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Social participation patterns and their associations with health and well-being for older adults

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ABSTRACT

Older adults are at an elevated risk of adverse health effects associated with social isolation and loneliness. Social participation is considered a modifiable determinant of health and well-being and has been proposed as a means to reduce this risk. However, there is limited knowledge to date about patterns of social activities among older adults. Using two waves of the Swiss Household Panel, a latent class analysis is performed to obtain discrete social participation profiles of adults aged 60 and older. Descriptive statistics and regression methods are used to study group compositions and estimate associations with self-assessed health, negative and positive affect, and life satisfaction. Once individual time-constant characteristics are controlled for, the majority of the positive associations between social participation and health or well-being found in the pooled data becomes small and insignificant, which is indicative of self-selection into different activity profiles. The role of self-selection into social participation implies that the design of interventions targeting social participation in the older adult population should be tailored to their heterogeneous needs and preferences.

1. Introduction

Switzerland, like many countries, is experiencing demographic ageing. Projections of the Swiss Federal Statistical Office show an increase in the proportion of people aged 65 and older of at least 50% between 2015 and 2045 (SFSO, 2016). As people age, health status generally deteriorates. Age is a major risk factor for non-communicable diseases such as cancer, cardiovascular diseases, and neurodegeneration (Niccoli & Partridge, 2012). Functioning and independence decline due to diminished cognitive and physical capacity (Balogun, Akindele, Nihinlola, & Marzouk, 1994). Evidence regarding ageing and life satisfaction is mixed. Some have argued for a u-shaped curve that rises in older age (Blanchflower & Oswald, 2008), while others have shown the association to be region-dependent (Steptoe, Deaton, & Stone, 2015). Health and life satisfaction are related (Ngamaba, Panagioti, & Armitage, 2017), and the relationship between physical health and subjective well-being is bidirectional (Steptoe et al., 2015).

As people age, social networks may shrink (Charles & Carstensen, 2010) and people may experience death of friends and/or their partner. These changes can make older people at risk for social isolation and loneliness, both of which have been associated with negative health outcomes (Leigh-Hunt et al., 2017) and early mortality (Holt-Lundstad et al., 2015). On the other hand, Cornwell, Laumann, and Schumm

(2008) find that socializing with neighbors, religious participation, and volunteering increase with age. Furthermore, older adults have often reported higher levels of satisfaction with their social relationships than younger adults (Luong, Charles, & Fingerman, 2011).

Social participation has been suggested to help promote active and healthy ageing (Turcotte, Carrier, Roy, & Levasseur, 2018), as well as a means to prevent non-communicable diseases (Holmes & Joseph, 2011), death ideations (Saïas, Beck, Bodard, Guignard, & du Roscoät, 2012), and social isolation and loneliness (Cattan et al., 2005; Gardiner, Geldenhuys, & Gott, 2018).

Putnam (2001) defines social capital as the "connections among individuals' social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2001, p. 19). Social capital has been theorized to support health and well-being through several mechanisms, including mutual support (Murgai, Winters, Sadoulet, & De Janvry, 2002), increased level of information about local health care systems (Scheffler & Brown, 2008), and the promotion of healthy behaviors, such as non-smoking (Brown, Scheffler, Seo, & Reed, 2006). There are two levels at which social capital is studied: the individual or the community. At the individual level, social capital includes cognitive social capital (trust) and structural social capital (social participation behaviors). This study focuses on the latter, and cross-sectional observational studies have consistently shown a positive and statistically

significant association between social participation of older adults and their well-being and health outcomes (see Curvers, Pavlova, Hajema, Groot, & Angeli, 2018 and Vozikaki, Linardakis, Micheli, & Philalithis, 2017 for recent examples).

According to Folland and Lorenzo (2013), the major challenge in studying the relationship between social capital and health is the endogeneity of social capital. Endogeneity in general refers to the correlation between an explanatory variable (here: social participation) and unobserved factors that determine the dependent variable (here: health or well-being). Endogeneity can arise from either social capital being jointly determined with health outcomes (referred to as simultaneity) or from omitted variables. Consequently, the analysis of cross-sectional observational data may produce biased results, and some of the associations found in the previous literature may well overstate the true relationship between social participation and health or well-being.

In this research, I contribute to the literature in two main ways. First, in order to reduce omitted variable bias, I explore longitudinal data from the Swiss Household Panel, a large and representative panel survey of the Swiss residential population. Due to the availability of multiple time points, I can control for time-constant unobserved factors in the analysis and thus adjust for more potential confounders than have been controlled for in most of the previous cross-sectional studies. Second, there is very limited analysis of social participation profiles for older adults. Furthermore, social participation can include multiple activities. In the panel, six different types of social activities are measured: providing informal support to others, meeting friends, having an online social network account, seeing own child(ren), being in a club or group, and volunteer activities. As a starting point for the analysis, individuals are grouped according to their social participation profile using a latent class analysis (LCA) and these groups are described.

The main research questions of this study are as follows: how do patterns of social participation vary in Switzerland among older adults? Are patterns of engagement in social activities associated with self-assessed health, frequency of negative effect, frequency of positive affect (hedonic well-being), or life satisfaction (evaluative well-being)? Are different associations found for single versus partnered adults, and does the social participation profile of someone's partner have a significant association with the selected health/well-being outcomes?

The results suggest four distinct social participation classes. These classes differ in the type and number of social participation activities as well as a variety of demographic characteristics. Applying pooled ordinary least squares (OLS) regressions, the research shows significant and positive relationships between certain social participation profiles and the health/well-being outcomes, corroborating earlier findings in the literature. However, as soon as time-constant individual characteristics are accounted for in a fixed effects (FE) regression model, the majority of these associations become insignificant. This supports the notion that there are individual, time-constant characteristics which confound and account for some part of the relationship between someone's pattern of social participation and his or her health and well-being. In other words, the analysis explicitly shows that there are individual-specific, unobserved factors that explain why some individuals engage in social participation activities and others do not, and thus the relationship between social participation activities and health and well-being is at least partly driven by self-selection into those activities.

2. Methods

2.1. Data source

My study is based on data from the Swiss Household Panel (SHP). The SHP is an annual panel survey following a representative sample of more than 4000 households in Switzerland over time (Voorpostel et al., 2017). Data collection began in 1999, the most recent wave is 2018 (see Tillmann et al., 2016 for details about the SHP). The study sample is limited to the years 2013 and 2016, as some of the social participation-related questions are only available in these two years. The sample is restricted to individuals aged 60[1] and above. Individuals in a partnership (married or cohabitation) in which his/her partner is younger than 60 are included in the overall and partnered sample regressions, but are excluded from the regressions in which the partner's social participation profile is included as additional covariates (as partners younger than 60 are excluded from the sample). Any records with missing information for variables in the main analysis are also dropped (8.7%, mainly due to missing income information). As the analysis is focused on a sub-sample of the SHP, original sample weights would not be appropriate to use. The final estimation sample includes 5167 person-year observations.

2.1.1. Outcome variables

Four outcomes are tested: self-assessed health, frequency of negative affect, frequency of positive affect, and life satisfaction. Self-assessed health is based on the question "How do you feel right now?" with possible responses of: not well at all, not very well, so-so (average), well, and very well. This is dichotomized with the well and very well responses set to one, indicating "good health", zero otherwise. All regressions with this outcome are linear probability models. The remaining outcome variables are all modeled as continuous variables on a scale from 0 to 10. Frequency of negative affect is measured through the question: "Do you often have negative feelings such as having the blues, being desperate, suffering from anxiety or depression?" where 0 means "never" and 10 means "always." Frequency of positive affect is measured through the questions: "How often are you full of energy, strength and optimism?" where 0 means "never" and 10 means "always." Life satisfaction is measured with the question: "In general, how satisfied are you with your life if 0 means 'not at all satisfied' and 10 means 'completely satisfied'?"

2.1.2. Social participation-related explanatory variables

The six binary variables selected to represent social participation are: providing informal support to others, meeting (at least) weekly with friends, having an online social network account, seeing children at least four times per month, being in a club or group, and performing volunteer activities. Providing informal support to others is based on the question: "Do you do other volunteering activities for persons who do not live in the same household as you, like for example looking after children, helping a neighbor or offering transportation?" (yes/no). The "meeting weekly with friends" variable is constructed for this analysis. The original question asks about the frequency of meeting with friends, acquaintances, colleagues, with responses ranging from: daily, at least once a week, at least once/month, to never. The variable is constructed with one equal to meeting friends daily or weekly, zero otherwise. The indicator for online social network is based on the question: "Do you have an account on a social network site such as Facebook, Twitter, MySpace or LinkedIn?" (yes/no). The indicator related to frequency of seeing one's children is based on a question that queried the number of times per month someone saw his or her children. The variable is constructed with one equal to seeing children at least four times a month, zero otherwise (which includes those without children). The variable regarding club or group membership is based on the question: "Do you take part in clubs' or other groups' activities, religious groups included?" (yes/no). The variable for volunteer activities is based on: "Do you have honorary or voluntary activities within an association, an organization, or an institution?" (yes/no).

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[1] The United Nations refers to people aged 60 and above as older persons (United Nations, 2015).

2.1.3. Additional control variables

Demographic and socio-economic controls include gender, age, education, household income (in logs), employed, rural residence, physical activity, presence of health problems, and single (versus partnered). Education indicates someone's highest level of education achieved: low (compulsory), medium (secondary), or high (tertiary). A value of one for employed means that someone is working full-time or part-time, zero if retired or unemployed. Living in a rural area is set to one if someone indicates s/he does not live in a city center, suburban, wealthy, or peripheral urban community, zero otherwise. Physical activity is measured through a question that asks if someone practices physical activities that lead to slight breathlessness (yes/no). To control for the presence of chronic health conditions, I use the question "Do you suffer from (have) any chronic (long standing) illness or condition (health problem)?"(yes/no). I consider someone to be single (as opposed to partnered) if in the survey the person self-identifies as "single, never been married," or "divorced," or "widow/widower," and at the same time does not have someone identified as spouse or partner in the SHP. If someone's record is linked to another person identified as spouse or partner in the SHP, I consider them to be "partnered."

2.2. Empirical approach

The empirical analysis has two goals. The first is to identify and describe different social participation profiles among older adults in Switzerland based on their pattern of engagement in the six aforementioned social activities. This is accomplished through a latent class analysis (LCA), which is an approach to identify and describe unobserved groups by analyzing their response patterns (in this case to questions about social participation). The second goal is to describe and quantify the associations between the identified social participation profiles and the health/well-being outcomes. This is done by using ordinary least squares (OLS) and fixed effects (FE) regression models. All analyses are performed in Stata version 15.

2.2.1. Latent class analysis

The LCA is based on the presumption that there are heterogeneous patterns of activity in social engagement: different groups of individuals may gravitate to certain activities and not to others. However, the SHP does not have a particular variable to identify which persons would fall into which groups. As an empirical technique, LCA allows one to identify and describe subgroups of the population with similar activity profiles. LCA is a probabilistic approach that uses maximum likelihood estimation to determine class membership. It is considered to be person-centric, as opposed to variable-centric. The sample individuals are assigned to different classes based only on their responses to six social activity indicators. After the optimal number of classes is determined through various goodness-of-fit statistics, the different classes can be compared in terms of their social participation profiles and their average demographic and socio-economics characteristics. For further explanation of the LCA, see Collins and Lanza (2010) or Hagenaars & McCutcheon (2002).

2.2.2. Regression analysis

To describe and quantify the associations between the identified social participation profiles and health and well-being for older adults in Switzerland, pooled OLS regressions are used in a first step to establish a benchmark. In these regressions, the data from the two waves of the SHP are pooled, and the longitudinal structure is ignored, except for the clustering of standard errors on the individual level, and the inclusion of an indicator for the 2016 wave to account for time effects. In the pooled OLS regressions, the set of demographic and socio-economic variables are added as control variables to adjust the associations for these factors.

Individual FE regressions are run in the second step to make use of the repeated observations per individual over time. The analysis is based on the following regression model:

$$y_{it} = class'_{it}\alpha + x'_{it}\beta + c_i + u_{it} \tag{1}$$

where y_{it} denotes any of the outcomes described above for respondent i in year t. The vector $class_{it}$ represents a set of indicators for the predicted class membership of social participation profiles obtained as a result of the LCA (indicated is the class with the highest predicted probability for each individual). The vector x_{it} contains the demographic and socio-economic controls and is added to the equation to obtain adjusted associations. The term c_i refers to time-constant characteristics unique to the individual, which can be observed (gender) or unobserved (genetics). The FE estimation does not distinguish between observed and unobserved time-constant factors and eliminates them from the equation through a 'within' transformation, i.e., a transformed equation is estimated that subtracts individual-specific means over time from all variables. With two waves available for the estimation, this approach is equivalent to a first difference transformation of equation (1). The key advantage of the FE estimation approach over the pooled OLS estimation is that in the former *all* time-constant factors (whether they are observed or unobserved, correlated or uncorrelated with x_{it}) are controlled for. By controlling for these time-constant factors, the confounding influences mentioned in Section 1 can be reduced.

The variable u_{it} represents a time-varying error term. For a causal interpretation of (1), u_{it} must be uncorrelated with x_{it}. While I control for time-constant personal characteristics in the FE estimation, the time-varying error term could include aspects such as changes in the demand for informal support (someone may suddenly or no longer need informal support), as well as changes in the availability and/or accessibility to friends, clubs/groups, organizations, etc. Unfortunately, the SHP does not allow to control for these types of influences due to limited information available. Therefore, since I cannot rule out possible confounding bias that arises from time-varying factors, the results cannot be interpreted causally. The regressions still have a meaningful descriptive interpretation in terms of associations that are adjusted for a variety of background characteristics, including both time-varying observed and time-constant unobserved factors, which goes beyond what many cross-sectional studies can control for.

All regressions are performed on three separate groups of adults aged 60 and older: (1) the entire sample of 3661 persons, (2) 1089 single persons, and (3) 2621 partnered persons.[2] An additional set of regressions is conducted for partnered individuals where the social participation class of his or her partner is also included as an additional covariate (1764 persons).

3. Theory

The study of social capital has garnered much interest across disciplines in the social sciences over the last three decades with the influential works of Bourdieu (1986), Coleman (1988), and Putnam (1993). Although there are similarities, the approaches of these three researchers emphasize different aspects through which social capital influences health. As summarized by Carrillo Álvarez and Riera Romaní (2017), Bourdieu's model focuses more on social networks and connections which can be a source of support (Bourdieu, 1986). They contrast this with Coleman's model, which views social capital as a resource between families and communities (Coleman, 1990), while Putnam's model expands the scope to include a variety of aspects of the community in which an individual lives (Putnam, 1993). Harpham, Grant, and Thomas (2002) summarize various approaches to defining

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[2] Forty-nine individuals changed their status between 2013 and 2016 (from single to partnered or vice versa) and are included in both single and partnered regressions.

and measuring social capital within health surveys. A common approach considers "structural social capital" to be the extent and intensity of someone's social participation (Harpham et al., 2002). Levasseur, Richard, Gauvin, and Raymond (2010) define social participation as "as a person's involvement in activities that provide interaction with others in society or the community."

As mentioned in the Introduction, a major challenge in studying the relationship between social capital and health relates to the reciprocal relationship between social participation and health/well-being indicators. Much of the literature on social participation of older adults focuses on predicting health/well-being outcomes, though one study (Hank & Stuck, 2008), models various social participation indicators as a function of various socio-economic and health-related characteristics. Leone & Hessel (2016) note that levels of social connectedness are strongly associated with both health and socioeconomic characteristics. Furthermore, socioeconomic characteristics, such as income and education, have also been associated with health (Lynch & Kaplan, 2000) and well-being outcomes (Pinquart & Sorenson, 2000). Leone and Hessel (2016) also remark on the Sirven & Debrand paper from 2012, which found that the effect of health on social participation appears to be significantly stronger than the effect of social participation on health, though they (Leone & Hessel) also refer to concerns about the methodology used to analyze the reciprocal relationship.

A variety of measures have been used in the literature to analyze the relationship between social participation and health and well-being among older adults. Health outcomes are measured with self-assessed health (Ichida et al., 2013) and/or objective health outcomes, such as grip strength (Leone & Hessel, 2016) or sleep measures (Chen, Lauderdale, & Waite, 2016). Mental health outcomes include the CES-D (see Liu, Xue, Yu, & Wang, 2016; Radloff, 1977) and the EURO-D (see Croezen, Avendano, Burdorf, & van Lenthe, 2015; Prince et al., 1999). Studies of well-being often use life satisfaction (Baker, Cahalin, Gerst, & Burr, 2005), while other studies have focused on CASP-12 (see Litwin & Stoeckel, 2014; Wiggins, Netuveli, Hyde, Higgs, & Blane, 2008) or a unique, study-specific well-being index (Vozikaki et al., 2017). To measure social participation, studies have used the practice of one specific activity as a measure of social capital (Fiorillo & Sabatini, 2015), at least one activity from a list of social activities (Sirven & Debrand, 2012), or a measure of the total time that someone is engaged in a set of social activities (Baker et al., 2005). Most commonly, studies use an index (count) of the number of social participation activities someone engages in (Liu et al., 2016). A few studies derive or construct a social participation profile: Amagasa et al. (2017) used exploratory factor analysis to characterize social participation in their study of older adults in Japan; Lam and Bolano (2018) and Morrow-Howell et al. (2014) use an LCA approach to analyze overall activity profiles (including social activities) and their relationship to self-rated health for older adults; and Katagiri and Kim (2018) construct an activity profile based on the number and types of social activities in which older adults in Japan and Korea participate.

A number of studies are observational (e.g., Curvers et al., 2018; Vozikaki et al., 2017). Even with rich cross-sectional data, associations between social participation and health or well-being may be confounded by unobserved background characteristics. Some studies deal with endogeneity (at least in part) by using instrumental variables (Fiorillo & Sabatini, 2015; Ichida et al., 2013; Liu et al., 2016), panel data fixed effects (Chen et al., 2016; Croezen et al., 2015; Liu et al., 2016), panel data growth curve models (Ang, 2018), panel data with lagged effects (Lam & Bolano, 2018) or structural equation modeling (Sirven & Debrand, 2012). A systematic review by Wanchai and Phrompayak (2018) analyzes quasi-experimental, experimental, and RCT interventions of social participation interventions for adults aged 60 and older. The aforementioned literature generally finds evidence of some positive effect of social participation on the studied outcome, but the evidence is not yet conclusive.

This study addresses several gaps in the previous literature on social participation and health and well-being in the older adult population: i) it considers participation in social media by older adults, ii) it includes

social participation of the partner in addition to his/her own participation, and iii) it applies an LCA to identify social participation patterns. I could not identify any study that included online social media as a measure of social participation for older adults, even though the usage of social media by older adults has been growing. Compared to other age groups in the US, adults aged 65 and older have had the largest increase in the use of internet and social media from 2005 to 2015 (Perrin, 2015). The use of social networking sites for older adults in the US also grew from 13% in 2009 to 33% in 2011 (Zickuhr & Madden, 2012). For older adults, social media has been suggested a means to strengthen social networks (Hogeboom, McDermott, Perrin, Osman, & Bell-Ellison, 2010) and promote social participation and intergenerational communication (Nef, Ganea, Mri, & Mosimann, 2013).

Social capital studies generally address one (or two) levels of analysis: the individual and/or the community level. I did not find any studies that considered social participation at the household level nor the social participation profile of someone's spouse, though the aforementioned study by Lam and Bolano incorporated the activity profile of the partner. The idea that the social capital of one's partner could benefit the health and well-being of an individual appears plausible. In this scenario, additional support, health information, and support for healthy behaviors could be conveyed through an expanded social circle via one's partner to the possible benefit of an individual. Dyadic study designs exist in health research to analyze dyadic- and family-level mechanisms of health and well-being (Reed, Butler, & Kenny, 2013), and life course research includes the concept of "linked lives", referring to the idea that lives of individuals influence and are influenced by the lives of others (Settersten, 2015).

4. Results

4.1. Basic description of the data

Table 1 shows basic descriptive statistics. The proportion of older adults rating their health as good is 77.0% in 2013 and 79.2% in 2016.

Table 1
Summary statistics by year.
Source: Swiss Household Panel 2013 and 2016, own calculations. *Notes:* The table reports sample means or proportions and standard deviations (Std. Dev.) of the main variables used in the analysis.

	2013	Std. Dev.	2016	Std. Dev.
	Mean		Mean	
Health and well-being indicators				
Self-assessed health	0.770		0.792	
Frequency of negative affect [0,10]	2.187	2.186	2.113	2.140
Frequency of positive affect [0, 10]	7.066	1.909	7.015	1.921
Life satisfaction, scale [0,10]	8.169	1.430	8.263	1.382
Social participation activities				
Provide informal support to others	0.420		0.360	
Meet friends at least weekly	0.576		0.588	
Have online social network account	0.124		0.185	
See child(ren) at least 4 times/month	0.550		0.684	
In a club/group (including religious)	0.460		0.509	
Honorary or voluntary activities	0.374		0.379	
Sum of social participation activities	2.504	1.376	2.704	1.442
Background characteristics				
Male	0.441		0.466	
Age in year of interview	70.351	7.452	70.681	7.471
Single	0.291		0.287	
Compulsory education	0.631		0.598	
Secondary education	0.251		0.258	
Tertiary education	0.118		0.144	
Log of household income	11.264	0.637	11.303	0.604
Employed	0.294		0.288	
Rural	0.245		0.253	
Physical activity	0.682		0.768	
Health problems	0.505		0.495	
Number of observations	2002		3165	

Table 2

Latent class estimated probabilities and actual sample results.

Source: Swiss Household Panel 2013 and 2016, own calculations. *Notes*: The table shows estimated and actual proportions of the sample within each social participation class. For example, the estimated proportion of individuals that falls into class 1 is 21.2%. The actual proportion of the sample that falls into this class is 23.7%, based on assigning an individual to that class where his/her predicted probability is the highest.

Class	Estimated	Delta-method		Actual
	probability	Std. Err.	95% Conf. Interval	sample results
1 Relatively inactive	0.212	0.076	(0.099; 0.398)	0.237
2 Moderately active (informal)	0.442	0.086	(0.296; 0.610)	0.434
3 Moderately active (formal)	0.066	0.043	(0.018; 0.217)	0.035
4 Highly active	0.279	0.034	(0.218; 0.350)	0.295

The mean score for the frequency of negative affect is 2.2 in 2013 and 2.1 in 2016. The mean frequency of positive affect is 7.1 in 2013 and 7.0 in 2016. The mean life satisfaction score is high in both years (8.2 and 8.3). On average, the number of social activities that someone participates in is 2.5 in 2013 and 2.7 in 2016. The most popular activities in both years are meeting with friends and meeting children, followed by being in a club or group. There are fewer men than women in the sample. The mean age is similar in both years (70.4 and 70.7 years, respectively), as is the proportion of single individuals (approximately 29%).

4.2. Description of classes identified in the latent class analysis

Different numbers of classes were tested. Goodness of fit measures indicated the model with four classes as providing the best fit (see Table A1 in the appendix). Table 2 reports the latent class marginal probabilities from the LCA for this model. The table shows the estimated proportion of the sample that would fall into each of the four classes, as well as the actual sample prevalence, after assigning an individual to that class with the highest predicted probability. Class 2 is the most prevalent in the sample (43.4%), followed by class 4 (29.5%). Class 3 is the smallest with 3.5%. Table 3 shows for each class the estimated proportion of individuals that indicated they participated in any of the six activities as well as their overall mean number of activities. Table 4 shows summary statistics of the health and well-being outcomes and the background characteristics by class.

Class 1, "Relatively inactive," comprises 23.7% of the sample and has the lowest mean number of activities, 0.90. The most prevalent activity is seeing children at four times/month (52.8%) followed by meeting friends at least weekly (37.5%). Individuals assigned to this class are on average the oldest, have the lowest income and the highest proportion of being single of all classes. They also have the least favorable health and well-being outcomes.

Class 2, "Relative active (informal activities)," represents 43.4% of the sample and has the second-highest mean number of activities, 2.55. As with Class 1, the most prevalent activities involve seeing children at four times/month (71.3%) and meeting friends at least weekly (60.7%). Nearly half (45.5%) are estimated to provide informal support. Being part of a club or group is the next most prevalent predicted activity (38.1%). They have the highest proportion of compulsory education (65.6%) and at/close to average in other characteristics.

Class 3, "Relative active (formal activities)," comprises 3.5% of the sample and has the second-lowest mean number of activities (2.18). In this class, the most prevalent activities are formal: being in a club or group (80.8%), followed by volunteering (67.4%). This is followed by meeting friends at least weekly (62.8%). Individuals in this class are likely to be male (61%), have a mean age that is the lowest of all classes while the mean log income is the highest. They are also most likely to be employed (41.1%). Most of their other characteristics are close to or above average.

Class 4, "Highly active," has the second highest proportion of the sample with 29.5% and has the highest mean number of activities, 4.2.

Table 3

Social participation profiles of classes identified in the LCA.

Source: Swiss Household Panel 2013 and 2016, own calculations. *Notes*: The table shows the estimated probabilities of members of each class report participating in each of the six social participation activities. For example, the LCA analysis estimates a probability that someone in class 2 provides informal support of 45.5%. Standard errors calculated with the Delta method in brackets. The mean number of activities per class is calculated as a descriptive statistic (standard deviations in parentheses), conditional on individuals being assigned to that class with their highest predicted probability given their social participation responses.

	Class 1	Class 2	Class 3	Class 4
	Relatively	Moderately	Moderately	Highly
	inactive	active (informal)	active (formal)	active
Provide informal support	0.140	0.455	0.000	0.546
	(0.062)	(0.045)	(0.000)	(0.050)
Meet friends weekly	0.375	0.607	0.628	0.694
	(0.047)	(0.029)	(0.050)	(0.016)
Online social network account	0.130	0.133	0.180	0.224
	(0.019)	(0.011)	(0.039)	(0.013)
See child(ren) at least 4 times/month	0.528	0.713	0.052	0.722
	(0.040)	(0.022)	(0.421)	(0.017)
Club or group	0.024	0.381	0.808	0.941
	(0.087)	(0.036)	(0.063)	(0.041)
Volunteer	0.085	0.078	0.674	1.00
	(0.033)	(0.056)	(0.075)	(0.000)
Number of activities	0.903	2.551	2.178	4.171
	(0.606)	(0.826)	(0.383)	(0.847)
Number of observations	1222	2240	180	1525

The two most prevalent activities are volunteering (100%) and being in a club or group (94.1%). This is followed by seeing children at least four times/month (72.2%) and meeting friends at least weekly (69.4%). Providing informal support is the highest among all classes (54.6%) as is having an online social network account (22.4%).This class has the most favorable outcomes for health and well-being.

4.3. Pooled OLS regression results

In the second step of the analysis, I seek to estimate the association between the different classes identified in the LCA with the four health/well-being outcomes. Table 5 summarizes the results of the pooled OLS regressions (full regression results are shown in appendix Tables A2-A5). In each regression, class 1 (*relatively inactive*) is chosen as the reference. For example, in column (1), when compared with someone who is in class 1, someone in class 2 (*moderately active (informal)*) has on average a higher life satisfaction rating (on the scale from 0 to 10) of 0.225 units. While column (1) only controls for a general time effect, in column (2) the regression results are shown for the full sample with the background characteristics added as controls. Columns (3) and (4) represent the same type of regressions for single individuals and columns (5) and (6) show results for partnered individuals. Columns (7) and (8)

Table 4
Social participation profiles of classes identified in the LCA.
Source: Swiss Household Panel 2013 and 2016, own calculations. *Notes*: The table shows proportions and mean values (standard deviations in parentheses) for the variables indicated in rows per class, conditional on individuals being assigned to that class with their highest predicted probability given their social participation responses. For example, for class 1 the proportion of people who rate their health as good or very good is 71.9%. Their mean life satisfaction is 7.992 with a standard deviation of 1.651.

	Class 1	Class 2	Class 3	Class 4
	Relatively	Moderately	Moderately	Highly
	inactive	active (informal)	active (formal)	active
Health and well-being indicators				
Self-assessed health	0.719	0.767	0.811	0.855
Frequency of negative affect	2.343	2.273	2.006	1.805
	(2.438)	(2.187)	(1.999)	(1.832)
Frequency of positive affect	6.751	6.999	6.961	7.329
	(2.090)	(1.964)	(1.964)	(1.751)
Life satisfaction	7.992	8.219	8.200	8.429
	(1.651)	(1.358)	(1.248)	(1.224)
Background characteristics				
Male	0.428	0.404	0.606	0.538
Age in year of interview	71.75	71.09	68.00	69.11
	(8.44)	(7.55)	(6.53)	(6.21)
Single	0.358	0.302	0.256	0.217
Compulsory education	0.643	0.656	0.494	0.533
Secondary education	0.242	0.226	0.391	0.302
Tertiary education	0.115	0.118	0.194	0.165
Log of household income	11.20	11.25	11.45	11.39
	(0.655)	(0.614)	(0.646)	(0.569)
Employed	0.277	0.249	0.411	0.349
Rural	0.250	0.233	0.256	0.273
Physical Activity	0.499	0.729	0.778	0.848
Health problems	0.516	0.502	0.428	0.489
Number of observations	1222	2240	180	1525

show the results for partnered individuals when the partner's social participation activity class is included in the regression model, focusing on the coefficients of the partner's profile only (full results are in the appendix).

For self-assessed health, the coefficients for classes 2–4 are statistically significant for the entire sample (column 1). Given that higher numbered classes are associated with a higher activity profile compared to class 1, more social participation is associated with better self-assessed health. The magnitude of the positive association generally increases with class designation. However, when control variables are included, only class 4 *(highly active)* remains significant (column 2). For this outcome, most of the coefficients are positive. When considering the single and partnered regressions, class 4 is always significant when compared to class 1. Classes 2 and 3 (both *moderately active,* with *informal* and *formal activities,* respectively) show limited significance in the uncontrolled regressions (columns (3) and (5)), but this goes away when control variables are included. When the partner profile is included in the regression, in only one instance is the partner's class designation significant, and this vanishes when control variables are incorporated.

For the other health/well-being outcomes, class 4 (*highly active*) coefficients show statistical significance in most cases, and class 2 *(moderately active (informal))* shows limited statistical significance. Overall, the pooled OLS results support earlier findings in the literature of a significant and positive association between social participation and health and well-being. However, not all classes show significance with each of the tested outcomes. This suggests that simply doing more activities is not always associated with better health and well-being. The partner's activity profile is included in the analysis and once control variables are included, the results indicate an insignificant association with a person's health and well-being.

4.4. Fixed effects regression results

Table 6 contains the summary results of the FE regressions (full regression results are shown in appendix Tables A6-A9). Compared to pooled OLS, the FE regressions control for all time-constant background characteristics by exploring the within variation of individuals across the two time periods. Overall, most of the coefficients of social participation classes become smaller and statistically insignificant. For self-assessed health, in the controlled regression for partnered adults, the coefficients are negative and significant (5% level). This indicates a relationship where self-assessed health decreases while social participation class increases, or where social participation class decreases and self-assessed health increases. No coefficients were significant for the outcomes of negative and positive affects. In one instance for life satisfaction, when control variables are incorporated there is a positive and significant (5% level) coefficient. These significant results may be due to repeated testing effects. The associations of the partner's social participation profiles and health and well-being are statistically insignificant throughout.

The results of the FE regression point to a positive bias in the OLS regressions, i.e., more social participation is generally positively associated with health and well-being, but mainly due to time-constant unobserved background characteristics. Once these time-constant factors are controlled for in the model, the significant associations diminish or vanish.

4.5. Model extensions

In the first extension, I test for moderating effects of the partner's social participation class, i.e., including interaction terms of an individual's own and his/her partner's social participation. While multiple instances of significance were found in the OLS models, most of these interaction terms are insignificant in the FE models. For outcomes of negative and positive affect, there is a pattern of significance when both partners were in class 3 (*moderately active (formal)*). The few other significant effects appear somewhat random and likely the result of repeated testing effects. I therefore do not discuss these results further.

For a second extension, because of potential selection bias in which health and well-being may influence the level of social participation, I ran a pooled OLS model on the full sample using health and well-being outcomes from the 2014 and 2017 waves of the SHP, with the prior years' (2013 and 2016) health and well-being indicators and social participation class as covariates, along with the same control variables. In these regressions, the coefficients of the social classes are somewhat comparable to the pooled OLS (non-lagged) models in significance, and their magnitudes are generally smaller. However, the results from these OLS regressions need to be interpreted with caution because they do not control for time-constant unobserved effects, which according to the previous section play an important role in the relationship between social participation and health and well-being. In summary, the results from these dynamic perspectives are not entirely conclusive, but mainly in line with the non-lagged OLS results.

5. Discussion

The relationship between social participation and health and well-being outcomes is of ongoing interest to researchers in various disciplines. Only a few studies published to date consider the interdependence of activities (Amagasa et al., 2017; Lam & Bolano, 2018; Morrow-Howell et al., 2014), and generate unique social participation profiles in the older adult population. Moreover, most studies consider the individual in isolation, and there is limited knowledge about how the partner's social participation is related to one's own health and well-being.

In revisiting my research questions, I find that social participation profiles of older adults in Switzerland can be described by four unique

Table 5

Associations between social participation and health and well-being: OLS results.

Source: Swiss Household Panel 2013 and 2016, own calculations. *Notes:* The table reports estimated coefficients of the indicators for the so1cial participation profiles in pooled OLS models with outcomes self-assessed health, frequency of negative affect, frequency of positive affect and life satisfaction. Odd columns represent simplified regressions without further controls, even columns represent pooled OLS regressions controlling for the background characteristics listed in Table 1. Columns 1 and 2 represent the full sample, columns 3 and 4 represent single older adults, columns 5 and 6 represent partnered older adults, and columns 7 and 8 report the coefficients for the social participation profile of the partner. Heteroscedasticity-robust and cluster-adjusted standard errors in parentheses. Significance levels: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

	Own social participation profile						Partner's	
	Total		Single		Partnered			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reference class: Relatively inactive	*Outcome: Self-assessed health*							
Moderately active (informal)	0.047**	0.026	0.058*	0.040	0.036	0.017	0.014	−0.003
	(0.016)	(0.015)	(0.029)	(0.027)	(0.020)	(0.018)	(0.023)	(0.022)
Moderately active (formal)	0.093**	0.016	0.050	−0.028	0.097**	0.023	0.104**	0.066
	(0.032)	(0.030)	(0.071)	(0.063)	(0.036)	(0.034)	(0.038)	(0.037)
Highly active	0.135***	0.073***	0.173***	0.104***	0.110***	0.060**	0.022	0.004
	(0.017)	(0.016)	(0.032)	(0.030)	(0.020)	(0.019)	(0.024)	(0.023)
	Outcome: Frequency of negative affect							
Moderately active (informal)	−0.069	−0.014	0.056	0.071	−0.082	−0.046	−0.140	−0.067
	(0.088)	(0.084)	(0.163)	(0.158)	(0.103)	(0.099)	(0.119)	(0.116)
Moderately active (formal)	−0.342*	−0.024	−0.470	−0.329	−0.228	0.089	−0.334	−0.266
	(0.168)	(0.153)	(0.295)	(0.263)	(0.203)	(0.186)	(0.238)	(0.231)
Highly active	−0.536***	−0.291***	−0.593***	−0.509**	−0.431**	−0.233*	−0.053	−0.047
	(0.090)	(0.087)	(0.171)	(0.174)	(0.106)	(0.109)	(0.128)	(0.123)
	Outcome: Frequency of positive affect							
Moderately active (informal)	0.246***	0.170*	0.381**	0.331*	0.140	0.086	−0.140	−0.178
	(0.075)	(0.073)	(0.132)	(0.130)	(0.089)	(0.088)	(0.103)	(0.101)
Moderately active (formal)	0.205	−0.021	0.085	−0.096	0.164	−0.021	−0.313	−0.443
	(0.160)	(0.157)	(0.329)	(0.327)	(0.181)	(0.178)	(0.253)	(0.256)
Highly active	0.580***	0.374***	0.776***	0.599***	0.419***	0.273**	−0.104	−0.167
	(0.079)	(0.079)	(0.163)	(0.165)	(0.091)	(0.090)	(0.110)	(0.108)
	Outcome: Life satisfaction							
Moderately active (informal)	0.225***	0.165**	0.144	0.115	0.233***	0.189**	0.018	0.003
	(0.058)	(0.055)	(0.115)	(0.110)	(0.063)	(0.061)	(0.066)	(0.065)
Moderately active (formal)	0.215*	0.125	0.143	0.137	0.193	0.126	0.097	0.065
	(0.106)	(0.105)	(0.249)	(0.251)	(0.122)	(0.110)	(0.135)	(0.134)
Highly active	0.434***	0.320***	0.330*	0.324*	0.400***	0.326***	0.031	0.015
	(0.061)	(0.059)	(0.134)	(0.133)	(0.066)	(0.064)	(0.071)	(0.071)
Control variables	no	yes	no	yes	no	yes	no	yes
Number of observations	5167	5167	1490	1490	3677	3677	2426	2426

classes that vary in the average number and type of activities in which individuals engage. Regarding an older adult's pattern of social participation and any association with his/her health and/or well-being, I find limited significant associations for self-assessed health and life satisfaction once time-constant unobserved factors are accounted for. Finally, I do not find consistent associations of the social participation profiles of someone's partner with his or her health and well-being outcomes.

The analysis of the latent classes highlights the degree of heterogeneity in social participation patterns in the older adult population in Switzerland. In particular, there are differences in the extent of activities and in their composition, with some groups engaging relatively more in formal activities (club/group, volunteering) and others in informal ones. The social participation classes also differ in background characteristics, including gender, age, and socio-economic status.

Some sociodemographic factors mentioned in the Theory section that influence both social participation and health/well-being outcomes have significant coefficients in the pooled OLS regressions, though FE regressions have reduced and/or insignificant coefficients. Some recent research has suggested additional characteristics that may influence social participation of older adults: fear of falling (Choi, Bruce, Dinitto, Marti, & Kunik, 2019); level of non-kin social networks (Katagiri & Kim, 2018) and for already lonely older adults, fears relating to social participation itself (Goll, Charlesworth, Scior, & Stott, 2015). These should

be further studied in future analyses of social participation for older adults.

Regarding the associations between social participation classes and health and well-being, the results of the pooled OLS regressions are generally consistent with many other cross-sectional studies that focus on social participation and health-related outcomes for older adults: that more social participation is associated with better health and well-being outcomes (Curvers et al., 2018; Vozikaki et al., 2017). While this is a consistent result in the literature, the results of cross-sectional studies may likely overstate the association between social participation and health and well-being due to (time-constant) unobserved confounders.

The results of the FE regressions show that when these confounders are accounted for, social participation does not have a significant association with frequency of negative affect or positive affect. For self-assessed health and life satisfaction, there are still some significant associations, though they decrease in both magnitude and level of significance compared to pooled OLS. In other words, individuals assigned to the different classes differ beyond their activity profile and observed demographic and socio-economic background. These differences (which are unobserved and unknown in the pooled OLS models) account for much of the differences in the tested outcomes. This result points to the existence of self-selection bias, i.e., individuals participate or not in social activities based on their unique and time-constant background characteristics. These characteristics influence them to

Table 6

Associations between social participation and health and well-being: FE results.

Source: Swiss Household Panel 2013 and 2016, own calculations. *Notes:* The table reports estimated coefficients of the indicators for the social participation profiles in linear FE regression models with outcomes self-assessed health, frequency of negative affect, frequency of positive affect and life satisfaction. Odd columns represent simplified FE regressions without further control variables, even columns represent FE regressions controlling for the background characteristics listed in Table 1 (time-constant variables are dropped due to collinearity). Columns 1 and 2 represent the full sample, columns 3 and 4 represent single older adults, columns 5 and 6 represent partnered older adults, and columns 7 and 8 report the coefficients for the social participation profile of the partner. Heteroscedasticity-robust and cluster-adjusted standard errors in parentheses. Significance levels: * $p \leq 0.05$, ** $p \leq 0.01$,*** $p \leq 0.001$.

	Own social participation profile						Partner's	
	Total		Single		Partnered			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reference class: Relatively inactive	*Outcome: Self-assessed health*							
Moderately active (informal)	−0.036	−0.035	0.008	0.010	−0.070*	−0.067*	0.013	0.011
	(0.025)	(0.026)	(0.046)	(0.045)	(0.030)	(0.031)	(0.038)	(0.038)
Moderately active (formal)	−0.100*	−0.112*	−0.116	−0.129	−0.110*	−0.126*	−0.037	−0.056
	(0.044)	(0.045)	(0.099)	(0.100)	(0.050)	(0.049)	(0.056)	(0.058)
Highly active	−0.049	−0.052	−0.018	−0.022	−0.082*	−0.080*	−0.028	−0.024
	(0.033)	(0.033)	(0.069)	(0.069)	(0.037)	(0.037)	(0.047)	(0.047)
	Outcome: Frequency of negative affect							
Moderately active (informal)	−0.101	−0.113	−0.284	−0.292	−0.052	−0.068	−0.027	−0.018
	(0.122)	(0.122)	(0.279)	(0.284)	(0.130)	(0.130)	(0.151)	(0.151)
Moderately active (formal)	0.038	0.077	−0.137	−0.190	−0.011	0.053	0.035	0.075
	(0.192)	(0.194)	(0.410)	(0.407)	(0.213)	(0.214)	(0.259)	(0.258)
Highly active	−0.250	−0.258	−0.465	−0.518	−0.233	−0.239	−0.181	−0.184
	(0.140)	(0.139)	(0.376)	(0.370)	(0.147)	(0.147)	(0.198)	(0.196)
	Outcome: Frequency of positive affect							
Moderately active (informal)	0.137	0.137	0.381	0.378	0.096	0.085	−0.150	−0.165
	(0.127)	(0.127)	(0.224)	(0.223)	(0.158)	(0.158)	(0.164)	(0.161)
Moderately active (formal)	−0.173	−0.223	0.136	0.072	−0.187	−0.246	−0.345	−0.463
	(0.257)	(0.265)	(0.363)	(0.376)	(0.329)	(0.336)	(0.341)	(0.338)
Highly active	−0.008	−0.026	0.205	0.136	−0.078	−0.093	−0.040	−0.045
	(0.152)	(0.153)	(0.291)	(0.295)	(0.183)	(0.184)	(0.212)	(0.208)
	Outcome: Life satisfaction							
Moderately active (informal)	0.198**	0.192*	0.314	0.308	0.079	0.072	−0.073	−0.165
	(0.077)	(0.077)	(0.180)	(0.180)	(0.0715)	(0.076)	(0.099)	(0.161)
Moderately active (formal)	0.179	0.140	0.248	0.226	0.163	0.134	−0.111	−0.463
	(0.139)	(0.139)	(0.243)	(0.239)	(0.166)	(0.165)	(0.163)	(0.338)
Highly active	0.124	0.120	0.270	0.247	0.037	0.032	0.030	−0.045
	(0.094)	(0.093)	(0.224)	(0.220)	(0.099)	(0.099)	(0.129)	(0.208)
Control variables	no	yes	no	yes	no	yes	no	yes
Number of observations	5167	5167	1490	1490	3677	3677	2426	2426
Number of groups	3661	3661	1089	1089	2621	2621	1764	1764

choose certain activities and also affect their health and well-being. If unaccounted for in the analysis, they bias the results (see also Chen et al., 2016; Croezen et al., 2015; Liu et al., 2016). In revisiting the relationship between age and well-being outcomes mentioned in the Introduction, in all of the FE regressions, age was a significant (1%) predictor only in frequency of positive affect, where it had a slightly negative relationship.

There are several limitations to this research. First, in working with survey data, there are various biases that may influence the estimates, such as recall, reporting, attrition and/or bias that may arise due to incomplete or missing information. Although the use of panel data FE regressions may partly overcome some of these issues, I cannot rule out the existence of time-varying confounding influences, and thus the results cannot be interpreted causally. Second, the Swiss Household Panel does not include certain populations, such as institutionalized persons, and it may exclude certain migrants, as the survey is only run in the national languages (German, French, Italian) or English. Third, the results are based on older adults in Switzerland, and may not be applicable to older adults elsewhere. Fourth, this study does not measure the intensity of certain activities, such as informal support, online social networks, being a member of a club or group, or volunteering. Fifth, changes in social participation profiles may not exactly coincide with changes in health or well-being. In other words, social capital supported by social participation may develop or decline at different rates than changes in social participation.

6. Concluding remarks

This study describes various social participation profiles of older adults in Switzerland and their associations to health and well-being. It considers a wide variety of social activities in determining these profiles. Using panel data FE methods, the results indicate that once individual time-constant effects are controlled for, the majority of the positive and significant relationships initially found between social participation profiles and negative affect or positive affect in the pooled data become insignificant. Self-assessed health has several small and negative associations and life satisfaction has limited small and positive associations. Factoring in the social participation profile of partners shows no significant associations with health and well-being. Future research should leverage additional time periods, and focus on uncovering the time-constant, unobserved factors that can explain differences in social participation patterns among older adults. Some of these may include genetic factors, general motivation, and preferences for, barriers to, or the availability of opportunities for social participation.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2019.100424.

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