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Methodological challenges in harmonisation of the variables used as indicators of social capital in epidemiological studies of ageing – results of the ATHLOS project

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Abstract

The present article aims to highlight methodological aspects related to understanding and conceptualising social capital for the purposes of population research as well as describing the key challenges in the harmonisation process of indicators of social capital. The study was conducted in the frame of the Ageing Trajectories of Health: Longitudinal Opportunities and Synergies (ATHLOS) project. After a review of social capital theories developed in social science and a subsequent review of the documentation of 18 international cohorts, decision trees of the harmonisation of social variables were developed. The known-group validity was verified. The results focused on generalised trust, civic engagement and social participation are presented. The summary of the availability of any indicators of these concepts is classified in seven domains (generalised trust, political participation, religious participation, senior-specific participation, participation in sport groups, participation in volunteer/charity group activities, any participation) across surveys. The results of the analysis for known-group validity support the construct validity of the harmonised variables.

Keywords: social capital; harmonisation; cohort studies; generalised trust; civic engagement; social participation

Introduction

No discussion about the patterns of healthy ageing can be considered complete without social determinants of health and wellbeing in ageing populations. Among these social determinants, social capital is frequently cited. In recent years, there has been increased interest in research on the health impact of social capital and a growing body of studies has demonstrated that this factor is positively related to health and wellbeing, especially in older people. Social capital in later life is considered a health resource (in the context of social aspects of healthy ageing; Nyquist and Forsman, 2015) and evidence suggests that different forms of this capital (*i.e.* social participation/informal social networks, social engagement, cognitive social capital: generalised trust, *etc.*) are positively related to self-rated health (*e.g.* Nummela *et al.*, 2008; Ichida *et al.*, 2009; Giordano *et al.*, 2012; Koutsogeorgou *et al.*, 2015; Boen *et al.*, 2020; Pan and Wu, 2020; Kim *et al.*, 2021), physical and social wellbeing (*e.g.* Cramm *et al.*, 2012; Boen *et al.*, 2020) as well as mental wellbeing (*e.g.* Nyqvist *et al.*, 2013; Chipps and Jarvis, 2016; Yu *et al.*, 2018). Social capital has significant impact on mental health in vulnerable groups, *e.g.* on mental wellbeing in recently widowed men living alone. It was observed that community-level civic participation moderated the association between depressive symptoms and recent widowhood, as well as living alone among men (Nakagomi *et al.*, 2020). In the same study, community-level civic participation was associated with lower depressive symptoms in both men and women. Community-level informal socialising and social participation buffered the negative impact of natural disaster on cognitive decline (Hikichi *et al.*, 2020). A recent study indicated that social capital can play an important role in sustaining and improving mental health in older people during the COVID-19 pandemic (Sun and Lu, 2020). Participation in social activities was found to explain the link between financial wellbeing and life satisfaction (Yeo and Lee, 2019). Studies have demonstrated that the level of social capital is a predictor of psychiatric medication prescription (Sundquist *et al.*, 2014) and that lack of social capital is significantly associated with depression and psychological distress (Forsman *et al.*, 2011). According to Bai *et al.* (2020), older people with higher levels of social capital have a smaller chance of developing depression. Low social capital at the community level was proven to be a determinant of poor quality of life (Nilsson *et al.*, 2006), while neighbourhood social capital was significantly associated with an older person's good quality of life (Lane *et al.*, 2020).

However, the strength of this evidence varies with differences in conceptualisation and measurements of the variable under study (Yip *et al.*, 2007). It must be noted that the term 'social capital' often serves as an umbrella concept, embracing social cohesion, social support, social integration and social participation in the studies analysing determinants of health in general, and mental wellbeing in particular (Almedom, 2005). As Alvarez and Romani noted:

a unified definition of social capital upon which all scholars agree is not available to date. Instead, multiple definitions, distinct dimensions and subtypes of social capital have been used to investigate and theorize about its relationship to health, creating a confusing landscape. (Alvarez and Romani, 2017: 57)

In empirical studies, social capital has been understood and measured according to a number of criteria based on more or less sophisticated theoretical models. Social capital is thus conceptualised (and operationalised) as a composition of social participation, social support, social connection, trust, cohesion and reciprocity (Bai *et al.*, 2020) or organisational membership, trust, reciprocity and mutual help (Yip *et al.*, 2007), as a combination of social participation/engagement and trust (Nummela *et al.*, 2008; Boen *et al.*, 2020) or social cohesion and associational membership (Lane *et al.*, 2020), informal social network and generalised trust (Koutsogeorgou *et al.*, 2015), civic participation and neighbourhood attachment (Gray, 2009), participation in common activities in the neighbourhood, *etc.* (neighbourhood capital), support from others, citizenship activities and trust (Cramm *et al.*, 2012), and social activities, contacts, support, pet ownership, loneliness (*i.e.* 'personal social capital'), quality of area, safety of area, problems of area and neighbourliness of area (*i.e.* 'neighbourhood social capital'; Bowling *et al.*, 2006). Social capital is sometimes identified (or partly identified) with the possession of social network, like in the study of Chipps and Jarvis (2016) measuring its impact on the mental wellbeing of older people residing in a residential care facility, where social capital was measured through network structure and dynamics (social connectedness, support, self-efficacy and trust). Some authors take into account the composition of the social network (*e.g.* in terms of homogeneity: links between community members whose social identities are similar *versus* connections between community members with differing status and power) (Kim *et al.*, 2021) and reciprocal exchanges of social support within the network (Yeo and Lee, 2019). Some of researchers are focused solely on trust as an indicator of social capital (Pan and Wu, 2020). Moreover, as Abbott (2010) noted, many studies take a rather simplistic view of social participation (an important component of social capital), failing to identify its different types, with various possible impacts on health (*e.g.* voting, organised activities designed to produce collective benefits, such as voluntary work, organised activities producing benefits for individuals, organised and informal leisure activities, *etc.*). It also seems that some of the social capital research has inadequately captured the difference between the macro level (context) and the micro (individual) level.

Theory of social capital

In the scientific literature, social capital is conceptualised as a resource possessed by an individual or by a group or society and could be defined as the good that is available to both individuals and communities through membership of social networks (Alvarez and Romani, 2017) and social participation (Nguyen *et al.*, 2020). Contemporary reflection on social capital is rooted in the sociological works of Pierre Bourdieu (1985), James Coleman (1988, 1990), Robert Putnam, Robert Leonardi and Raffaella Nanetti (Putnam *et al.*, 1993), Robert Putnam (2000) and Francis Fukuyama (2000). There are significant differences in their approaches to the analysed phenomenon. Definitions can be divided into structural (Bourdieu), functional (Coleman) and the paradigm of collective action, co-operation and network of connections (Fukuyama, Putnam). Perhaps the most widely cited (Cramm *et al.*, 2012), often adapted for the needs of empirical studies (*e.g.* Yeo and Lee,

2019; Lane *et al.*, 2020, Kim *et al.*, 2021, *etc.*) and useful in the context of health and ageing research (Coll-Planas, 2016), is the concept of Putnam *et al.* (1993) and Putnam (2000) – and that is the reason why the empirical operationalisation of social capital in the presented paper leans towards this seminal concept.

In Putnam's theory, social capital is a feature attributed not to individuals but to social groups, including local communities. Putnam analysed this phenomenon in the context of civil society. In his approach, social capital is based on the sum of trust that the members of the community have for each other and the level of individuals' membership of associations is an indicator of social capital (Putnam *et al.*, 1993; Putnam, 2000). Social capital is thus impossible without trust and voluntary participation. As regards social groups/associations, participation in primary (family, peer groups, local communities, neighbourhoods), secondary and tertiary groups were analysed by Putnam. Tertiary groups are forms of mass, top-down, non-local organisations, created from above, functioning supra-locally; such associations are not based on direct relationships between individuals and the main form of activity is, for example, paying fees. Secondary associations are the bottom-up groups that are goals for themselves, based on face-to-face contacts. Such associations, unlike tertiary organisations, play a major role in creating so-called bridging social capital (*i.e.* one of the forms, along with bonding social capital, distinguished by American sociologists), as they bring individuals of different characteristics together. Analysing social capital in his book entitled *Bowling Alone*, Putnam (2000) emphasised that religious organisations were a treasury of this type of resource in American society. In the same book, analysing the erosion of social capital in American society, Putnam emphasised the replacement of the older civic generation (the Second World War generation, with high patriotism and civic engagement) by baby-boomers and later generations, less civically engaged than the predecessors.

Among the types of trust, 'thick' trust, which is embedded in personal relationships, and 'thin' (generalised) trust (*i.e.* trust in the unknown) are distinguished. The latter is crucial in the context of building social capital (Putnam, 2000).

Trust, which can be defined as a belief in reciprocation by others, is a necessary feature of social relations that facilitates interactions between people, is the lubricant of co-operation (Putnam, 2000) and is considered (*i.e.* the generalised trust, that is the expectation of others' trustworthiness or ethical assumption that other people share your fundamental values; Uslander, 2008) to be a key component of cognitive social capital. Mistrust is not necessarily an exact opposition for trust – it increases with the erosion of certain moral principles of trust (*e.g.* keeping one's word, speaking the truth, being loyal, *etc.*). When people think that the moral principles do not function properly in a community, they become mistrusting. Social trust is reciprocal. Reciprocity, another important component of cognitive social capital, could be defined as the willingness to help others, with or without the expectation that the help will be paid back (Hyypä, 2010).

As regards generalised trust, Sztompka (1997) has made a distinction between the cultures of trust and mistrust (distrust). He argues that the culture of trust liberates and mobilises human agency by releasing creative, innovative activism. At the same time, trust lowers the transaction costs and increases the chance for co-operation. Endowing others with trust evokes positive actions towards them

and interactions with those we trusted in are free from anxiety, suspicion and watchfulness, and are more spontaneous, with no necessity to monitor and control every move of others. Moreover, the culture of trust encourages tolerance and acceptance of strangers, as well as increases sociability and social participation in various forms of associations, enriching the network of personal ties. Additionally, the culture of trust strengthens the bond of the individual with the community and contributes to collective solidarity leading to reciprocal help. Analysing the consequences of distrust, Sztompka (1997) emphasised that the generalised climate of suspicion and cynicism, *i.e.* the culture of distrust, hampers the proper functioning of society through paralysing human agency, erodes social capital leading to social isolation, breakdown of associations and decay of interpersonal networks, mobilises prejudice and xenophobia, *etc.*, and increases the transaction costs due to the necessity of constant vigilance.

Measurements of social capital

Putnam (2000) suggested that, along with the level of generalised trust, membership of voluntary groups or the number of such groups in a society is also a reliable indicator of social capital. Additionally, he suggested taking participation in elections into account. High social capital means that many people will be associated with voluntary groups for various common and individual goals, as well as take active part in public life through participation in elections. Fukuyama (2000) suggested analysing the number of members of voluntary groups in a society in relation to the total population.

As mentioned above, depending on the theoretical approach, both individuals and communities are considered to be the holders of social capital. If an individual is recognised as an owner of the capital, the research interests are focused on the level of capital that an individual actor has at his or her own disposal as a consequence of social participation, belonging to social network(s), having social contacts (structural dimension of social capital), but also on trust (generalised and in institutions) and norms (reciprocity, solidarity, togetherness, sense of belonging and community, *etc.*) (Hyypä, 2010).

If a community is recognised as the owner of social capital (the collective-level social capital), then indicators such as aggregate figures of membership, volunteerism, voting, social contacts, *etc.* (the structural dimension of social capital), along with social trust and norms (aggregate figures of democratic attitudes, social cohesion, *etc.* – the cognitive dimension of social capital) are analysed. Additionally, differences in the level of social capital between various communities (regions, nations, societies) are evaluated (Hyypä, 2010). Data to assess community-level social capital are typically derived from official statistics, register data, polls, surveys and other existing sources of statistical figures, that are usually not originally aimed at studying social capital. Datasets used for measuring and studying social capital (as in the case of the Ageing Trajectories of Health: Longitudinal Opportunities and Synergies (ATHLOS) project) have been usually compiled for other purposes, which make their application in social capital and health research complicated. Hyypä (2010) emphasises that there are some problems with aggregating figures to capture community-level social capital. First of all, figures must be investigated

against data describing the opinions, feelings and behaviours of the individuals under study. The cognitive dimension of social capital is difficult to present in aggregate figures and the compilation of such figures on the norms of trust and reciprocity may require anthropological, qualitative studies evaluating civic norms and values.

In empirical studies social trust is typically measured by the question: ‘Generally speaking, would you say most people can be trusted?’ and mistrust is assessed by the question: ‘Do you think most people would try to take advantage of you, if they got a chance?’ Reciprocity is often mixed with altruism (*i.e.* volunteering is mistakenly seen as an expression of reciprocity) and although it is the core component of social capital, it is rarely measured. In those studies where it is evaluated, it is assessed by inquiring about the willingness to help other people in general (or neighbours in particular). In some cultures, reciprocity can be more complicated to operationalise and measure, and researchers should keep in mind that they should take into account this context (Hyyppä, 2010).

According to Halpern (2005), what we call social capital at the macro-social level manifests itself as a culture of trust and civic engagement. At the mezzo-social level, social capital is primarily associated with voluntary membership of groups and associations and a high level of social participation among members of a local community. At the micro-social level, social capital manifests itself in the presence of informal social networks, relationships with others based on trust and social support – this is the level of direct relationships between individuals.

Aim

The present article aims to highlight some methodological aspects related to understanding and conceptualising social capital for the purposes of population research. Potential indicators of social capital available in epidemiological studies of ageing analysed within the ATHLOS project are reviewed against the background of social capital theories developed in social science (especially in sociology).

This is one of papers comparing different indicators of social variables across epidemiological surveys and describing the key challenges in the harmonisation process of these variables. This article is focused on three indicators of social capital: (a) trust (generalised), (b) civic engagement (*i.e.* participation in public life through either voting in elections or political activity), and (c) social participation (*i.e.* participation in secondary groups/associations, referring to Putnam’s terminology). The created variables aim to enable comparative research, which allows testing of the cross-national determinants of healthy ageing.

Study design and sampling

The study was conducted to fulfil one of the aims of the ATHLOS project. In general, the goal of the project was to achieve better understanding of the impact of ageing on health, by analysing the determinants of healthy ageing trajectories. To achieve this result, data from 18 international cohorts were harmonised and integrated to create one large dataset. Systematic harmonisation methodology and tools provided by Maelstrom Research were used (Fortier *et al.*, 2016). The

harmonised dataset included around 170 variables classified in ten main domains. The area of interest – *social environment and life events* – includes 27 variables that can be considered determinants of healthy ageing. This domain includes indicators of social capital along with stressful life events. The detailed description of the project and its general challenges were described in a paper published previously (Sanchez-Niubo *et al.*, 2019). The documentation of the harmonisation algorithms is publicly available at <https://github.com/athlosproject/athlos-project.github.io/>.

Construct validity

To determine known-group validity based on the literature review the following hypotheses were tested. It was expected that

- (1) People with a higher level of education more frequently report trust in people than those with a lower educational level (Nannestad, 2008; Huang *et al.*, 2011; Borgonovi, 2012).
- (2) People with poorer self-rated health and the oldest old (85+) less frequently report participation in any political activity in comparison to those with good health and those aged 65–74 or 75–84 (Blakely *et al.*, 2001; Lee *et al.*, 2008; Ichida *et al.*, 2013).
- (3) Women are more likely to participate in religious activities than men in Christian-majority countries (Voas *et al.*, 2013; Murphy, 2016).
- (4) People with poorer self-rated health and the oldest old (85+) are less likely to report participation in sport activities in comparison to those with good health and those aged 65–74 or 75–84 (Scheerder *et al.*, 2005).
- (5) People with poorer self-rated health and the oldest old (85+) are less likely to participate in volunteer/charity group activities in comparison to those with good health and those aged 65–74 or 75–84; also respondents with a higher level of education are more likely to report participation in volunteer/charity group activities than those with a lower educational level.
- (6) People with poorer self-rated health and the oldest old (85+) are less likely to report any form of participation in comparison to those with good health and those aged 65–74 or 75–84.

To verify the hypotheses, the distribution of harmonised variables across demographic or health characteristics was compared within each cohort and wave of the study using chi-square tests.

Results

After a review of social capital theories and a subsequent review of the documentation of all cohorts, results focused on generalised trust, civic engagement and social participation are presented. The summary of the availability of any indicators of these concepts classified in seven domains (generalised trust, political participation, religious participation, senior-specific participation, participation in sport groups, participation in volunteer/charity group activities, any participation) across surveys is presented in [Table 1](#).

Table 1. Summary of concepts measured in each survey

Domain and sub-domain	10/66	ALSA	CHARLS	COURAGE	ELSA	HAPIEE	HEALTH2000	JSTAR	KLOSA	MHAS	SAGE	SHARE	TILDA	LASI
Generalised trust	–	–	–	+	+	+	+	+	–	–	+	+	–	+
Political participation:														
General political activity	–	–	–	+	+	–	–	+	+	–	+	+	–	–
The act of voting	–	–	–	+	+	–	–	–	–	–	+	–	+	+
Religious participation	+	+	–	+	+	–	+	+	+	+	+	+	+	+
Senior-specific participation	–	+	–	+	–	–	–	+	–	–	–	–	–	–
Participation in sport groups	–	+	–	+	+	–	–	+	–	–	–	–	–	–
Participation in volunteer/charity group activities	–	+	+	+	+	–	–	+	+	+	+	+	+	–
Any participation	+	+	+	+	+	+	–	+	+	–	+	+	+	+

Notes: 10/66: 10/66 Dementia Research Group. ALSA: Australian Longitudinal Study of Ageing. CHARLS: China Health and Retirement Longitudinal Study. COURAGE: Collaborative Research on Ageing in Europe. ELSA: English Longitudinal Study of Ageing. HAPIEE: Health, Alcohol and Psychosocial Factors in Eastern Europe. HEALTH2000: Finnish Health 2000 Survey. JSTAR: Japanese Study of Aging and Retirement. KLOSA: Korean Longitudinal Study of Aging. LASI: Longitudinal Aging Study in India. MHAS: Mexican Health and Aging Study. SAGE: Study on Global Ageing and Adult Health. SHARE: Survey of Health, Ageing and Retirement in Europe. TILDA: The Irish Longitudinal Study on Ageing. There were no considered concepts of social participation in the ATTICA, The Study on Nutrition and Cardiovascular Risk in Spain (ENRICA), United States Health and Retirement Study (HRS) and Uppsala Birth Cohort Multigenerational Study (UBCoS) surveys.

Generalised trust

The operationalisation of the definition of generalised trust was *social trust in other members of the society, not counting relatives and close friends*.

Eight out of 18 cohorts provided some items (mostly one item) eligible for the harmonisation process, *i.e.* COURAGE (see Table 1 for the full survey names), ELSA, HAPIEE, HEALTH2000, JSTAR, SAGE, SHARE and LASI (see online supplementary material 1, Table 1).

In general, items related to trust in the analysed cohorts can be divided into two groups. The first one concerns items asking about trust in most people, with no further information on how the group of 'most people' should be understood. The second group of items also asked about trust in 'most people', but in order to specify how this group should be understood, additional information about the narrower understanding of 'most people' as people in the neighbourhood or local area was added.

The COURAGE, SAGE and SHARE studies belonged to the first group, and included the following question: 'Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?' In COURAGE and SAGE there were two response options: *can be trusted* and *can't be trusted/can't be too careful*. In SHARE, study participants were asked about the rating on the scale from 0 to 10, where 0 means *can't be too careful* and 10 means that *most people can be trusted*. The middle value of the response scale is 5 and it was assumed as a neutral response. Thus, it was decided to recode values from 6 to 10 into the category *can be trusted* in the harmonised variable.

HEALTH2000 also measured trust in regard to all people, asking about the degree of agreement with the sentence 'It is better not to trust anyone'. There was a four-point response scale ranging from *agree* to *disagree*. Finally, HAPIEE asked about trust in people in general ('Do you think that you can trust people?') with a five-point response scale ranging from *always* to *never*. Those who reported that they trust people at least sometimes were classified as those who trust in people in the harmonised variable.

The second group embraced the ELSA, JSTAR and LASI studies. In the first case, respondents were asked about feelings related to the local area, defined as 'everywhere within a 20-minute walk or about a mile of the home'. Then the subjects reported their level of trust on a seven-point scale ranging from *most people in this area can be trusted* (marked as 1) to *most people in this area can't be trusted* (marked as 7). In the JSTAR, respondents were asked about trust in their neighbours ('Do you think you can trust most of the people who live near you?') with *yes/no* answers. Finally, LASI asked 'Can people in your neighbourhood be trusted?' Similarly to SHARE, in ELSA the middle value (4) was considered neutral. Values from 1 to 3 were recoded to the category indicating those who trust in people.

Additionally, in the case of COURAGE and SAGE, there were also questions about trust in people in the neighbourhood: 'Generally speaking, would you say that you can trust people in your neighbourhood?' The five-point Likert response scale ranging from *to a very great extent* to *to a very small extent* was used. These variables might be used to create a harmonised variable which is related to the second aforementioned group together with the ELSA and JSTAR studies.

Figure 1 shows the scheme of decisions taken to create the harmonised variable *trust*. The possibility of creating a harmonised variable with an ordinal rating scale is also shown.

The assessment of known-group validity showed that in most cases the expected association reached statistical significance, which supported the overall validity of the harmonised general trust variable (see online supplementary material 2, Table 1).

Political participation (indicator of civic engagement)

Operationalisation of the definition of political participation for the purpose of the harmonisation process was: *any political activity (voting, membership of a political organisation, etc.)*.

The review of the surveys' questionnaires showed that three aspects of political participation were measured: voting, membership of any political organisation or participation in any political activity (see online supplementary material 1, Tables 3a and 3b).

Information about voting was available for five studies: ELSA, TILDA, SAGE, COURAGE and LASI. ELSA and TILDA asked if the respondent voted in the general election. The SAGE and COURAGE questionnaires had items concerning state, national or presidential elections and, more precisely, using country-specific terms, LASI asked 'Did you vote in the last panchayat/municipal/assembly/parliament elections?' Items about the act of voting were built in a comparable way (see online supplementary material 1, Table 3a). The harmonised variable (*pol_vot*) assessed whether the respondent voted in the last political election.

Membership of any political organisation was measured directly only in the ELSA study through the question: 'Are you a member of any of these organisations: political party, trade union or environmental groups?' In other studies the frequency of participation was assessed. The COURAGE and SAGE studies provided information on (a) attending a public meeting in which there was discussion of local or school affairs and (b) meeting a community leader during the last 12 months. Both questions had five response options (*never, once or twice per year, once or twice per month, once or twice per week, daily*). SHARE in the first two waves assessed whether respondents had taken part in a political or community organisation in the last month and then they were asked how often it was done during this time. In Waves 4 and 5, respondents were asked about the frequency of doing the aforementioned activity during the last 12 months. Two items in the KLOSA questionnaire were applicable to be the base of the harmonisation process: participating in an apolitical party/a non-governmental organisation/an interest group and then how often the respondent participated in the group with a detailed list of proposed answers (*almost every day, once a week, two or three times a week, once a month, twice a month, once or twice a year, three or four times a year, five or six times a year, almost never a year, almost never*). Two similar questions were asked in the JSTAR but in the reverse order. At first, respondents were asked about engaging in some form of activity (non-work activities with anyone other than family and friends) during the last months, then they had to clarify what kind of activity it was – and in particular the survey asked about any political

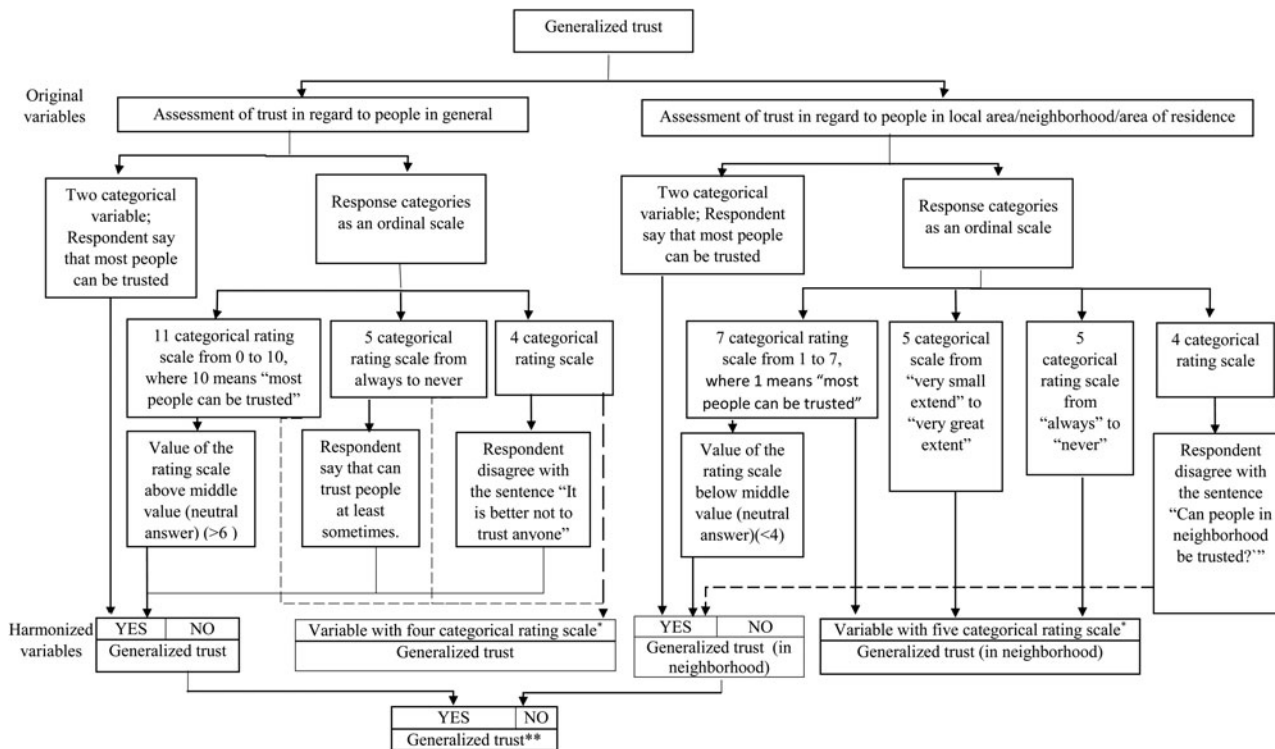


Figure 1. Decision tree of the harmonisation process of the trust variable.

Notes: *Required additional studies to link response categories, e.g. using item response theory techniques. **Created harmonised variable.

organisation with *yes/no* answers (see online supplementary material 1, Tables 3a and 3b).

As a result of the comparative analysis of the studies, the variable *pol_act* with two response categories (*yes, no*) was created, where *yes* means *being a member or participating in political activity at least once a year*.

Taking together voting, membership and active participation, the harmonised variable called *any political activity* might be defined in two ways. Firstly, as a two-category variable with *yes/no* response categories, where *yes* means participation in voting or any form of active participation in politics or being a member of any political organisation. Secondly, as a three-category variable with options: (a) only voting (respondent was neither a political organisation member nor participated in any political activity), (b) respondent was a member of a political organisation or participated in some political activity, and (c) none of the above. The scheme of creating the harmonisable variables is presented in Figure 2.

The percentage of respondents who reported participation in the last voting (*pol_vot*) or any political involvement (*pol_act*) is presented in the online supplementary material 1, Tables 4a and 4b.

The assessment of known-group validity showed that in most cases the expected association with self-rated health reached statistical significance, which supported the overall validity of the harmonised political participation variables. In the case of age differences, also all significant results confirmed the expected relationship (see online supplementary material 2, Tables 2a and 3b).

Religious participation

The operationalisation of the definition of religious participation for the purpose of the harmonisation process was: *any form of religious participation (religious services attendance, taking part in religious meetings, religious organisation membership, etc.)*.

Most of the studies (12 out of 18) provided one or at most two questions eligible for the harmonisation process (see online supplementary material 1, Tables 5a and 5b). However, in some studies it was about the frequency of participation and in others it was about being a member of a religious group.

In the ALSA, COURAGE, ELSA (Waves 5 and 7), HEALTH2000, KLOSA, SAGE, SHARE (Waves 4 and 5), LASI and TILDA surveys the frequency of attendance at/going to/participation in religious events/activities/meetings or services was measured. Ordinal response scales related to the frequency during the year were applied in all these items. The most detailed response scale was applied in the KLOSA study, as there were ten categories of answers (*almost every day, once a week, two or three times a week, once a month, twice a month, once or twice a year, three or four times a year, five or six times a year, almost never a year, almost never*).

In the JSTAR and SHARE (Waves 1 and 2) studies, respondents were asked about engagement in religious activities or taking part in religious organisations in the past/last month.

MHAS also assessed if the respondent attended religious services (a binary variable – *yes, no*) and how frequently he or she participated in religious events, but

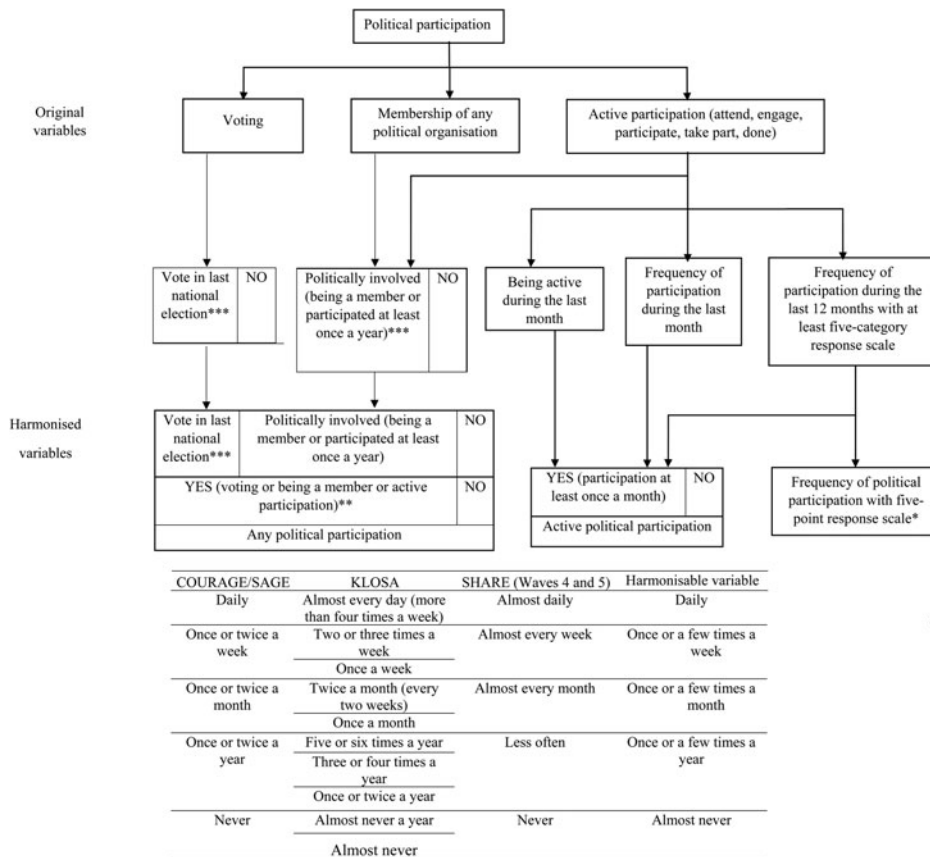


Figure 2. Decision tree of the harmonisation process of the political participation variable.

Notes: *Response categories are presented in the table. **If any information is available the respondent is categorised as participated in political activity. ***Created harmonised variables.

response options were not directly comparable with others (*never, once in a while, once or more per week*).

Although the survey 10/66 also provided a variable related to the frequency of participation in religious activities, the response categories differed greatly in comparison to the previous ones (*no; yes, regularly; yes, occasionally*). It was assumed that the response *regularly* will be recoded as *at least once a month* and the response *occasionally* as *less often, but at least once a year*.

The ELSA questionnaire (Wave 1) had a simple item asking about the membership of a church or other religious group.

The possibilities of creating harmonised variables are presented in Figure 3. Firstly, a variable related to any religious participation could be created, with two response options (*yes, no*), where *yes* included being a member of a religious group or participating regularly or at least once a month in religious activities (*relig*). The second option was to assess only active participation, and, as a result of the harmonisation process, the variable *at least monthly participation in any religious activity* was created. This variable avoided ambiguity and lacked information only from one study (ELSA Wave 1). Finally, in the case of the same studies it was possible to create a harmonised variable containing more information on the intensity of engagement, *i.e.* with five response categories: *daily, once or a few times a week, once or a few times a month, once or a few times a year* and *almost never* (Figure 3).

The percentage of people participating in religious activities is presented in the online supplementary material 1, Table 6.

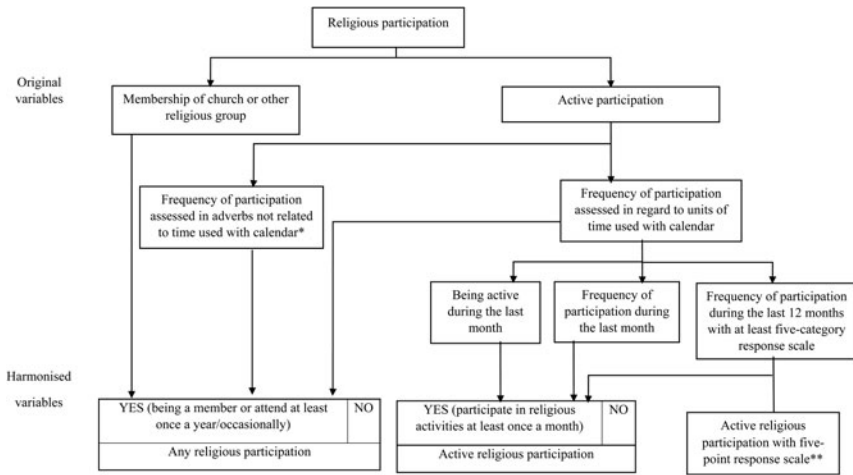
The test for known-group validity showed that in most cases the expected association reached statistical significance, which supported the overall validity of the harmonised variable related to religious participation (*see* online supplementary material 2, Table 4).

Senior-specific participation

The operationalisation of the definition was *participation in a senior club/organisation*. However, only three of the analysed studies addressed the matter (ALSA, COURAGE, JSTAR).

In the case of the ALSA study (Wave 3), specific questions related to participation in senior clubs were asked. There were five questions concerning membership of senior citizens clubs, aged pensioners groups, retired persons groups, 50+ people clubs and 60+ people clubs. In the first wave, participation in senior clubs was assessed together with other social activities at such institutions as a club, a church or a community centre, thus it was not possible to estimate unambiguously the participation in senior clubs. A similar situation was observed in the JSTAR, where respondents were asked about engagement in community activity, including senior club events and festivals. This question was too general to assume that it covers only participation in senior clubs.

In the COURAGE study there was one question: 'How often in the last 12 months have you attended senior clubs or organisations (day-care centres, self-help groups, University of the Third Age)?', with a five-point Likert response scale related to the frequency of attendance.



COURAGE/ SAGE	ELSA (Waves 5 and 7)	HEALTH2000	KLOSA	SHARE (Waves 4 and 5)	TILDA	Harmonisable variable
Daily	More than once a week	Every day or during most days	Almost every day (more than four times a week)	Almost daily	More than once a week	Daily
Once or twice a week	Once a week	Once or twice a week	Two or three times a week	Almost every week	Once a week	Once or a few times a week
Once or twice a month	Two or three times a month	Once or twice a month	Twice a month (every two weeks) Once a month	Almost every month	Once or twice a month	Once or a few times a month
Once or twice a year	Once or more times a year	Once or a few times a year	Five or six times a year Three or four times a year Once or twice a year	Less often	Every few months Once or twice a year	Once or a few times a year
Never	Not at all	Less frequently or never	Almost never a year Almost never	Never	Never or almost never	Almost never

Figure 3. Decision tree of the harmonisation process of the religious participation variable. Notes: *It was assumed that response *regular* will be recoded as at least once a month; response *occasionally* as less often but at least once a year. **Response categories are presented in the table.

The harmonised variable was defined as attendance at a senior club or organisation at least once a month. Original items are available in the online supplementary material 1, Table 7.

Participation in sport groups

For the harmonisation process, the following operational definition was assumed: *any participation in organised/group sport activities (like sport clubs, doing sport with other people, membership of gyms, exercise classes, etc.).* Cultural activities are not covered here.

Questions referring to this type of participation were asked in five cohorts: ALSA, COURAGE, ELSA, JSTAR and TILDA. Original items are available in the online supplementary material 1, Table 9a.

The ALSA and ELSA studies investigated the respondents’ membership of sports clubs, gyms, exercise classes (ALSA) or football clubs, other sport clubs or golf clubs (ELSA). In the ALSA study (Wave 6 or further), there was a question

about spending some time outdoors participating in recreational or sporting activity (bowls, fishing, golf, excluding spectator sports), whereas it was not clear whether the item was related to organised group activities. Thus, it was not taken into account in the further harmonisation process. There was a similar situation in the TILDA cohort, which included a question concerning participation in sport activities or exercises.

The JSTAR examined engagement in sport activities with someone other than family or friends in the past month. On the other hand, COURAGE measured the frequency of participation in sport activities with someone else (without the exclusion of family or friends) during the year.

As a result of the harmonisation process the following options were proposed (Figure 4). The first one is a dichotomous variable indicating whether an individual participated in sports activities at least once a month or is a member of a sport club. The second option is a dichotomous variable taking into account being physically active at least once a month. This option was available for three studies and in this case we have a higher level of comparability than in the previous one.

The percentage of people participating in organised sport activities across studies, cohorts and waves is presented in the online supplementary material 1, Table 10.

The analysis for construct validity showed that the expected relationships between self-rated health and participation in sport groups were statistically significant for all analysed cohorts and waves. The expected relationships between age and participation in sport groups were also significant in most cases. The results support known-group validity of the harmonised variable (*see* online supplementary material 2, Tables 5 and 6).

Participation in volunteer/charity group activities

For the purpose of the harmonisation process, the following definition was adopted: *any voluntary or charitable activities.*

The review of the surveys showed that two aspects were measured: (a) membership of charity or volunteer clubs or groups (formal volunteering) and (b) doing any kind of voluntary or charity work (formal or informal volunteering).

Firstly, ALSA and ELSA assessed in one question whether the respondent was a member of a charity or voluntary group in the last month/year. Participation in voluntary groups was also measured in the KLOSA study, where the frequency of participation was assessed with ten response options, ranging from *almost every day (more than four times per week)* to *almost never*.

MHAS asked about participation in any voluntary work in the last two years.

In COURAGE and SAGE there were two identical variables related to this matter, asking how often in the last 12 months the respondent had worked with others to fix or improve something in the neighbourhood. Despite the difficulty in equating the meaning of the question with doing voluntary activity, it was decided that the variable was eligible to be harmonised. Although one cannot be sure that this kind of social participation was done with or without payment, it was assumed that if they worked for the good of the community, it was voluntary work. Similarly, membership of a voluntary group or charity club does not necessarily mean that

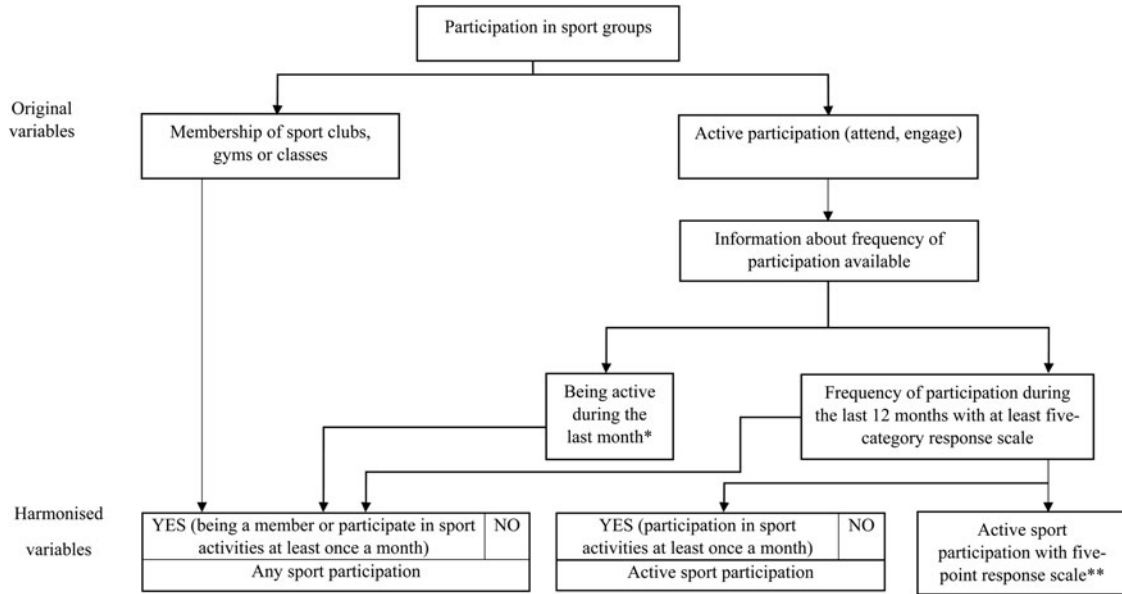


Figure 4. Decision tree of the harmonisation process of the sport participation variable.

Notes: *In the case of the JSTAR, just information from the last month is available. **Because questions from the TILDA study were not considered to be harmonised, just the COURAGE study provided this type of response scale.

everyone who works for it must be a volunteer, which is another problem for further discussion.

In JSTAR, the variables selected to be harmonised were: engaging in non-work activities such as (a) voluntary or charity work and (b) helping neighbours (in a personal capacity). In the introduction to this question it was underlined that only activities done with people other than family or friends should be reported.

The CHARLS provided a multiple choice question asking about activities of the respondent. The possible answers included: 3. *Provided help to family, friends or neighbours*; 6. *Done voluntary or charity work*; and 7. *Cared for a sick or disabled adult*. If any of the options 3, 6 or 7 were selected, then the outcome variable (participation in volunteer) was equal to 1. In the case of possible options 3 and 7, respondents were asked about helping people who did not live with them and who did not pay for help. Nonetheless, in some cases providing help might not have been voluntary but rather obligatory, especially when the person in need of help was a family member or friend, even though they did not live with a care-giver. Similarly, in the SHARE study there was a question about doing voluntary or charity work, and two items asking about providing help.

As a result of the harmonisation process, three options were proposed. The first one is a dichotomous variable indicating whether during the last year an individual was a member of any voluntary or charity group, or participated in its activities. The second option was a dichotomous variable only taking into account being active at least once a month. Finally, a harmonised variable with five response categories was also considered. The scheme of harmonising variables is presented in [Figure 5](#).

The percentage of people participating in voluntary activities is presented in the online supplementary material 1, Table 12.

The analysis for known-group validity showed that the expected relationships between level of education, self-rated health, age and participation in volunteer/charity group activities were observed as statistically significant in most cases, thus supporting the overall validity of the harmonised variable (*see* online supplementary material 2, Tables 7 and 9).

Any participation

At first, this harmonised variable was assumed to indicate any other form of participation than previously mentioned (political, religious, sport, voluntary and in senior clubs), but during the review process of the questionnaires of cohorts included in the ATHLOS project, the definition of this variable was changed into any participation. It was done because it was possible to harmonise participation in sport groups or senior typical participation only for four studies (ALSA, COURAGE, ELSA, JSTAR), and distinguishing other forms of participation proved to be even more difficult. Besides, in several studies only one or two general questions about participation were available and those items could not be related to the aforementioned forms of participation but provided us with important information about the respondents' engagement in social life.

Original items used in the harmonisation process are presented in the online supplementary material 1, Table 13a.

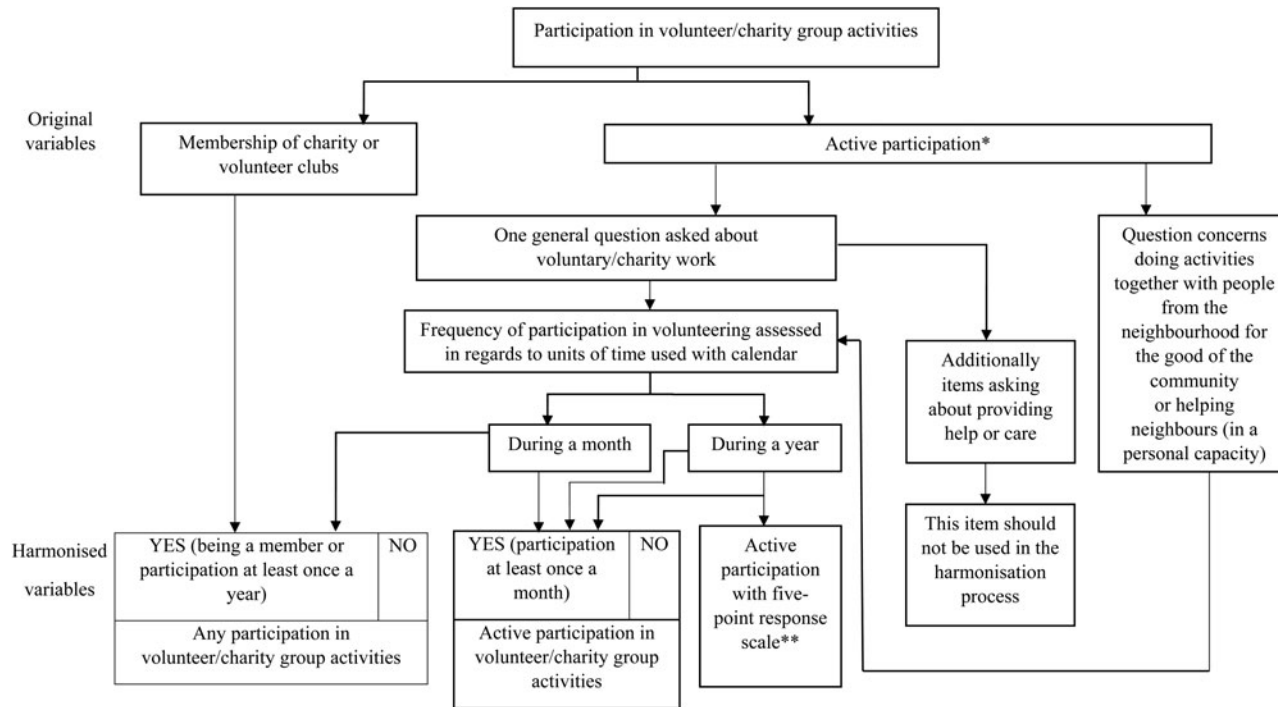


Figure 5. Decision tree of the harmonisation process of the voluntary participation variable.

Notes: *In the case of the JSTAR, just information from the last month is available. **Response categories are the same as presented in the table of Figure 3.

The review of the surveys showed that any participation was operationalised in the following way: (a) as membership of any groups, clubs or organisations, (b) attending or taking part in any groups, clubs or organisations meetings, or (c) doing or engagement in some social activities (with someone other than family or friends). In general, there were 12 studies where some information about general/any social participation was available.

Direct questions about membership were found in ALSA, ELSA, HAPIEE and LASI. Nonetheless, the ALSA study had a different assessment of participation during the follow-up. In the first wave there was one general question about membership of any clubs or organisations such as church-related groups, social or sporting groups; in the third wave there was a list of 34 variables assessing membership of different kinds of groups with *yes/no* answers. In the ELSA and LASI surveys there were lists of eight questions about belonging to certain kinds of organisations and one additional question about membership of any organisations, clubs or societies. In the ALSA, ELSA and LASI studies membership of at least one of the listed clubs was understood as *membership of any clubs/organisations/societies* in the case of the harmonised variable. The HAPIEE survey had one general dichotomous variable asking about membership of any clubs/organisations.

Cohorts which contained questions about attending or taking part in/participation in any community or social group meetings were: 10/66, COURAGE, SAGE, CHARLS, KLOSA, SHARE and TILDA.

10/66 had a general dichotomous variable asking about attending meetings of any groups with response categories related to the frequency of participation (*no, regularly, occasionally*). The response options were not directly comparable with others, where response categories referred to the calendar (*e.g. times per week or month*). In order not to lose any information, it was assumed that membership of any clubs or organisations will be classified as one of the responses: *regularly* or *occasionally*.

In the case of the COURAGE and SAGE studies two variables were considered to be harmonised. They assessed how often in the last 12 months the respondent (a) had attended any group, club, society or organisation meeting and (b) got out of the house to attend social meetings, activities, programmes or events, or to visit friends or relatives. It was decided to use only the first item, because the second one asked about participation outside the house, which is also covered by the first question. Besides, the second one includes visiting friends and relatives, which was not the point of this harmonised variable.

In the CHARLS there were two items considered for harmonisation, asking about (a) going to any kind of club and (b) taking part in a community-related organisation in the last month. If either of these two activities was reported to be done, the harmonised variable was coded as 'any participation'.

The KLOSA had six questions assessing participation in religious meetings, social clubs, leisure/cultural/sport groups, alumni or hometown societies, political parties, interest groups, or any other groups. Every question was followed by another one investigating the frequency of activities within that group (ten categories ranging from *almost every day* to *almost never*). If any kind of group was selected by the respondent and the provided frequency indicated at least one activity per year, then the resulting variable would be recoded to *yes* (any participation).

The SHARE study provided a list of activities, asking about doing them in the last month (Waves 1 and 2) or in the last year (Waves 4 and 5). In the harmonisation process, the following activities were chosen: sport, attending social clubs or other kind of clubs, and taking part in activities of a religious, political or community-related organisation.

In the TILDA study there was one question about participation in any groups, such as sport or social groups, with a *yes/no* answer.

The JSTAR asked about respondents' engagement during the last month in non-work activities with someone other than family and friends. There was a list of eight possible types of participation, e.g. community activities, helping neighbours, volunteering religious activities, political activities, etc. (see online supplementary material 1, Table 13a).

As a result of the harmonisation process, three options were proposed. The first one was a dichotomous variable indicating whether an individual participated in certain activities or was a member of any group during the last year. To be comparable with being a member of any group, it was assumed that attending any group meetings at least once a year was the minimal frequency of such an activity. Another option, which narrowed the number of harmonised studies only to those where the frequency of participation was assessed, was a dichotomous variable with response options *participate at least once a month* and *less often or never*. It was also possible to use a harmonised variable with five response categories. The scheme of creating harmonised variables is presented in Figure 6.

The analysis for construct validity showed that the expected relationships were found to be significant in most analysed cohorts and waves. Thus, the results support the known-group validity of the harmonised variable (see online supplementary material 2, Tables 10 and 11).

Discussion

The results of the study showed the extent to which the measures used as an indicator of social capital are comparable across 18 cohorts included in the ATHLOS project. Based on the careful and long-term investigation of the documentation about the international ageing cohorts, post-harmonisation algorithms were created to merge the datasets and enable statistical analysis that allows testing of cross-national determinants of healthy ageing.

The availability of any measures of generalised trust and civic engagement and social participation across 18 studies was presented in a previous paper (Sanchez-Niubo *et al.*, 2019). Nonetheless, there was a need to prepare a methodological paper which shows in detail the process of decision making during the harmonisation and will serve as a reference for further comparative studies.

All questionnaires were available in the English language and cultural adaptation was conducted in the particular studies.

The previous paper (Sanchez-Niubo *et al.*, 2019) discussed the main problems inherent to harmonisation, such as trade-off between precision and quantity, differences in conceptualisation of the same underlying construct, and ethical and legal issues. The second one is especially relevant in the case of social variables; the differences across surveys were mainly related to the conceptualisation of the measures

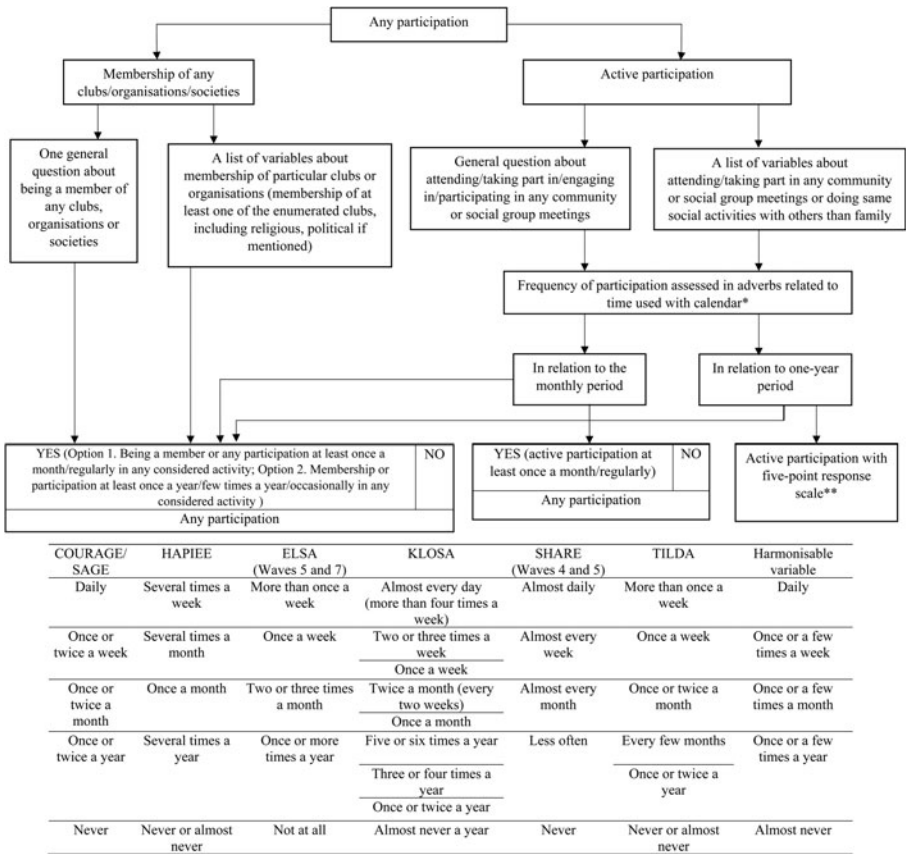


Figure 6. Decision tree of the harmonisation process of any participation variable.

Notes: *Harmonised variable was coded as Option 1; participation at least once a month in one of these activities was included. **Response categories are presented in the table.

used as indicators of social capital. Among other methodological differences which may affect the comparability across datasets are: various sampling, attrition bias occurring in the follow-up studies, and differences in the phrasing of questions and response categories. The time-frame for questions and response categories and translating questions from original languages into English for reporting purposes may have changed the meaning of the concepts being measured (Bath *et al.*, 2010).

Generalised trust

This concept was investigated in eight studies. Two type of questions were used. The first type assessed trust in people in general, the second one measured ‘trust in the neighbourhood’. The problem which occurred is that in the first case people reported trust mostly based on their general expectations, rather ‘thin’ trust is assessed. On the other hand, when people reported trust in people in the neighbourhood, they usually assessed trust based on their personal experiences (‘thick’

trust). The results from the other research showed that in the first case usually the percentage of respondents who trust people is lower than in the second case (Sturgis and Smith, 2010). This type of question rather should not be used interchangeably as measures of generalised trust (Sturgis and Smith, 2010; van der Meer and Tolsma, 2014).

The other point is that the meaning of 'most people' might be different in various cultures depending on the width of a circle which respondents have in mind when they indicate their trust in unspecified people. In some countries, especially Confucian countries, which are in-group- and family-centred, respondents might narrow down the understanding of 'most people' to the circle of friends, colleagues and neighbours. The understanding of 'most people' might be wider in wealthy countries (Delhey *et al.*, 2011). Thus, trust levels can be compared properly across countries only when the concept is understood in the same way. As a possible solution, we may compare those items where the term 'most people' was clarified as people in the neighbourhood. Besides, the results of the Delhey *et al.* (2011) study might be useful to create some weights reflecting how broadly the concept of 'most people' is understood in different countries.

Another problem with the harmonisation of the trust variable lies in the various formats of the response options, even though the phrasing of the question was very similar. There were dichotomous variables dividing respondents into those who trust and do not trust people, but there were also rating scales from 0 to 7 or from 0 to 10. To create dichotomised harmonised variables from original variables with rating scales, the middle value was assumed as neutral and values below or above the 'neutral value' were gathered into *yes* or *no* categories, where *yes* meant those who trust in people. There was also a possibility of creating a harmonised variable rating generalised trust on an ordinal scale, but in this case additional studies are needed to establish the linking rules.

Civic and social participation

There were greater differences in measuring civic and social participation across studies than in the case of generalised trust. Thus, it was decided to distinguish between such sub-domains as: political participation, religious participation, senior-specific participation, participation in sport groups, participation in volunteer/charity group and any participation.

Firstly, in some studies items referred only to membership of groups, clubs or organisations, while in others the respondents were asked about the intensity of involvement, or sometimes both aspects were measured. It is necessary to consider to what extent we can collate information about membership with information about *e.g.* taking part in the same activities. The second problem referred to the extent of generalisation: in some studies there were one or two questions concerning various types of organisations, groups or clubs, the others referred to engagement in a very narrow type of collective or civic activity. It was decided to first create variables to measure some of its particular aspects, such as political or religious participation, enabling a more in-depth analysis, maybe not for the whole ATHLOS dataset, but for at least four cohorts; then to create a variable which describes broadly understood social participation.

Otherwise various time-frames were used. Fortunately, in most cases it was the last 12 months, but there were some studies which asked about the last month or the last two years. Direct comparison of these items might lead to under- or over-estimation of the percentage of respondents who 'participated in social life' or information inaccuracy. Also, the important point to consider was the cut-off point which should be used to classify a person as active, *e.g.* in the area of charity and volunteering; is it enough to engage in such activities once a year, or rather once a month? Besides, while in some studies response categories referring to frequency are defined by times per some period, such as a week or month, others assess frequency, for instance in terms of *regularly* or *occasionally* (*e.g.* 10/66 study). To achieve a higher level of comparability it might be worth using just those cohorts or waves of cohorts where information about participation at least once a month is available. Moreover, harmonised variables with five or four response categories were possible to create in *e.g.* seven studies in the case of religion or voluntary participation. This solution limits the number of studies but minimises the loss of information.

Finally, it is worth mentioning a very important problem related to cultural differences between countries, *e.g.* participation in voting is naturally affected by various factors such as political issues, intensity of rivalry, weather conditions and changes in the constituency system. Participation in sport groups is related to different cultures of movement or physical exercise. Religious participation across the world varies depending on religion.

The next point which needs to be discussed is that the harmonised variable volunteering included both formal and informal volunteering. The first refers to unpaid, voluntary work, mediated by organisations, the second is defined as help with unpaid, voluntary work not co-ordinated by an organisation or institution (Einolf *et al.*, 2016). Informal care-giving may fill the gaps that official systems cannot fill, particularly in those regions with fewer charitable or non-governmental organisations or groups (Yumagulova and Handmer, 2021). The results of the SHARE study showed rather complementary relationships between volunteer work, informal help, and also care at the individual level (Hank and Stuck, 2008). Some studies showed that minority or migrants groups do not define helping as volunteering, thus, they might be unlikely to report helping others as volunteering (O'Neill *et al.*, 2011). In the ATHOS project, in seven out of ten studies where the information about volunteering was available, there was a direct question about doing or participation in voluntary work, which might refer to both formal and informal volunteering. In some studies there was additional information about help to neighbours, family and friends, but only in one was there information that they do not live with the respondent and did not pay for the help. In case of the COURAGE and SAGE studies only information about informal volunteering was available, whereas in the case of the ALSA study information about formal volunteering was available.

In summary, using the general question focused on any form of social participation is only partially suitable for linking this indicator to other aspects of healthy ageing, because it is not clear what kind of participation is typical of the older respondent. The best solution is to use a general question about participation and then specific forms of participation.

The role of political participation of older people could be an indicator of their willingness to be active and play an active role in social life, as well as their personal feeling that their voice is important for the society. On the other hand, special strategies could be used by politicians to encourage older people to vote. Taking into account participation in religious activity, we can indirectly investigate the involvement of an older person in a religious community and such networks are well known to be a source of significant resources for older people, such as the feelings of common values, beliefs and emotional support. When we receive the information that respondents are involved in sport clubs it could be useful to evaluate directly or indirectly the lifestyle of these older persons (physical activity). Participation in senior clubs could indicate the lack of loneliness and social isolation of older people and, on the other hand, it can have an influence on social distance between older people and the younger generation.

Despite the critical remarks, using the variable of social participation as an indicator of healthy ageing is very important, because it shows social activity of older persons. The above-mentioned different forms of social participation are usually associated with social interactions and ability to co-operate with other people, and provide information about good cognitive functioning, independence in decisions and ability to share positive emotions with other people.

A summary of the implications of the findings:

- (1) In studies gathered in the ATHLOS project the most common indicators of social participation were political participation, religious participation and participation in volunteer/charity group activities.
- (2) Senior-specific participation was not a topic of major interest in the analysed cohorts and was available only for two out of 18 studies.
- (3) To consider social participation as an indicator of social capital, in most of the studies a harmonised variable related to general assessment of any form of social participation seems to be a good solution.
- (4) The harmonisation of generalised trust as an indicator of social capital was available in eight out of 18 studies, but both 'trust in most people' and 'trust in people in the neighbourhood' were harmonised in the same variable.
- (5) The results of the analysis for known-group validity support the construct validity of the harmonised variables.

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