Perceived Control Over Physical Ageing: An Exploratory New Zealand Survey

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An exploratory survey investigated adults' views on control over physical ageing. A sample of 174 New Zealand adults responded to specially constructed scales, which measured: perceived primary control over, and acceptance of, age-related physical changes; actual and potential use of strategies to help control physical ageing; potential use of sources of information about physical ageing. Participants rated age-related physical changes as modestly controllable on the whole, but rated some changes as much more controllable than others, and some changes as more appropriately accepted than resisted. Perceived control over, and acceptance of, physical ageing were negatively correlated with each other. Participants' responses indicated some discrepancies between actual and potential use of specific strategies, and a preference for observing other people to learn about physical ageing.

Recent gerontological research indicates that many physical changes associated with ageing are largely secondary, i.e. caused by disuse, abuse or disease, rather than intrinsic to ageing itself (Leventhal, Rabin, Leventhal, & Burns, 2001). Research also increasingly suggests that the individual can minimize his or her own secondary ageing by adopting appropriate lifestyle strategies (Hazzard, 2001). It is clear, however, that many people do not consistently follow such strategies (Hazzard).

The gulf between usual and optimal physical ageing probably has complex causes. One cause may lie in individuals' perceptions of the extent to which they can influence the physical ageing process. This proposition has support from a substantial body of research in relevant fields such as health psychology. An important psychological determinant of behaviour and health is the individual's sense of control.

Perceived control, especially since Rodin and Langer's (1977) seminal study of mortality and control over the physical environment, has been shown to be an important predictor of health behaviour and health outcomes in many contexts (Krause & Shaw, 2000; Shapiro & Astin, 1998; Walker, 2001; Wallhagen, 1998). For example, a New Zealand study (Campbell, Busby, Robertson, & Horwarth, 1995) using a single-item measure of control, found that perceived control over future health in old age was positively correlated with health practices in old age. Such findings from the wealth of research in the field of health psychology and from the general field of perceived control (Schulz & Heckhausen, 1999; Skinner, 1995), suggest that an individual's perception of the possibility of control over physical ageing will influence the extent to which he or she follows strategies that can minimize secondary ageing.

There are reasons to speculate that people tend to underestimate the controllability of physical ageing. For instance, extensive research (Palmore, 1998) suggests that people do not know very much about ageing in general, and typically hold negative stereotypes about it. In the past, inadequacies of research methods - such as reliance on clinical samples and cross-sectional designs - have probably led gerontologists to reinforce such negative stereotypes by mistaking secondary for primary ageing (Rowe & Kahn, 1998).

The preceding arguments suggest that there is substantial justification for investigating people's perceptions of their control over physical ageing. It is perhaps surprising, then, that there appears to be very little directly relevant research. As discussed above, there is a lot of published research on perceived control over health. There are also several studies on perceived control over psychological aspects of ageing. For example, Heckhausen and Baltes (1991) asked respondents to rate how much influence people have over age-related increases in various psychological attributes. The overall mean perceived control score was slightly above the scale midpoint, indicating that participants believed the changes as a whole to be moderately controllable. There is some research on perceived control over development in general (Lang & Heckhausen, 2001). But published research looking specifically at perceived control over physical ageing seems to be very limited. The

most relevant study we could find is on perceived control over age-related changes in various aspects of physical appearance (Thompson et al., 1998). Participants in that study indicated stronger agreement with statements implying perceived control than with statements endorsing acceptance of changes. Participants were also asked about their potential and actual use of various control strategies. Actual and potential use of some specific strategies were correlated positively with perceived control and negatively with acceptance. There was a negative correlation between age and perceived control.

We decided to conduct a small-scale survey as a first step in extending the investigation of perceived control into the general area of physical ageing. To locate our investigation within the bewildering array of overlapping constructs, inconsistent terminology, and miscellaneous measuring instruments used in research on control (see Skinner, 1996), we drew on Skinner's integrative framework. She theorises that control beliefs are specific to particular sources of control ("agents"), methods ("means"), and outcomes ("ends"), so that general unidimensional measures of control are not appropriate. Skinner's framework classifies control-related constructs according to two kinds of distinction. The first distinction is whether the focus of the construct is on objective control, subjective control (beliefs about control) or experiences of control. The second distinction is whether the construct is concerned with an agent-ends, agent-means, or means-ends relationship. The focus of the present study was on subjective control and agent-ends relationships. Our central construct was perceived control, which we defined in Skinner's own straightforward terms as: "an individual's beliefs about how much control is available" (1996, p.551).

Work by Heckhausen and Schulz (1995) prompted us to add another dimension to our investigation. We adopted these researchers' division of control-related behaviour into primary and secondary types. The former involves trying to change the external world directly, while the latter refers to trying to change one's thoughts, feelings and motivations. In this model, one

type of secondary control is acceptance of failures to attain personal goals (Heckhausen, 1997). On the basis of the model, we decided to investigate secondary as well as primary control, by assessing the extent to which people believe in accepting certain aspects of physical ageing rather than trying to control them directly.

In the present study, our first goal was to investigate perceived primary control over, and acceptance (secondary control) of, age-related physical changes. In relation to this goal, we had a research question and two predictions, as outlined below.

We wanted to explore the extent to which adults believe that physical ageing is amenable to control, and the extent to which they think that it is better to accept age-related physical changes rather than trying to control them. Because the research literature did not seem to provide a firm basis for specific predictions, we posed a research question rather than hypotheses:

> *Question one*: To what extent will participants indicate that they believe physical ageing can be and should be controlled?

We expected that individuals with higher levels of perceived control over physical ageing would have lower levels of acceptance. Thompson et al. (1998) found that acceptance was negatively correlated with perceived control over age-related changes in physical appearance. We also expected that there would be a negative relationship between age and perceived control over physical ageing. Thompson et al. found a negative relationship between age and perceived control over changes in physical appearance. In summary, the following hypotheses were tested in relation to our first goal:

> *Hypothesis one:* Individuals with higher levels of perceived control over physical ageing will have lower levels of acceptance
>
> *Hypothesis two*: Older individuals will perceive the physical changes associated with ageing as being less controllable than will younger individuals.

Our second goal was to explore people's use of strategies and information sources to control physical

ageing. As discussed above, the research literature shows that, in many contexts, perceived control predicts efforts to exert control. Accordingly, we expected that individuals with higher levels of perceived control over physical ageing, and those with lower levels of acceptance, would be more likely to consider using anti-ageing strategies. The relevant hypotheses were:

> *Hypothesis three:* Extent of potential strategy use will be positively related to level of perceived control.
>
> *Hypothesis four:* Extent of potential strategy use will be negatively related to level of acceptance.

Because of the paucity of directly relevant research, we had no strong basis from which to derive predictions as to the relative likelihood of use of different strategies and information sources. Therefore, we had a research question rather than a hypothesis:

> *Question two:* Which strategies and information sources are people more and less likely to use to control physical ageing?

Method

Participants

The participants were 174 adults, with an age range of 18 to 86 years ($M = 51$, $SD = 17.36$). Fifty eight percent were male. Participants were recruited from local service organisations such as Rotary, and from the local tertiary student population. Their levels of education ranged from primary schooling to advanced degrees; the typical participant reported having completed some undergraduate papers. On a single-item self-report health scale (Idler & Kasl, 1991), 73.6% of participants rated their health as good or very good, and none rated their health as very poor or terrible.

Questionnaire

Because there were no suitable existing questionnaires, we designed one specifically for this study. Our questionnaire had a number of sections, only some of which are discussed in this paper.

Perceived Control over Physical Ageing. One section of the questionnaire was concerned with perceived control

over physical ageing. The most direct influence on the design of this section was the questionnaire developed by Heckhausen and Baltes (1991). These researchers asked respondents to rate, on nine-point scales, how much influence people have over age-related increases in 163 psychological attributes. We developed a shorter set of items to assess perceived control over the physical aspects of ageing.

Our scale contained 16 items, each specifying a physical change which commonly occurs with age. We chose items to represent aspects of physical ageing which are well documented in the gerontological literature, are likely to be reasonably familiar to the general public, and represent varying levels of objective potential for control. Two examples of our items are weight gain and development of wrinkles. To assess perceived control, participants were asked to indicate (on five-point scales) "how much control you think people *in general* have" over each item. The responses to the items were summed and divided by the number of items, to form the perceived control scale (alpha = .84). The scale ranged from 1 (no control) to 5 (a great deal of control).

Acceptance of Physical Ageing. We assessed acceptance of physical ageing using the list of items described in the previous paragraph. Participants rated "the extent to which you think that it is better for people in general to accept the following physical changes rather than trying to control them." The responses to the items were summed and divided by the number of items, to form the acceptance scale (alpha = .92). The scale ranged from 1 (strongly disagree) to 5 (strongly agree).

Actual and Potential Use of Strategies. Another section of the questionnaire investigated actual and potential use of strategies to help control physical ageing. Here we followed the general approach used by Thompson et al. (1998). Our participants were asked to rate "how likely it is that you would use" each of 10 strategies "to help control *your* physical ageing". Participants were also asked whether they had already used these strategies for the same purpose. We devised the list of strategies in accordance with research evidence on ways of reducing secondary ageing (Hazzard, 2001; Papalia et al., 2002). Examples of our items include low salt diets and staying out of the sun. The scales will

be referred to as the potential strategy use scale and the actual strategy use scale. The potential strategy use scale included an open-ended item where participants could list additional strategies they might use. The item responses in the potential strategy use scale, from 1 (would never consider) to 5 (would definitely consider), were summed to give a total mean score, for which the alpha coefficient was .79.

Potential Information Use. We asked participants to rate how likely they would be to use each of 11 listed sources of information (such as doctors and television) to learn more about physical ageing. The item scores, from 1 (very unlikely) to 5 (very likely) were summed to form the mean potential information use scale score (alpha = .85).

Procedure

The questionnaire was self-administered, and returned by mail. Most questionnaires and return envelopes were distributed at meetings of local service organisations, following a brief presentation by one of the researchers. Students were recruited by one of the researchers outside of class time.

Table 1. Means and SDs for the Perceived Control and Acceptance Items and Component Loadings for the Acceptance Scale.

Item	Control		Acceptance		Acceptance Component Loadings			
	M^a	SD	M^b	SD	Sensory A	Structural	Sensory B	Appearance
Decreases in eyesight	2.02	1.08	3.03	1.24	.87			
Cataracts	1.78	1.09	2.99	1.37	.82			
Hearing loss	2.36	1.03	3.09	1.14	.78			
Loss of balance	1.86	0.99	3.00	1.24	.75			
Declining muscle strength	3.16	1.02	2.61	1.16		.77		
Increased blood pressure	3.49	0.93	2.32	1.09		.76		
Weight gain	4.06	0.89	2.12	1.09		.75		
Loss of bone density	2.89	1.10	2.80	1.14		.69	.42	
Osteoporosis	2.68	1.12	2.75	1.17		.66		
Decreases in smell	1.78	0.94	3.49	1.09			.89	
Decreases in taste	1.90	0.98	3.47	1.09			.88	
Increased reaction times	2.27	1.04	3.12	1.07			.66	
Arthritis	2.17	0.99	2.91	1.13	.46	.45	.47	
Wrinkles	2.35	0.92	3.85	1.07				.88
Hair loss	1.64	0.79	4.06	1.05				.88
Age spots	2.09	0.99	3.71	1.09				.78
Eigenvalue					7.42	2.05	1.29	1.17
% of variance					46.4	12.81	8.05	7.28

a. Item scales ranged from 1 (no control) to 5 (a great deal of control)
b. Item scales ranged from 1 (strongly disagree) to 5 (strongly agree)

Results

Analysis of the Measures

Principal components analyses (PCA) were carried out for the perceived control, acceptance, potential strategy use and potential information use scales. For each PCA, varimax rotation was used (Aiken, 2003; Bryman & Cramer, 2001). The number of components retained in the final solution for each analysis was decided via an examination of scree plots and the criterion of eigenvalues greater than one (Zwick & Velicer,1986). The results for each scale analysis are reported below. For clarity of presentation, component loadings less than .4 are not reported.

Perceived Control Scale. The PCA of the perceived control scale revealed a five-component solution explaining 65.5% of the variance. However, an examination of the scree plot for this PCA suggested that the control scale was best described by a single component, and the five components explained little additional variance. The item loadings of the single component ranged from .36 to .70. The control scale was used as a whole in subsequent analyses.

Acceptance Scale. A four-component solution for the PCA (see Table 1) explained 74.5 percent of the total variance on the acceptance scale. The components were identified as *sensory A* (related to vision and hearing), *sensory B* (related to other senses), *structural* (related to body structure), and *appearance* (related to appearance). Consequently four acceptance sub-scales were formed; the alpha coefficients are shown in Table 3. One variable (development of arthritis) was a complex item which conceptually fitted the structural component and so was included in the structural sub-scale.

Potential Strategy Use Scale. From the PCA of the potential strategy use scale, a two-component solution was selected (see Table 2). The solution explained 63 percent of the total variance. The components were identified as *dietary* and *behavioural*; the alpha coefficients for these sub-scales are shown in Table 3.

Potential Information Use Scale. An examination of the scree plot for this PCA, and use of the criterion of eigenvalues greater than one, showed that the potential information use scale was best described by one component that explained 43% of the variance. This component loaded substantially on all of the items; the loadings ranged from .33 to .81, with most around .70.

Perceived Control and Acceptance. The means and SDs for individual items on the perceived control and acceptance scales are shown in Table 1. The means, SDs and alpha coefficients for the total scales and sub-scales are shown in Table 3. The mean score on the perceived control scale was below the scale midpoint, at 2.40 ($SD = 0.54$). The mean score on the acceptance scale was just above the scale midpoint at 3.08 ($SD = 0.78$).

Correlations among the main study variables are shown in Table 4. There were no significant correlations between self-rated health and any of the study variables, so self-rated health was not controlled for in subsequent analyses. Total scores on the perceived control and acceptance scales were significantly correlated, $r(157) = -.36$, $p<.01$, such that the higher the level of perceived control over age-related physical changes, the lower the level of acceptance of these changes.

Table 2. Component Loadings of the Items on the Potential Strategy Use Scale and Item Statistics for the Strategy Use Scales

Item				Component Loadings	
	M^a	SD	Already used strategy (%)	Dietary	Behavioural
High calcium diet	4.01	1.02	22.50	.86	
Low salt diet	4.05	1.09	35.50	.84	
Low fat diet	4.34	0.96	56.10	.84	
Calcium supplements	3.86	1.15	22.50	.78	
Avoid loud noise	4.02	1.10	56.40		.73
Exercise programmes	4.61	0.71	72.30		.67
Staying out of sun	3.66	1.16	52.10		.65
Not smoking	4.74	0.87	90.10		.61
Little or no alcohol	3.57	1.26	47.60		.45
Using sunscreen	4.72	0.64	89.50		.43
Eigenvalue				3.57	1.57
% of variance				35.66	15.68

a. The item scales ranged from 1 (would never consider) to 5 (would definitely consider).

Table 3. Descriptive Data for Perceived Control, Acceptance, Potential Strategy Use and Potential Information Use Scales and Sub-scales

Item	M	SD	alpha
Control	2.40	0.54	.84
Acceptance	3.08	0.95	.92
Acceptance sensory A	3.03	1.11	.91
Acceptance sensory B	3.36	0.98	.89
Acceptance structural	2.58	0.87	.86
Acceptance appearance	3.88	0.98	.86
Potential strategy use	4.16	0.59	.79
Potential strategy dietary	4.06	0.88	.85
Potential strategy behavioural	4.22	0.59	.66
Potential information use	3.04	0.76	.85

Table 4. Pearson's r Correlation Coefficients between Perceived Control, Acceptance, Acceptance sub-scales, Potential Strategy Use, Potential Strategy Use sub-scales and Potential Information Use.

Variable	1	2	3	4	5	6	7	8	9
1.Control	1.00								
2.Acceptance	-.36**	1.00							
3. SensoryA	-.27**	.86**	1.00						
4.SensoryB	-.33*	.78**	.60**	1.00					
5.Structural	-.30**	.84**	.60**	.54**	1.00				
6.Appearance	-.28**	.63**	.46**	.44**	.30**	1.00			
7.Strategies	.14	-.15	-.10	-.03	-.22**	-.08	1.00		
8.Behavioural	.10	-.08	.00	-.02	-.16*	-.06	.84**	1.00	
9.Diet	.10	-.16*	-.15*	-.02	-.20**	-.08	.83**	.40**	1.00
10.Information	.06	-.17*	-.14	-.11	-.16*	-.11	.26**	.20*	.25**

$*\ p<.05,$ $**\ p<.01$ (two-tailed)

To investigate the relationship between perceived control and specific components of acceptance, a multiple stepwise regression equation was run with the four sub-scales of acceptance as predictors and control as the criterion variable. The results of this regression are shown in Table 5. With a criterion probability of .05 to enter, the only variables which contributed significantly to the equation were sensory B and appearance. These dimensions of acceptance explained 12% (Adj. R^2= .12) of the variance in perceived control, F (2,154) =11.71, $p<.001$.

There was no correlation between age and perceived control. Age was positively correlated with the behavioural sub-scale of the potential strategy use scale, r (170) = .18, $p<.05$.

Potential and Actual Use of Strategies; Potential Use of Information Sources.
Table 2 includes the mean and *SD* for each individual item in the potential strategy use scale, and the percentage of participants who had already used each strategy. Table 3 includes summary data for the potential strategy use scale and sub-scales. The overall mean score on the potential strategy use scale (4.16) was well above the scale midpoint. Percentages of participants reporting having already used specific strategies to control physical ageing ranged from 22.5 (calcium) to 89.5 (sunscreen). Table 6 shows summary data for items in the potential information use scale, and for the total scale. The overall mean score (3.04) was just above the scale midpoint.

Table 4 shows that overall total scores on potential strategy use and potential information use were not directly related to overall perceived control or acceptance, but there were several weak negative relationships between the acceptance scale (or one of its sub-scales), and the potential strategy use scale (or one of its sub-scales).

Discussion

The results suggest that adults see physical ageing as amenable to control to a modest extent. The overall level of perceived control

Table 5. Results of stepwise regression of Control on the Sensory B and Appearance sub-scales of Acceptance

Variable	Std Error	Beta
Sensory B	.05	-.26**
Appearance	.05	-.17*
R		.363
R^2		.132
Adj. R^2		.121***

$*\ p<.05,$ $**\ p<.01,\ ***\ p<.001$

Table 6. Means and SDs for items of the Potential Information Use Scale (rank ordered by mean).

Variable	M^a	SD
Doctors	3.75	1.11
Observation of others	3.57	1.24
Health promotional pamphlets	3.51	1.16
Books	3.49	1.13
Nurses	2.93	1.21
Clubs and organisations	2.83	1.13
Magazines	2.78	1.24
Television	2.78	1.23
Advertisements	2.67	1.26
Internet	2.59	1.30
Radio	2.43	1.07
Mean Potential Information use score	3.04	0.76

a. The item scales ranged from 1 (very unlikely) to 5 (very likely).

appeared lower than that found by Heckhausen and Baltes (1991) for age-related psychological changes. But since age-related physical changes are overwhelmingly negative, our results are congruent with Heckhausen and Baltes' findings of a positive correlation between desirability and perceived controllability of changes.

The variability in perceived primary control across scale items seems to mirror reasonably well the actual potential for primary control over specific physical changes. It is only possible, of course, to make a crude assessment of the correspondence between participants' ratings and actual control potential: there are not, and cannot be, any precise objectively determined "correct" ratings. It would be useful, nevertheless, to compare participants' ratings against gerontologists' ratings for the same items: the latter could provide a reasonable operational definition of objectively accurate ratings.

The gerontological literature does suggest that those physical changes (such as weight gain, increased blood pressure and muscle strength loss) which participants rated as most controllable, represent secondary, and hence potentially controllable, ageing to a substantial degree (Papalia et al., 2002). In contrast, at least two of the changes rated as least controllable - loss of sense of smell and hair loss - are probably less controllable. It seems, then, that participants' perceptions of control were reasonably realistic. On the other hand, it could be argued that participants underestimated the potential for control over some common age-related changes, such as the development of wrinkles and osteoporosis (Papalia et al.).

An important but difficult question is whether the participants expressed an optimal, as distinct from realistic, degree of perceived primary control. It is not necessarily desirable that perceived primary control be an accurate representation of objective control potential: research findings are complex, but tend to suggest that in many contexts perceived control is positively correlated with well-being, even when objective potential for control is relatively low (Skinner, 1995).

Our first hypothesis, that perceived control would be negatively correlated with acceptance, was supported. One possible explanation of the modest size of the correlation is that some people prefer to resign themselves to physical ageing even though they believe it to be controllable in principle. People may feel that exerting control in this domain is too onerous to be worthwhile.

Our second hypothesis, that there would be a negative relationship between age and perceived control, was not supported. A likely reason is that our participants were too young and healthy to show the predicted effect. In Heckhausen and Schulz's lifespan model (1995), for which there is some empirical support (Heckhausen, 1997), individuals generally try to maintain primary control over their own development until the feasibility of such control is severely reduced in later life. Our older participants had probably not reached this stage.

Our third hypothesis, that perceived control would be positively correlated with potential use of anti-ageing strategies, was not supported, but our fourth hypothesis, that acceptance would be negatively correlated with potential use of anti-ageing strategies, received qualified support. The mixed findings may reflect characteristics of one or both scales. Some possible limitations of our potential strategy use scale are discussed below.

Our second research question asked about the relative use of various specific strategies and information sources. The scores for potential and actual use of some specific strategies are hard to interpret. Only about half the sample reported having ever tried to control aspects of physical ageing by staying out of the sun, going on a low fat diet, avoiding loud noise or drinking little or no alcohol; about a third had tried to control physical ageing by adopting a low-salt diet, and about a quarter had done so by adopting a high calcium diet. There seems to be a consensus in the research literature that such strategies are likely to reduce secondary ageing and that it is generally best to adopt the strategies at an early age (Hazzard, 2001; Leventhal et al., 2001). But although the participants seemed to recognise the value of such strategies, and although they were predominantly middle-aged or older, many of them had not begun to act accordingly.

One possible explanation for these apparent discrepancies may lie in our measure of potential strategy use. Our scale probably measures something like intention. Discrepancies between intentions and behaviours are commonly reported in the health psychology literature (Ogden, 2000). According to Ogden, some researchers argue that measures of intention need to be supplemented with measures of implementation intentions or broadened to incorporate elements such as self-predictions, behavioural willingness, and perceived need. If our measure is too narrow, it may have provided an inflated estimate of the likelihood that participants would adopt the anti-ageing strategies. An alternative interpretation of our findings is that the Potential Strategy Use Scale *is* a valid predictor of actual future use, and that the apparent discrepancies between actual and potential strategy use simply reflect the fact that people do not fully appreciate the advisability of adopting anti-ageing strategies early in life. If this explanation is correct, it suggests that efforts to educate people about healthy ageing need to place more emphasis on the benefits of adopting appropriate behaviours at an early age.

The responses to the Potential Information Use Scale suggest, unsurprisingly, that people rely quite heavily on health professionals to find out about physical ageing. One less predictable finding is the relatively high rating given to the item "observation of people in your life, for example grandparents". Further research could look more closely at what people hope to learn about physical ageing by observing others. One possibility is that people are particularly interested in the physical ageing of those to whom they are genetically linked, because they believe that they are destined to age similarly. Another possibility is that people are keen to learn from models of successful ageing.

This study should be regarded as exploratory. Our scales could be developed a lot further: their psychometric properties need to be examined more closely, and their scope of content could be expanded. For instance, the perceived control and

acceptance scales could be extended to include items on sexual functioning. The potential strategy use scale could incorporate additional items - such as stress management - which several participants gave in response to the open-ended question. Different ways of measuring potential behaviour could be explored. The factorial structure of the constructs requires further investigation. There is obvious scope for sampling more widely and systematically, studying the views of special populations such as health professionals, and investigating the effects of participant characteristics such as gender.

Our survey has helped to extend the study of perceived control into the broad domain of physical ageing, and has suggested several promising avenues for further research. As the population ages, the independence and well-being of older people are becoming increasingly important public policy concerns. Research into the determinants and behavioural consequences of perceived control over physical ageing could make worthwhile practical as well as theoretical contributions.

References

Aiken, L. R. (2003). *Psychological testing and assessment* (11th ed.). Boston: Allyn and Bacon.

Bryman, A., & Cramer, D. (2001). *Quantitative data analysis with SPSS Release 10 for Windows: a guide for social scientists*. London: Routledge.

Campbell, A. J., Busby, W. J., Robertson, M. C., & Horwarth, C. C. (1995). Control over future health in old age: characteristics of believers and sceptics. *Age and Ageing, 24,* 204-209.

Hazzard, W. R. (2001). Aging, health, longevity, and the promise of biomedical research: The perspective of a gerontologist and geriatrician. In E. J. Masoro, & S. N. Austad (Eds.), *Handbook of the biology of aging* (5th ed., pp.445-456). San Diego, CA: Academic Press.

Heckhausen, J. (1997). Developmental regulation across adulthood: primary and secondary control of age-related challenges. *Developmental Psychology, 33,* 176-187.

Heckhausen, J., & Baltes, P. B. (1991). Perceived controllability of expected psychological change across adulthood and old age. *Journal of Gerontology: Psychological Sciences, 46,* 165-173.

Heckhausen, J., & Schulz, R. (1995). A lifespan theory of control. *Psychological Review, 102,* 284-304.

Idler, E. L., & Kasl, S. (1991). Health perceptions and survival: Do global evaluations of health status really predict mortality? *Journal of Gerontology, 46,* 555-565.

Krause, N., & Shaw, B. A. (2000). Role-specific feelings of control and mortality. *Psychology and Aging, 15,* 617-626.

Lang, F. R., & Heckhausen, J. (2001). Perceived control over development and subjective well-being: Differential benefits across adulthood. *Journal of Personality and Social Psychology, 81,* 509-523.

Leventhal, H., Rabin, C., Leventhal, E. A., & Burns, E. (2001). Health risk behaviors and aging. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (5th ed., pp.186-214). San Diego, CA: Academic Press.

Ogden, J. (2000). *Health psychology: a textbook* (2nd ed.). Buckingham, England: Open University Press.

Palmore, E. B. (1998). *The Facts on Aging Quiz* (2nd ed.). New York: Springer.

Papalia, D. E., Sterns, H. L., Feldman, R. D., & Camp, C. J. (2002). *Adult development and aging* (2nd ed.). Boston: McGraw-Hill.

Rodin, J., & Langer, E. (1977). Long-term effects of a control-relevant intervention with the institutionalized aged. *Journal of Personality and Social Psychology, 35,* 897-902.

Rowe, J. W., & Kahn, R. L. (1998). *Successful aging*. New York: Pantheon Books.

Schulz, R., & Heckhausen, J. (1999). Aging, culture and control: Setting a new research agenda. *Journal of Gerontology: Psychological Sciences, 54B,* P139-145.

Shapiro, D. H., & Astin, J. A. (1998). *Control therapy: An integrated approach to psychotherapy, health, and healing*. New York: Wiley.

Skinner, E. A. (1995). *Perceived control, motivation, and coping*. Thousand Oaks, CA: Sage.

Skinner, E. A. (1996). A guide to constructs of control. *Journal of Personality and Social Psychology, 71,* 549-570.

Thompson, S. C., Thomas, C., Rickabaugh, C. A., Tantamjarik, P., Otsuki, T., Pan, D., et al.(1998). Primary and secondary control over age-related changes in physical appearance. *Journal of Personality, 66,* 583-605.

Walker, J. (2001). *Control and the psychology of health: theory, measurement, and applications*. Buckingham, England: Open University Press.

Wallhagen, M. I. (1998). Perceived control theory: A recontextualized perspective. *Journal of Clinical Geropsychology, 4,* 119-140.

Zwick, W. R., & Velicer, W. F. (1986). Comparison of five rules for determining the number of components to retain. *Psychological Bulletin, 99,* 432-442.

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