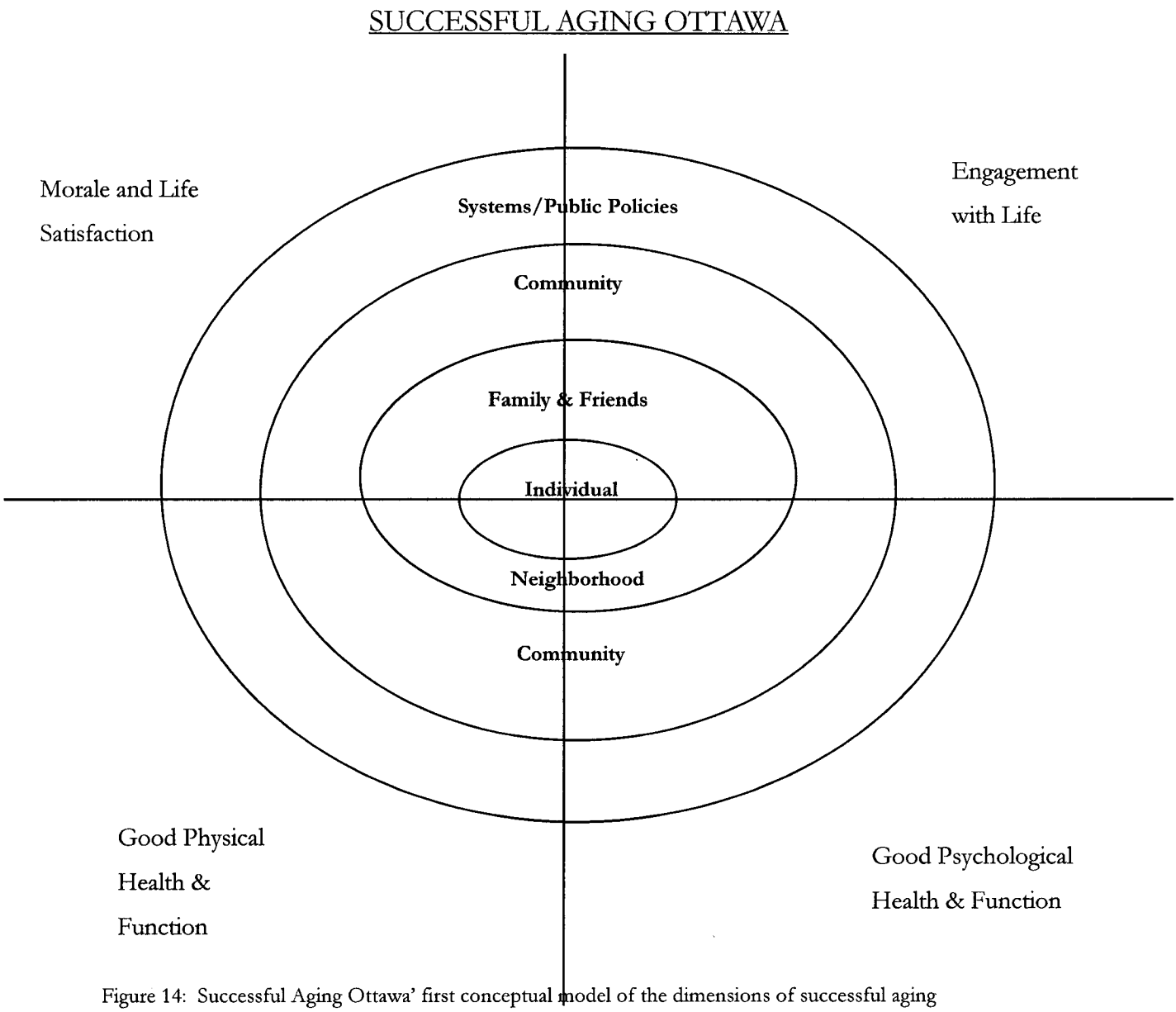


Figure 14: Successful Aging Ottawa' first conceptual model of the dimensions of successful aging From Kristjansson et al.

This model was considered by the group to be a good representation of successful aging at any point in time, but because we were interested in successful aging as an adaptive process, we felt we needed a model that shows the interactions between the various

dimensions of successful aging, as well as the impact of community resources. Our group decided to search the literature for a model that might show the dynamic nature of successful aging, and identified the following model by von Faber et al, which I discussed in Chapter 5.

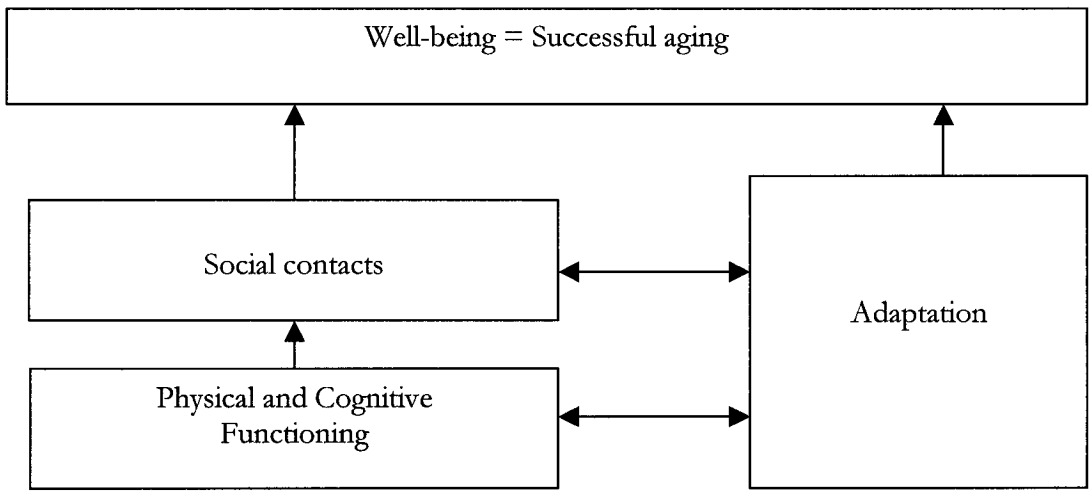


Figure 15: Qualitative model for successful aging.
From von Faber et al, Successful aging in the oldest old: Who can be characterized as successfully aged? Arch Intern Med 2001; 161(22):2694-2700.

This model was unique in that rather than being a pure state model, it showed the role of adaptation in achieving successful aging. Building upon the work of von Faber's group, but wanting to incorporate our working definition of successful aging into a revised SAO model, our Conceptual Model Working Group proposed the following model:

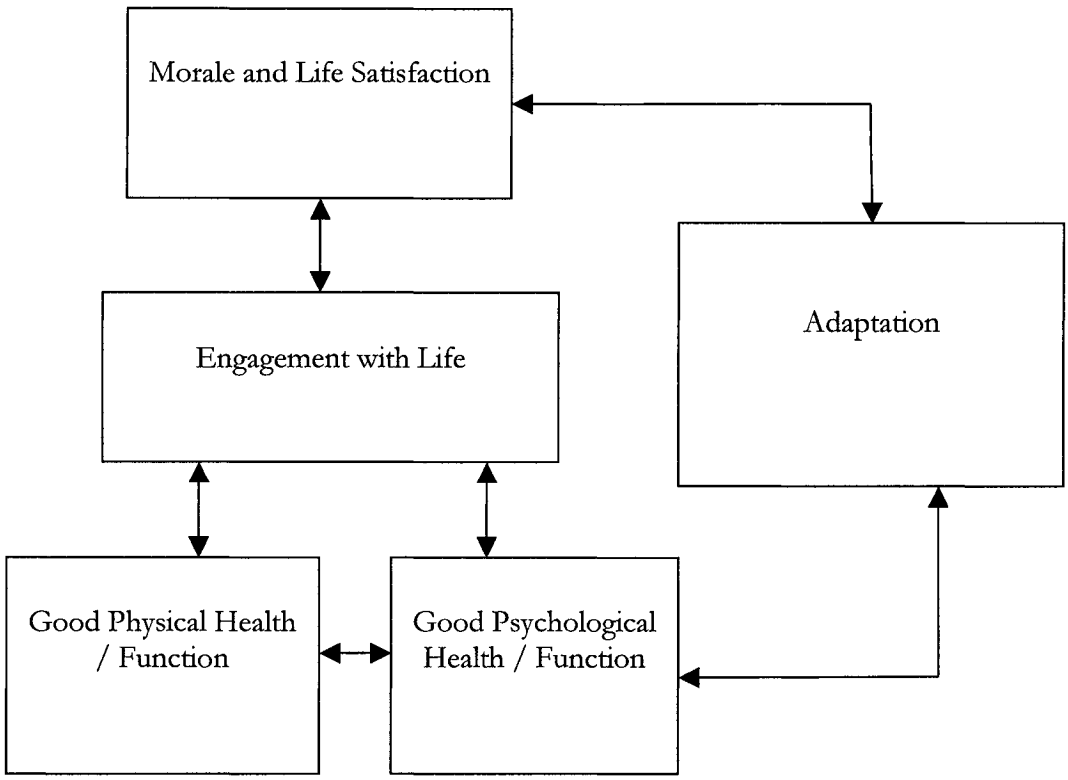


Figure 16: SAO working conceptual model (1)

These models are both hierarchical, following the work of Rowe and Kahn. However, in the von Faber model, the authors do not refer to health, but only to functioning. They do this to emphasize that elderly people can enjoy significant well-being even in the face of ill health. Adaptation is the mechanism by which people affected by losses associated with old age are able to maintain their well-being. In the von Faber model, physical and cognitive functioning is important in that it facilitates social contacts, which leads to greater well-being. Similarly, the SAO model shows physical and mental health and functioning as being necessary

for active engagement with life. Active engagement with life incorporates social contacts, but is actually a much broader concept encompassing both social supports and activity (168) (169)

In contrast to the von Faber model, the SAO model shows mutual direct relationships between physical health and functioning, psychological health and functioning, and active engagement with life. The bi-directional nature of these influences is supported by a body of literature. Numerous authors have examined the effect of activity and social supports on physical functioning and also on psychological health. Unger, Johnson and Marks showed that engagement in social activities was associated with increased physical function and predicted a slower decline in functional status over a six year period (170); Everard showed a positive association between leisure activities and mental health (169). Glass et al showed that social, productive and physical activities in older people were associated with a decreased risk of mortality from all causes (171). Lennartsson and Silverstein, however, found that in their study of activity and mortality in Sweden, that most of the benefit from activity stemmed from the fact that those elders with higher activity levels were healthier at the outset (172). They did however find a reduced mortality risk for men engaged in "solitary-active" activities. Garfein and Herzog (173) reported a positive association between health and social contacts in the elderly. Many authors have shown that social contacts are associated with lower morbidity, improved subjective health, and enhanced survival (174-176) Causal mechanisms have been postulated but not proven. Although it makes intuitive sense that healthier individuals are able to participate in more activities and maintain more social contacts, the mechanisms by which engagement with life may promote physical and mental health are speculative at the moment. Possible mechanisms include: (i) improvements in physiologic function (e.g. immune function, cardiovascular reactivity, cardiopulmonary fitness) (ii) improvements in mental health as a result of an increased sense of belonging, self-esteem or purpose in life and (iii) adoption of

health promoting behaviors, such as smoking cessation, better nutrition or exercise, which in turn improve physical and mental health.

With respect to well-being (or life satisfaction, which is often used as a synonym for well-being in the literature), a strong positive association has been reported with "engagement with life". Everard (177) showed that engaging in social activities was associated with increased well-being among community dwelling elderly. At least five other studies (177-182) have also shown that increased activity levels in terms of either frequency or number of activities performed are associated with increased well-being.

The left hand side of our model illustrates *what* is considered to be successful aging (i.e. the state of successful aging) for the purposes of the SAO initiative and the hierarchical relationships between the various dimensions identified as necessary for successful aging. The right hand side of our model attempts to account for *how* some people achieve successful aging (the process of successful aging). Unfortunately, although there are well-developed scales in the literature to objectively measure the dimensions of successful aging (physical functioning, social functioning, psycho-cognitive functioning and well-being), there are few established measures for adaptation. It remains a bit of a black box. Baltes and Baltes have proposed a strategy of selective optimization with compensation to describe a general process of adaptation, but have not proposed a measurement model.

We felt that the "what is successful aging" part of our model (on the left hand side) was useful, but that the concept of adaptation on the right hand side of the model needed to be expanded upon. We also felt that the model did not illustrate the use of community resources. To better represent adaptation and the use of community resources, we proposed the following model. The left hand side remains unchanged, although it is now boxed in order to show that it represents individual well-being.

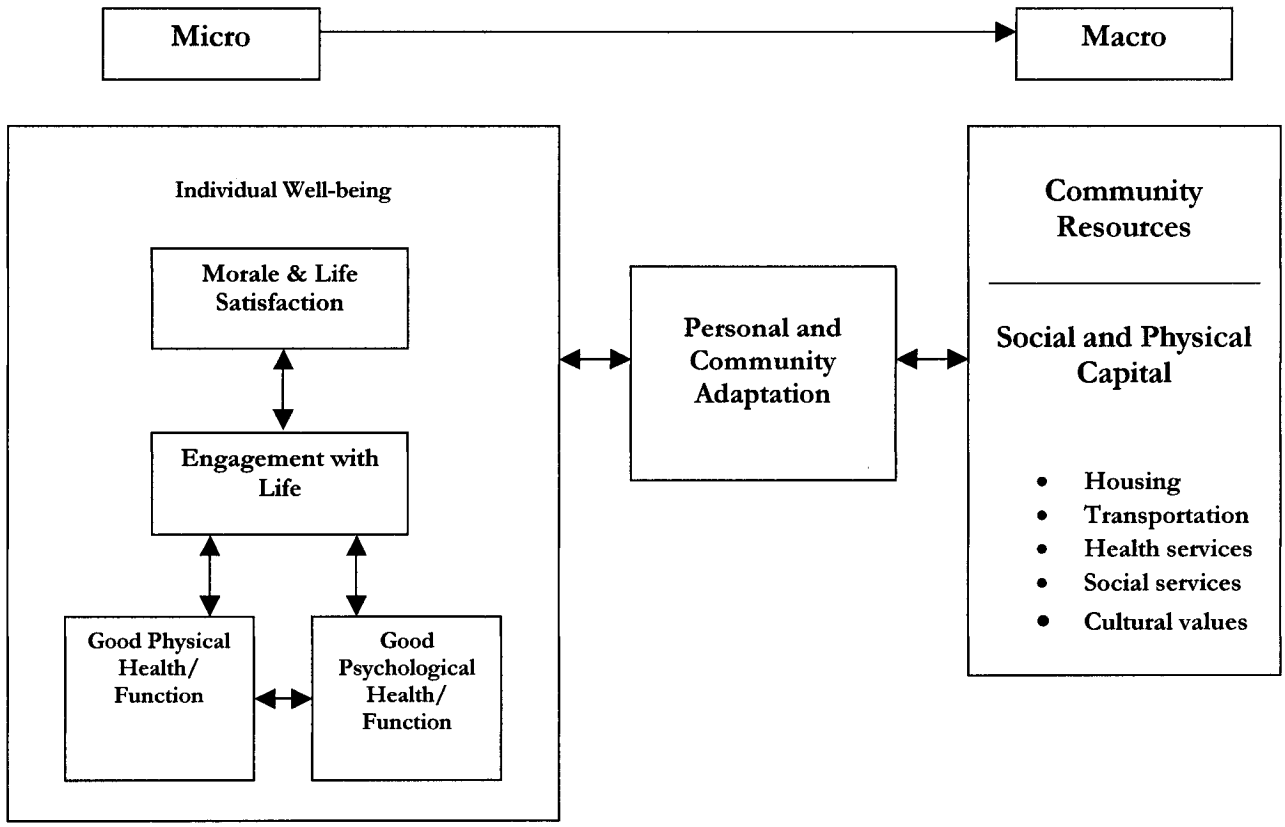


Figure 17: SAO Working Conceptual Model (2)

This model shows a link to community in that it begins to show how a community can support an elderly person. It also shows that adaptation occurs at the community as well as the personal level. It does illustrate that individuals can and do give back to the community in both material wealth and in creating "social capital". To describe the next stages in developing this model, a brief discussion of theories of social capital is required.

The term "social capital" has been used to describe "the resources and obligations available to community members on an interpersonal and organizational basis." (164). Some authors have described it as a combination of social networks and high social trust (183). Putnam has postulated that "high levels of social trust in settings of dense social networks often provide the crucial mechanism through which social capital affects aggregate outcomes." There is evidence that increased levels of social capital are correlated with social outcomes

such as lower crime rates, improved child welfare, better public health and reduced political corruption and tax evasion, among others (184). Helliwell and Putnam (183) showed that increased social capital is linked to increased subjective individual well-being. Conversely, a community composed of individuals who enjoy high subjective well-being are more likely to contribute back to the community and therefore further increase levels of social capital.

Contextual analysis

The previous model illustrates an interaction between an individual and his or her community as it relates to successful aging. Studying the interaction of individuals with their social contexts presents a very great challenge to epidemiology today. In order to do so, the researcher must conduct a multilevel or contextual analysis, which requires consideration of both group and individual variables and outcomes. We have known for some time that group and individual factors are both important in determining why some individuals become sick and others do not. For example, we know that the overall rate of an infectious disease in a population, the level of immunity in that population and a particular individual's immune status affects that individual's risk of becoming infected. Other interactions may be more complex, however. Ana Diez-Roux (185) has thoroughly reviewed methodological issues that arise when one attempts to use a conceptual model to explain how group-level and individual level variables interact in shaping health and disease. She has identified four different "fallacies" or "level of analysis problems" which may arise when relationships at one level are inferred bases on data from another level:

I. the ecological fallacy, which is the fallacy of drawing inferences at the individual level based on group level data. For example, if the mean number of hours worked per physician per week is 60 hours, one cannot assume that an individual physician works 60

hours per week. There may be a group of physicians who work 40 hours per week and another group who work 80 per hours per week, producing an average of 60 hours per week, even though few physicians work those hours. In this case, the conceptual model being tested is at a lower level, but the data is collected at a higher level.

II. the atomistic fallacy, which is the fallacy of drawing inferences at the group level based on individual level data. For example, within a country one might find that increasing income is associated with a decreased risk of coronary artery disease. However, between countries one might find that the opposite is true, and that increased mean per capita income is correlated with increased risk. To assume that the association found within countries holds true across countries is to commit the atomistic fallacy. In this case, the conceptual model being tested is at a higher level, but the data is being collected at a lower level.

III. the psychologistic fallacy, which is the fallacy of assuming that individual level outcomes can be explained exclusively in terms of individual-level characteristics. For example, a finding of an increased incidence of depression in immigrants versus the native population might only be true in communities where the immigrants represent a small minority. Although the level of analysis is appropriate for the conceptual model being tested, which are both looking at the individual, important contextual information is being ignored.

IV. the sociologistic fallacy, which refers to ignoring the role of individual level factors in the study of groups. For example, if a study shows an increased suicide rate in a community with a higher transient population, once could conclude that increased numbers of transient residents lead to decreased social cohesion and increased suicide in all members of the community. However, it could be that transients have a higher suicide rate than

that of permanent residents, which is constant across all communities, and that the increased number of suicides is simply due to the high number of transient residents. In this case, again the level of data collection and analysis is appropriate to the conceptual model, which is at a group level, but important individual data is being ignored.

In addition to these pitfalls, confounding may be a problem in multi-level analyses at both the group and the individual levels.

An individual model for successful aging

The preceding discussion points out some of the challenges in multi-level analysis, and also serves to highlight some of the strengths and weaknesses of the SAO model in its current iteration. This model combines a state model of successful aging for an individual with community effects (i.e. community adaptation), thus blending two levels of analysis into a single conceptual model. As we have just seen, it is very difficult to understand the impact of group level and individual level variables even when the conceptual model is on the level of the individual or the group. When both are combined in the same model, even more confusion may result. Also, the concept of what constitutes a healthy community and how a healthy community might work has not been addressed. Adaptation has been mentioned, but there has been no attempt to explain how it might work. In order to do so, I am proposing two separate models of successful aging, an individual level model and an expanded community level model, which may then be linked. Both of these models draw upon the Social Production Function theory of Steverink et al. (186). The individual level model is as follows. See Figure 18:

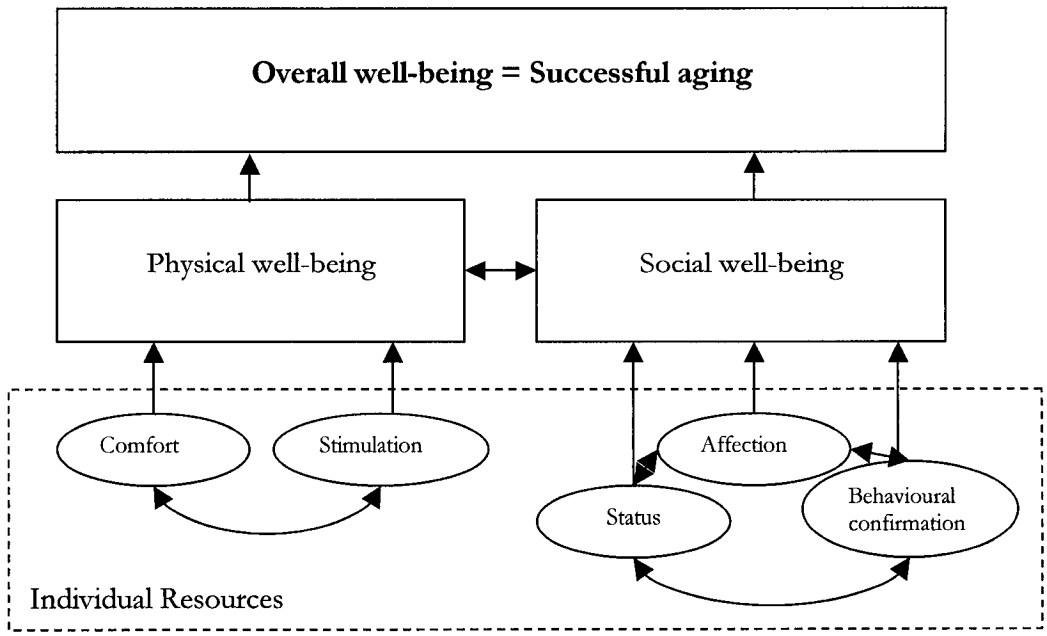


Figure 18: Individual Model for Successful Aging.
C. Caron, 2004. The curved arrows represent the process of adaptation, which is taking place inside the box, in the context of the available resources. First order instrumental goals are represented in the ovals.

This model is a state model, in that it describes successful aging for a particular person at a particular moment in time and uses well-being as its definition of successful aging. The advantage of a state model is that it lends itself to measurement. Overall well-being is best measured using subjective criteria, but physical well-being and social well-being may be measured using both objective and subjective criteria. The first level instrumental goals may also be measured subjectively and objectively, and they may be further broken down into components, or determinants of health, that lend themselves to measurement. For example, affection may be measured by scales of perceived emotional supports and by number and strength of social ties. Status may be measured by having the individual rate himself or by using an occupational prestige scale. Stimulation could be measured by self-perception or by

measures of the time an individual spends in doing activities of daily living and in pleasurable pursuits.

Another strength of the model is that it acknowledges the process of adaptation as necessary to maximize well-being and to age successfully. According to social production function theory, in order to maintain well-being, shifting needs to occur between social and physical aspects in order to achieve optimal overall well-being. There is some empirical evidence for such shifting in the literature. Jang et al found that "disabled individuals may compensate for their lower physical function by placing more emphasis on social networks and social activities" (187). Also, SPF maintains that there is shifting between the first order goals, (comfort, stimulation, behavioural confirmation, status and affection), in order to maximize physical and social well-being. In the model, however, factors that affect one's ability to make the shifts are not elaborated. There is some evidence that the greater the number of cognitive adaptive strategies one has at one's disposal, the more likely one is to be able to make substitutions in an effective manner (188). The more losses a person experiences, however, the more reduced are his or her options for substitution and the more idiosyncratic we expect the substitution mechanisms to become. Individuals may use different strategies of substitution and compensate for losses by tapping into different resources, and they may have different resources available to them. The model also makes explicit the role of resources as being necessary in order to achieve successful aging, which (except for the work of Alice Day (154)) has been missing from other models of successful aging.

Further, the cumulative experiences of a lifetime become most evident in old age, leading to still greater heterogeneity. For example, damage associated with years of cigarette smoking results in on average smokers experiencing accelerated cognitive aging (189).

Certainly the model may be elaborated in more detail by empirical research into mechanisms and effects of substitution behaviours.

A Community Model for Successful Aging

Next, I propose a community model for successful aging. See Figure 19:

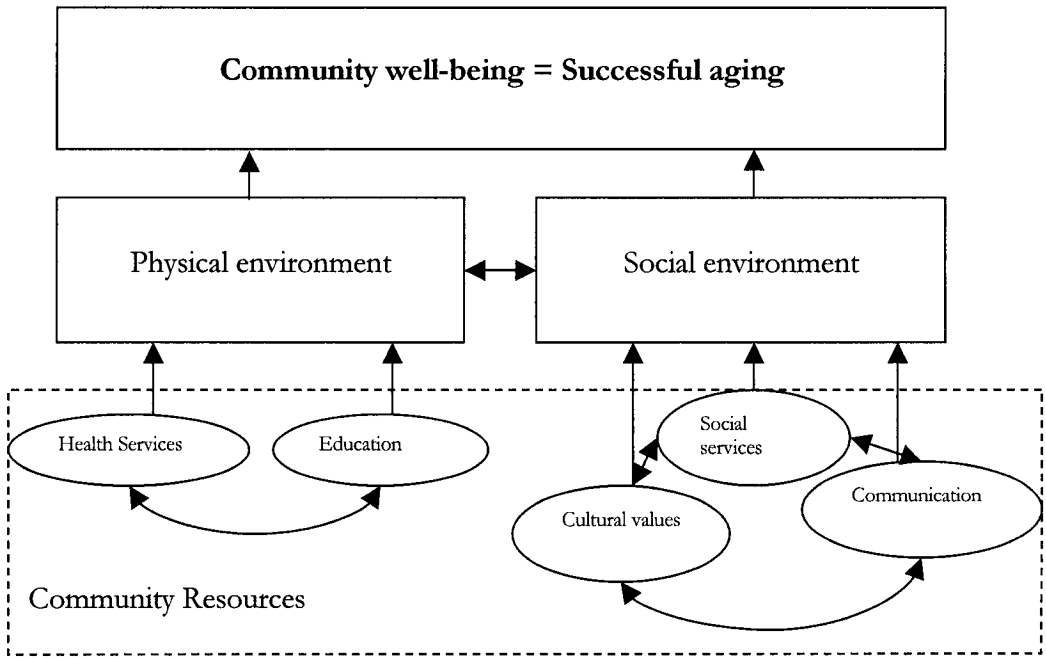


Figure 19: Community Model for Successful Aging.
C. Caron, 2004. The curved arrows represent the process of adaptation, which is taking place inside the box, in the context of the available resources. First order instrumental goals are represented in the ovals.

As one can see, the community model is analogous to the individual model. Well-being is achieved by a similar process, but the factors that may contribute to well-being on a community level are different.

The community model shares some of the strengths and weaknesses of the individual model, as well as presenting some of its own unique strengths and challenges. As we have discussed earlier, there has been a great deal of discussion about the definition of successful aging. Thankfully there is more agreement in the literature about what constitutes community well-being. In 1985 in Toronto, a conference was held commemorating the tenth anniversary

of the release of the Lalonde report. The purpose of this conference, which was called "Beyond Health Care", was to look at how factors other than medical care influence population health. The conference was the genesis of the Healthy Cities movement, which is a major initiative of the European WHO. In North America, the term "healthy communities" is often used to refer to initiatives which are similar in nature, but not formally connected with the WHO. In Ontario, there exists the Ontario Healthy Communities Coalition. They state that healthy communities are based on the following principles:

I. Health is a state of complete physical, mental and social well-being. Social, environmental and economic factors are important determinants of human health and are inter-related.

II. People cannot achieve their fullest potential unless they are able to take control of those things which determine their well-being.

III. All sectors of the community are inter-related and share their knowledge, expertise and perspectives, working together to create a healthy community

They go on to specify twelve qualities of a healthy community:

a) clean and safe physical environment

b) peace, equity and social justice

c) adequate access to food, water, shelter, income, safety, work and recreation for all

d) adequate access to health care services

e) opportunities for learning and skill development

f) strong, mutually supportive relationships and networks

g) workplaces that are supportive of individual and family well-being

h) wide participation of residents in decision-making

i) strong local cultural and spiritual heritage

j) diverse and vital economy

k) protection of the natural environment

l) responsible use of resources to ensure long term sustainability

These criteria are similar to those proposed by the healthy cities initiative.

Using these criteria, we can see that it may not be possible to measure community well-being directly, as we can measure individual well-being with a life satisfaction scale. However, there are a number of potential indicators of the quality of the physical and social environments. We can, for example, measure the quality of the air and water, and can measure social cohesiveness.

This model does illustrate community resources, and can be elaborated to show them in greater detail. It also shows the potential substitution of resources that can take place in order to achieve optimum conditions in the physical and social environments. How these substitutions may be coordinated is another thesis topic, but will be discussed briefly in the next chapter.

The next step is to link the individual and community models. See Figure 20:

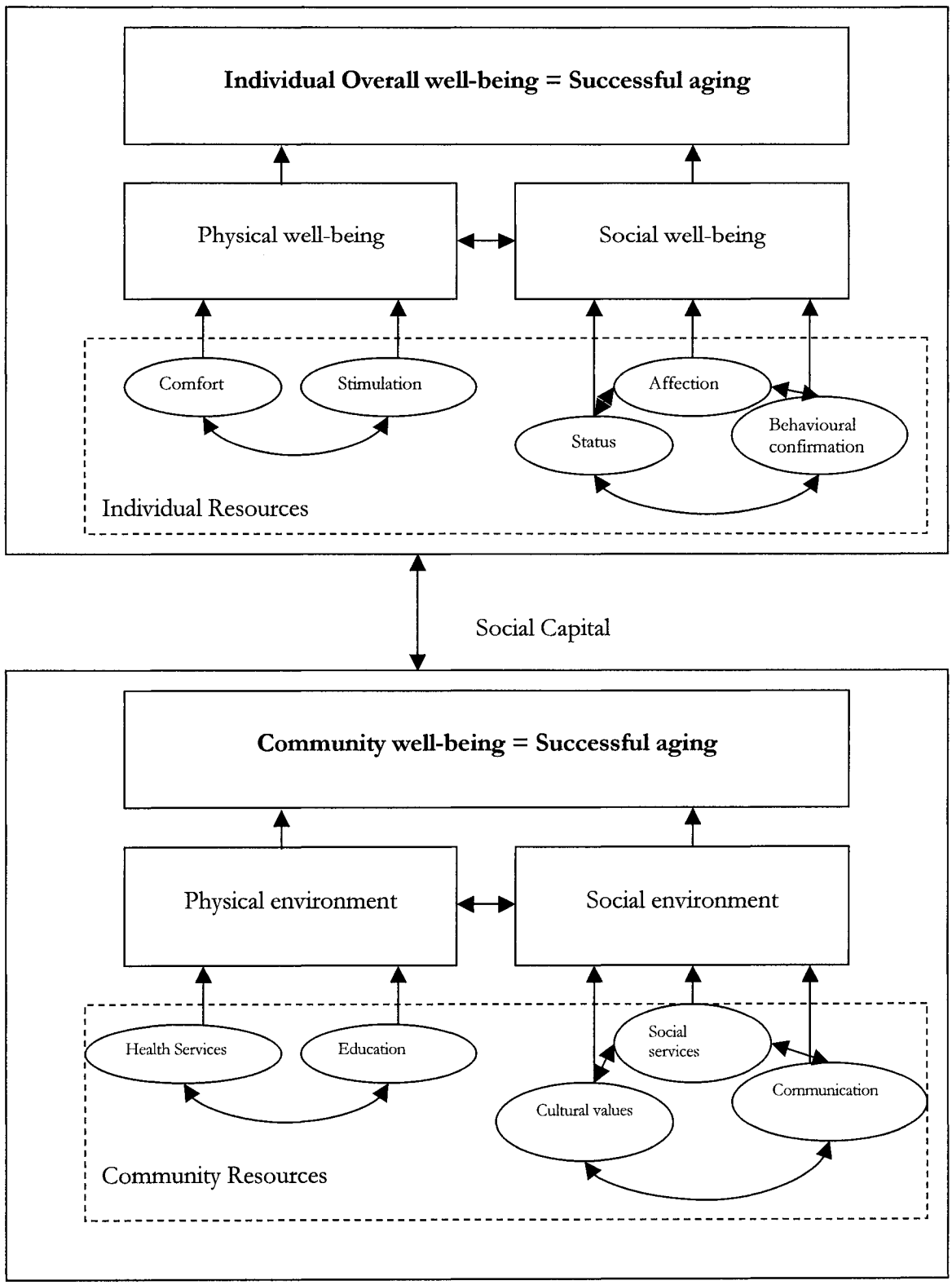


Figure 20: Linked model of individual and community well-being.
C. Caron 2004.

Community well-being may be seen as a resource that is available to individuals, but also as an entity that directly affects individual well-being. Although healthy individuals may exist in unhealthy communities, and unhealthy individuals may live in healthy communities, increasing the health of the community overall increases the chances that a particular individual will have greater sense of well-being. The model shows one individual's connection to the community, but the community model could in fact have any number of individuals connected to it. An underlying theory of this model is that communities need to engage in similar processes of adaptation as do individuals in order to maximize the use of available resources. In the next chapter, I will discuss how the model might be applied to a project such as Successful Aging Ottawa.

Chapter Eight: Testing, Implementation and Policy

As I have described in the preceding chapters of this thesis, my model has been designed using an iterative process, in order to meet the needs of the Successful Aging Ottawa Initiative. The next steps are to operationalize and test the model. One of the major challenges will be to develop operational definitions of the first order instrumental goals, such as comfort, stimulation and affection, and to break down these first order goals into components or determinants. Once these goals are defined and delineated, then small parts of the model may be empirically tested. In parallel with the development of the model, Successful Aging Ottawa undertook a survey of seniors in the City of Ottawa. The survey was designed as the conceptual model was evolving, and an attempt was made to use the survey to explore the following six components of successful aging:

- morale and life satisfaction
- engagement with life
- physical health and function
- adaptations to limitations in physical health and psychological function, and
- community assets

A next step could be to look at survey data, particularly from the latter two categories, once the first order goals have been operationalized, in order to test relationships between determinants. The area which holds the most interest for the City of Ottawa, and that which I consider to be most challenging, is the relationship of community resources or assets and adaptations to limitations in functioning. According to Social Production Function theory, on which the model is based, individuals will shift between first order instrumental goals in order to maximize well-being, while compensating for diminishing resources. From a community

standpoint, where assets are finite, the ideal would be to provide adequate resources, while assisting individuals to successfully shift strategies in order to effectively use resources and maximize well-being, even in the face of loss. For communities too, the challenge is to continually shift priorities in order to achieve the greatest good for the greatest number of people. The question is how to organize the resources at a community level in order to maximize well-being, recognizing that needs for individuals may be different from the needs of the community as a whole, and taking into account the principles of equity and social justice. As Robert Havighurst said in "Successful Aging" in 1963, "No segment of society should get satisfaction at a severe cost to some other segment" (150).

Although the model has not yet been tested, we could use it to help organize our thinking around these very difficult choices. To consider the individual part of the model first, we need to analyze where interventions will be most successful. For example, we could consider maximizing individual resources in order to enhance overall well-being. We first need to define individual resources and then to decide on an acceptable minimum standard for resources such as income, housing or access to medical care. Of course, maximizing individual resources requires the use of community resources, which leads us back to the community model. With other resources, such as education level, which may not lend themselves to direct intervention in the elderly, the link to community becomes even more important. We need, however, to be mindful that today's youth are tomorrow's elderly, and recognize that investments in programs such as education will affect successful aging in the future.

On an individual level, we have seen that stimulation is a necessary requirement for physical well-being. On a community level, we could consider encouraging activities that are not resource intensive, and that promote stimulation. These could include programs specifically targeted to the elderly, such as Tai Chi classes or university classes. Or an attempt

could be made to make activities which are directed at the whole community to be more welcoming to the elderly. Considering that status is an important aspect of well-being, we also need to look at the status of the elderly in the community. Often an individual's career provides him or her with status. Currently we have mandatory retirement at age 65 in many institutions, including the University of Ottawa. Given that the health and lifespan of the population has improved over the last 40 years such that the average Canadian can expect to live to live into his or her 80s in relatively good health, we need to re-examine mandatory retirement. From an individual viewpoint, allowing those who are able and who so desire, to continue in their careers could promote continued high status and well-being. From a community standpoint, a less discriminatory approach to retirement could result in more people making a greater contribution to their community. The needs of younger workers need of course to be considered as well, but the demographics would indicate that Canada is heading for an overall labour shortage as the baby boomers retire.

As well as looking at how to maximize the components that have been identified as necessary for successful aging, we also need to consider adaptation. On an individual level, it would seem that adaptation is best enhanced by increasing the resources available to an individual to facilitate his or her ability to make appropriate substitutions. From a community standpoint however, a process for continually shifting priorities is more complex. Given that we have finite resources, we need to continually reprioritize in order to achieve the greatest good for the greatest number of people. Health care and education are two areas which are both necessary to maximize community well-being, but could each consume apparently limitless resources. Furthermore, both of these areas are under provincial jurisdiction, as is transportation. On a local level, though, a city can identify needs and priorities and lobby the provincial government for funds. For example, the city has asked the province for funding to

improve public transit. From a community standpoint, it becomes important to ask who is involved in the decision making. As we discussed in the intervention chapter, top-down approaches do not work. Broad-based community efforts are presumed to be more effective, although there is a distinct lack of literature in this area, and more research is clearly needed.

My model provides a framework for thinking about successful aging from an individual and a community perspective. The model incorporates the viewpoints of both the biological and the psychological schools, recognizing that we need to consider not only the state but also the process of successful aging. Explicit in the model is the role of resources as well as the role of adaptation. The process of adaptation has not been well elucidated at a community level, but is a subject of current interest in the literature. How the Successful Aging Ottawa coalition might work together to create a more senior friendly community under the terms defined by the model is a subject for ongoing research.

Glossary (from J. Last's Dictionary of Public Health(190))

Conceptual framework: A statement of theoretical principles to guide logical and systematic development of a research design, a specific policy, or an approach to problem solving. It is sometimes called a statement of principles, and is widely used in social and behavioral sciences.

Determinant: A definable entity that causes, is associated with, or induces a health outcome. It may be a factor or combination of factors that can be classified as inherited or acquired. The latter, lumped together as environmental determinants, include biological, behavioural, social, economic, cultural, and other factors. Any combination of these may be determinants of health.

Model: 1. A small-scale replica or reproduction of a physical structure. 2. A theoretical (usually mathematical, often computerized) equation or simulation, abstract representation, or the formal expression of a theory. 3. A replication in an animal population of a human disease, such as an environmentally related respiratory disease. 4. The alternative scenarios set out in GAME THEORY. The several meanings indicate that models have many applications in many aspects of human existence, including applications in public health sciences and practice.

Theory: A belief system based on observation and supposition; cf. axiom, canon, hypothesis. Many scientific theories are based on observation or inference, some on experiments, including THOUGHT EXPERIMENTS. All commonly applied theories in the natural and public health sciences are subjected to many and frequent tests of their validity, and are vulnerable to REFUTATION. For example, the MIASMA THEORY of disease causation was thereby overturned whereas the GERM THEORY prevailed. The theory of evolution is denied by some people but is confirmed by DNA studies and empirical observations of how resistance develops to antibiotics and insecticides.

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