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Original article

Musculoskeletal health and capability wellbeing: Associations between the HAQ-DI, ICECAP-A and ICECAP-O measures in a population survey

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ABSTRACT

Background: The capability approach has received increasing attention in wellbeing measurement in the past years, but it has still remained an underexplored area in musculoskeletal (MSK) health.
Objective: We aimed to explore the capability wellbeing in relation to MSK health, by measuring the associations between the Health Assessment Questionnaire Disability Index (HAQ-DI) physical functioning and the ICECAP-A and ICECAP-O capability wellbeing measures.
Design: A cross-sectional survey was performed in 2019 on a representative sample of the Hungarian general adult population.
Method: Capability wellbeing was measured by the ICECAP-A (age-group 18–64) and ICECAP-O (age group 65+) questionnaires. MSK health was defined by the HAQ-DI, the mobility domain of the EQ-5D-3L/-5L health status measures, self-reported walking problems and MSK diagnosis (neck/back/low back defects, hip/knee arthrosis, osteoporosis).
Results: Altogether 2021 individuals (female: 50.1%) participated in the survey with mean (SD) age of 48.7 (17.9) years and HAQ-DI of 0.138 (0.390). ICECAP-A (N = 1568, 77.6%) and ICECAP-O (N = 453, 22.4%) scores were on average (SD) 0.894 (0.126) and 0.828 (0.150), respectively. Spearman correlations between the HAQ-DI and ICECAP-A/-O index scores were moderate ($r = -0.303$ and -0.496; $p < 0.05$). Both the ICECAP-A/-O index scores differed significantly (ANOVA test, $p < 0.05$) across all MSK subgroups. In the ordinary least square regressions, marginal effects of ICECAP-A/-O scores on HAQ-DI were significant (−0.149 and −0.123) when controlling for socio-demographic characteristics.
Conclusions: MSK health problems are associated with lower capability wellbeing. ICECAP-A/-O might capture effects of MSK conditions not measured by the HAQ-DI or the EQ-5D-5L. Further studies should test these associations in disease-specific samples.

1. Introduction

The prevalence of musculoskeletal (MSK) diseases is on the rise worldwide and is expected to increase even further in the future, causing substantial disability and burden on individuals and societies (Sebbag et al., 2019). According to the Global Burden of Diseases, Injuries and Risk Factors Study 2019, the number of people living with MSK conditions was about 1.714 billion worldwide and an increasing tendency (62% in average) has been observed in all MSK groups since 1990 (Cieza et al., 2021). The most prevalent MSK disorders were low back pain, fractures and osteoarthritis, and MSK disorders contributed in total to 149 million years of life lived with disability.

The measurement of patient reported outcomes and health-related quality of life (HRQoL) has become the cornerstone of medical

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decision making in the care of patients with MSK diseases (Fernandes et al., 2013; Smolen et al., 2017). These outcomes can provide an insight into the disease burden caused by the disease and the effects of the treatment across the physical, mental and social domains of health from the patients' perspective. Wellbeing is related to HRQoL, however, it assesses the person's life in a broader sense, covering aspects like happiness, satisfaction or capabilities. The measurement of wellbeing is especially important for the planning and the evaluation of interventions that are aiming not so much at improving health, but increasing wellbeing. This includes, for instance, rehabilitation, various social care or long-term care interventions (Woods, 2005; Scoglio et al., 2019; Bauer et al., 2021). Therefore, wellbeing measures are particularly relevant in chronic MSK disorders.

In the assessment of wellbeing, a relatively new framework, the capability approach has gained momentum in the past years (Sen and Nussbaum, 1993; Coast et al., 2008). The ICECAP-O was one of the first capability-based measures of wellbeing developed for the elderly, which was followed by the ICECAP-A for adults and by further ICECAP instruments (Flynn et al., 2011; Al-Janabi et al., 2012). Tariff values have been elicited both for the ICECAP-A and –O in the UK, reflecting societal preferences, the value people attach to each level of the five domains covered by these measures (Coast et al., 2008; Flynn et al., 2015). Therefore, the ICECAP-A/-O can also be used for economic evaluations to evaluate the benefits of interventions targeting wellbeing beyond health. The growing importance of the capability approach is shown by the fact that the guideline of the National Institute for Health and Care Excellence in the UK recommends the use of capability measures, including ICECAP, for the evaluation of social care (NICE, 2013).

Nonetheless, the use of ICECAP measures has not yet spread in the field of MSK diseases and little is known about the burden that MSK health problems pose on patients' capability wellbeing. Moreover, the relationship between the physical functional status and the capability wellbeing has remained underexplored so far (Afentou and Kinghorn, 2020; Proud et al., 2019). The Health Assessment Questionnaire Disability Index (HAQ-DI) has been originally developed to assess the physical functional status in multiple illnesses (Bruce and Fries, 2003). It is one of the most widely applied measure of functioning and disability across rheumatic diseases, and it has been successfully used also in the general population (Carmona et al., 2001; Krishnan et al., 2004; Sokka et al., 2004, 2006; Chandratre et al., 2013; Rose et al., 2014; Jennings et al., 2015; Ramadass et al., 2018). The relationship between HAQ-DI and generic health status measures, such as the EQ-5D or the SF-36 has been assessed in various MSK conditions (e.g. rheumatoid arthritis, psoriatic arthritis, osteoarthritis, gout) (Chandratre et al., 2013; van Groen et al., 2010; Pennington and Davis, 2014; Leung et al., 2020). However, the relationship between the HAQ-DI and ICECAP measures has not yet been investigated. Diseases-specific studies are undoubtedly needed to fill in this gap, however population-based studies focusing on MSK symptoms would allow to capture MSK health in a wider context and also could involve individuals living with MSK symptoms but without having a well-defined diagnosis.

The aim of our study was, therefore, to explore the capability wellbeing in relation to MSK health in the general population and analyze its determinants. Our primary focus is on the associations between the HAQ-DI and ICECAP-A/-O measures. Secondarily, we consider mobility problems reported on the EQ-5D-3L and EQ-5D-5L generic health status measures and the relevant questions (walking problems, self-reported MSK diagnoses) adapted from the questionnaire of the European Health Interview Survey (EHIS) (EuroQol, 1990; Herdman et al., 2011; Eurostat European Health, 2020).

2. Materials and methods

2.1. Study design and participants

In May–June of 2019, a population-based, cross-sectional computer-assisted personal interview survey was performed among the adult general population (aged 18 and over) of Hungary. Recruitment of respondents (random walk door-to-door recruitment method, target sample size N = 2000) and interviews were conducted by a market survey company (New Land Media Kft.) using random sampling method. Individuals aged 18 and over who provided informed consent were eligible to participate in the study. To ensure representativeness, quota sampling method was applied. Predefined quotas by sex, age-group, settlement type and geographic region were set based on national population statistics. All human studies have been approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Participants signed informed consent form before their inclusion in the study. Ethical approval was obtained from the Scientific and Ethical Committee of the Medical Research Council of Hungary (10058–3/2019/EKU).

2.2. Survey

This study was part of a larger population health survey in Hungary (Baji et al., 2020). Here we focus on the modules used for the purpose of the analyses in this paper. The socio-demographic characteristics (age, sex, educational level, place of residence, household characteristics) of the participants were recorded in computer-assisted personal interviews. The paper-based self-completed versions of the ICECAP-A, ICECAP-O, EQ-5D-3L and EQ-5D-5L questionnaires were completed by the respondents and these data were recorded subsequently in the electronic database.

2.3. Main outcome variables

2.3.1. ICECAP-A and ICECAP-O

The ICECAP-A and ICECAP-O are measures of capability wellbeing developed for adults (of age 18 and over) and elderly people (of age 65 and over), respectively. Both measures comprise five domains in which the statements are formulated in terms of 'can have' or 'being able to' and refer to 'Attachment' (have love, friendship and support), 'Stability' (feel settled and secure), 'Achievement' (achieve and progress in life), 'Enjoyment' (experience enjoyment and pleasure), 'Autonomy' (be independent) in the ICECAP-A, and 'Attachment' (love and friendship), 'Security' (thinking about the future without concern), 'Role' (doing things that make you feel valued), 'Enjoyment' (enjoyment and pleasure), 'Control' (independence) in the ICECAP-O. Respondents are asked to choose the statement out of the four levels for each domain that best describes their quality of life at the moment (full capability: level 4, no capability: level 1). A preference-based index score (1 – full capability; 0 – no capability) can be calculated based on the responses. Tariffs for the ICECAP-A/-O are available only from the UK, therefore we used these tariffs to calculate the ICECAP-A and ICECAP-O index scores (Flynn et al., 2015; Coast et al., 2008). In this study, we applied the ICECAP-A in the age group of 18–64 years and the ICECAP-O in the age group of 65 and older.

2.3.2. HAQ-DI

The HAQ-DI is a 2-page questionnaire that assesses the respondent's level of functional ability over the past week in 20 questions (Bruce and Fries, 2003). The questions are grouped into eight categories (dressing and grooming, rising, eating, walking, hygiene, reach, grip, usual activities). Responses can be provided on a 0–3 scale (0-without any difficulty, 1-with some difficulty, 2-with much difficulty, 3-unable to do). In addition, specific aids or devices utilized for assistance, as well as help needed from another person (aids/help) are also identified. To calculate HAQ-DI score, we applied the alternative scoring method, i.e. the score of the categories were not corrected for the use of devices or assistance (Ornbjerg et al., 2020). The worst component score defined the score of the category and the average of the eight categories was calculated

(range 0–3).

2.3.3. EQ-5D-3L and EQ-5D-5L

The EQ-5D-3L is a generic health status measure that consists of two parts: the EQ-5D descriptive system and a visual analogue scale (EQ VAS) (EuroQol, 1990). The descriptive part covers five domains of health (mobility, self-care, usual activities, pain/discomfort, anxiety/depression). Respondents are asked to indicate the problem level they have in each domain on a 3-level scale (1-no, 2-some/moderate, 3-unable/extreme). The more recent EQ-5D-5L has the same construct, however with a 5-level response scale (1-no, 2-slight, 3-moderate, 4-severe, 5-unable/extreme) (Herdman et al., 2011). These responses can be converted into a preference-based index score reflecting the utility of the health status from the societal perspective. Although measurement properties of the EQ-5D-5L are superior to EQ-5D-3L, given the huge amount of accumulated data with this latter instrument in the past 25 years, we used both versions to ensure comparability (Thompson and Turner, 2020). Due to the lack of country-specific tariffs for Hungary at the time of the study, we used that of the UK and England to calculate the EQ-5D-3L (range: −0.594 — 1) and EQ-5D–5L index scores (range: −0.285 — 1), respectively, in which 1 indicates full health and 0 indicates death, while negative scores refer to health states that are considered to be worse than death (Devlin et al., 2018; Dolan, 1997). The EQ VAS records the respondent's self-rated health on a 0–100 scale with anchors 'The best health you can imagine' and 'The worst health you can imagine'.

2.3.4. Self-reported MSK problems in the European Health Interview Survey (EHIS)

The EHIS is conducted every five years and collects data on the health status of the population among the EU member states (Eurostat European Health, 2020). The following set of questions of the EHIS were selected for our study: 'Do you have difficulty walking 500 m on level ground without the use of any aid?' (no/some/a lot of difficulty/cannot do at all or unable to do); 'Do you have difficulty in walking up or down 12 steps?' (no/some/a lot of difficulty/cannot do at all or unable to do). Questions about self-reported presence of MSK diseases of the EHIS were also applied: 'Low back disorder or other chronic back defect', 'Neck disorder or other chronic neck defect', 'Arthrosis' (we have specified this item for hip and knee arthrosis, separately) and 'Osteoporosis'. For each condition, respondents were asked to indicate whether a.) the condition have been present in the past 12 months, b.) was diagnosed by a medical doctor and c.) the respondent has taken medications for the condition based on medical advice.

2.3.5. Identification of participants with MSK disorders

We considered the HAQ-DI (response levels and index score), Mobility domain of the EQ-5D-3L/-5L (response level) and the questions of EHIS (levels of self-reported walking problems, self-reported presence of MSK disorders (such as neck/back/low back defects, hip/knee arthrosis, or osteoporosis) to identify people living with MSK health problems in the population.

2.4. Statistical analysis

Descriptive statistics were performed. Subgroup comparisons were carried out by ANOVA tests. Spearman's rho correlation coefficients were calculated between continuous variables. In all types of analysis, a 5% significance level was applied. The strength of correlation coefficients was assessed as follows: <0.1 trivial; 0.11–0.3 small; 0.31–0.5 moderate; 0.51–0.7 high; 0.71–0.9 very high; and >0.9 nearly perfect (Hopkins, 2002). Ordinary least square (OLS) regression analysis was carried out to explore association between ICECAP-A/-O and HAQ-DI scores, controlling for socio-demographic characteristics (such as sex, age, education, settlement type, marital status, employment, net household income, household size). In all models ICECAP-A/-O index scores were dependent variables. In model 1–2, we in included only the HAQ-DI score, while in models 3–4, we also added EQ-5D-5L index and EQ VAS as health measures. (In models 5–6, all HAQ-DI domains, while in models 7–8 EQ-5D-5L domains were added to the models as independent variables.) Analysis was carried out in SPSS Statistics 25.

3. Results

Altogether 5439 households were approached during the recruitment but in 1548 cases (28.5%) nobody was at home. Out of the 3891 invites, 1388 individuals (35.7%) refused to participate, 468 (12.0%) were younger than 18 years and 12 participants (0.3%) quitted during the study. A total of 2023 interviews (52.0%) were completed. Predefined quotas for representativeness were fulfilled. Two respondents were excluded due to missing data on the ICECAP-A, hence 2021 individuals were included in the analyses.

3.1. Sample characteristics

Full details of the sample, including population normative data with the ICECAP-A and –O have been published elsewhere (Baji et al., 2020). In brief, the average (S.D.) age of the total sample was 48.7 (17.9) years and it was 41.6 (13.1) years in age-group 18–64 (N = 1,568, 77.6%) and 73.3 (7.0) years in age group ≥65 (N = 453, 22.4%). In age-group 18–64, the average (S.D.) EQ-5D-3L, EQ-5D-5L index, EQ VAS and ICECAP-A scores were 0.924 (0.164), 0.950 (0.119), 85.6 (14.9) and 0.894 (0.126), respectively; while these scores were 0.716 (0.245), 0.804 (0.196), 67.2 (17.8) and 0.828 (0.150) in age group ≥65. Both ICECAP-A and ICECAP-O index scores showed a decreasing tendency with age (Fig. 1A).

Population norms with the HAQ-DI are provided in Table 1 and the distribution of answers on the HAQ-DI domains are presented in Table 2. The HAQ-DI index score of the total sample was on average (S.D.) 0.138 (0.390); while in subgroups of age 18–64 and ≥ 65 years it was 0.052 (0.253) and 0.463 (0.586), respectively. The number (%) of respondents with HAQ-DI score of 0 was 1427 (91.0%) and 200 (55.8%) in the two age groups, respectively. HAQ-DI index score differed significantly by age-groups (Fig. 1B), educational level, employment status, marital status and household income level, but not by sex or settlement type. Mean HAQ-DI scores by socio-demographic characteristics for age groups 18–64 and ≥ 65 years are presented separately in Online Resource 1.

3.2. Relationship between ICECAP-A/-O and HAQ-DI measurement tools

Both the ICECAP-A and ICECAP-O average index scores were inversely associated with HAQ-DI problem levels (with some exceptions on the most severe HAQ-DI levels, where sample sizes were very low, i.e. varied from 2 to 17 respondents) and the difference across levels was significant ($p < 0.01$) in all the eight HAQ-DI domains (Table 2).

Correlations between both the domains and index scores of the HAQ-DI and ICECAP-A/-O were significant ($p = 0.0000$) (Table 3). The correlations between the HAQ-DI score and both ICECAP-A/-O index scores were moderate, but it was bordering on high in the case of ICECAP-O ($r = -0.496$) and bordering on low in the case of ICECAP-A ($r = -0.303$). Domain-level correlations with the HAQ-DI were the weakest in the 'Attachment' domain of the ICECAP-A and the strongest in the 'Achievement'. In the case of ICECAP-O, also the 'Attachment' showed the weakest domain-level correlations with HAQ-DI, and the strongest was found in the 'Role' domain (which is the counterpart of the ICECAP-A 'Achievement' domain).

3.3. ICECAP-A/-O and HAQ-DI scores by self-reported MSK health

Results are presented in Table 4. Both the ICECAP-A and ICECAP-O index scores differed significantly across all the observed subgroups.

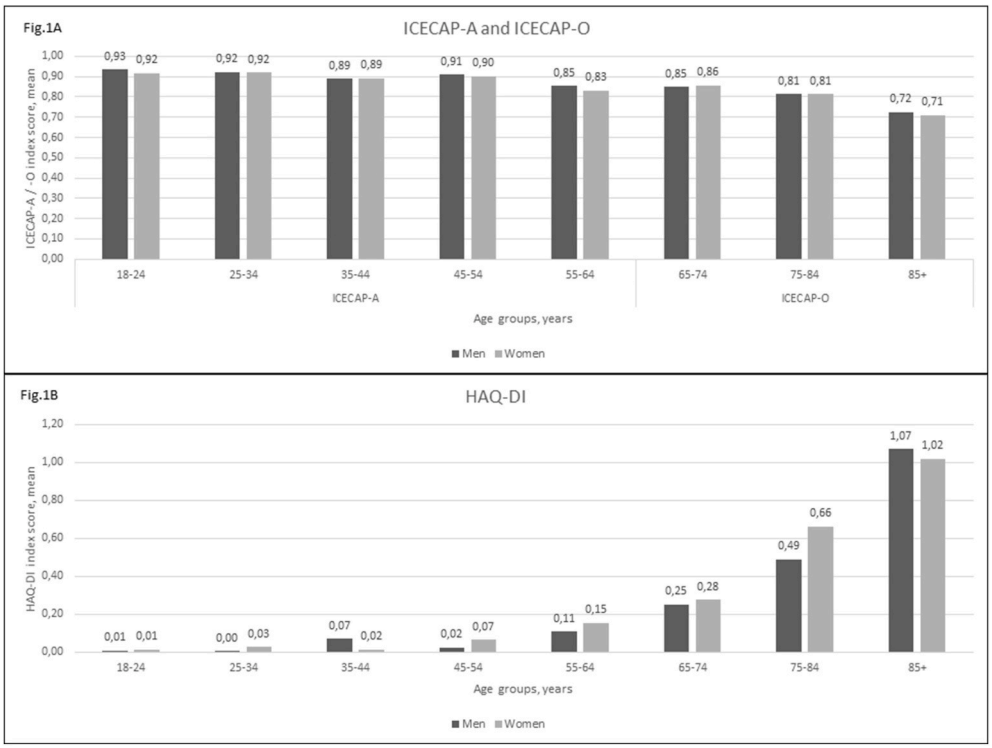

Fig. 1. Average ICECAP-A (18–64 years), ICECAP-O (65 years and over) and HAQ-DI index scores by sex and age-groups.

Table 1
Characteristics of the sample (N = 2021) and population norms for the HAQ-DI index score.

	N	%	HAQ-DI index score, mean (S.D.)
Sex			P = 0.204
Woman	1013	50.1%	0.15 (0.4)
Man	1008	49.9%	0.13 (0.38)
Age, years			**P = 0.000**
18-24	208	10.3%	0.01 (0.09)
25-34	308	15.2%	0.02 (0.18)
35-44	386	19.1%	0.04 (0.26)
45-54	332	16.4%	0.04 (0.2)
55-64	334	16.5%	0.13 (0.37)
65-74	267	13.2%	0.26 (0.41)
75-84	145	7.2%	0.58 (0.64)
85+	41	2.0%	1.05 (0.78)
Education			**P = 0.000**
Primary	844	41.8%	0.24 (0.51)
Secondary	768	38.0%	0.07 (0.25)
Tertiary	409	20.2%	0.07 (0.26)
Paid work			**P = 0.000**
No	734	36.3%	0.33 (0.57)
Yes	1287	63.7%	0.03 (0.13)
Settlement type			P = 0.105
Budapest (capital)	399	19.7%	0.1 (0.28)
Town	1060	52.4%	0.14 (0.4)
Village	562	27.8%	0.16 (0.43)
Married/partner			**P = 0.000**
No	783	38.7%	0.22 (0.5)
Yes	1238	61.3%	0.09 (0.29)
Per capita net income category (missing N = 678)			**P = 0.000**
1st quintile	271	20.2%	0.21 (0.47)
2nd quintile	327	24.3%	0.12 (0.35)
3rd quintile	312	23.2%	0.2 (0.45)
4th quintile	232	17.3%	0.07 (0.22)
5th quintile	201	15.0%	0.05 (0.2)

Note: Subgroups were compared by ANOVA tests.

As walking problem levels increased, the average ICECAP-A/-O scores decreased indicating a worsening capability wellbeing, with a few exceptions (ICECAP-A: 'unable to walk 500 m … ', 'unable to walk up or down 12 steps'; ICECAP-O: 'unable to walk 500 m … ').

With respect to self-reported MSK diagnoses, both ICECAP-A and –O scores were higher (better status) for respondents who reported no MSK diagnosis compared to those who reported to have medically confirmed MSK diagnosis. HAQ-DI score showed similar patterns.

3.4. Regression

Regression results are presented in Online Resource 2. In Model 1 and 2 HAQ-DI scores were significantly (negatively) associated with ICECAP-A and ICECAP-O index scores (with marginal effects of −0.149 and −0.123, respectively). However, when we include EQ-5D-5L index and EQ VAS in the models (Model 3 and 4), the HAQ-DI score is no longer significant (while EQ-5D-5L index and EQ VAS were significantly associated with the ICECAP-A/-O scores). Model 5 indicates that none of the HAQ-DI domains were associated with the ICECAP-A score, while in Model 6, 'Dressing', 'Walking' and 'Hygiene' were found to be associated with the ICECAP-O score at a 10% significance level. Models 7 and 8 showed that 'Pain/discomfort' and 'Anxiety/depression' EQ-5D-5L domains were significantly associated with both ICECAP-A and –O index scores, while 'Usual activities' was associated with the ICECAP-O index score.

4. Discussion

We have assessed capability wellbeing measured by the ICECAP-A (age group 18–64) and ICECAP-O (age group 65 and over) in relation to MSK health in a cross-sectional survey among the general adult population of Hungary. Both the ICECAP-A and ICECAP-O index scores were lower as problems in physical functioning (HAQ-DI) and mobility (EQ-5D-3L/-5L) and on the relevant questions of the EHIS questionnaire) occurred. Correlations between the ICECAP-A/-O index and HAQ-DI scores were moderate, but it was stronger in the case of ICECAP-O.

Table 2
Mean ICECAP-A/-O index scores by HAQ-DI domains.

HAQ-DI domains	Age-group 18-64			Age-group 65 and over		
	N	%	ICECAP-A, mean (SD)	N	%	ICECAP-O, mean (SD)
Dressing & grooming			P = 0.000			P = 0.000
without any difficulty	1523	97.1%	0.90 (0.12)	336	74.2%	0.86 (0.12)
with some difficulty	32	2.0%	0.72 (0.16)	94	20.8%	0.77 (0.14)
with much difficulty	7	0.4%	0.62 (0.22)	17	3.8%	0.57 (0.16)
unable to do	6	0.4%	0.5 (0.15)	6	1.3%	0.46 (0.28)
Arising			**P = 0.000**			**P = 0.000**
without any difficulty	1500	95.7%	0.90 (0.12)	305	67.3%	0.87 (0.12)
with some difficulty	53	3.4%	0.74 (0.17)	122	26.9%	0.78 (0.14)
with much difficulty	8	0.5%	0.73 (0.17)	21	4.6%	0.6 (0.21)
unable to do	7	0.4%	0.54 (0.16)	5	1.1%	0.59 (0.21)
Eating			**P = 0.000**			**P = 0.000**
without any difficulty	1543	98.4%	0.90 (0.12)	364	80.4%	0.85 (0.13)
with some difficulty	16	1.0%	0.72 (0.19)	70	15.5%	0.74 (0.17)
with much difficulty	2	0.1%	0.8 (0.16)	10	2.2%	0.64 (0.19)
unable to do	7	0.4%	0.53 (0.16)	9	2.0%	0.68 (0.18)
Walking			**P = 0.000**			**P = 0.000**
without any difficulty	1499	95.6%	0.90 (0.12)	282	62.3%	0.87 (0.12)
with some difficulty	49	3.1%	0.74 (0.18)	134	29.6%	0.78 (0.14)
with much difficulty	14	0.9%	0.76 (0.17)	28	6.2%	0.65 (0.18)
unable to do	6	0.4%	0.54 (0.14)	9	2.0%	0.68 (0.24)
Hygiene			**P = 0.000**			**P = 0.000**
without any difficulty	1511	96.4%	0.90 (0.12)	279	61.6%	0.87 (0.12)
with some difficulty	30	1.9%	0.73 (0.13)	102	22.5%	0.79 (0.13)
with much difficulty	11	0.7%	0.67 (0.18)	29	6.4%	0.75 (0.21)
unable to do	16	1.0%	0.68 (0.21)	43	9.5%	0.67 (0.18)
Reach			**P = 0.000**			**P = 0.000**
without any difficulty	1492	95.2%	0.90 (0.12)	279	61.6%	0.87 (0.12)
with some difficulty	58	3.7%	0.76 (0.15)	127	28.0%	0.79 (0.14)
with much difficulty	7	0.4%	0.66 (0.19)	30	6.6%	0.67 (0.19)
unable to do	11	0.7%	0.57 (0.15)	17	3.8%	0.69 (0.17)
Grip			**P = 0.000**			**P = 0.000**
without any difficulty	1543	98.4%	0.9 (0.12)	360	79.5%	0.85 (0.13)
with some difficulty	15	1.0%	0.68 (0.2)	77	17.0%	0.75 (0.17)
with much difficulty	2	0.1%	0.8 (0.16)	10	2.2%	0.66 (0.18)
unable to do	8	0.5%	0.56 (0.2)	6	1.3%	0.65 (0.11)
Activities			**P = 0.000**			**P = 0.000**
without any difficulty	1484	94.6%	0.90 (0.12)	263	58.1%	0.87 (0.12)
with some difficulty	60	3.8%	0.76 (0.15)	127	28.0%	0.8 (0.14)
with much difficulty	13	0.8%	0.67 (0.17)	36	7.9%	0.72 (0.15)
unable to do	11	0.7%	0.59 (0.21)	27	6.0%	0.65 (0.21)

Note: Subgroups were compared by ANOVA tests.

We observed also lower ICECAP-A/-O index scores in the presence of self-reported MSK diagnosis than in its absence. Regression analysis revealed that HAQ-DI score was a significant determinant of the ICECAP-A/-O index scores indicating that physical functioning plays substantial role in capability wellbeing. Nonetheless, HAQ-DI score (physical functioning) was no longer significant when it was controlled for the EQ-5D-5L (general health status).

To the best our knowledge, this has been the first study to assess MSK health and capability wellbeing of adults in a sample representative for the general population. It has also been the first to analyze the associations of the HAQ-DI functional disability measure with the ICECAP-A and ICECAP-O capability wellbeing measures.

Before we discuss our findings in the light of the available literature, some limitations of our study have to be noted. The prevalence of MSK health problems was low in the age group 18–64, which needs to be considered when interpreting the ICECAP-A results. We collected self-reported data, therefore we could not compare participants' responses with medical records to check their validity. This drawback is especially relevant for the self-reported diagnosis, which might be influenced by various individual factors such as socio-demographics, physical and mental health status. We reached only few respondents in the worst MSK health states, hence further targeted studies are needed to test this relationship for the most severe cases. We used UK values to calculate ICECAP-A and ICECAP-O index scores as these were the only available value sets at the time of the study. Similarly, the tariffs of UK and England were used to calculate the EQ-5D-3L and EQ-5D-5L index scores, respectively, although there has been some controversy about this latter (NICE, 2019; van Hout et al., 2020). We used the alternative scoring method of HAQ-DI due to its simplicity and common use in clinical practice (Ornbjerg et al., 2020). The cross-sectional design of the study did not allow us to assess the measures in terms of responsiveness to changes. These shortcomings are suggested to be addressed in future studies.

In previous ICECAP-A/-O studies involving (partially representative or) selected samples of the general population, physical functioning was assessed by functional independence measures or was approached by generic health status measures. Hackert et al. found moderate correlation between ICECAP-O and the Barthel Index in an online survey among the elderly general population of the UK and in a sample of social care users (Hackert et al., 2017, 2019). Makai et al. reported strong correlation between the Instrumental Activities of Daily Living (IADL) scale and the ICECAP-O index scores in a group of post-hospitalised older people in the Netherlands (Makai et al., 2013). Our findings with the HAQ-DI measure support the partial overlap and complementarity between physical functioning and capability wellbeing. The literature is far richer regarding the associations between the ICECAP-A/-O and the EQ-5D-3L/-5L among the general public (Afentou and Kinghorn, 2020; Proud et al., 2019; Cleland et al., 2019). Our results on the relationship between the ICECAP-A/-O and the 'mobility' domain and index scores of the EQ-5D-3L/-5L are in line with and strengthen the results of precedent studies.

The ICECAP-A/-O have been used in relatively few MSK disorders (falls prevention cohort, knee/hip osteoarthritis, hip fracture, arthritis as a diagnosis group) (Mitchell et al., 2013, 2015; Davis et al., 2012, 2013, 2015, 2017; Parsons et al., 2014; Keeley et al., 2015, 2016; Williams et al., 2016; Milte et al., 2018). Only some of them analyzed their associations with condition-specific measures. Mitchell et al. (2013) explored the predictive ability of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) in relation to capability wellbeing (ICECAP-O), involving a group of patients with knee or hip osteoarthritis (Mitchell et al., 2013). Like the HAQ-DI in our survey, the WOMAC showed significant association with the ICECAP-O. However, the 'Attachment' ICECAP-O domain showed no significant relationship with any WOMAC category, just as in our sample the 'Attachment' domain showed the weakest correlation with the HAQ-DI score. Mitchell et al. (2015) highlighted that severity level of arthritis (as measured by the Arthritis Impact Measurement Scales 2–Short Form) was a decisive factor in the deterioration of capabilities (ICECAP-A) (Mitchell et al., 2015). In our survey, the worsening of ICECAP-A/-O by HAQ-DI levels seems to support the importance of disease severity in relation to

Table 3
Spearman's correlations between HAQ-DI and ICECAP-A/-O domains and index scores.

Correlations, age-group 18–64	ICECAP-A. Stability	ICECAP-A. Attachment	ICECAP-A. Autonomy	ICECAP-A. Achievement	ICECAP-A. Enjoyment	ICECAP-A index score
HAQ dressing	−0.197	−0.147	−0.178	−0.203	−0.164	−0.217
HAQ arising	−0.190	−0.143	−0.162	−0.230	−0.164	−0.228
HAQ eating	−0.118	−0.089	−0.124	−0.147	−0.083	−0.149
HAQ walking	−0.208	−0.122	−0.158	−0.216	−0.144	−0.223
HAQ hygiene	−0.194	−0.145	−0.167	−0.238	−0.173	−0.235
HAQ reach	−0.215	−0.153	−0.167	−0.242	−0.182	−0.247
HAQ grip	−0.150	−0.097	−0.145	−0.152	−0.134	−0.161
HAQ activity	−0.244	−0.130	−0.178	−0.236	−0.181	−0.255
HAQ-DI index score	−0.282	−0.184	−0.208	−0.284	−0.222	−0.303
Correlations, age-group 65 and over	ICECAP-O Attachment	ICECAP-O Security	ICECAP-O Role	ICECAP-O Enjoyment	ICECAP-O Control	ICECAP-O index score
HAQ dressing	−0.225	−0.316	−0.433	−0.304	−0.364	−0.403
HAQ arising	−0.249	−0.284	−0.390	−0.290	−0.343	−0.396
HAQ eating	−0.191	−0.261	−0.345	−0.294	−0.270	−0.335
HAQ walking	−0.205	−0.316	−0.421	−0.298	−0.367	−0.418
HAQ hygiene	−0.229	−0.309	−0.438	−0.342	−0.337	−0.433
HAQ reach	−0.194	−0.2096	−0.372	−0.318	−0.316	−0.390
HAQ grip	−0.168	−0.235	−0.300	−0.264	−0.296	−0.326
HAQ activity	−0.184	−0.331	−0.404	−0.327	−0.332	−0.429
HAQ-DI index score	−0.252	−0.373	−0.489	−0.387	−0.400	−0.496

Note: for all correlations, P = 0.0000.

capabilities. Taking medicine for MSK problems (which can be considered as a rough proxy indicator of disease severity) was associated also with worse ICECAP-A/-O scores in most of the cases. Hence it is worthwhile investigating further by using condition-specific measures to define how disease severity can shape capability wellbeing in different MSK disorders.

With the exception of one study (Mitchell et al., 2013), the EQ-5D was applied alongside the ICECAP-A/-O in the MSK studies and the complementarity of these measures have been proved. Also, it has been revealed that the relationship between change in health status (EQ-5D) and change in capabilities (ICECAP-A/-O) is not straightforward and may vary substantially across MSK patient groups (Parsons et al., 2014; Davis et al., 2015; Keeley et al., 2015). However, all but one (Mitchell et al., 2015) studies used the EQ-5D-3L version. Moreover, analyses on the EQ-5D domains' level was reported only in one MSK study (Milte et al., 2018). Therefore, our research has been an important step towards filling the knowledge gap about the relationship between the EQ-5D-5L version and ICECAP-A/-O measures in the context of MSK health.

Regarding the generalizability of our results, we believe that our findings cannot be transferred to other jurisdictions without adjustments as the health status of the general population varies significantly across countries (Janssen et al., 2019; Zrubka et al., 2019). Rather than involving well-defined patient groups, we focused on self-reported MSK health status, hence the generalizability of our data about specific MSK diseases should be investigated in future studies. This is particularly relevant in age group 18–64 where the rate of individuals with MSK problems was low. We would especially be interested in matching our results to studies in rheumatoid arthritis where the HAQ-DI is a core measure.

Our results have important implications for clinical practice and health economic evaluations alike. The ICECAP-A/-O capture important additional aspects of quality of life (e.g. attachment) that would remain invisible for the HAQ-DI. Moreover, the moderate associations with the EQ-5D-5L indicate that the ICECAP-A/-O alone may not entirely cover all aspects of health. Therefore, the use of additional physical functioning and health status measures alongside the ICECAP-A/-O is recommended to assess disease burden or treatment effects. Caution is required when using HAQ-DI for estimating capability wellbeing scores in the lack of measured ICECAP-A/-O data and, if available, it is preferable to use the EQ-5D-5L for the estimations.

5. Conclusions

Our study confirmed that MSK health problems could play a significant role in the capability wellbeing of individuals. The use of ICECAP-A/-O, in addition to the physical functioning and health status measures is encouraged to get a broader picture of the burden of MSK diseases and effectiveness of interventions. Our results in terms of the self-reported MSK problems of the general population are encouraging for those interested in using the ICECAP-A/-O instruments in MSK diseases. Disease-specific studies are much needed to explore the determinants of capability wellbeing across diverse MSK conditions.

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Ethics approval

All human and animal studies have been approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The Scientific and Ethical Committee of the Medical Research Council of Hungary has approved the research protocol (10058–3/2019/EKU).

Consent to participate

All persons gave their informed consent prior to their inclusion in the study.

Availability of data and material

The data underlying this article will be shared on reasonable request to the corresponding author.

Authors contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Márta

Table 4
Mean ICECAP-A/-O and HAQ-DI scores by self-reported mobility problems and musculoskeletal diagnoses.

	Age-group 18–64 years				Age-group 65 years and over			
	N	%	**ICECAP-A score, mean (S.D.)**	**HAQ-DI index score, mean (S.D.)**	N	%	ICECAP-O, mean (S.D.)	**HAQ-DI index score, mean (S.D.)**
Self-reported mobility problems								
Difficulty in walking 500 m on level ground without the use of any aid			**P = 0.000**	**P = 0.000**			**P = 0.000**	**P = 0.000**
No difficulty	1449	92.5%	0.91 (0.11)	0.01 (0.07)	222	49.1%	0.88 (0.12)	0.09 (0.21)
Some difficulty	76	4.9%	0.75 (0.17)	0.36 (0.43)	158	35.0%	0.81 (0.13)	0.56 (0.44)
A lot of difficulty	23	1.5%	0.66 (0.21)	1.02 (0.8)	54	11.9%	0.69 (0.18)	1.09 (0.74)
Unable to do	19	1.2%	0.77 (0.22)	0.69 (1.19)	18	4.0%	0.71 (0.25)	1.6 (0.79)
Difficulty in walking up or down 12 steps			**P = 0.000**	**P = 0.000**			**P = 0.000**	**P = 0.000**
No difficulty	1420	90.6%	0.91 (0.11)	0.01 (0.07)	202	44.6%	0.89 (0.12)	0.19 (0.01)
Some difficulty	93	5.9%	0.79 (0.17)	0.23 (0.33)	149	32.9%	0.82 (0.12)	0.4 (0.03)
A lot of difficulty	42	2.7%	0.68 (0.19)	0.77 (0.75)	83	18.3%	0.73 (0.16)	0.66 (0.07)
Unable to do	12	0.8%	0.71 (0.24)	1.14 (1.34)	19	4.2%	0.68 (0.25)	0.86 (0.2)
EQ-5D-3L: Mobility (walking around)			**P = 0.000**	**P = 0.000**			**P = 0.000**	**P = 0.000**
No problems	1386	88.6%	0.75 (0.18)	0.01 (0.05)	178	39.4%	0.9 (0.09)	0.21 (0.02)
Some problems	176	11.2%	0.51 (0.23)	0.35 (0.55)	271	60.0%	0.79 (0.16)	0.63 (0.04)
Confined to bed	3	0.2%	0.89 (0.13)	2.92 (0.14)	3	0.7%	0.51 (0.37)	0.07 (0.04)
EQ-5D-5L: Mobility (walking around)			**P = 0.000**	**P = 0.000**			**P = 0.000**	**P = 0.000**
No	1362	87.0%	0.92 (0.1)	0.01 (0.05)	152	33.6%	0.9 (0.1)	0.18 (0.01)
Slight problems	138	8.8%	0.79 (0.16)	0.19 (0.37)	166	36.6%	0.84 (0.11)	0.41 (0.03)
Moderate problems	40	2.6%	0.68 (0.18)	0.41 (0.45)	97	21.4%	0.77 (0.17)	0.56 (0.06)
Severe problems	24	1.5%	0.65 (0.22)	1.16 (0.98)	37	8.2%	0.62 (0.19)	0.66 (0.11)
Unable to walk	1	0.1%	0.37 (0)	0.01 (0.05)	1	0.2%	0.88 (0)	konstant
Self-reported musculoskeletal diagnosis in the past* 12 months *or currently								
Low back disorder or other chronic back defect			**P = 0.000**	**P = 0.000**			**P = 0.000**	**P = 0.000**
No	1125	71.7%	0.92 (0.1)	0.03 (0.21)	178	39.3%	0.87 (0.14)	0.5 (0.04)
Yes, but not diagnosed	254	16.2%	0.87 (0.14)	0.03 (0.2)	92	20.3%	0.83 (0.15)	0.51 (0.05)
Diagnosed but no medicine	47	3.0%	0.86 (0.14)	0.04 (0.11)	29	6.4%	0.83 (0.13)	0.54 (0.1)
Diagnosed and medicine	142	9.1%	0.78 (0.17)	0.26 (0.5)	154	34.0%	0.78 (0.15)	0.67 (0.05)
Neck disorder or other chronic neck defect			**P = 0.000**	**P = 0.000**			**P = 0.007**	**P = 0.000**
No	1313	83.7%	0.91 (0.11)	0.04 (0.22)	317	70.0%	0.84 (0.15)	0.55 (0.03)
Yes, but not diagnosed	175	11.2%	0.85 (0.16)	0.04 (0.14)	55	12.1%	0.84 (0.14)	0.47 (0.06)
Diagnosed but no medicine	22	1.4%	0.82 (0.14)	0.20 (0.53)	13	2.9%	0.80 (0.09)	0.69 (0.19)
Diagnosed and medicine	58	3.7%	0.73 (0.2)	0.39 (0.63)	68	15.0%	0.77 (0.14)	0.72 (0.09)
Arthrosis of the hip			**P = 0.000**	**P = 0.000**			**P = 0.000**	**P = 0.000**
No	1363	86.9%	0.90 (0.12)	0.03 (0.16)	307	67.8%	0.84 (0.14)	0.53 (0.03)
Yes, but not diagnosed	146	9.3%	0.88 (0.14)	0.06 (0.33)	47	10.4%	0.85 (0.16)	0.52 (0.08)
Diagnosed but no medicine	12	0.8%	0.80 (0.20)	0.26 (0.65)	14	3.1%	0.76 (0.2)	0.76 (0.2)
Diagnosed and medicine	47	3.0%	0.71 (0.2)	0.61 (0.79)	85	18.8%	0.77 (0.15)	0.64 (0.07)
Arthrosis of the knee			**P = 0.000**	**P = 0.000**			**P = 0.005**	**P = 0.000**
No	1315	83.9%	0.91 (0.11)	0.03 (0.2)	280	61.8%	0.84 (0.14)	0.54 (0.03)
Yes, but not diagnosed	156	9.9%	0.86 (0.15)	0.08 (0.37)	45	9.9%	0.85 (0.18)	0.34 (0.05)
Diagnosed but no medicine	31	2.0%	0.83 (0.18)	0.14 (0.37)	22	4.9%	0.76 (0.22)	0.61 (0.13)
Diagnosed and medicine	66	4.2%	0.79 (0.17)	0.30 (0.52)	106	23.4%	0.80 (0.14)	0.69 (0.07)
Osteoporosis			**P = 0.000**	**P = 0.000**			**P = 0.000**	**P = 0.000**
No	1386	88.4%	0.90 (0.12)	0.05 (0.24)	339	74.8%	0.84 (0.14)	0.52 (0.03)
Yes, but not diagnosed	144	9.2%	0.87 (0.15)	0.04 (0.19)	42	9.3%	0.86 (0.14)	0.36 (0.06)
Diagnosed but no medicine	7	0.4%	0.81 (0.18)	0.18 (0.34)	11	2.4%	0.76 (0.18)	0.60 (0.18)
Diagnosed and medicine	31	2.0%	0.72 (0.2)	0.39 (0.64)	61	13.5%	0.75 (0.17)	0.79 (0.1)

Note: Subgroups were compared by ANOVA tests.

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Declaration of competing interest

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Appendix A. Supplementary data

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