Multidimensional Quality of Life of Older Adults in South Africa

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Abstract

It is estimated that by 2050, the world population over the age of 65 will reach 1.5 billion. The United Nations predicts that the fastest growth will be in Africa, which suffers from extreme poverty and inequalities. Therefore, older people who play an essential role in African culture face significant well-being challenges. To mitigate these challenges and improve quality of life (QoL), we must first assess their well-being levels. Well-being is a multidimensional concept and needs a multidimensional measure. However, the dimensions that explain older people’s QoL differ from other age groups and between developed and developing countries. We construct a unique index applicable to Africa. We functionalised the index using the South African National Income Dynamic Study dataset. By applying the new index empirically, we determine the level of QoL of older adults. Additionally, we establish which dimensions explain the most variance signalling areas for policy intervention. Furthermore, analysing panel data allows us to follow older individuals’ well-being over time to determine the trend. Lastly, we analyse different demographic groups’ well-being to establish the most vulnerable. We find the dimensions that explain the most variance are household services, economic status, safety, mental and physical health. The well-being of older adults increased over time, likely due to policy interventions, and the most vulnerable group is black African women in traditional and farming areas. Other developing countries could adopt our QoL index to measure the well-being of older people at a micro-level.

Keywords Quality of life · Older adults · Categorical principal component analysis · South Africa

JEL Classification I31 · J14 · J18

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Introduction

It is estimated that by the year 2050, the world population over the age of 65 will reach 1.5 billion people. The United Nations predicts that this rapid ageing will mainly happen in developing countries situated in Africa (United Nations, Department of Economic and Social Affairs, Population Division, 2020). This is problematic because the continent is already plagued by extreme poverty and high inequalities. Rapid ageing in Africa may further affect economic growth, the sustainability of families, the ability of governments and communities to provide resources for older people, and international relations. Hence, the Second World Assembly on Ageing guided the development of social policies at national and international levels to address the opportunities and challenges of population ageing (United Nations, 2002). However, Kofi Annan, a former Secretary-General of the United Nations, stated that “the real test will be in implementation” of these policies (United Nations, 2002). A decade later, the summary report submitted to the Human Rights Council showed that governments still fail to guarantee the well-being of older people (United Nations Human Rights Council, 2013).

Ensuring the well-being of older adults in the African context is especially important since they fulfil a crucial role in society. Grandparents often provide childcare to allow parents to work far away from home (StatsSA, 2021a, b, c, d, e). Additionally, older African men are seen as decision-makers among their communities, upholding values and beliefs (StatsSA, 2021a, b, c, d, e; Apt, 1992).

The first step in addressing the well-being of older people lies in measuring it. As Peter Drucker famously said, “If you can’t measure it, you can’t manage it”. However, there is a need for an accurate measure specifically tailored to the needs of older adults living in Africa, which is home to the poorest of the poor (Zimmer & Das, 2014). Since some of the domains of QoL are more relevant to older people and differ from the Western world, a unique multidimensional composite index is needed.

Previous studies measuring older individuals’ QoL were mostly not tailored to African countries. The indices could not capture whether multidimensional well-being improved over time or established the success of policy initiatives. Primarily this was attributable to a lack of adequate data. Studies used cross-sectional data (Ralston, 2018; Phaswana-Mafuya et al., 2013), while other studies only used

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1 Well-being and quality of life are used interchangeably
individual indicators (Forjaz et al., 2010; Wister et al., 2019; Doron et al., 2019) or focused on macro-level to compare well-being dimensions and countries. To make a difference in the QoL of older people, policy should be implemented at a micro-level. Therefore, a measure should be developed to specifically capture the well-being of older people (in developing countries), which can be customised according to the needs of individual countries. Such a measure can inform policymakers on those dimensions that should be addressed, the success of implemented policy measures and highlight the most vulnerable older adult cohort (Chen et al., 2018; HelpAge, 2019; UNECE, 2018).

Given the above, the study’s primary contribution is to construct a multidimensional QoL index that includes domains of an economic and non-economic nature and objective and subjective indicators focusing specifically on older adults living in Africa. To the best of our knowledge, no other study constructed such an index specifically applicable to developing countries at a micro-level. We call our index the Quality of Life Index of Older People (QoLIOP). We choose a South African (SA) dataset in our empirical application of the index, namely the National Income Dynamic Study (NIDS), due to the richness of the dataset.

In addition, SA is an interesting case study as the proportion of older adults is rapidly increasing (one of the fastest growth rates in Africa). In 2020, 9.2% (5.51 million) of the population was 60 years or older (StatsSA, 2021a, b, c, d, e). Furthermore, the country is unique as it is the most unequal country globally (Gini coefficient of 65 in 2015), and it has an unstable socioeconomic and political situation with an official unemployment rate of 32.6% (StatsSA, 2021a, b, c, d, e). SA’s older people are poor (44% of older adults) and food insecure, with almost 19% of older adults not meeting the food poverty line of R441 ($30.69). Additionally, a significant proportion access the Old Age Pension welfare payment (StatsSA, 2021a, b, c, d, e). With the SA population aging (many over 60 years), there is also an increase in chronic conditions and disabilities (Garin et al., 2016). SA has targeted policies, such as the SA Policy for Older Persons and the Plan of Action on Ageing (Republic of South Africa, 2005). In 2006, the Older Persons Act 13 (Republic of South Africa, 2006) was developed to empower older people and promote and maintain their status, rights, well-being, safety, and security. These policies, acts, and social welfare payments offer the opportunity to measure whether these improve the well-being of older adults over time.

Using SA’s NIDS panel dataset, the QoLIOP will allow us to empirically determine the current QoL level among older people. Additionally, we will establish which dimensions in the QoLIOP explain the most variance signalling areas for policy intervention. As we have the benefit of using panel data, we follow older individuals’ well-being over time to determine the trend and compare the QoL of different demographic groups to highlight the most vulnerable. This index can be customised

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2 The official definition of unemployed persons of 15–64 years old is when persons were not employed; and actively looked for work; and were available for work or had not actively looked for work. The expanded definition of unemployment rate (43.2% in 2021) describes persons of 15–64 years old, not employed and were available for work but discouraged from seeking work. Unemployed youth (aged 15–34 years) were the driver of both unemployment rates (StatsSA, 2021a, b, c, d, e).
by other countries (especially those in Africa) to inform policymakers on QoL levels, the most important dimensions, the trends over time, and highlight the most vulnerable groups among older people.

The results show that the newly developed composite multidimensional index is robust and reflects the well-being of older people in an African country. For our empirical application case study, South Africa, we find that the dimensions of household services, economic status and safety explained the most variance in QoL. We find that the QoL of older adults increased over time as they aged due to the improvements made in the household services, economic status and mental health dimensions. The dimensions that showed a decrease are safety and health. We find that white South Africans have the highest QoL among demographic groups, followed by coloureds and Africans.

We note with interest that only the QoL of black South Africans increased over time, whereas it decreased for the other population groups. Furthermore, we find that the QoL of black South Africans is catching up with the other population groups. This shows that the South African government’s policy measures implemented in 2006 to empower older and disadvantaged groups had a positive effect. Finally, older males have higher QoL scores compared to females. The older adults that live in rural (traditional) areas have the lowest QoL scores, especially females residing in farming households.

The rest of the paper is structured as follows. The next section contains a brief discussion on the relevant literature and provides theoretical underpinnings for our multidimensional QoL index. “Methodology and data” section outlines the methodology and describes the data used in presenting the functionality of the index. The empirical application of the index and analyses follow in “Empirical application of the QoLIOPE” section, while the paper concludes in “Conclusions” section.

**Literature Review**

*Existing Multidimensional Indices of Older Adults*

Existing multidimensional indices of QoL of older adults, which measures the extent of the progress of active ageing in European countries, include the Active Ageing Index (AAI) (UNECE, 2018) and the Global AgeWatch Index (GAWI) (HelpAge International, 2015). Their goal is to create a global overview of the ageing challenges faced by various countries and help politicians and policymakers focus on ageing-related issues. Additionally, the Hartford Index of Societal Aging measures societal adoption of ageing in 18 Organisation of Economic Cooperation and Development (OECD) countries (Chen et al., 2018).

These indices have several limitations, such as focusing mainly on developed countries, non-comparable data sources, and lacking theoretical underpinning and transparency. Additionally, income insecurity is measured by GDP per capita, which is not the best indicator since the relationship between a country’s economic development and older people’s well-being is not direct (Varlamova et al., 2017). Moreover, life expectancy indicators obtained higher weights which can be discriminative...
towards the countries that experience high mortality rates. Furthermore, comparisons among various groups (like gender or race) are difficult due to the lack of data on many indicators and an age restriction with a minimum of 65 and a maximum limit of 85 does not allow for the analysis of the oldest adults in this cohort.

Apart from the above, various other composite indices for older people have been attempted internationally. However, they explore domains of QoL of older adults from a specific nature like an index on the satisfaction with their local place of residence (Forjaz et al., 2010), isolation index (Wister et al., 2019) or index on human rights (Doron et al., 2019).

The literature on the one-dimensional QoL of older people is abundant. Often, it is expressed in terms of socioeconomic well-being measured by i) household income and per capita income (Gildner et al., 2019), ii) psychological well-being (Møller & Radloff, 2013; Ralston, 2018), iii) a health perspective (Phaswana-Mafuya et al., 2013; Oldewage-Theron & Égal, 2021) or iv) QoL of older South Africans depending on their housing, for example, at the residential care facilities (van Biljon et al., 2015). However, there is a need for a multidimensional index.

**Dimensions of QoL of Older Adults**

When investigating which dimensions influence the QoL of older adults, Kelley-Gillespie (2009) proposed it should be viewed from the perspective of general systems theory. This theory emphasises the significance of people’s interactions with various systems that impact their behaviour, circumstances and QoL. This means that positive and negative internal or external forces affect an individual’s QoL on multiple micro- (individual, family) and macro (community) levels.

Researchers agree that despite the variety in methods used to measure QoL, the components are quite similar (Brown et al., 2004; Kelley-Gillespie, 2009). A synthesis of the existing literature shows that the QoL of older adults has the following overlapping domains (Kelley-Gillespie, 2009): i) social; ii) physical; iii) psychological; iv) cognitive; v) spiritual, and vi) environmental.

While Bond (1999) argued there is no agreement concerning those domains that reflect low or high QoL, some studies investigated the importance of specific domains in older people’s lives. Results showed that health (Evans et al., 2005; Henchoz et al., 2015), activities of daily living (Henchoz et al., 2015; Robleda & Pachana, 2019), sensory abilities (Kalfoss & Halvorsrud, 2009; Molzahn et al., 2010), mobility (Kalfoss & Halvorsrud, 2009; Molzahn et al., 2010), home environment (Kalfoss & Halvorsrud, 2009), family (Evans et al., 2005; Henchoz et al., 2015), finances (Henchoz et al., 2015), social life or relationships (Robleda & Pachana, 2019; van Biljon et al., 2015), neighbourhood safety (Henchoz et al., 2015; Paschoal et al., 2007), living arrangements (Evans et al., 2005), spirituality (van Biljon et al., 2015) and energy (Molzahn et al., 2010) were of high importance.
Change in QoL of Older Adults over Time and Differences between Various Groups

Certain theories in gerontology highlight that older individuals learn to adapt to their strengths and weaknesses and thus have more realistic goals, increasing their well-being. For example, socio-emotional selectivity theory suggests that individuals spend more time doing activities that contribute directly to their well-being (Charles & Carstensen, 2009). While some studies find a decrease in well-being over time (Fernández-Ballester et al., 2011), some theories propose that individuals are born with a predisposition to a certain level of happiness and, based on genetics and personality, will always revert to it (Lucas, 2007). Nonetheless, researchers agree that QoL outcomes vary across the lifespan (Lang & Heckhausen, 2001; Jokisaari, 2004) and draw no conclusion on whether it is a continuous process or a generational effect (Blanchflower & Oswald, 2008).

Measuring the QoL of different groups of older adults highlights the most vulnerable groups in a country. The hypothesis that being old and belonging to a minority group has been found to have a double jeopardy effect meaning that the combined negative effects of two stigmatised statuses have a double disadvantage to the outcome due to their interactive effects (Chappell & Havens, 1980). Literature on gender-based, racial and environmental differences in QoL outcomes among older adults is scarce and inconclusive.

There is no clear consensus on whether older females experience higher levels of subjective well-being than older males (Pinquart & Sorensen, 2000; Chappell & Havens, 1980; Meggiolaro & Ongaro, 2015; Sindhuja et al., 2021) nor on which factors influence older men and women’s well-being respectively, i.e., support and financial levels for men and participating in group activities, friendships and government assistance for women (Rishworth et al., 2020).

Regarding racial differences, two studies undertaken in the USA by Ortega et al. (1983) and Tang et al. (2019) found that older African Americans were significantly more satisfied with life than whites. In contrast, Krause (1993), also using an American dataset, found the opposite.

Furthermore, the literature has shown that environmental factors may cause possible differences depending on the place of residence. Some studies find that people residing in rural areas achieved higher scores in some domains of QoL (Tavares et al., 2014), while others found that those individuals who reside in urban areas had enhanced subjective well-being than their rural counterparts due to the positive effects of social networks and support systems (Tobiasz-Adamczyk & Zawisza, 2017). Nzabona et al. (2016) confirmed that older persons living in urban areas felt lonelier.

Limitations of Previous Research

From the discussion in “Existing multidimensional indices of older adults”, “Dimensions of QoL of older adults”, “Change in QoL of older adults over time and differences between various groups” sections, studies that focused on developing...
instruments to assess QoL among older adults have several limitations that we aim to address in our study. Firstly, we construct a QoL index that is more suitable for developing countries. More specifically, we functionalise a composite multidimensional QoL index for an African country where most of the world’s vulnerable older people reside. To the best of the authors’ knowledge, this has not been done before. We also benefit from no age restrictions when applying our index since we include older adults of 60 years and above without a maximum limit. Secondly, while the advantage of international indices lies in comparison across dimensions and countries, such comparability often leads to the loss of accuracy in evaluating multidimensional QoL. Additionally, while these indices might highlight the plight of older people, it does not allow for practical policy initiatives at the country level. Therefore, we rely on one nationally representative data source in our study and inform policymakers accordingly. Thirdly, most studies used cross-sectional, non-representative or macro data and data estimates, while we benefit from a panel dataset spanning five waves. This allows us to follow the same individuals over time to determine well-being changes and highlight the most vulnerable groups among older people.

Methodology and Data

Constructing the Multidimensional QoLIoP

In constructing the composite Quality of Life Index of Older People (QoLIoP), we follow the methodology as put forth in the ‘Handbook on Constructing Composite Indicators’ (OECD, 2008), Hagerty and Land (2007), Land (2014) and Greco et al. (2019).

First, guided by the theory and the literature (see “Existing multidimensional indices of older adults”, “Dimensions of QoL of older adults”, “Change in QoL of older adults over time and differences between various groups” sections), we select the domains and the indicators within each domain which likely can explain the QoL of older people.

Next, we normalise each indicator to adjust scales for our data to be comparable. We code indicators with nominal and ordinal scales in the same direction, with lower values showing the worse outcome and higher values the best. Then we use the discretisation method to transform continuous variables (household expenditure and years of education) into categorical data.

Different multivariate methods are available to explore the data structure, such as principal component analysis (PCA) and factor analysis (FA). However, we use categorical principal component analysis (CATPCA), a form of PCA, which is best suited for the categorical nature of our data. CATPCA allows for nonlinear relationships between indicators and manages indicators with mixed measurement scales, while PCA fails to do so. CATPCA assigns category quantifications to the variables of mixed measurements, also referred to as optimal scaling (spline ordinal, spline nominal, ordinal and nominal) (Linting et al., 2007). CATPCA uses an iterative algorithm that alternates the estimation of optimal quantifications and the linear PCA model, which is achieved by minimising a least-squares loss function (for more technical information on CATPCA, please refer to Gifi, 1990; Linting et al., 2007).
Using different combinations of our selected indicators, we run various CATPCAs to determine the best fit and select the most appropriate indicators to explain the relevant components. The results show that closely related indicators load on the same components. Eigenvalues measure the total variance in the data explained by each component, while the sizes of the eigenvalues determine the number of components that need to be extracted. The largest possible variance guides our final set of indicators in the data.

There are a few options to weight the index, such as equal weighting, various objective statistical measures, and subjective weighting. Equal weights do not account for variation in weights of the individual indicators, while subjective weights are often not internationally comparable as they depend on the opinion of various stakeholders (OECD, 2008). We selected CATPCA as it benefits from being an objective weighting method: it allocates weights according to the variance explained in the data instead of depending on subjective evaluations of the weights of researchers or policymakers (Decancq & Lugo, 2013; Booysen, 2002). It means that the data itself determines the weighting. The standard method of constructing composite indices using CATPCA, PCA or FA includes only the factor loadings on the first component.

However, if the first component does not provide sufficient explanatory value, Nicoletti et al. (2000) suggest a method to use not only the first component but also the subsequent extracted components. Therefore, we aim to keep the most variation of the data with the minimum number of components. We use the factor loadings as the weights of our intermediate composites indices (ICI), i.e., the different sub-dimensions of QoL. We square each factor loading and scale it to a unity sum to obtain the ICI. In addition, we also weight each of the extracted components to derive our QoLIOP. These weights are equal to the proportion of the explained variance of the extracted component in the dataset (Nicoletti et al., 2000). In doing so, we determine that the first component explains the most variance and therefore carries the largest weight in the composite index. All subsequent components explain less variance and attract a lower weight in the index.

We chose the linear aggregation method rather than a geometric or multi-criteria aggregation method because it assumes that indicators have preferential independence and are more compensatory. In other words, it allows the dimension with a higher score to compensate (offset) the dimension with the lower score (Dobbie & Dail, 2013). Linear aggregation permits the assessment of the marginal contribution of each indicator separately, which, further added together, yields a total value (OECD, 2008). Furthermore, linear aggregation is simplistic and eases the replication of the methodology used to construct the index.

Finally, to test the robustness of the QoLIOP to the subjective choices we made regarding the (i) imputation of missing data, (ii) scaling of the variables, (iii) method of weighting and (iv) aggregation of the composite index, we conduct an uncertainty and sensitivity analysis. The different methods to treat the “missingness” in the data include pairwise and listwise deletion, which is compared to our choice using CATPCA. Additionally, we use different optimal scaling methods such as spline ordinal and spline nominal to compare our scaling results. The weighting method we apply is equal weighting. Furthermore, we used geometric aggregation rather than linear
aggregation to aggregate the different dimensions of QoL. To test the robustness of our index to these subjective choices, we calculate the Pearson correlation coefficient between our index and the alternative indices. If the correlation is strong, positive and significant, we assume our index to be robust (see Jordá et al., 2015).

We test the linkage (correlation) of the QoLIOP to other published indices and well-being measures as an additional method to validate our index (Hagerty & Land, 2007; OECD, 2008). Lastly, we also compare the trend of a single indicator of subjective well-being to our index, included in the dataset but not included in the composite index itself. For this purpose, we make use of life satisfaction. If the trend over time is significantly correlated, we assume that the QoLIOP is a valid representation of the quality of life for older adults in South Africa (Groh et al., 2010).

In applying the QoLIOP using the NIDS dataset, we calculate the mean per subsample either per wave or demographic group. We tested the significance of the difference in the mean scores of the different sub-samples (per wave or demographic group) using a t-test for those sub-samples with two categories (gender and geographical area) and one-way between-sub-sample analysis of variance (ANOVA) for sub-samples with two or more categories (population group).

Data

The data used to demonstrate an empirical application of the QoLIOP comes from the National Income Dynamics Survey (NIDS). NIDS is a face-to-face longitudinal survey repeated with the same individual household members every two years (Chinhema et al., 2016). This dataset focuses on the livelihoods of individuals and households over time. The reason for choosing the NIDS data to demonstrate the construction of the index lies with the questionnaire capturing data on many dimensions of QoL, including the socioeconomic profiles of households and their individuals. Additionally, we have information on sources of income, including grants, household expenditures, assets, community-level data, and health-related components, which is ideal for this study as it covers various aspects of older adults’ well-being. Furthermore, NIDS allows for countrywide coverage as all nine provinces were targeted for the individual and household questionnaires (Leibbrandt et al., 2009).

To select the sample data used in the construction of QoLIOP, we included all five waves from the individual and household levels spanning a period from 2008 to 2017. As our focus is on the well-being of older adults, we include older persons of 60 years and above (as per our definition mentioned in “Introduction” section). We choose individuals 60 years or older in wave one and follow these individuals over five waves meaning that there were no new entrees of individuals within those five waves. We excluded those individuals that died in one of the waves. Moreover, we excluded those individuals that did not answer the questionnaire in at least three waves.

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3 The data is stored on the DataFirst portal: [http://www.datafirst.uct.ac.za/dataportal/index.php/catalog/NIDS](http://www.datafirst.uct.ac.za/dataportal/index.php/catalog/NIDS)
As a first instance, we pool the data from all five waves when constructing the QoLIOP. In this manner, we derive the same weights over time and across subsamples making the QoL indices comparable (see “Empirical application of the QoLIOP” section). The final balanced data consists of 1287 individuals in the target age group (60+) and 6435 observations in all five waves.

The demographic characteristics of SA’s older population are represented in Table 1. A substantial proportion of older South Africans consists of females, 70% or 902 individuals. The share of black Africans in the sample is significant at 77% (987 older adults), with a smaller percentage share allocated to the other population groups. We divide geographical areas into urban and rural areas. In the SA context, urban areas are continuously built-up areas with economic activity and land use such as cities, towns, townships, and suburbs (StatsSA, 2021a, b, c, d, e). We combined the categories “traditional” and “farms” into “rural” according to the StatsSA definition that rural area includes tribal/traditional areas (former homeland areas), commercial farms and informal settlements (StatsSA, 2021a, b, c, d, e). A high level of those living in urban areas (60% or 760 individuals) is expected since older people prefer a slower and more relaxed lifestyle.

| Variable          | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 |
|-------------------|--------|--------|--------|--------|--------|
| Gender:           |        |        |        |        |        |
| female            | 902    | 902    | 902    | 902    | 902    |
| male              | 385    | 385    | 385    | 385    | 385    |
| Population group: |        |        |        |        |        |
| black African     | 987    | 987    | 987    | 987    | 987    |
| coloured          | 167    | 167    | 167    | 167    | 167    |
| Asian / Indian    | 16     | 16     | 16     | 16     | 16     |
| white             | 117    | 117    | 117    | 117    | 117    |
| Geographical area:|        |        |        |        |        |
| urban             | 527    | 535    | 538    | 541    | 538    |
| rural             | 760    | 752    | 749    | 746    | 749    |
| N                 | 1287   | 1287   | 1287   | 1287   | 1287   |

Source: Author’s calculations based on the NIDS dataset

Empirical Application of the QoLIOP

In our empirical application of the QoLIOP, we first illustrate the construction of the index and, secondly, the application to the South African NIDS dataset.
Construction of the Multidimensional QoLIOP

Following the methodology as set out in “Constructing the multidimensional QoLIOP” section, we firstly identify likely dimensions and indicators to be included in a composite index to measure the QoL of older people. We base the selection of the dimensions and the indicators on the theoretical framework, reviewed literature, the existing indices (see “Existing multidimensional indices of older adults”, “Dimensions of QoL of older adults”, “Change in QoL of older adults over time and differences between various groups” sections), and the NIDS data availability.

We notice that national and international indices include certain common dimensions of older adults’ well-being, namely: health, income, housing, safety, social, and the environment. However, we find a wide range of indicators to measure these dimensions.

Our initial selection replicates those dimensions found in the abovementioned indices; however, the NIDS dataset has certain data restrictions; therefore, we could not include the environmental or the political participation dimension. The identified dimensions and likely indicators are explained below:

1. Education. Nearly all existing indices mentioned in “Existing multidimensional indices of older adults” section used years of education as one of the indicators. We also added the indicator reading skills to capture the literacy level of older people due to government-enforced educational inequalities in the Apartheid era. Older adults in our sample were alive during this time and would have received a limited education.

2. Health. Our analysis represents overall physical health by the subjective indicator of self-reported health status. The consultation about health variable was also included indicating the number of times an individual sought medical assistance. Disabilities, diabetes, eyesight and hearing represent the physical conditions of an individual. Personal care, medical aid, effort, exercising and smoking indicate the levels of individuals’ ability to look after themselves.

3. Mental health. Drawing on existing indices, we included the mental health dimension with the following indicators: happiness, loneliness, depression and hope.

4. Economic status. In terms of income dimensions, there was little variation in the indicators in existing indices, i.e., pension receipt and employment status. Household income is one of the other indicators used in all the indices. However, we used the household expenditure per person indicator since it directly measures household well-being (Slesnick, 1998).

5. Safety. Regarding the safety dimension, there are indicators like trust in neighbours, murders, theft, violence, and drugs and alcohol consumption in the neighbourhood indicators according to the Elderly Quality of Life Index (EQoLI) (Paschoal et al., 2007).

6. Housing. According to the literature and other indices, the housing dimension includes basic needs like toilet access, rubbish removal, water access, and electricity, number of rooms per person and type of dwelling.
7. Social contact. According to the literature and other indices, marital status, number of children, number of people living in the household, and religion are indicators that can be used in the analysis.

As explained in the methodology, to normalise the data, we recode all the variables in the same coding direction (higher values represent better QoL outcomes for older adults) and discretise the selected continuous variables (household expenditure and years of education).

Next, we use exploratory factor analysis, namely CATPCA, to determine the closest related indicators and loads on a specific extracted component, highlighting a latent QoL dimension captured in the NIDS data. These dimensions would be specific to a developing country due to the use of the South African dataset.

To execute the CATPCA, we test our data for suitability for our analysis using the KMO measure of sampling adequacy and Bartlett’s test of sphericity. The results showed that our sample is suitable for the CATPCA analysis. The overall KMO was 0.803, which is above 0.5, meaning that our sample has high sampling adequacy. Bartlett’s test of sphericity showed a 0.0000 p value which is less than 0.05; thus, we reject the null hypothesis of no correlation in the dataset and conclude that there is enough correlation among the indicators to use CATPCA.

Following the Kaiser criteria, which states that components with eigenvalues of more than one should be extracted, and the results of the scree plot (see Supplementary Information Fig. S1), we extract five components. Furthermore, we find that five components are appropriate and theoretically sound and mirrored by the literature review. The extracted components explain approximately 58% of the variance. According to Hair et al. (2014), there is no absolute threshold for the percentage of variance criterion; however, it is satisfactory to use approximately 60% (also see in Greyling & Tregenna, 2017 and Rossouw & Naude, 2008). We use varimax rotation rather than the oblimin method to simplify the structure of the CATPCA as we found our components to be orthogonal. See Table 2 for the final CATPCA results reflecting the five extracted components and the selection of the most suitable indicators.

On inspection of those indicators with the highest loading on the five extracted components, each defining a latent sub-dimension of quality of life, we named these dimensions accordingly: household services, economic status, safety, mental health and health. Figure 1 depicts these dimensions and the indicators best suited to measure them.

We weight the index using the final results of the CATPCA (see Table 2) as explained in the methodological section. For example, to weight the sub-index for health, we multiply each of the indicators with the weights: consultation about health (0.39), self-reported health status (0.38), disability (0.23). To construct the final index, we weight the sub-indices as explained in the methodology and linearly aggregate the subindices: household services sub-index (0.27), economic status sub-index (0.24), safety sub-index (0.21), mental health sub-index (0.15), health sub-index (0.13).
| Indicator            | Extracted components | Squared factor loadings scaled to unity sum |
|----------------------|----------------------|--------------------------------------------|
|                      | 1       | 2       | 3       | 4       | 5       | 1       | 2       | 3       | 4       | 5       |
| Toilet access        | 0.845   | 0.265   | 0.023   | 0.051   | −0.031  | 0.287   |
| Rubbish removal      | 0.832   | 0.195   | −0.005  | 0.059   | −0.055  | 0.279   |
| Water access         | 0.807   | 0.093   | −0.017  | 0.054   | 0.033   | 0.262   |
| Energy source        | 0.655   | 0.103   | −0.063  | 0.038   | 0.023   | 0.172   |
| Years of education   | 0.256   | 0.826   | 0.088   | 0.101   | −0.003  | 0.322   |
| Reading skills       | 0.284   | 0.787   | 0.07    | 0.093   | 0.029   | 0.292   |
| HH expenditure pp.   | 0.333   | 0.725   | 0.123   | 0.088   | −0.065  | 0.248   |
| Pension receipt      | 0.002   | −0.541  | 0.041   | 0.035   | −0.053  | 0.138   |
| Frequency of murders | −0.005  | 0.151   | 0.795   | 0.039   | −0.014  | 0.297   |
| Frequency of theft   | 0.018   | −0.137  | 0.759   | −0.007  | 0.116   | 0.270   |
| Frequency of violence| −0.045  | 0.062   | 0.738   | 0.078   | −0.089  | 0.255   |
| Frequency of drugs   | −0.025  | 0.36    | 0.617   | 0.019   | 0.062   | 0.178   |
| Loneliness           | −0.03   | 0.005   | 0.002   | 0.786   | 0.025   | 0.428   |
| Depression           | 0.012   | 0.039   | 0.024   | 0.775   | 0.087   | 0.416   |
| Happiness            | 0.259   | 0.097   | 0.095   | 0.475   | −0.008  | 0.156   |
| Consultation about health | −0.109  | 0.051   | 0.039   | −0.04   | 0.709   | 0.386   |
| Self-reported health status | −0.012  | 0.218   | 0.005   | 0.181   | 0.706   | 0.382   |
| Disability           | 0.095   | −0.157  | −0.002  | 0.004   | 0.55    | 0.232   |
| % variance in data   | 15.752  | 13.950  | 12.102  | 8.475   | 7.510   | 0.232   |
| Eigenvalue           | 2.835   | 2.511   | 2.178   | 1.525   | 1.352   |
| % variance of extracted components | 0.273   | 0.241   | 0.209   | 0.147   | 0.130   |

Source: Author’s calculations

*Factor loadings in bold indicate the highest loadings per component

**Extracted components explain 57.8% (15.8 + 13.9 + 12.1 + 8.5 + 7.5) of the variance of the data

Multidimensional Quality of Life of Older Adults in South Africa
To ensure the robustness of our QoLIOP index, we refer to the sensitivity analysis results in Table 3. This shows that the alternative QoLIOP indices constructed using alternative weighting (equal weighting) and different aggregation methods using equal weighting (linear – and geometric) are highly correlated. Based on these results, we conclude that our QoLIOP is robust to the subjective choices in constructing the index.

Table 3 Correlation between alternative composite QOL indices

| Well-being indices | QoLIOP | QoLIOP (equal) | QoLIOP (geometric) | LS |
|--------------------|--------|----------------|--------------------|----|
| QoLIOP             | 1.0000 |                |                    |    |
| QoLIOP (equal)     | 0.9769*** | 1.0000         |                    |    |
| QoLIOP (geometric) | 0.9650*** | 0.9909***      | 1.0000             |    |
| LS                 | 0.3491*** | 0.3423***      | 0.3278***          | 1.0000 |

Source: Authors’ calculations using NIDS

***Correlation is significant at the 0.001 level. QoLIOP = composite well-being index with CATPCA weighting and linear aggregation. QoLIOP (equal) = composite well-being index with equal weighting and linear aggregation. QoLIOP (geometric) = composite well-being index with equal weighting and geometric aggregation. LS = life satisfaction – single-dimensional measure of QoL transformed into index.

To ensure the robustness of our QoLIOP index, we refer to the sensitivity analysis results in Table 3. This shows that the alternative QoLIOP indices constructed using alternative weighting (equal weighting) and different aggregation methods using equal weighting (linear – and geometric) are highly correlated. Based on these results, we conclude that our QOLIOP is robust to the subjective choices in constructing the index.
We also correlated the QoLIOP to the single-dimensional measure of QoL – subjective well-being (life satisfaction) and found that it was positively correlated with a medium correlation level (Table 3). This implies that although a single-dimensional measure such as life satisfaction might reflect the trend in QoL, it has limitations. Subjective well-being is an umbrella measure of experienced well-being and does not highlight the exact dimensions of QoL that should be prioritised to increase the well-being of older people.

Finally, to test the linkage (correlation) of the QoLIOP to other published indices and well-being measures as an additional method to validate our index, we were limited in our choices, as no other multidimensional composite well-being index exists for older adults in South Africa. A likely alternative measure for well-being that we use as a robustness check is the HDI (Fig. 2). The HDI index published yearly shows an improvement in the QoL of the SA population. However, one must remember that it is constructed at the macro-level and includes only three domains, compared to our index, which is more comprehensive and constructed at the micro-level. When comparing the trends of both HDI and QoLIOP, we find an upward trend.

Based on these findings, we assume the QoLIOP is a valid measure of the quality of life of older adults in South Africa (Groh et al., 2010); thus, it measures what it is purported to measure.

**Empirical Application of the QoLIOP Index Using NIDS Data**

Based on the results from “Construction of the multidimensional QoLIOP” section, we can determine those components explaining the most variance in the QoLIOP. The dimension that explains the most variance in the dataset also carries the highest weight in the composite index. Therefore, we assume it has the highest importance in the QoL of older people in SA. In order of the most explained variance, they are *household services* explaining 15.8% of the variance in the data, *economic status* (13.9%), *safety* (12.1%), *mental health* (8.5%) and *health* (7.5%) (see Table 2).

The dimension that explains the most variance and can be seen as the most important is the *household services* dimension. According to Maslow’s hierarchy
of needs (Maslow, 1943), this dimension represents the essential needs people need to fulfill for survival and security. The importance is consistent with previous research where access to basic needs like water, residing in a house and having electricity are some of the biggest contributors to people’s well-being in SA (Greyling & Tregenna, 2017; Kalfoss & Halvorsrud, 2009). The importance of household services can be arguably more important to older adults, with 36.4% of African older adults staying in three or more generation households. Therefore, stressing the importance of access to basic services in overcrowding situations (StatsSA, 2021a, b, c, d, e).

The second most important dimension was economic status. In South Africa, less than 15% of the older population are in the labour force market, increasing the burden on the productive population (StatsSA, 2021a, b, c, d, e). Additionally, lower incomes from being less active in the labour force are associated with poorer health and psychological well-being (Arendt, 2005). As of March 2020, there were 3.7 million older people (69% of the whole older population) who received an Old Age Grant (OAG) of R1780 ($122) (StatsSA, 2021a, b, c, d, e). Notably, the older-adults-headed households were more likely to depend on grants as the main source of income. However, even though the comprehensive social security system in SA could make older adults feel more secure, economic status still plays a larger role than other dimensions because of the risk of rising living costs and fewer options for continued income.

Safety was another dimension that contributed the most to the variance of QoL of older adults in SA. It is not surprising, considering that SA has the third-highest crime rate globally, with 77% in 2021 (World Population Review, 2021). This finding is consistent with the literature (Henchoz et al., 2015; Robleda & Pachana, 2019). High frequencies of violence, theft, murders, drugs, or alcohol abuse in the neighbourhood have a significant impact on the well-being of individuals. In South Africa, the risk of being a victim of a crime causes older adults to feel more vulnerable.

Mental health showed a smaller variance in the QoL of older people. Older people may experience stressors, for example, the loss of health, independence, a decline in functional abilities, and the loss of their loved ones, that influence their mental outlook (Gabriel & Bowling, 2004).

It was expected that the health dimension would have a higher variance in the QoL of older people since there is an increase in chronic conditions and disabilities among this cohort. The most common conditions among the older adults were high blood pressure (47.3%), diabetes (16.6% in 2019) and arthritis (15.6% in 2019) (StatsSA, 2021a, b, c, d, e). Most of the older population in SA (75.7% in 2019) rely on the public health system (StatsSA, 2021a, b, c, d, e). Although public health care is free for older people, they struggle to access quality care due to the challenges of waiting times, medical staff shortages, and transport costs (Solanki et al., 2019). Instead, they rely heavily on self-medication (63.5% in 2019) and do not consider it necessary to consult a medical doctor (27.4% in 2019) (StatsSA, 2021a, b, c, d, e).

Our secondary application of the QoLIOP is to follow individuals across time and determine the change in the level of QoL of the same people across the waves (see Table 4). For this purpose, we use the panel nature of the NIDS dataset.
Table 4 shows that the mean QoLIOP increased over time. The QoLIOP increased overall by approximately three percentage points, suggesting that SA older people maintain and maximise their gains in their later life which agrees with the Selectivity Theory by Charles and Carstensen (2009) mentioned in “Change in QoL of older adults over time and differences between various groups” section. The minimum QoLIOP score that an individual received was approximately 37% which indicates that some older people still experience relatively low levels of QoL and lack fulfilment of their basic needs.

To test if the differences are significant between wave 1 and wave 5, we use a t-test. We specifically compare the differences between wave 1 and wave 5. Thus, for a period of approximately ten years, as the influence on well-being should be measurable and significant over this longer period of time. As we know, the outcome of the implementation of fiscal policy is not immediate (the results of the t-test can be found in Table S2 in Supplementary Information). We find that the mean level of the QoLIOP differs significantly between wave 1 and wave 5. This is proof that policy measures applied did increase the well-being of older people.

A significant improvement of 4% has been made in the household services dimension scores. Likely signalling the results of The National Development Plan (NDP, 2012) and the National Water Act (RSA, 1997). These policy measures have made significant progress in providing water supply and sanitation services since the end of Apartheid. However, there are still backlogs and challenges (Mudombi, 2020). Economic status scores increased over the years by 3%, which could be attributed to the government providing inflation-linked adjustments to the OAG (National Treasury, 2016). The mental health dimension showed that psychological well-being improved with age by 3%, consistent with the U-shaped happiness curve (Blanchflower & Oswald, 2008). Furthermore, safety scores have worsened over the years by 7%, consistent with the national statistics on crime (South African Police Service, 2021). The decline of the health dimension scores by 3% is not surprising since old age is associated with fragility and an increase in chronic conditions (StatsSA, 2021a, b, c, d, e).

In the following section, we test the differences between demographic groups (gender, population and demographic area) to see if the differences are significant (the results can be found in Table S3 in Supplementary Information). We found

| Table 4 | Change of the QoLIOP scores and its ICIs over time (Mean, %) |
|---------|----------------------------------------------------------------|
|         | Min      | Max      | Wave 1  | Wave 2  | Wave 3  | Wave 4  | Wave 5  | Δw1 to w5 |
| QoLIOP  | 36.786   | 99.007   | 66.566  | 67.678  | 66.555  | 66.607  | 66.821  | 0.255     |
| ICI1 HH Services | 50 | 100 | 73.308 | 75.249 | 76.157 | 76.599 | 76.952 | 3.644     |
| ICI2 Economic Status | 26.844 | 100 | 50.933 | 51.652 | 51.857 | 52.937 | 53.728 | 2.795     |
| ICI3 Safety | 20 | 100 | 68.165 | 64.011 | 60.485 | 61.822 | 60.969 | −7.196    |
| ICI4 Mental Health | 25 | 100 | 81.255 | 83.938 | 82.762 | 83.552 | 84.409 | 3.154     |
| ICI5 Health | 26.967 | 100 | 62.311 | 69.124 | 65.208 | 59.635 | 59.479 | −2.832    |

Source: Authors’ calculations using NIDS
that gender, geographical area, population groups (race) and belonging to a farming household had significant differences among the categories.

Older males have higher QoL scores than females (see Fig. 3). In each group, the QoLIOP increased over time, though by a negligible margin: females increased from 65.51% to 65.67%, and males improved their scores from 69.03% to 69.51%. Our findings are consistent with the literature results (Chappell & Havens, 1980; Ebrahim et al., 2013). Pinquart and Sorensen (2000) stated a few reasons why women have lower well-being. Firstly, on average, older women have

![Fig. 3 Gender comparisons of the average of the QoL indices of older adults (60+). Source: Authors’ calculations using NIDS](image)

![Fig. 4 Population group comparisons of the average of the QoL indices for older adults (60+). Source: Authors’ calculations using NIDS](image)
lower material resources due to the previous income inequalities. Secondly, their morbidity rates are higher, and lastly, they are more likely to be widowed.

When comparing population groups (see Fig. 4), older white people were found to have higher QoL levels than black African, coloured and Asian. The lowest QoL was found among older black Africans, consistent with the literature (Krause, 1993; Ebrahim et al., 2013). Possible reasons for this result could lie in the historical inequalities created by the Apartheid era. For example, in 2019, there were more illiterate older females (0.67 million) than males (0.32 million), and the majority of them were black African older people (0.91 million or 92% of all illiterates) (StatsSA, 2021a, b, c, d, e). When it comes to basic services, the African population group experienced the worse access to piped water (only 64% had access in 2019), sanitation (almost 80% had access in 2019) or waste disposal (46% in 2019) compared to other population groups where almost everyone had access (StatsSA, 2021a, b, c, d, e). However, despite the past inequalities, the QoL of black Africans is catching up with the other population groups. This shows that the South African government’s policy measures implemented in 2006 to empower older people and policies such as the National Development Plan and Black Economic Empowerment to resolve economic and non-economic disparities among disadvantaged population groups have been relatively successful.

Figure 5 illustrates that the older adults that live in rural areas have the lowest QoL scores in our sample. This is consistent with the previous research (Nzabona et al., 2016; Tobiasz-Adamczyk & Zawisza, 2017), where individuals living in urban areas had enhanced well-being outcomes compared to those in rural areas. Rural areas in SA are characterised as economically and socially deprived due to urban migration, which causes a lack of services, facilities and employment opportunities (van Schalkwyk et al., 2014).
Conclusions

Given that rapid ageing is happening mainly in developing countries and that the fastest growth will be in Africa, we constructed the first multidimensional QoL index for older adults (QoLIOP), focusing specifically on the needs of older adults in Africa at a micro-level. Choosing a dataset of an African country allowed us to determine the current level of QoL of older persons and the dimensions of QoL most important in explaining their well-being. Furthermore, applying the index empirically, we determined whether the well-being of a specific group of older adults increased over time and identified the most vulnerable groups.

We contributed to the existing literature by developing a multidimensional QoL index, which accurately measures the well-being of older people in Africa. Other African and developing countries can replicate the method to measure the well-being of their older people. It is important to determine the level of well-being of older people as we can only manage what we can measure. As the index is applied to a South African dataset, it highlights those dimensions most important to African countries rather than developed countries. Our choice of dataset gives us the benefit of deriving information about well-being changes over time and highlights the most vulnerable groups among older people. Often previous studies used either small cross-sectional data sets, thus not being nationally representative or macro data, which is important for cross-country analysis but does not highlight microeconomic issues for future policy initiatives.

Our results from CATPCA showed the dimensions of household services, economic status, and safety had the most variance in QoLIOP. Moreover, the QoL of older adults increased as they aged due to policies implemented and, therefore, the improvements made in household services, economic status and mental health over time. We found that black Africans have the lowest QoL compared to coloured and white South Africans. However, we found that only the QoL of black Africans increased over time and was catching up with the other population groups. Finally, older males have higher QoL scores compared to females. The older adults that live in rural areas have the lowest QoL scores.

Given our results, additional specific interventions are needed to improve the well-being of older adults. Possible policy initiatives could be targeted at improving housing conditions, reducing crime rates, improving access to health care, creating mental health policies specific to older adults, formulating policies to decrease gender and racial inequalities, and promoting active involvement of older adults in the economy. The introduction of these more specific initiatives parallel to already existing policies can provide basic human needs and improve the living standards of older adults, not only in South Africa or Africa but in the rest of the developing world.

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Declarations

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