Profiles of functioning as predictors of mortality in old age: The advantage of a configurative approach

Dov Shmotkin [a,b,*], Liat Lerner-Geva [c], Jiska Cohen-Mansfield [b,d], Tzvia Blumstein [c], Nitza Eyal [b], Aviva Shorek [b], Gitit Kave [b], Haim Hazan [b,e]

[a] Department of Psychology, Tel Aviv University, Tel Aviv 69978, Israel
[b] The Herczeg Institute on Aging, Tel Aviv University, Tel Aviv 69978, Israel
[c] The Gertner Institute for Epidemiology and Health Policy Research, Chaim Sheba Medical Center, Tel Hashomer 52621, Israel
[d] Department of Health Promotion, Tel Aviv University, Tel Aviv 69978, Israel
[e] Department of Sociology and Anthropology, Tel Aviv University, Tel Aviv 69978, Israel

A R T I C L E   I N F O

A B S T R A C T

This study proposes the concept of functioning profile, by which one's status is summarized across essential functioning domains, and validates its efficiency in predicting mortality. The study analyzed data of two cohorts of community-dwelling Israelis aged 75 and over, nationally sampled in 1989 ($N = 1200$) and 1999 ($N = 421$), respectively. Eight groups with differential profiles reflected higher versus lower levels of functioning in three domains: physical (activities of daily living), cognitive (Orientation–Memory–Concentration test = OMC) and affective (depressive symptoms). The analyses predicted mortality within 4 years, adjusting for sociodemographic and health variables. Relative to the optimal profile, most functioning profiles represented groups having elevated mortality risks of considerable consistency across cohorts. Physical functioning was the most predictive component in the profiles, but its combinations with cognitive and affective functioning produced unique contributions to mortality prediction. The study suggests that the functioning profile, representing a person-centered configurative approach (i.e., one that considers the person's combined standing on key factors), is a useful concept for delineating risk groups in late life and evaluating risk factors in predicting mortality.

© 2009 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Research on mortality prediction typically examines the unique contribution of individual predictors. An effective predictor is one whose contribution proves independent (i.e., non-redundant) after the variance shared with other factors has been partialled out. An extension of this prediction strategy is the transformation of predictors into a linear prognostic index, in which independent predictors are assigned weights that can be summed up to a general predictive score for each participant (Carey et al., 2004; Lee et al., 2006). The present paper proposes that mortality prediction can be facilitated by the notion of functioning profiles referring to combinations in people's levels of adaptive activity across key factors such as physical daily living, cognition and affect. In this approach, the predictors of mortality are not the individual factors of adaptation but rather their combinations. Our study examines how functioning profiles, designed as configurations of interac-

tions among factors, provide a prediction, and possibly a further understanding, of mortality risk in late life.

This study focuses on three major risk factors in old age. The first is difficulty in physical functioning as reflected in partial or full disability of performing vital daily activities of self-maintenance (Guralnik and Simonsick, 1993; McDowell and Newell, 1996). Although overlapping mental factors of cognition and affect, this kind of functional disability is a core indicator of biologically based physical decline whose trajectory parallels aging and morbidity processes (Ferrucci et al., 1998; Fried et al., 2004). Physical functioning has been repeatedly reported to predict mortality (Bernard et al., 1997; Nybo et al., 2003; Sundquist et al., 2004).

Cognitive decline poses another risk factor. Poor cognitive performance, especially when associated with a dementing disorder, often reflects accelerated biological aging (Anstey et al., 2001) and enhances other mortality risks (Cohen-Mansfield et al., 1999). Research has confirmed that cognitive impairment predicts mortality in the old (Bosworth et al., 1999; Smits et al., 1999; Nguyen et al., 2003).

A third risk factor is difficulty in affective functioning as typically manifested by depressive symptoms or clinical depression. While studies yield mixed results as to whether depression

* Corresponding author at: Department of Psychology, Tel.: Aviv University, Tel Aviv 69978, Israel. Tel.: +972 3 640 8937; fax: +972 3 967 0381.
E-mail address: shmotkin@post.tau.ac.il (D. Shmotkin).

rates increase with aging, depression is frequently associated with biological and psychosocial adversities that are characteristic of old, and particularly old–old, age (Gatz and Hurwicz, 1990; Blazer, 2003; Copeland et al., 2004; Alexopoulos, 2005). Depression may relate to mortality either as a determinant of biological and behavioral conditions conducive to death or as a moderating variable that modifies the effects of such conditions (Schulz et al., 2000; Ganguli et al., 2002).

This study aims: (1) to examine the effect of functioning in the physical, cognitive, and affective domains on mortality among older adults, and (2) to examine a configurative rather than a discrete model for predicting mortality. A configurative model defines risk groups according to functioning profiles that take into account the simultaneous standing in all three domains whereas a discrete model considers the risk separately for each domain.

The configurative approach adopted here offers both theoretical and practical advantages. Notably, as part of person-centered methodologies, the current approach focuses on differential functioning patterns among subgroups within the investigated sample, rather than on the variability of unitary variables across the entire sample (Singer and Ryff, 2001; Shmotkin, 2005). Also, by reflecting combinations of higher and lower levels of functioning, profiles depict people in differing conditions of resilience versus vulnerability. Hence, the study hypothesis was that the three-domain functioning profile would be better at predicting mortality than its individual components. This hypothesis relied on findings that underscored the importance of combining functioning indicators in different domains into differential subgroup profiles when relating to outcomes in old age (Smith and Baltes, 1997; Raji et al., 2002; Mehta et al., 2003; Gerstorf et al., 2006).

The configurative approach is presently investigated in two cohorts representing older Israelis studied 8–13 years apart. Pertinent to this particular population is the intense experience of stressful, often traumatic, events (e.g., the Holocaust, immigration, multiple wars) which shaped vulnerability and resilience up to late life (Lomranz, 1990; Litwin, 1995; Shmotkin et al., 2003b). The double sample design allows us to examine whether mortality prediction shows consistency with regard to the suggested functioning profile or rather reflects changes in the surveys' historical and procedural conditions.

2. Methods

2.1. Participants and procedure

Out of two national surveys, the present study analyzed samples that respectively included only self-respondent, community-dwelling participants of a parallel age range (75–94). The first sample was part of the Cross-Sectional and Longitudinal Aging Study (CALAS). The CALAS conducted a multidimensional assessment of a random sample of the older Jewish population in Israel, stratified by age group (75–79, 80–84, 85–89, 90–94), gender, and place of birth (Asia-Africa, Europe-America, Israel). The sample was drawn from the National Population Registry (NPR) in January 1989. Out of 2400 sampled individuals, 15.7% had died before the sampling day or were not located, and 8.5% refused to participate. At the first wave (out of three), during 1989–1992, 1820 participants were interviewed either as self-respondents (75.2%) or by proxies who answered factual questions for participants that were incapable of responding or had passed away between the sampling day and the interview date. More information regarding the CALAS appears in various publications (e.g., Walter-Ginzburg et al., 2002, 2005; Benyamini et al., 2003; Shmotkin et al., 2003a,b; Ben-Ezra and Shmotkin, 2006; Blumstein et al., 2008).

The second sample was part of the Israeli Multidisciplinary Aging Study (IMAS). The IMAS conducted a multidimensional

assessment of a random sample of the older Jewish population in Israel stratified by age group (65–69, 70–74, 75–79, 80–84, 85–89, 90–94), gender, and place of birth (Asia-Africa, Europe-America, Israel). The sample was drawn from the NPR in December 1999. Out of 1757 sampled individuals (after exclusion of 438 who lived in institutions or abroad, or passed away between the sampling day and the interview date), 15.1% were not located, 32.3% refused to be interviewed, and 5.7% could not complete the interview because of language or health difficulties. During 2000–2002, 825 participants were interviewed either as self-respondents (87.4%) or by proxies for those who were incapable of responding (but not for those who had passed away prior to the interview date).

The IMAS used the CALAS questionnaire with slight modifications. In both surveys, interviews took place in the participant's home after the participant had signed an informed consent. The CALAS and IMAS were approved for ethical treatment of human participants by the Institutional Review Board of the Chaim Sheba Medical Center in Israel.

In order to employ comparable samples, the present analyses exclude younger participants (age 65–74), who were sampled by the IMAS but not by the CALAS. Also excluded are participants living in institutions or sheltered housing, who were approached by the CALAS (12.3% of the self-respondents at the target age of 75–94) but not by the IMAS. These restrictions result in study samples of 1200 participants from the CALAS and 421 participants from the IMAS. For the distributions of sociodemographic characteristics and the other study variables in the two cohort samples, see Table 1.

2.2. Measurements

2.2.1. Markers of functioning

Physical functioning was measured by the ADL (activities of daily living) index of Katz et al. (1970). Respondents rated their

Table 1
Distributions of sociodemographic and study variables in two cohort samples (mean + S.D. or %).

Variable	1989 cohort (N = 1200)	1999 cohort (N = 421)
Socio-demographic characteristic		
Age	83.1 ± 5.3	83.1 ± 5.2
Gender (men)	55.1%	57.0%
Place of birth		
Asia-Africa	32.7%	33.5%
Europe-America	37.0%	34.7%
Israel	30.3%	31.8%
Education (school years)	7.6 ± 5.5	9.4 ± 5.2
Income		
Only national insurance	41.8%	24.0%
Other sources	58.2%	76.0%
Marital status		
Currently unmarried	53.4%	50.4%
Married	46.6%	49.6%
Religiousness		
Secular	27.3%	36.6%
Traditionalist	35.9%	39.3%
Religious	36.9%	24.1%
Health status indicator		
Comorbidity (number of diseases)	3.6 ± 2.1	3.9 ± 2.6
Self-rated health	2.0 ± 0.9	2.2 ± 0.7
Marker of functioning		
Physical: ADL difficulties	1.3 ± 3.0	2.2 ± 4.1
Cognitive: OMC test errors	8.7 ± 7.8	8.7 ± 7.4
Affective: depressive symptoms	0.7 ± 0.4	0.7 ± 0.5

Note: Data of individual variables were occasionally missing for 0–57 and 0–30 participants in the 1989 and 1999 cohort, respectively.