

Student loneliness: Proposing a framework to identify and measure areas at greatest risk

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Abstract

Objective: This research aims to predict the relative risk of student loneliness at a small area geography. **Method:** This research creates a multi-dimensional, composite index (named the Student Loneliness Index), which consists of five key determinants of student loneliness: living alone, poor mental health, poor physical health, financial insecurity, and area deprivation. The Student Loneliness Index is mapped and applied to the city of Leeds, the UK's fourth largest city by population. The Student Loneliness Index is then analysed and evaluated by a focus group of university students. **Results:** This research finds a strong north-south divide in student loneliness in Leeds, identifying hotspots of loneliness in inner-city areas, towns and to a lesser extent, parts of rural Leeds. Poor mental health, financial insecurity, and area deprivation correlate most strongly to areas at extreme risk of student loneliness. **Discussion:** This is the first known piece of academic research to predict, map and analyse relative levels of student loneliness. Through the creation of an easily replicable and transparent methodology, it is hoped that a similar framework can be employed in cities across the UK. Such an approach will contribute to a greater understanding of student loneliness and hence inform the allocation of support and associated resources.

Keywords: Loneliness, Students, Health, Mental Health, Composite Index

1. Introduction

Feelings of occasional loneliness is considered normal, therefore loneliness of loneliness in the context of this research focuses on the ‘chronically lonely’, those who feel lonely most or all of the time (Mansfield et al., 2019). Overall, contemporary academic research emphasises the determinants, lived experiences, and intervention measures to reduce loneliness in the older population (aged 65 years and over) (Hawkley et al., 2009; Ige et al., 2019; Quan and Lohman, 2019). By contrast, research into student loneliness (and hence typically younger demographic groups) remains marginal and disjointed (see: Diehl et al., 2018; Hysing et al., 2020; Jones et al., 1981; McIntyre et al., 2018; Wiseman, 1997; Xin and Xin, 2016).

The Office for National Statistics found that more young people (aged 16-24) are experiencing chronic loneliness than ever before (ONS, 2021a). The Student COVID-19 Insight Survey (SCIS) found that 22% of students reported feeling lonely “often or always” across England in April 2021, almost three times greater than that of the non-student adult population (8%) over a similar duration (ONS, 2021b). Despite the small and unrepresentative sample size of the SCIS (2,759 respondents), the SCIS represents a watershed for UK government policy – that student loneliness is a unique entity and worthy of investigation (ONS, 2021c).

Despite explicit recommendation from the Office for National Statistics (2018), attempts to measure, classify, and predict loneliness for every demographic group in England are yet to materialise, either in academic or public sector / governmental research. This research attempts to address this problem through the development a ‘framework’ to measure student loneliness, ‘tested’ on the city of Leeds, West Yorkshire, a city with an estimated student population (aged 16+ years) of circa 200,000 (Population UK, 2021). For the purpose of this research, a student is defined as being over 16 years of age and in full-time education, therefore capturing both further and higher education.

In this research, the relative risk of chronically lonely students living in Leeds, West Yorkshire is indexed and mapped. The methodology utilises open-source datasets and software, and so is fully replicable for other university towns and cities in England. The outcome of this research is to two-fold: (1) to develop a working measure for student loneliness that can be applied across the UK and (2) to invigorate discussion about the

determinants, likelihood, and geographical distribution of chronically lonely students.

2. Research Rationale

Over the last decade, loneliness literature has grown exponentially beyond academia and health research and into government policy (Ortiz-Ospina and Roser, 2020; Lineham et al., 2014). However, Franssen et al. (2020) and Asghar and Iqbal (2019) argue that loneliness literature is narrowly focussed, with disproportionate attention to given to loneliness in the older population groups (aged 65 and over). A further limitation of existing literature is the scarcity of focus on the spatial distribution of loneliness, with most research to date undertaking a highly qualitative approach (Menec et al., 2019).

Lucy and Burns (2017) created a composite index of loneliness and tested and mapped relative levels of loneliness for the older population in Southwark, a London borough, England. Lucy and Burns (2017) prioritised reproducibility, by utilising exclusively open-source data and generally available methods and software. The scores for the loneliness index were mapped at a small-area geography (Lower Super Output Areas). Age UK also mapped loneliness at a small area geography for older populations across England (Iparraguirre, 2016). Age UK's research had greater focus on service provision and stakeholder coordination (Iparraguirre, 2016). A loneliness workshop in Rotherham, West Yorkshire was conducted by Age UK with the 'Loneliness Heat Map' used as a primary visual resource. This resulted in greater awareness of loneliness and generated measures to predict and prevent older people becoming chronically lonely (Age UK, 2016). Consequently, this research fuses the benefits from past works and uses mixed method approaches to (1) replicate the quantitative methodology and data display utilised by Lucy and Burns (2017) and (2) employ a predominantly qualitative-driven focus group (as with Age UK, 2016) for reasons of validation and enrichment.

3. Past Loneliness Research

The differentiation between social isolation, solitude, and loneliness is critical, with such words regularly used interchangeably in academic and other research – but in reality, these adopt different meanings as reflected below.

Social isolation refers to having few contacts for emotional support, often a consequence of physical separation or a small social network (Endo et al., 2017; Victor and Yang, 2012).

Solitude is defined by consensus as self-sought aloneness (McIntyre et al., 2018).

Loneliness is “the unpleasant experience that occurs when a person’s network of social relations is deficient in some important way, either quantitatively or qualitatively” (Perlman and Peplau, 1981, p.31).

The ‘Typology of Loneliness’ (by Weiss, 1973) conceptualised and distinguished between *social* and *emotional* loneliness. Weiss (1973) defines *social* loneliness as not belonging to a group or social network. Implicitly or explicitly, social loneliness is felt because of a deficit in the expectation of social relationships (Mansfield et al., 2019).

Meanwhile, *emotional* loneliness is a response to the absence or loss of a close, intimate relationship or the absence of an accessible social network following relocation (Weiss, 1973). *Emotional* loneliness can occur because of a change in relationship, mental health, physical health, or experiences of domestic abuse (Mansfield et al., 2019).

In contrast, *existential* loneliness was created and examined through the Model of Estrangement (see: Andersson, 1986). *Existential* loneliness is a perceived disconnection from others and the wider world, a lack of meaning in life, and mortality-related fears (van Tilburg, 2020). This separation from reality for example, is heightened during bereavement or in retirement (Mansfield et al., 2019). As a result, elderly individuals and those in psychotherapy exhibit more characteristics of chronic *existential* loneliness (McIntyre et al., 2018).

This research considers student-specific risk factors of loneliness, many of which are drawn from past works:

The most cited determinant of student loneliness is living alone (Snell; 2017). Most self-rated loneliness scales such as De Jong Gierveld hypothesise a close association between 'alone-ness' and subjective feelings of loneliness. This is most likely as living alone is seen as a proxy for experiencing feelings of bereavement, relationship breakdowns, and social isolation (de Jong Gierveld, 1998; Perlman and Peplau, 1982; Steptoe et al., 2013; Victor and Yang, 2012).

(Dis)ability, poor mental and/or physical health also contribute to a student feeling lonely (Burholt and Morgan, 2017). Disabled 16- to 24-year-olds self-reported to be four times more likely to feel chronically lonely than their non-disabled counterparts (ONS, 2019). Societal and environmental barriers to participation can occur, especially when an individual is subject to poor physical health. For example, 'ableism' (discrimination in favour of able-bodied people) can be apparent through communication challenges at a site of social interaction or physical inaccessibility, often because of the architecture and design of the space itself (Olsen, 2018). Olsen's (2018) autoethnographic experience of barriers to social activity and feelings of emotional loneliness are persuasive, emphasising the need for social inclusion of disabled students.

Poor mental health is another important factor in a student experiencing *emotional* loneliness. The Education Policy Institute (2018) argues that during the transition to university, mental health services are poorly planned, executed, and experienced. The healthcare transition where students relocate to attend university can lead to discontinuity of care, no access to treatment, and even patient disengagement with the healthcare system. Stansfeld et al. (2014) found that the rate of common mental health disorders peak for women at 16-24 years old (26.0%). Thus, the risk of *emotional* loneliness is compounded at the transition stage to university when students are already at risk of mental health difficulties (Diehl et al., 2018).

Financial constraints can limit an individual's ability to participate and interact with other students from a social perspective (Bosma et al., 2015). The impact of financial constraints is apparent as greater numbers of students attend university from low participation neighbourhoods than ever before (Higher Education Statistical Authority., 2020; Cooke et al., 2004). In the UK, the drive for financial

security often results in pressure on students to obtain a part-time or flexible employment at the expense of creating and maintaining social relationships (Lauder and Mayhew, 2020).

Students who live in deprived areas have also been found to experience greater levels of loneliness and to participate less in social activity (Burholt and Morgan; 2017). Area deprivation can occur due to inaccessible services, poor public transport links, poor housing and local environmental quality, high crime-rates, personal safety concerns and frequent anti-social behaviour, a lack of a local social networks, mistrust of neighbours, and a perceived lack of belonging in the neighbourhood (Johnson and Adeniji, 2019; ONS, 2018a). Given additional challenges generated by area deprivation, students are at greater risk of feeling isolated, fearful, and lonely (Menec et al., 2019).

4. Methodological Framework

To undertake this research, a two-phased explanatory sequential design model was used to inform the mixed methods approach (Figure 1).

Phase 1 involved the compilation of secondary data to create and analyse the Student Loneliness Index (SLI). Phase 2 comprised the evaluation of the SLI by an independent online focus group of students.

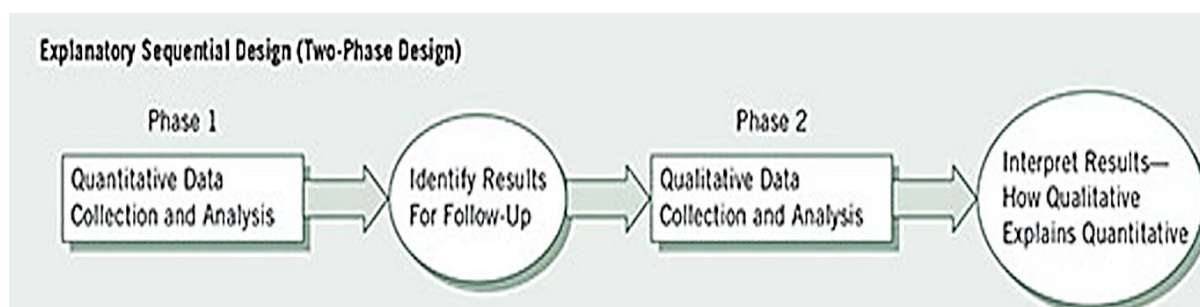


Figure 1: An Explanatory Sequential Mixed Methods Design (Creswell and Creswell, 2017, p.217).

This two-phased explanatory sequential design model (Creswell and Creswell, 2017) was applied and integrated pragmatically into a seven step methodology for creating a composite index, as proposed by Gibson and See, 2006 (Figure 2).

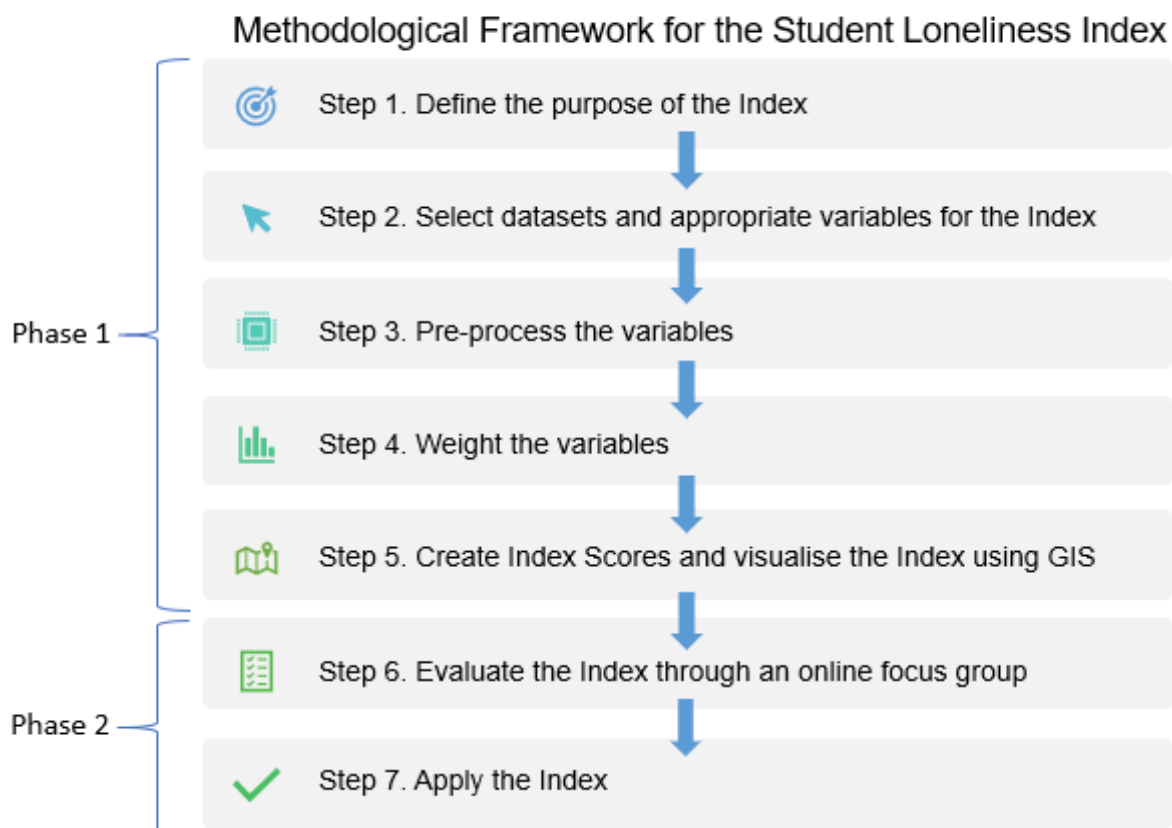


Figure 2: Framework applied to create and analyse the Student Loneliness Index. (Adapted from: Gibson and See, 2006, p.214).

The follow sections of this paper overview each of the seven stages required to design and validate the SLI, as presented in Figure 2.

Step 1. Define the purpose of the Index.

The purpose of the SLI is to predict and visualise the likelihood of student loneliness, evidenced on the city of Leeds. The SLI was evaluated by a focus group of university students to both ensure validity and add credibility. While quantitative standardised secondary data provide a precise description of each determinant of loneliness and how predicted loneliness varies across geographical space in Leeds (Rivero Jiménez et al., 2021), qualitative data enriches understanding of student loneliness in the context of Leeds (socio-politically, emotionally and culturally) (Rivero Jiménez et al., 2021).

Step 2. Select datasets and appropriate variables for the Index.

For the index to be as transparent and replicable as possible, five freely available independent variables were selected as informed by a thorough review of related literature (see Section 3 for a synopsis):

1. The number of students living alone.
2. The number of students with long-term life limiting illnesses (poor physical health),
3. The number of students that considered their health to be bad or very bad in the last week (used as a holistic measure to account for poor mental health).
4. The number of unemployed students actively looking for work.
5. The English Index of Multiple Deprivation Scores (used as a holistic measure to account for area deprivation).

Four variables were extracted via Infuse Population Statistics (UK Data Service, 2021) from the 2011 England national census. These variables accounted for every student aged 16 years old and over that studied in Leeds in March 2011. Whilst the English census is measured decennially, results from the most recent 2021 census were not available at the time of undertaking this research, however, given the transparency and use of freely available data, this framework can easily be updated once data 2021 enter the public domain. Although census data can be obtained at a range of small area geographical scales in England, Middle Super Output Areas (MSOA) were selected for this research. With an average population of circa 8,200 individuals, MSOA's are regularly likened to neighbourhoods and, as such, are able to capture local-level effects which more granular and coarse levels of geography often miss.

The fifth variable included in the SLI was that of area deprivation and this was sourced from the English Indices of Multiple Deprivation (IMD). This variable was deemed necessary to create a discriminative, multidimensional index specific to student loneliness. To maintain compatibility across all variables, the 2015 IMD was sourced and extracted from Public Health England (2021) as an average index score per MSOA across Leeds (Public Health England, 2021).

It should be noted that open-source datasets and boundary data were extracted from the UK Data Service (UK Data Service, 2021). The UK Data Service is a free online repository of national datasets, made available through the Open Government License v.3.0 (ONS, 2016).

Step 3. Pre-process the variables

This step involved preparing the data for use in the SLI.

Census variables 1-4 were standardised as percentages to ensure the equal comparison of data between MSOAs. This process was undertaken as follows, using a suitable student population denominator:

$$\text{Percentage of variable per MSOA} = \frac{\text{Variable value}}{\text{Raw student population}}$$

Variable 5 was kept as a deprivation score given how these already operate on a common numeric scale across all MSOAs (Lucy and Burns, 2017). For this reason, this variable did not need standardising, nor did any suitable denominator exist.

Statistical tests were conducted to ascertain if the variables were suitable for use in the SLI. Ensuring all variables adopt the same polarity was important given how any differences would result in a flawed SLI. Polarity refers to the positive or negative direction of a variable (Saisana et al., 2019). Hypotheses were created to illustrate polarity and to ensure any adjustments were correctly actioned. Each input variable exhibited positive directionality, meaning that the higher an individual variable value, the more perceived loneliness in the area. For this reason, no variables had to be adjusted.

Data were also assessed for multi-collinearity. In this instance, collinearity occurs when two predictor variables correlate, often strongly, and multicollinearity occurs when more than two predictor variables correlate, often strongly (Meyers et al., 2006). In this research, no variables exhibited 'high' correlation. High correlation was defined as any variable pair correlating above 0.75 (Burns, 2017).

Results were also inspected for skewness (non-normal, non-uniform distribution) and extreme outliers (using Ordinary Least Squares regression). No adjustments were deemed necessary.

The independence of each variable was tested using tolerance values (the predictor variance not accounted for by other variables) and Variance Inflation Factors (VIFs) (the degree of inflation of the regression coefficient estimates, caused by multicollinearity) (Meyers et al., 2006). Both statistical tests deemed the variables to be highly independent and not inflated. Therefore, statistical testing demonstrated how strongly independent each variable was. Hence, none of the variables had a compounding effect.

The predictor variables were then normalised. Normalisation in this research is where variables with different minimum and maximum values can be aligned regardless of the value range (Burns, 2017; Gibson and See, 2006). Several approaches exist for undertaking normalisation, z-scores and min-max scaling are two such examples. For ease of calculation and interpretation (and to make the framework as easily accessible as possible), the min-max scaling approach was used. This mode of normalisation linearly rescales all variables onto a simple 0 to 1 numeric scale. The min-max scaling approach operates as follows:

$$x_{norm} = (x_{raw} - \mathit{min}_i) / (\mathit{max}_i - \mathit{min}_i)$$

Where i is the variable number from 1 to n and min_i is the minimum value for x_i and max_i is the maximum value for x_i . This process results in each variable, x_{raw} , being normalised, x_{norm} , onto a 0-1 scale (Lucy and Burns, 2017).

This process ensured that each MSOA was given a number that ranged from 0 (minimum value) to 1 (maximum value) per variable. The smaller the normalised value, the less relative risk of student loneliness.

Step 4. Weight the variables

When developing a composite index, it is possible to apply weights to the input variables if there is suitable intelligence to suggest a hierarchy of importance. As no such intelligence was available when creating the SLI, the index in this research was not weighted.

Step 5. Create index scores and visualise the index using GIS

The final steps in creating the index (prior to any validation) involved generating the final SLI score and mapping.

The pre-processed input variables were summed to create the index score. For ease of interpretation, the final SLI score was also normalised (using the min:max approach, to rescale results onto the 0-1 range) and then multiplied by 100 (Suarez-Alvarez et al., 2012). Consequently, the MSOA which scored 0 when modelled was predicted to be the least at risk of relative student loneliness, and the MSOA which scored 100 was deemed to be at greatest risk.

In order to visualise cartographically, the numeric SLI scores were joined to an MSOA boundary map of Leeds and represented in choropleth map format (Gibson and See, 2006; Martin, 1996). SLI

scores were classed into five natural breaks to facilitate visual discrimination of the statistical variation in predicted loneliness (Stewart and Kennelly, 2010). The Jenks Natural Breaks Classification (Jenks, 1967) was computed to minimise within-class variations from the mean. The Jenks Natural Breaks Classification was chosen to represent “natural” rather than statistical breaks (such as by quartiles) in the data. In this research, QGIS, an open-source application was used to undertake all map visualisation (see QGIS, 2021).

Choropleth maps use colour to represent ordered values of the attribute characteristic (SLI score) on ‘equal’ geographical zones (Martin, 1996). Graduated colours were specifically selected to be discernible to the colour-blind and visually impaired (Brewer, 1995). The attribute data were mapped using the georeferenced boundary data (MSOAs in Leeds). Conventionally, dark shades are used to represent high values whereas light shades represented low values on a choropleth map (Brewer, 1995). Therefore, in this analysis student loneliness was represented in graduated shades of colour where the darker the shade, the greater the relative predicted risk of student loneliness.

Step 6. Evaluate the Index through an online focus group.

Bosco and Herman (2010, p.196) compellingly argue that focus groups provide the opportunity to have a “*conversation with a purpose*”, and are uniquely “*appropriate for examining complex socio-spatial practices and discourses*” (Bosco and Herman, 2010, p.195). For this reason, a focus group was used to both validate and enrich the SLI.

The focus group took place as an online synchronous meeting of University of Leeds students and the research team. An online questionnaire invited students to share their views on loneliness in Leeds, and to indicate if they were willing to elaborate on their points through a focus group. Focus group participants were then selected such that a representative cohort could contribute to discussion. A student group with a mix of characteristics (age group, sex, level of study and living arrangements) were selected, with the only stipulations being that (1) participants must have studied in the city for at least twelve months and (2) they must reside in Leeds. The stipulations were put in place to ensure reliability and that lived experiences could be accurately captured.

This process enabled a collaborative and somewhat horizontal power structure between the researcher and the actively engaged participants (Kneale, 2001). The focus group comprised a series of open-ended

questions and an opportunity for participants to individually flag areas of the city where they perceived student loneliness to be at its greatest, *before* seeing the SLI output.

Focus group participants, on the whole, corroborated the results of the index with areas deemed most at risk by the group matching those categorised as 'Extreme risk' or 'High risk' in the SLI in over 80% of cases.

Step 7. Apply the Student Loneliness Index

By determining where students are at perceived greatest risk of feeling chronically lonely, appropriate services and support can be made available and resources optimised to reduce this likelihood. Such policy interventions and strategies extend beyond the remit of this research, but the outputs are available to be shared with interested third parties, made easier by the open nature of the methodology and data.

5. Results

Overall, mapped SLI output (Figure 3) exhibited a strong north-south divide. North Leeds was predicted to be at a lower relative risk of student loneliness than the central or southern parts of the city.

Closer analysis of the five most at-risk MSOAs of student loneliness was undertaken to better understand how the relationships between SLI component variables varies in different locations. Three of the most at-risk MSOAs were situated in inner-city Leeds (Cross Flats Park and Garnets, Beeston Hill, and Hunslet Moor and Harehills North). The most at-risk areas experienced: high or very high rates of poor mental health, financial insecurity, and area deprivation.

Student loneliness exhibited a strong geographical relationship in Leeds, building on findings in extant loneliness literature (Iparraguirre, 2016; Lucy and Burns, 2017). Comparison between the most and least at-risk MSOAs found that poor mental health, financial insecurity, and area deprivation had the most profound impact on where MSOAs were placed on the SLI scale. Although this largely reflects existing knowledge, somewhat surprisingly, living alone and poor physical health had less of an overall impact. Hence, if resources are allocated with a view to reducing loneliness among the student population in a targeted manner, intervention should focus on areas with high self-reported rates of poor mental health, financial insecurity, and area deprivation.

The focus group provided a unique insight into how students perceive student loneliness. For the most part, similarities between the SLI and loneliness literature were apparent. However, new innovative ideas not previously considered, such as the link between student loneliness and intergenerational family homes and how big data could be utilised were considered.

Primarily, the datasets and the choice of input variables caused contention, rather than the output map of the SLI itself. The purpose of each variable was questioned, reflecting of the complexity of quantifying the subjective experience of loneliness. The participants decided collectively that the component indicators were less representative of personal or circumstantial determinants of loneliness. For example, one participant highlighted that “*personal situations like a (relationship) breakup I dunno or something really tragic going on in the family*” have the potential to “*determine a lot of loneliness if you don’t have people to relate to*”. Other participants suggested that the distribution of student loneliness had changed since 2011 and so it would be beneficial to replicate the SLI once the 2021 census data have been released, something made possible due to the transparent use of both freely available data and methods. One participant argued that due to an exponential increase in student numbers in Leeds, student loneliness would be more prevalent today than in 2011, hence reinforcing the need to reproduce the SLI when new data are available.

6. Evaluation and Limitations

Loneliness is complex to define, let alone attempt to measure, predict, or analyse. At each stage of the framework (Figure 2), necessary but somewhat subjective choices were made by the research team.

The greatest issue was the availability of open data sources on determinants of loneliness that could be utilised quantitatively. National health and lifestyle surveys were initially considered (such as the Annual Population Survey, Community Life Survey and Health Survey for England) because of the emphasis these datasets place on community ties, identity, mental health, social networks, subjective wellbeing, and individual levels of self-reported loneliness. These datasets were also timely having been recently published (between 2018-2020) and updated frequently (annually or bi-annually).

However, national health and lifestyle surveys were only extractable from sources such as the UK Data Service (2021) at regional areal

geographies (such as Yorkshire and the Humber). As such results from high-level (coarse) geographical analysis cannot be disaggregated to lower spatial resolutions, something needed for local-level policy intervention (Harris, 2005), more traditional datasets were utilised. The typically small sample sizes within health and lifestyle surveys also restricted the potential for robust inference of data in Leeds (Fotheringham et al., 2000).

As a result of these limitations, data from the England national census were used, together with a measure of local-level deprivation. Limitations of census data also exist, not least the decennial nature of the dataset and the delay between collection and dissemination. Furthermore, certain techniques such as record swapping small cell adjustment were applied to MSOAs in 2011 with small counts with a view to preserving confidentiality. As such, representations may not be entirely accurate, especially for students living alone or with poor physical health in some MSOAs in Leeds given small numbers. Additionally, the 2011 census and the 2015 IMD were outdated at the time of this research. Utilising the IMD was a limitation, given how this increased the risk of compounding the health domain within the SLI. In addition, the IMD could also not be limited to the student demographic. The IMD is also updated more frequently than the English census resulting in inconsistent data timeframes, something remedied in part by using the 2015 iteration.

The sampling strategy for the focus group was situational to Covid-19 measures, costs, and time constraints and so opinions represent the cohort of participating students at that point in time.

As with any choropleth map, the final map of the SLI (Figure 3) also has limitations in so far as it is a pragmatic representation of the relative student loneliness index scores, not the 'objective truth' (Wood, 1994). Also, within-area MSOA difference is 'hidden' by a single shade on a map thus leading to an ecological fallacy – something unavoidable when working with aggregate spatial data (Leventhal, 2016).

7. Conclusion

To conclude, the Student Loneliness Index presented in this paper is the first known attempt to map student loneliness spatially through the creation of a composite index. Visualising the SLI on a choropleth map demonstrated the clear geographic distribution between predicted student loneliness and geographical location in Leeds. Although loneliness literature weighted students living alone as the key causal factor, results from the SLI and follow-up focus group activity indicated that students living alone and to a lesser extent, poor physical health held less weighting over final index scores than poor mental health, financial insecurity, and area deprivation.

Although the apparent relative difference in loneliness could be more of a consequence of analytical methods than a true real-world variation between people and places they live in, a composite indicator simplifies complex geographic reality to create a universal global model. To meet the aim of this research, the SLI has been deliberately created to be simple, readily applicable, easily understood and a ‘common currency’ for comparing complex georeferenced data and information (Harris, 2005). As a tool, the SLI captures and reveals some socio-economic and demographic geographies that should inform decision making and may otherwise have remained hidden.

A mixed methods approach balances the methodological weaknesses of quantitative index creation and qualitative evaluative focus groups. The seven-step framework (Figure 2) required a range of research-informed choices, tailored in this instance to suit small scale area geographies to better understand how, where, and why student loneliness clusters. The authors are very aware of how this research can be extended and Figure 4 summarises the likely future trajectory.

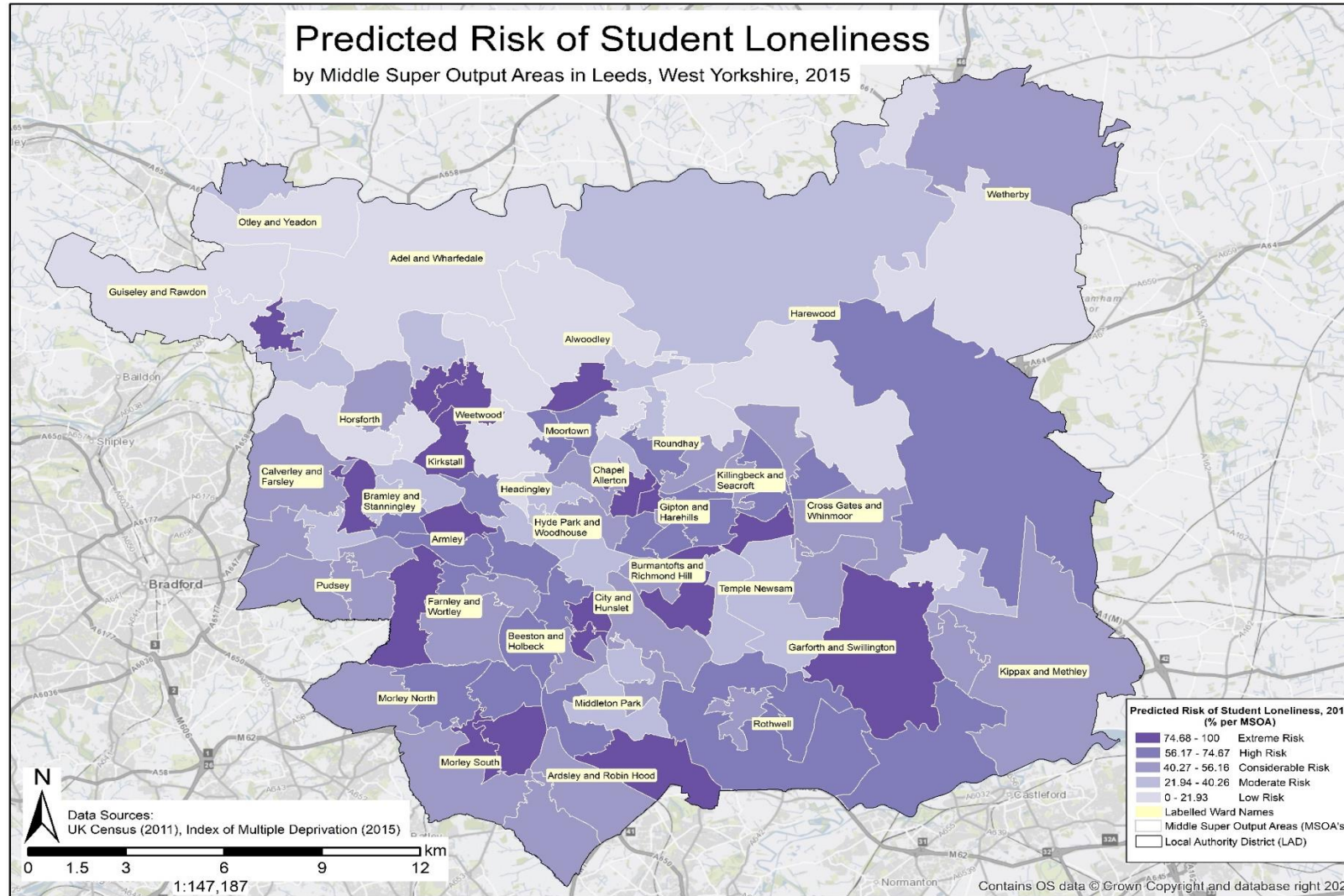


Figure 3: A choropleth map visualising results of the Student Loneliness Index across Leeds.

Flowchart of Key Recommendations from Mixed-Methods Research on Student Loneliness

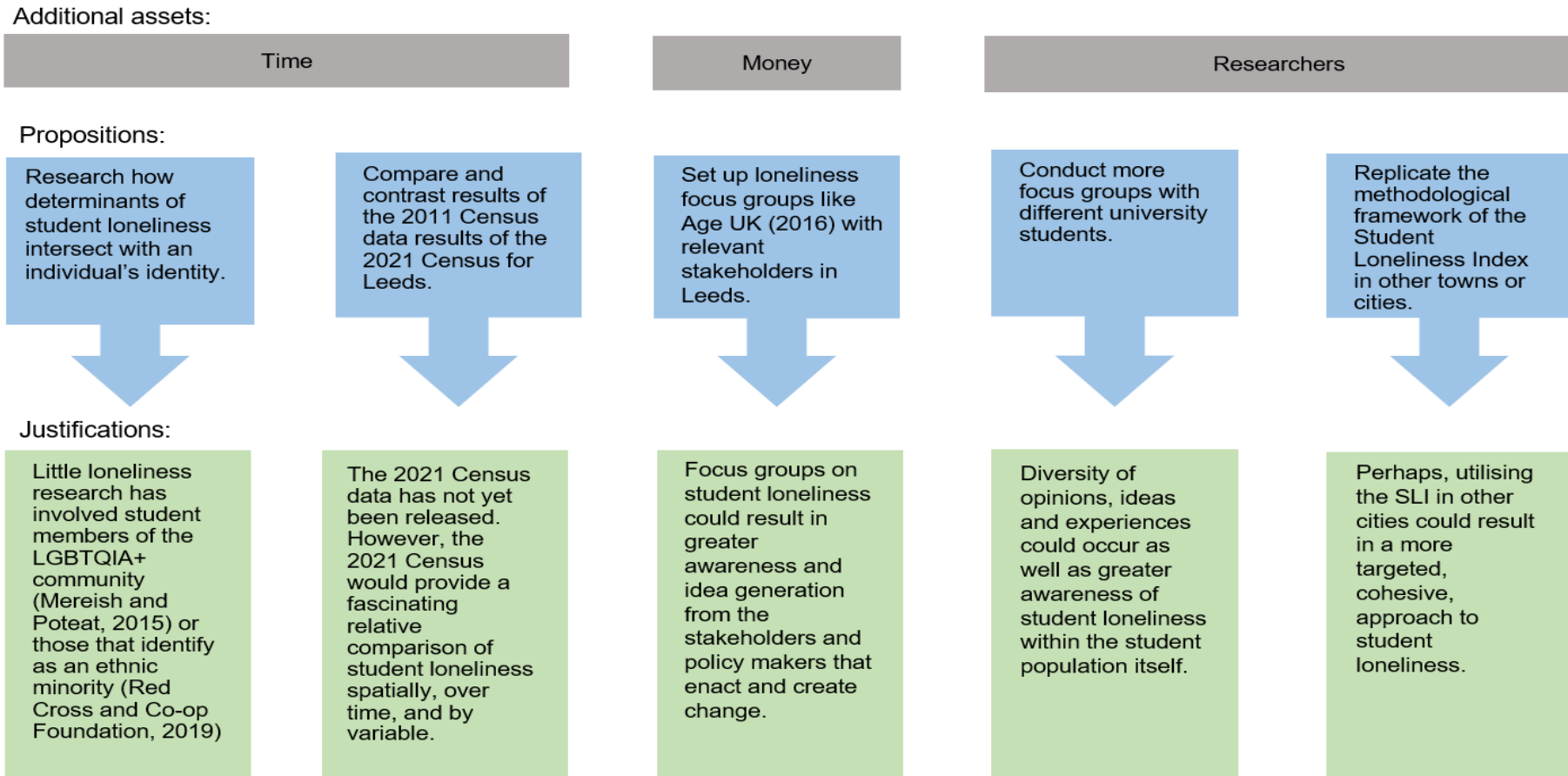


Figure 4: Proposed future research trajectory – extending the SLI.

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