

The Selška Valley Study of Health and Aging: Unraveling Senescence, Stress and Frailty

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ABSTRACT

In this project we use an age-stratified sample of 100 men and 100 women aged 55 years and older who were residents of the Selška valley in order to explore two health indices, allostatic load (AL), and frailty. AL assesses lifelong stress responses using commonly assessed and clinically meaningful aspects of physiology; our frailty index assesses current somatic well-being using 5 aspects of functioning. Both correlate with clinical morbidity, self-reported health, life style, health history, and well-being. Our research site includes 9 villages located in the isolated Selška valley. Given their relative isolation, residents of this region provide a natural experimental setting for assessing stress, frailty, morbidity, and senescence in a local isolate. This isolated alpine setting provides numerous advantages for continuing research on health, disease and senescence. Our fieldwork protocols include detailed health demographic and SES interviews, measurement of blood pressure, anthropometry, walking speed, strength/endurance, and collection of blood and saliva samples for determinations of hormones, plasma proteins, and lipids. In this paper, we present one segment of data for 41 participants on self-report health and use of prescription medications during our 2008–2010 survey. In general, most participants rate themselves as being in good to excellent health (34/41=85%). However, over 66% are taking medications for a chronic condition, with about 25% taking 4 or more medications.

Key words: senescence, aging, disease, isolated populations, Selška valley

Introduction

This paper introduces our international collaborative project on aging, senescence, stress, frailty and health in the Selška valley of Slovenia. The project entails exchange visits and is funded by the Slovenian Research Agency and the collaborating institutions of the National Institute of Public Health of the Republic of Slovenia and the Department of Anthropology and School of Public Health, Ohio State University.

Aging of populations is affecting all inhabitants of the world today. Improved survival of elders is bringing changes to societal organization and is altering traditional sociocultural functions. Worldwide, more people are surviving to ages beyond their 7th and 8th decades of life today, as is also evidenced by data from the Statistic Office of Slovenia. A common trend is that shown by the population aged 65 years and over in Slovenia from 1990 to 2011 (Figures 1 and 2). Between 2001 and 2011 the average age of the population increased by 2.8 years, from 38.9 to 41.7 years, while the proportion of the total popu-

lation aged 65 years and over increased 2.4%; those over age 80 by 1.74% (Figure 2) (Statistic Office of Slovenia). Given that, in general, senescence is an age-related but age-independent process affecting individuals differently in different ecological, social, cultural and nutritional settings^{1–4}. Similar trends across multiple populations increase the need to unravel physiological changes secondary to senescence, aging, and disease.

Given variability in senescence, aging, and chronic disease risks, it is no longer acceptable to view most physiological decrements occurring with age as normal aging. We are now attempting to differentiate among processes of senescence that increase frailty and benign changes with age and disease processes that are neither age-related nor senescent, but may be preventable or curable. Underlying biological alterations in cellular activity and molecular senescence lead to physiological changes that appear as aging. Although many diseases

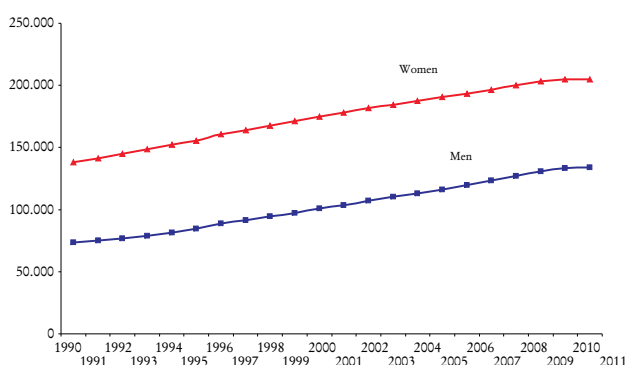


Fig. 1. Increases in the Slovenian population aged 65 and over 1990 to 2011 by sex (Data from Statistic Office of Slovenia).

may take advantage of age-weakened systems, they still represent pathological alterations and dysfunction, not senescence. Although distinctions blur in many ways, chronic degenerative diseases (CDC) often are visible manifestations of cellular senescent processes. Thus, to assess senescent change in healthy elders, we need reliable and replicable methods to differentiate between underlying senescence and disease processes that take advantages of stress-related physiological changes. In this project, we examine two health indices, allostatic load (AL) and frailty, for validity as assessment tools in Selška valley residents. We then assess associations of AL and frailty with one another and with clinical variables, self-reports of health predications, life style, health history, and well being among elderly residents of the Selška valley. Our project follows a series of ongoing multidisciplinary anthropological studies of the population structure and health of residents of the Selška valley^{5–11}. (Figure 3)

Material and Methods

Location

Our research setting is the Selška valley, a closed mountain valley (Figure 4) which is surrounded by mountains ranging up to 1700 meters; a road connecting the lower valley with the mountain villages was built in the

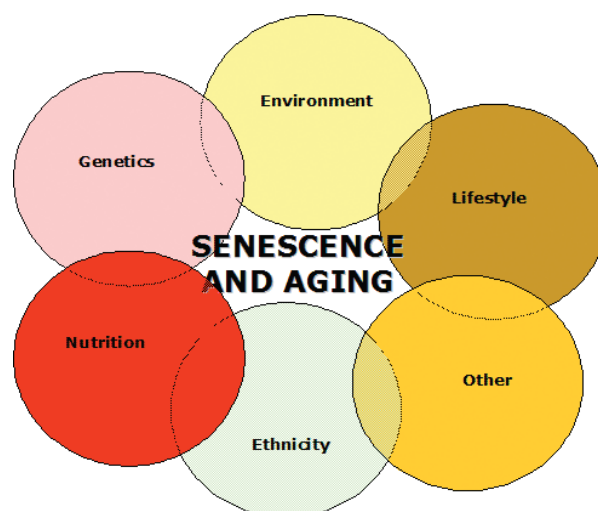


Fig. 3. Multiple factors impact senescence, aging and diseases and their interactions.

20th century. Within the valley are 9 villages: 5 line the bottom of the valley along the road and river, while the remaining 4-colonized by Germans in the 13th and 14th century- are nestled on the slopes of the surrounding mountains. The highest village is located at more than 1000 meters above sea level (Prtovc̃). These villages have been isolated over most of their history because of geographical, social, linguistic and other factors. Given their continued relative isolation, especially villages in the upper part valley, the residents of the Selška valley are an ideal study sample for examining stress load and senescence in a natural setting. An isolated alpine setting provides numerous advantages for studying health, disease, and senescence. In addition, over the past decade, people of the Selška valley have participated in a natural experimental study designed to assess their biocultural and biomedical history, health and well-being^{8–14}.

Assessments

Allostatic load (AL) and frailty, respectively, reflect dynamic stress response processes and the visible phenotypic outcomes of ongoing physiological loss due to the one's inability to halt all cultural/physiological/somatic

Index	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Average age (years)	38,9	39,3	39,6	40,0	40,3	40,6	40,8	41,1	41,3	41,4	41,7
Aging index	89,8	94,1	98,5	103,0	106,9	110,5	113,7	116,3	117,6	117,7	116,5
Chare of the population, aged 65 and over (%)	14,1	14,5	14,8	15,0	15,3	15,6	15,9	16,1	16,4	16,5	16,5
Chare of the population, aged 80 and over (%)	2,4	2,5	2,7	2,9	3,0	3,2	3,4	3,6	3,8	3,9	4,1
Coefficient of age dependence	42,6	42,6	42,4	42,1	42,2	42,4	42,6	42,9	43,7	44,0	44,3
Coefficient of age dependence of elderly	20,2	20,6	21,0	21,4	21,8	22,2	22,7	23,1	23,6	23,8	23,9

Fig. 2. Increases in average age and proportion of population aged 65+ and 80+ years in Slovenia 2001 to 2011 (Source: Statistics Office of Slovenia).

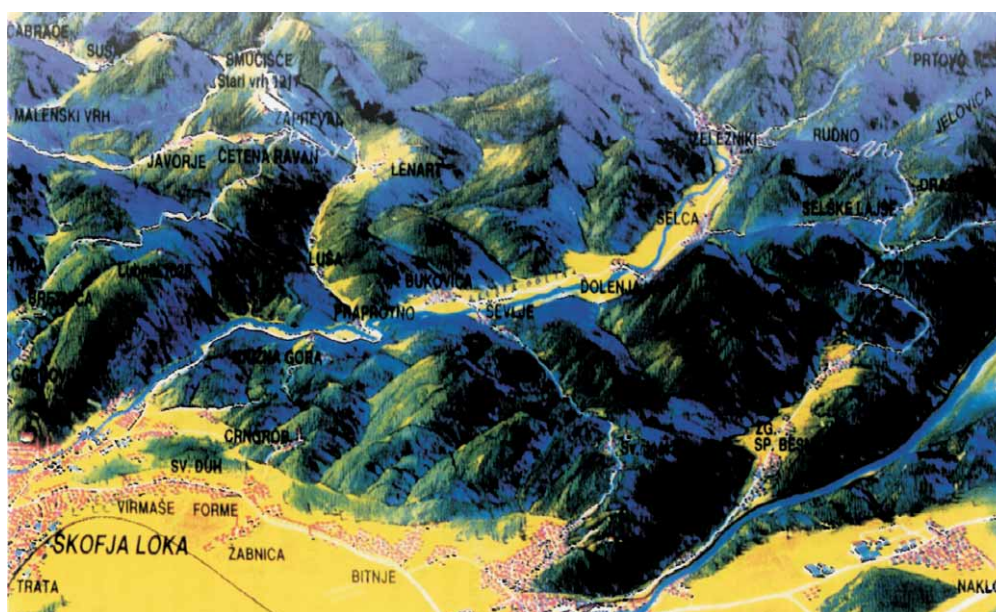


Fig. 4. The Selška valley of northwest Slovenia.

damage. Commonly, AL is measured by a set of 10 physiological variables designed to assess cumulative effects of stress and stress responses across multiple domains: cardiovascular, hormonal, metabolic, and storage^{15–17}. Frailty is a phenotype reflecting compromised health and recent loss of somatic function due to stress, senescence, and aging those results in reduced ability to perform basic life-sustaining functions. It is characterized by a loss of muscle cell and strength (sarcopenia), weight, and mobility¹⁸.

Both AL and frailty are expected to be higher in those individuals with greater morbidity or poorer health. Over the term of follow-up, those with higher AL and frailty are expected to show greater morbidity and mortality and decreased self-reported health. Our overall goal is to determine how AL and frailty may be used as adjuncts to health assessments outside the clinical set-

ting for assessing non-institutionalized elders. AL has been observed to be differentially correlated with health outcomes and age across populations^{3,17}. Assessing AL across various populations will provide a better test of its validity and usefulness for assessing health of elders.

Our fieldwork is time consuming and intensive. We go door to door in each village following up on persons who had participated in previous fieldwork and are now aged 55 and older. Our questionnaires and physical assessments range up to more than two hours for each participant to complete. Before being able to conduct actual fieldwork we must visit with possible participants, in order to gain their trust so they permit us to come into their homes to begin our work; people of the Selška valley are friendly, but a little more closed to outsiders compared with urban dwellers. Based upon the number of persons aged 55+ (Figure 5) we are obtaining an age



Fig. 5. Research locations and population counts by age for elders.



Fig. 6. Sorica, village in the upper part of Selška valley.

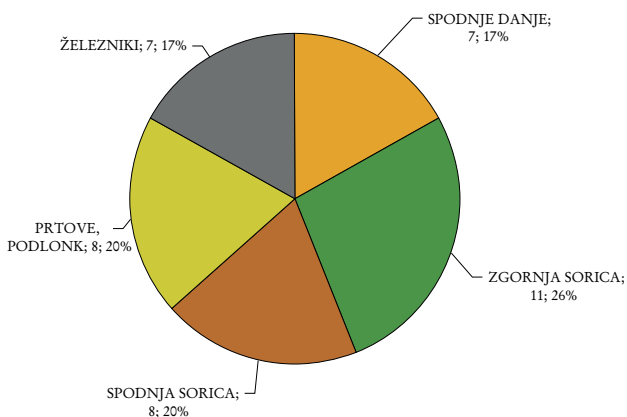


Fig. 7. Participants in the 2009–2010 survey of the Selška valley Study of Health and Aging by village of residence.

stratified sample of 100 men and 100 women distributed 50% in upper villages and 50% in lower ones. We use these data to examine age, sex, birth place, location of residences, AL, and frailty on health and well-being. As previously stated, our fieldwork protocols include detailed interviews, along with measurements of blood pressure, anthropometry, walking speed and grip strength and endurance, and obtaining of blood and saliva samples for laboratory analysis of hormones, plasma proteins, and lipids. The survey instrument elicits information on patterns of daily activity, abilities to perform activities of daily living, socioeconomic, demographic, and cultural factors, personal health habits, self-perceived health, life style, cultural affiliations, ethnicity and aspects of nutrition. In this paper we introduce the analysis of one segment from the entire set of collected data regarding two aspects self-reported health and medication use by 41 participants from the upper valley and one lower valley location (Železniki).

Results

The percent of 41 participants (25 women and 16 men) from 5 specific villages is presented in Figure 7.

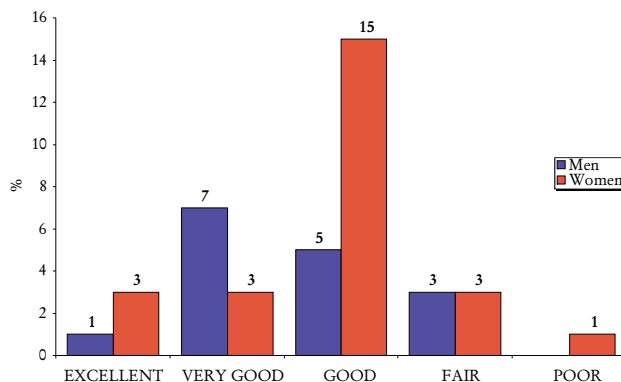


Fig. 8. Self-reported health among 41 participants in the Selška valley Study of Health and Aging.

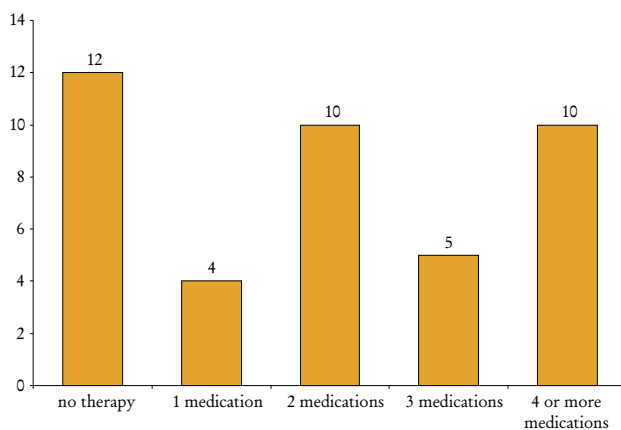


Fig. 9. Number of participants currently receiving therapy/medication by number of medications prescribed in the Selška valley Study of Health and Aging.

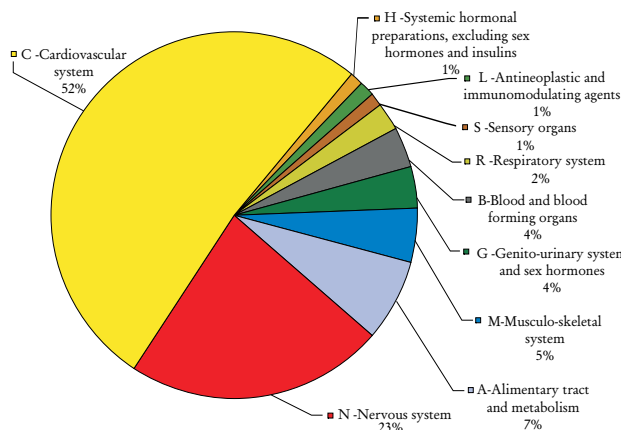


Fig. 10. Therapeutic groups classified by ATC of the specific medications used by participations in the Selška valley Study of Health and Aging for all medications reported.

The majority of individuals in this sample report themselves as being in good to excellent health (Figure 8).

However, 29 of 41 people are taking prescribed medications for a variety of conditions; 25% of the total sample is using 4 or more medications (Figure 9).

Next, we examined medications by the therapeutic groups defined in the Anatomical-Therapeutic-Chemical (ATC) classification of medication. Medications prescribed to participants are from three main groups by ATC classification. The main group includes medications for treatment of cardiovascular system irregularities (52%; Figure 10). The next two groups included medications for the nervous system (23%) and those for treating the alimentary tract and metabolism (7%). Together, these three types of prescriptions account for 82% of all medications (Figure 10).

Within the cardiovascular group, the majority of medications used are aimed at controlling high blood pressure (88% of the total) (Figure 11). Within the nervous system group, the majority of medications are analgesics (55%) and other painkillers (22%), totaling 77% (Figure 12). Of all medications for treating alimentary tract and metabolism, those for controlling hyperglycemia accounted for 40%; another 40% were vitamin and mineral supplements with 20% related to controlling acid reflux (Figure 13).

Discussion and Conclusion

People of the Selška valley follow a more traditional way of life than people living in more urban areas of Slovenia. They generally report good health: over 85% of this sample of elders report they are healthy. Only 10% take more than three medications, and these are mainly for maintaining cardiovascular function (Figure 10) or are medications to control pain and hyperglycemia (Figures 11-13). We have not linked diagnoses with the medication files. Our segmental study of health and aging in the Selška valley suggests that health is high among participants of the Selška valley Study of Health and Aging. Participants are receiving medical care and maintaining good health. The health of these elders is maintained to some degree by reliance upon medications from the healthcare system, but also may reflect aspects of their isolated setting, more traditional daily activities and diet, a slower pace of daily life, and/or benefits of good nutrition and living in an isolated setting.

Our project is in progress to examine multiple associations among AL, frailty, age, disease, health and well-being in the Selška valley Study of Health and Aging. This collaborative research project is expected to contribute to growth and development of biological anthropology in Slovenia. It is designed to show how biological anthropology may be employed to aid in understanding multiple public health issues. This international collaboration project was designed to create new knowledge regarding theories and methods in the study of senescence and

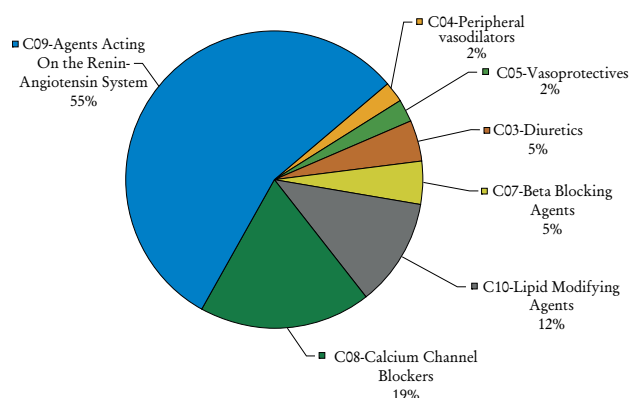


Fig. 11. Proportion of medications affecting the cardiovascular system by type.

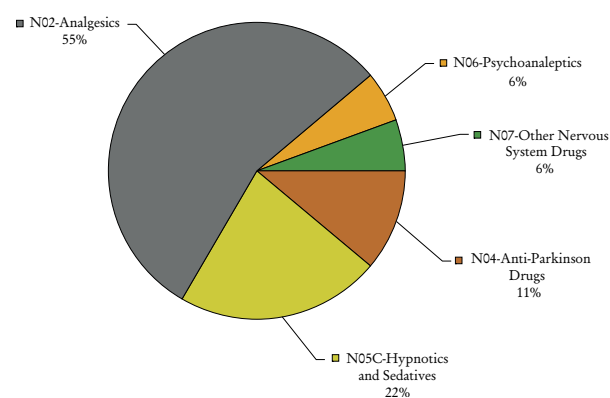


Fig. 12. Proportion of medications affecting the nervous system by type.

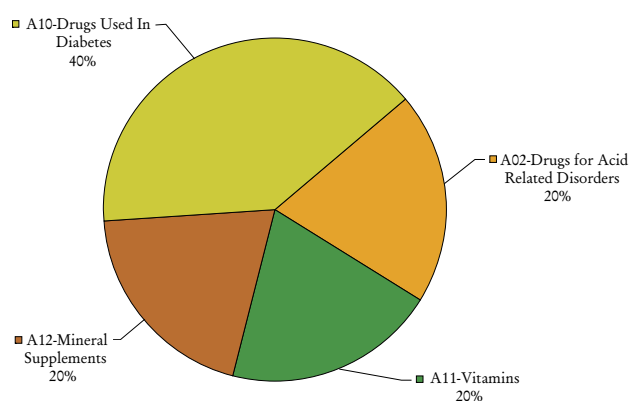


Fig. 13. Proportion of medications affecting the alimentary tract and metabolism by type.

health by applying practical interdisciplinary techniques collaboratively to the Selška valley Study of Health and Aging.

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STUDIJA ZDRAVLJA I STAROSTI U SELŠKOJ DOLINI: ISTRAŽIVANJE STARENJA, STRESA I OSLABJELOSTI

SAŽETAK

U ovom projektu koristili smo dobno stratificirani uzorak od 100 muškaraca i 100 žena u dobi od 55 godina i starijih stanovnika Selške doline kako bi se istražila dva zdravstvena indeksa - alostatsko opterećenje (AL) i oslabjelost. AL procijenjuje odgovore cijeloživotnog stresa i klinički značajne aspekte fiziologije; indeks oslabjelosti ocijenjuje trenutno somatsko stanje s pet aspekata funkcioniranja. Oba su povezana s kliničkom oboljelošću, samoprocijenjenim zdravstvenim stanjem, stilom života, anamnezom i osjećanjem. Naše istraživanje uključuje 9 sela koja se nalaze u izoliranoj Selškoj dolini. S obzirom na njihovu relativnu izoliranost, stanovnici ovog područja pružaju prirodno eksperimentalni okoliš za procjenu stresa, oslabjelosti, kliničke oboljelosti i starenja u lokalnoj izolaciji. Ovo izolirano alpsko područje nudi brojne prednosti za nastavak istraživanja o zdravlju, bolesti i starenju. Naši terenski protokoli uključuju detaljne zdravstvene, demografske i SES intervjue, mjerenje krvnog tlaka, antropometriju, hodanje/brzinu, snagu/izdržljivost i prikupljanje uzoraka krvi i slinje za određivanje hormona, plazme proteina i lipida. U ovom radu predstavljamo jedan segment podataka za 41 sudionika za samoocjenu zdravstvenog stanja i uzimanje propisanih lijekova tijekom našeg istraživanja 2008–2010. Općenito, većina sudionika se ocijenjuje kao dobrog i izvrsnog zdravlja (34/41 = 85%). Međutim, više od 66% uzima lijekove za kronična stanja, a od toga ih oko 25% uzima 4 ili više lijekova.