



**CHANGES IN BEHAVIORS
AND THE PROJECTED HEALTH BENEFITS
FOR MEMBERS OF HEALTHY AGEING CENTRES
IN BOSNIA AND HERZEGOVINA**



Introduction

Due to a combination of low birth rates and migration of young people to Western Europe, countries in Eastern Europe have an increasingly aging population. This includes Bosnia and Herzegovina (BiH), where 17% of people were over the age of 65¹ in 2019, with projections for this to reach more than 25% by 2050². A majority of research and medical funding for ageing is targeted to treating diseases and medical conditions associated with ageing, such as Alzheimer's disease, stroke, cancer, hearing loss and vision loss. Preventative approaches for healthy ageing receive less emphasis; however, promoting healthy ageing could potentially reduce the risk for numerous diseases, or at least delay the age of onset. Given the high costs of treating diseases, interventions for healthy ageing could provide a cost-effective way to reduce medical and societal costs associated with an ageing population and provide increased quality of life for older people. In general, a healthy lifestyle that includes regular exercise, a healthy diet with moderate-to-low alcohol use, regular social interactions and not smoking is associated with a reduction of many age-related diseases³, including dementia, cancer, stroke, and heart-related diseases⁴.

In line with the idea of preventative healthy ageing, the NGO Partnership for Public Health has developed a series of Healthy Ageing Centres (HAC) throughout BiH over the past decade. These HACs are day centres that provide a place for older people to gather, socialize, and partake in organized courses and activities such as exercise, painting, traditional crafts, computer skills, language skills, sports, singing and cooking. There are currently 17 centres in nine municipalities in BiH, with another one planned to open by the end of 2020. The UNFPA has supported these HACs and in recent years has been promoting the development of a network of

HACs throughout Eastern Europe and Central Asia.

In 2019, a collaboration was formed between the NGO Partnership for Public Health, the United Nations Population Fund (UNFPA) in BiH and research scientists from University College London (UCL) to determine the degree to which HAC members engaged in different activities that critically affect healthy ageing, including exercise, diet, smoking, alcohol consumption, social engagement, feelings of social support and hearing loss. Survey results from HAC members were compared to those from older people in BiH who do not attend HAC but would like to do so (non-members), and an aged-matched cohort population in the UK⁵. Data were then used to project the expected average health outcomes and potential benefits for people who attend HACs.



Methodology

Older men and women were given a survey based on the survey given as a part of the UK Biobank study⁵. The survey consisted of 87 questions and was translated into local language. The survey asks a number of questions to understand health history and life experiences, including diet, exercise, drinking, smoking, hearing and social activities. Six people from the NGO Partnership

1 <https://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS?locations=BA>

2 European Health for All Database.

3 Rossman et al., J Appl Physiol, 2018; Kaeberlein et al., Science, 2015

4 Partridge et al., Nature, 2018

5 UK Biobank; <https://www.ukbiobank.ac.uk/>

for Public Health were trained to assist in giving the survey on individual tablets. Participants were asked to choose the best answer whenever possible, but were always given the option to choose that none of the answers applied. The survey was administered in three sections so that participants could take breaks during the survey as necessary and it took on average 16 minutes to complete all three sections. All surveys were completed within one session, taking up to 35 minutes in total.



All answers to the survey were anonymized and stored in accordance with GDPR regulations prior to analysis. Participants were recruited at HACs in both Sarajevo and Banja Luka. Comparisons were made between groups as a function of how frequently participants attended healthy aging centres (0-5 times per week), as well as to an age- and gender-matched cohort from the UK Biobank.

A total of 455 surveys were completed, with a roughly even split between men and women. Approximately 15% of those completing the survey did not attend HACs and were categorized as non-members (they stated that they had not attended a HAC before and answered that they attended 0 times per week). Non-members were surveyed in HAC premises as they had intentions to join centres at later date. Adjustments for differences in group size was performed and all data were compared based on the number of days per week

that the respondents attended a HAC. For all questions and conditions, a power analysis was performed to determine how many responses would be necessary to detect a difference between groups. Expected effect sizes were based on sizes observed in the UK Biobank cohort and in an earlier survey conducted on members of the HACs by the NGO Partnership for Public Health and the UNFPA.

The differences within the BiH groups between people who attended HACs at least one time per week (HAC members) and those who attended 0 times per week were first measured. Then cohorts in the BiH members and non-member groups were compared to age- and gender-matched groups from the UK Biobank, who have been tracked repeatedly over more than ten years, to determine the outcomes associated with particular health conditions and survey results. This approach allowed the expected health outcomes for HAC members and non-members to be projected, given their reported activities related to exercise, diet, socialization, smoking and alcohol consumption.

While these approaches allow us to examine the current cohort using the HACs, some potential limitations of the study include that the cohort surveyed do not include people who are unable or uninterested in attending a HAC. Thus, the results and conclusions should be interpreted in this context. Survey samples are also biased toward older people who live in more densely populated areas where the HACs are concentrated. Further research should be conducted to determine best methods for reaching older people in underserved and rural areas (see Recommendations). Finally, outcomes projected from the UK Biobank are from people living in the UK. While comparisons were made across age- and gender-matched groups, there may be differences between cohorts based on cultural differences. Furthermore, a 'healthy-volunteer' bias has been reported in the UK Biobank cohort, such that outcomes and health conditions are better than expected for the UK Biobank cohort; however, despite this bias, meta-

analyses have indicated that risk factor associations derived from the UK Biobank are generalizable⁶ across populations. This potential confound will be addressed with future longitudinal studies of the BiH population, but until this has been completed, the Biobank serves as a resource for projecting long-term outcomes based on single time point data from the BiH populations.

Situation analysis

There are currently a number of factors that research has shown to influence healthy ageing, including exercise, diet, alcohol consumption, smoking and social interactions and support.

First, exercise is associated with a decrease in overall obesity levels, which decreases risk for age-related diseases and increases life expectancy by 7.7% and 11.7% for men and women respectively⁷. Older people who undertake no moderate exercise weekly are at an increased risk for a number of diseases, including heart disease, type 2 diabetes, stroke, cancer, dementia (including Alzheimer's disease), asthma and forms of pulmonary disease⁸. Several studies have shown that moderate levels of physical activity have protective effects against cognitive decline associated with ageing⁹, with more physical activity being associated with stronger protection. Furthermore, for people who already have mild cognitive decline, exercise in the form of resistance training improves cognitive outcomes 6 and 18 months later¹⁰. Regular moderate exercise alone is associated with a 16% decrease in breast cancer risk for post-menopausal women, and when paired with a healthy diet and not smoking, the relative risk is

decreased by nearly 30%, independent of genetic risk¹¹. Additionally, the consumption of fruits and vegetables is associated with a reduction in the risk of a number of non-communicable diseases and an increase in the number of disease free years in old age⁸. Daily alcohol consumption has been associated with an increase in brain ageing¹² in populations in the UK, particularly when combined with regular smoking.

A reduced social network has been shown to have a high mortality risk in older persons, as large as regular smoking or obesity, and is even more strongly correlated with a decrease in life span than physical inactivity¹³. Reduced social relationships also are linked to increases in cardiovascular disease¹⁴ and depression¹⁵, and are a risk factor for dementia¹⁶. Across all medical conditions, older people with increased social networks have decreased lengths of hospitalization for a given condition¹⁷.

Finally, smoking has long been associated with increases in a number of cancers and a substantial decrease in life expectancy⁷, but it also affects brain function. When testing relative brain age of smokers in middle and older age, those who smoked daily had lower scores on cognitive function tests and had a higher relative brain age by 0.5 years. This effect was not seen in those who smoked 3-4 times per week, so a minor reduction in smoking frequency can have a significant effect on cognitive function during ageing¹². The survey administered queried the BiH populations in each of the above described areas.

6 Batty et al., *BMJ*, 2020

7 Mackenbach et al., *Lancet Public Health*, 2019

8 Nyberg et al., *Lancet Public Health*, 2018

9 Hamer and Chida, *Psychol Med*, 2009; Sofi et al., *J Intern Med*, 2011

10 Fiatarone Singh et al., *J Am Med Dir Assoc*, 2014

11 Guo et al., *BJC*, 2020

12 Ning et al., *Sci. Reports*, 2020

13 Holt-Lundstad et al., *PLoS Medicine*, 2010

14 Knox and Uvnas-Modberg, *Psychol Bull*, 1998; Yang et al., *Proc Natl Acad Sci*, 2016

15 Santini et al., *J Affect Disord*, 2015

16 Livingston et al., *The Lancet*, 2017

17 Lett et al., *Health Psychol*, 2007; Murphy et al., *Eur J Cardiovasc Prev Rehabil*, 2008

Survey Results

There were two groups of respondents in BiH to the survey. Those that attended HACs at least once per week (HAC members) and those who had shown interest, but had not attended yet (HAC non-members). HAC members attended HACs on average 3.8 days per week, with 42% of respondents attending five times per week and 87% of respondents attending at least 3 days per week. Non-members attended 0 days per week, but they spent roughly as many days (3.4 days per week) participating in another group activity, including sports clubs, social clubs, religious organizations, or other group activities. The average age of the HAC member respondents was 72.8 years old, with a range of 54 to 94 years. The differences reported here are measured at the population level between HAC members and non-members. There is variability in any given group, so an individual will have specific outcomes that may be different from the population.

Exercise

Given that the exercise classes at the HACs are one of the best attended activities, the degree to which HAC members and non-members undertook exercise was examined. A significant increase in the levels of moderate exercise was found for members of HACs relative to non-members and the UK Biobank population. HAC members were more likely than non-members to undertake any form of moderate exercise (members: 85% vs non-members: 75%; Chi-squared test, $p=0.002$), with 83% of HAC members exercising at least twice per week. Members of HACs also exercised for longer periods of time than non-members when they did exercise, leading to an overall increase in total exercise time per week for HAC members (members: 215 minutes/week vs non-members: 155 minutes/week; Chi-squared test, $p = 0.019$).

In addition to moderate exercise, HAC members on

average walked more per day than non-members (members: 41 ± 21 minutes per day vs non-members: 31.3 ± 23 minutes per day; Chi-squared test, $p = 0.009$). The number of metabolic equivalents (METs), which is a combination of walking, moderate physical activity and vigorous physical activity and gives a general measure of overall physical activity, was then calculated (METs are the sum of: $3.3 \times$ minutes walking per day + $4.0 \times$ minutes of moderate exercise per day + $8.0 \times$ minutes of vigorous exercise per day¹⁸). On average, HAC members have a higher number of METs per week than non-members (Figure 1). Furthermore, a higher number of HAC members fell in the group of high activity (METs > 50) (15% of HAC members vs 8% of non-members), which is associated with protection against several age-related diseases.

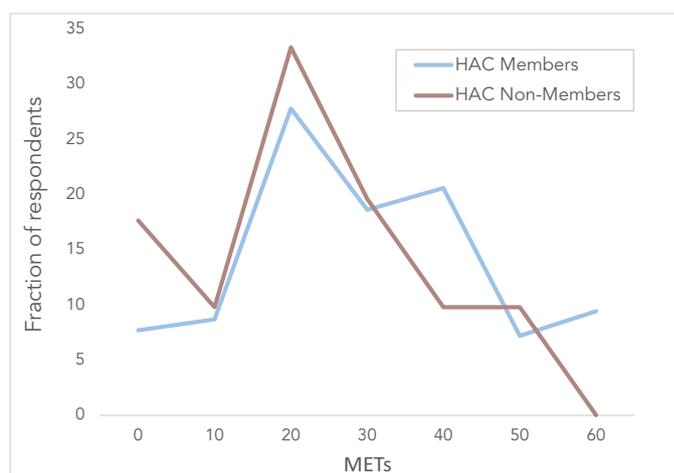


Figure 1: Total METs for members of HAC (blue) and non-members (brown). Chi-squared test, $p < 0.001$.

Diet

Several aspects of the diets of members and non-members of HACs were examined. Only one difference was found in that members of HACs consumed significantly more fruits and vegetables compared to their non-member counterparts (Figure 2; members: 2.6 ± 1.2 vs non-members: 2.0 ± 0.87 portions per day; Chi-squared test, $p < 0.001$), with 10% more HAC members eating the recommended fruits and vegetables per day than non-members. There were no other significant

differences in diet between the members and non-members. Also, there was no significant difference in alcohol consumption between HAC members and non-members (members: 0.49 ± 1.82 drinks per week, non-members: 0.92 ± 2.06 drinks per week; Chi-squared test, $p = 0.17$).

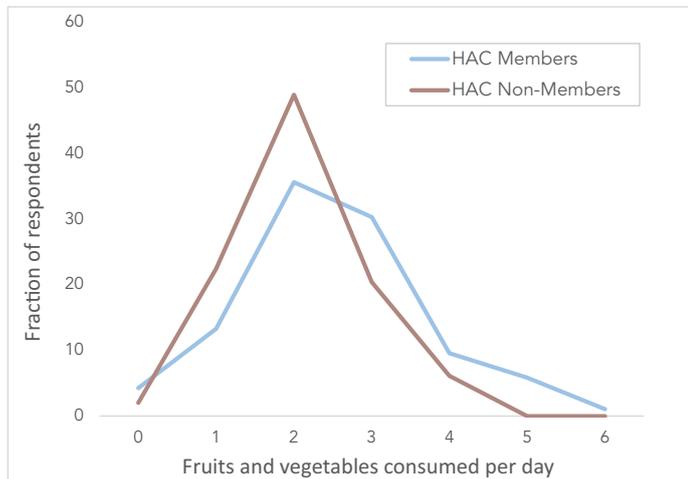


Figure 2: Total fruit and vegetable servings consumed per day for members of HAC (blue) and non-members (brown). Chi-squared, $p < 0.001$.

Social interactions

The social support networks of members of HACs were examined, given that many of the activities ongoing in the HACs have a social aspect. There are several key areas of social support networks for healthy ageing, including received support (actual actions of support from other people), perceptions of social support (the feeling that there is someone to support you if necessary) and perceptions and feelings of loneliness. These areas can be measured through functional measures, including reports on relationship satisfaction and perceived loneliness¹⁹, as well as through structural measures, such as marital status and living alone or with family. Both functional and structural measures of HAC members and non-members were examined in this survey.

There were no differences between HAC members and non-members on structural measures. They were

equally likely to be married and living with other people. For functional measures, members of HACs had a high reported satisfaction with their familial relationships and with their friendships. Further surveys would be necessary to determine if this outcome was a result of being an HAC member or if people who are satisfied with their relationships are more likely to have interest in joining an HAC; however, the fact that the control cohort of non-members have shown interest in joining an HAC, but have lower reported relationship satisfaction, suggests that increases in reported relationship satisfaction among HAC members may be at least in part attributable to HAC membership. HAC members were more likely than non-members to report that they were extremely happy or very happy with their friendships (members: 59% vs non-members: 44%; Chi-squared test, $p < 0.001$). HAC members were also more likely than non-members to report that they were extremely happy or very happy with familial relationships (members: 58% vs non-members: 30%; Chi-squared test, $p < 0.001$). Members of HACs were significantly less likely to report that they often feel lonely than non-members (members: 75% vs non-members: 87.7% report often feeling lonely; Chi-squared, $p = 0.008$).



There were no observed differences in other functional social network measures relative to non-members of HACs, indicating that members of HAC centres did not

19 Holt-Lunstad et al., PLoS Medicine, 2010

have any additional social network risks relative to non-members. Also, there were no significant differences observed between the groups in the frequency with which they confide in someone close, where HAC members reported similar levels of having a confidant to non-members (Chi-squared, $p = 0.87$). Having a confidant is an important functional measure for social support, which is not enhanced by HAC membership and is therefore a potential area for improvement in the existing HACs (see Recommendations).

Smoking

All HACs are non-smoking spaces. Therefore, differences in the smoking habits between members and non-members were examined. It was found that 89% of members and 84% of non-members were not smokers, with no significant difference between these groups. Of members and non-members who did smoke, there was no significant difference between the total amount of cigarettes that they smoked (members: 1.4 ± 5.9 vs non-members: 1.68 ± 4.77 cigarettes per day; Chi-squared test, $p = 0.7$).

Potential Health Outcomes

Disease Free Years and Mortality

Physical activity and a healthy body weight are associated with an increase in the number of disease-free years in older age²⁰, including later onset for coronary heart disease, stroke, cancer, type 2 diabetes, asthma, and chronic obstructive pulmonary disease. Using a model that takes into account the amount of moderate exercise, the fruit and vegetable intake and the Body Mass Index (BMI – a ratio measure of height to weight) range for member and non-member groups²⁰, HAC members are projected to have an increase of 1.9 disease-free years for men (onset of disease age: median 68.8, CI 68.4-69.2 for HAC member men and median 66.9, CI 66.2-67.7 for

non-member men) and an increase of 0.8 disease-free years for women (onset of disease age: median 69.5, CI 69.3-69.8 for HAC member women and median 68.7, CI 68.2-69.2 for non-member women). Using a model based on benefits associated with diet, exercise and social network support²¹, HAC members are projected to have a 35-45% increase in survival over the span of seven years relative to non-members, when controlling for age and BMI.

Breast Cancer

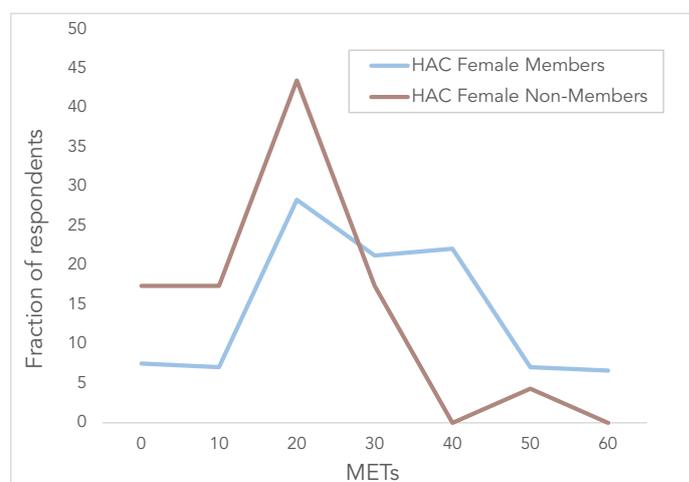


Figure 3: Total METs for female members of HAC (blue) and non-members (brown). Chi-squared test, $p < 0.001$.

Physical activity and a healthy lifestyle have been previously correlated with a reduced risk in developing breast cancer for post-menopausal women²², with a specific correlation between METs and breast cancer risk. On average, women who are HAC members have higher METs per week than non-members (Figure 3). Using a model based on the UK Biobank that controls for age, body mass index, alcohol intake and previous breast cancer diagnoses²⁰, there was a decrease in relative risk of breast cancer for HAC members relative to non-members (median 0.88, CI 0.8 to 0.95 relative risk for HAC members vs median 0.98, CI 0.94 to 1.08 relative risk for non-members).

20 Nyberg et al., Lancet Public Health, 2018

21 Holt-Lundstad et al., PLoS Medicine, 2010

22 Guo et al., BJC, 2020; Arthur et al., 2020

Conclusions

Overall, this survey measured the ageing health-critical activities of HAC members and non-members in BiH. Members of HACs have higher levels of moderate exercise, improved diet and greater satisfaction with their social interactions than their non-member counterparts. Differences observed in the behaviors of HAC members are associated with an increase in disease-free years in older age, a decrease in breast cancer risk for women and an increase in longevity.

Given that non-members are people who have an interest in joining a HAC, but have not yet joined to date, the results suggest that the differences observed may at least in part be attributable to attending HACs, rather than the fact that those who are interested in attending HACs lead healthier lifestyles to begin with. Additional surveys should be conducted to further probe into these differences and try to assess the degree to which healthier populations are self-selecting to attend the HACs or that behavior changes as a result of becoming an HAC member. Follow up surveys would need to be conducted with the cohort surveyed here to directly assess this question.

Recommendations

Given the clear benefits measured for HAC members and the relatively low cost of running these centres, the expansion of the HACs to other densely populated areas will provide value for money in long-term health benefits, as well as improve the general well-being for older people. When considering setting up a new HAC, using the survey administered in this study to the cohort of potential HAC members would help identify the areas for focus in the centre. Understanding the existing levels for potential HAC members in exercise, diet, social interaction, smoking and alcohol consumption will allow resources to be optimally allocated to areas with the greatest potential to support improvement in lifestyles. Different populations of users may have different needs

and therefore identifying these needs in advance will provide value for money in establishing new centres.

Furthermore, the current HACs are a very good model for more densely populated areas; however, this model has not been tested in more underserved rural areas, which currently do not have access to these types of social support. Finding ways to encourage and support healthy ageing in underserved populations is critical for the health and well-being of these older people. Using this survey would be a first step in identifying the needs of older populations in these underserved areas. Providing exercise classes daily, one of the most critical aspects for healthy ageing, could be done through daytime television, radio or internet, rather than in person centres, which would also help to reach people with other access and mobility restrictions. Social interactions could be addressed through the development of multi-generational programmes, where younger or more mobile people engage socially with those who are unable to attend in person centres. Programmes that exist for these types of multi-generational interactions should be supported where they have been evaluated to be successful. These programmes could be assessed through the survey used here to determine if reports of social satisfaction are increased as a result of existing programmes. These multi-generational programmes will also serve to share knowledge between generations and educate younger people about the importance of healthy ageing. Developing education programmes to educate young people on the importance of a healthy lifestyle and healthy ageing is critical for preparing the next generations for improved health and well-being in older age.

There are several areas in which HAC members have improvements in critical areas for healthy ageing and potentially improved health outcomes. But there are also several important areas for healthy ageing that provide opportunity for even greater gains if addressed in the HACs.

While there is a significant decrease in the number of

HAC members relative to non-members who report that they often feel lonely, seventy-five percent of members still report that they often feel lonely. Furthermore, there is no difference between the degree to which HAC members and non-members have someone to confide in, which is an additional measure for social support that is associated with lower mortality and a reduction in age-related diseases²³. Thus, initiatives that target reducing loneliness and increasing close relationships for members have the largest potential for increases in improved health outcomes. Future surveys and interviews should investigate why HAC members feel that they do not have someone to confide in and what could potentially be done to address this point. Evaluating the degree to which HAC members wish to

have confidants from their family or friend groups, and whether family or friend confidants are already available could provide direction for addressing this issue.

Another area for potential health improvement is with smoking. Even limited decreases in smoking – for example, reducing smoking daily to only 3-4 times a week – can have substantial effects on cognitive abilities in ageing²⁴. While a large number of HAC members are non-smokers, providing support for simply reducing total smoking for members who are smokers, could have considerably positive outcomes in cognitive protection.

23 Holt-Lundstad et al., PLoS Medicine, 2010

24 Ning et al., Sci Reports, 2020

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