

A MINIMUM DIGITAL LIVING STANDARD FOR HOUSEHOLDS WITH CHILDREN

SURVEY FINDINGS REPORT



Loughborough
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in Social Policy



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 **Critical**
RESEARCH



Simeon Yates¹, Zi Ye¹, Alex Singleton¹, Katherine Hill²,
Chloe Blackwell², Abigail Davis², Matt Padley²,
Emma Stone³, Gianfranco Polizzi¹, Jeanette D'Arcy¹,
Rebecca Harris¹, Paul Sheppard⁴, Elinor Carmi⁵,
Supriya Garikipati⁶, Patricia Barrera¹

1 University of Liverpool 2 Loughborough University
3 Good Things Foundation 4 Critical Research
5 City University 6 University College Dublin

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Minimum Digital Living Standard: For Households With Children: Survey Report

Simeon J. Yates¹, Zi Ye¹, Alex Singleton¹, Katherine Hill², Chloe Blackwell², Abigail Davis², Matt Padley², Emma Stone³, Gianfranco Polizzi¹, Jeanette D'Arcy¹, Rebecca Harris¹, Paul Sheppard⁴, Elinor Carmi⁵, Supriya Garikipati⁶, and Patricia Barrera¹

¹University of Liverpool

²Loughborough University

³Good Things Foundation

⁴Critical Research

⁵City University

⁶University College Dublin

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Chapter 1

The MDLS and the MDLS survey

1.1 Introduction

This report details the results from a UK national survey undertaken as part of the “Minimum Digital Living Standard” (MDLS) multi-method study to assess:

- What is the minimum basket of digital goods, services and skills that households need to live and participate in the digital world?

The MDLS project addresses this question through a novel household-based assessment of digital needs. The project, which is funded by the Nuffield Foundation and Nominet, has been developed by an interdisciplinary team combining social, geographic, and economic researchers, and utilises a range of interlinked methods:

- It uses the proven and innovative Minimum Income Standard (MIS) methodology¹ to undertake a proof-of-concept study to develop (through a series of focus groups with members of the public) a definition of MDLS which sets out what the standard should encompass, and establish a “minimum basket of digital goods, services and skills” that households with dependent age children need to meet this standard. Once this initial proof-of-concept project has been undertaken, there is potential to extend the methodology to look beyond households with dependent children and include the needs of other household types in the future. This work is reported on in our prior reports².
- In-depth group consultations with stakeholders have explored the relevance of the standard concerning key dimensions of lived experience and intersectionality, such as disability, ethnicity, rurality, and poverty.
- Ongoing engagement with government, regional, public, and third-sector organisations to explore using MDLS as a tool to inform ongoing policy development. This includes exploring the relevance of MDLS in the Welsh context on behalf of the Welsh Government³.

This report covers the survey stage of the MDLS research. It reports on the development of the survey-based MDLS measure. The report provides initial findings on the demographic and social factors that underpin meeting - or not - the MDLS as defined by the earlier deliberative MIS methodology.

1.2 The core issues

The MDLS project examines an ongoing social issue that the Covid-19 pandemic and subsequent ‘cost-of-living crisis’ brought sharply up the policy and public agenda – the risks and realities of digital exclusion. The scale and significance of digital systems and media in our everyday lives have never been more apparent. As a result, the digital divide between those who have the devices and data - and the skills and capabilities - and those who do not has never been more consequential. With the ‘cost-of-living’ crisis placing more pressure on household budgets and people having to make difficult decisions about which bills to pay, those on the lowest incomes are at even greater risk of being digitally excluded.

¹Davis, A., Stone, J., Blackwell, C., Padley, M., Shepherd, C., & Hirsch, D. (2022) A Minimum Income Standard for the UK in 2022. York: Joseph Rowntree Foundation.; Hill, K., Marshall, L., Padley, M., & Hirsch, D. (2016). Sight loss and Minimum Income Standards: The additional costs of living for people of working age who are severely sight impaired and for people of pension age with acquired sight impairment. Loughborough: Centre for Research in Social Policy.; Hill, K., Davis, A., Hirsch, D., Padley, M., & Smith, N. (2015). Disability and minimum living standards: The additional costs of living for people who are sight impaired and people who are Deaf. Loughborough: Centre for Research in Social Policy. Padley, M., Bevan, M., Hirsch, D., & Tunstall, R. (2013). Minimum acceptable place standards. Loughborough: Centre for Research in Social Policy.

²<https://mdls.org.uk/publications/>

³<https://www.gov.wales/towards-welsh-minimum-digital-living-standard-final-report-summary-html>

While there is a complex interplay between levels and types of social and digital inequalities, current policy often focuses on digital access (broadband) and defines digital 'exclusion' predominantly in terms of material access to technologies. Many prior academic studies have focused on individual access and skills as do many measures used by policy makers here in the UK and globally. There is therefore a substantial need for deeper understandings and robust measures to guide interventions. This must build on an in-depth assessment of what individuals, households and communities need to be digitally included. This report provides the first results of a project to do this via the development of a "Minimum Digital Living Standard" (MDLS) based on the established and innovative Minimum Income Standard (MIS).

To date the majority of research on digital inequalities has focused on three issues: first, inequalities in material access to computers, an internet connection or information sources; second, differences in digital skills; and third differences in digital use. These can relate to socioeconomic variations and the personal and economic resources that people have available to them⁴ However, these predominantly survey-based methodologies are effectively 'top-down' in their assessment of what counts as digital inequalities, inclusion, or exclusion, and are derived from a policy or theoretical position rather than citizens' perceptions of needs.

This MDLS study moves research and policy debate forwards – away from simple individualised measures of access or skills – by taking a new citizen and household focused approach to understanding digital inclusion, exclusion, and inequalities. By utilising the MIS methodology to develop MDLS we will draw directly on the lived experience of citizens but situate the measure at the level of the household – this is particularly relevant in families with children where individual family members' needs and resources can interlink with each other. This will help us to:

1. Understand digital exclusion as the product of a mix of factors (access to goods, services and skills and knowledge) that limit citizens' and households' digital opportunities and participation.
2. Understand digital inequalities as complex, relative to time and social context and deeply linked to other aspects of social inequality.
3. Understand which digital inclusion policies and interventions do or might best address the factors and contexts that limit citizens' and households' digital capabilities.

1.3 Building MDLS on the MIS methodology

The Minimum Income Standards (MIS) methodology is central to developing MDLS. The MIS methodology utilises deliberative methods to determine a minimum budget that meets material needs but also enables social participation and inclusion and is based on and rooted in public consensus. Full details of how it is drawn on in this project are outlined in our prior report⁵.

The MIS approach is founded on the assertion that what constitutes a minimum living standard should be informed by the lived experience of individuals and households in a society. It aims to identify a minimum socially acceptable standard of living; it is a 'minimum' in the sense that it refers to a threshold under which no one should fall; it is 'socially acceptable' in the sense that such a threshold is defined by society; and it encompasses participation or connections with others in society, recognising that while it is possible to survive at a lower level, this is not a dignified or acceptable standard. Within the MIS approach, minimum living standards are viewed as a reflection of the values in a given society.

Echoing the roots of MIS, our approach to establishing MDLS focuses on the public's perspective of what is needed 'digitally' in order to participate in UK society. Just as MIS determines a 'participation income' needed in order to achieve a minimum living standard, so MDLS establishes a 'digital participation threshold' below which individuals and households do not have all they need to take part in ordinary living patterns, customs and activities in the UK.

Between February and October 2022, we carried out the first part of this study, conducting focus groups with members of the public, rather than experts, to develop a definition of MDLS and to identify the digital goods, services, and skills important in everyday life, from their perspectives. This chapter presents both the methodological framework used to define MDLS and a summary of the digital goods, services, and skills required to meet it. Further details of the method and approach are available in the interim report⁶.

The definition was an integral aspect of the research, describing the standard of living that groups considered when deciding what would be needed to reach it. The MDLS definition provided a clear reference point for participants and was at the heart of all the focus group discussions around the contents of MDLS and what was needed for this benchmark.

⁴Hargittai, E. (2001). Second-level digital divide: Mapping differences in people's online skills. arXiv, Cornell University; Helsper, E.J. (2012). A corresponding fields model for the links between social and digital exclusion. *Communication Theory*, 22(4), 403–426.; Van Deursen, A.J.A.M., Helsper, E.J., & Eynon, R. (2014). Measuring digital skills. From digital skills to tangible outcomes project report.; Yates, S. J., Kirby, J., & Lockley, E. (2015). Digital media use: Differences and inequalities in relation to class and age. *Sociological Research Online*, 20(4), 1-21.; Yates, S.J., & Lockley, E. (2018). Social media and social class. *American Behavioral Scientist*, 62(9), 1291-1316.; Yates, S.J., & Lockley, E. (2020). Digital Engagement and Class: Economic, Social, and Cultural Capital in a Digital Age. In S.J. Yates & R. Rice (Eds.) *The Oxford Handbook of Digital Technology and Society* (pp. 426-448) Oxford: Oxford University Press.

⁵<https://mdls.org.uk/publications/>

⁶Blackwell, C., Davis, A., Hill, K., Padley, M. and Yates, S. (2023) A UK Minimum Digital Living Standard for Households with Children. Loughborough: Centre for Research in Social Policy.

The final lists of digital goods, services, and skills represented a benchmark that households with children should be able to reach.

A total of 17 deliberative focus groups (13 groups with adults, and four groups with young people – ages 11 to 17 years) were carried out. The groups involved four stages, with discussions from one group or stage feeding into the next. Research outcomes were formed through the following funnelling process:

- **Orientation** > Groups discussed what digital inclusion meant to them and developed a definition of MDLS which could then be presented to subsequent groups. These groups were conducted with working-age people without children, pension-age people, parents, and young people to ensure that the resultant definition was relevant to many household types and not just those with children.
- **Task** > New groups with parents and young people worked together to agree on the digital inclusion needs of hypothetical individuals within households (rather than their own needs) and how these could be met.
- **Checkback** > New groups with parents and young people reviewed the decisions from the task stage to identify any missing or unnecessary items and resolve where previous groups had been unable to agree.
- **Final** > New groups with parents and young people reviewed the lists of goods, services, and skills resulting from the checkback stage and addressed any discrepancies.

Groups with adults included a mix of participants across gender, single and couple households, socio-economic circumstances, and income sources, in work and not working, levels of digital engagement. Most groups also included participants from minority ethnic backgrounds. Adults' groups were held in urban locations in Scotland, Northern Ireland, Wales, and in the North, South, East and West of England. Groups with young people were recruited through direct liaison with secondary schools and held in schools in the East Midlands during the school day, with students aged 11 to 17. From the orientation stage of our research, our deliberative groups developed the following MDLS definition:

A minimum digital standard of living includes, but is more than, having accessible internet, adequate equipment, and the skills, knowledge and support people need. It is about being able to communicate, connect, and engage with opportunities safely and with confidence.

The MDLS as defined by our prior deliberative work is presented in Figure 1.1. Figure 1.1 lists the goods, services, and skills that households with children **themselves determined** are needed for **their own definition** of a minimum digital living standard.

1.3.1 Digital goods and services

The MDLS groups defined the minimum digital goods and services required by a household with children to be:

- Home broadband with sufficient reliability and speed to support multiple family members to access the internet at the same time.
- An entry-level smartphone per parent and secondary school child and 5GB data a month, each.
- Plus, an additional 3GB of data per month for parents of a pre-school or primary school child.
- A laptop, tablet, or PC per household – parent(s) and first child share one device with an additional device for every further school-age child.
- A smart TV, TV licence, and TV subscription service.
- Access to gaming and online gaming.

1.3.2 Functional and practical skills

MDLS groups agreed on minimum functional and practical skills that enable households with children to engage online and carry out everyday tasks and activities. These functional and practical skills include:

- Using digital devices, programs, and the internet. Downloading apps, changing device and app settings, and connecting devices to the internet are all examples of the types of functional skills required for performing any online tasks.
- Engaging online. These are the skills needed for interacting with others and for accessing online content, as well as for using services. Examples include using school apps to pay for school dinners and school trips, making cashless payments, making video calls, submitting homework online, booking appointments and activities, filling out forms, and ordering prescriptions.

- Managing and maintaining digital devices and data usage. These skills enable people to continue to use and get the most out of their devices for the tasks and activities outlined above. Managing data usage requires knowing how to monitor it and understanding how much data different apps use. Maintaining devices includes knowing how to clear and monitor device storage space.

1.3.3 Critical skills for understanding and managing digital risks

MDLS groups agreed on minimum critical skills for understanding and managing digital risks that enable households with children to go online safely and with confidence to participate in society. They are what support families to avoid and manage online harms such as scams and fraudulent links, identity theft, bullying, grooming, and mis/disinformation. Examples of skills for understanding and managing digital risks include:

- Managing security. Understanding why and how to create secure passwords, knowing how to remove debit and credit card information from websites, and being able to make secure payments and monitor bank activity online.
- Interacting with others. Discerning what information to share online, evaluating the legitimacy of friend requests, and managing different online pressures, such as responding instantly to messages.
- Sharing and receiving information. Evaluating online information and knowing where reliable sources of information can be found online or knowing how to avoid or report harmful content.



Figure 1.1: MDLS definition

1.4 Survey design and data preparation

1.4.1 Survey

This report is based on a survey of 1582 UK households from all UK administrations (England, Scotland, Wales and Northern Ireland) undertaken in 2023. This was a quota sample sourced from UK Geographics. The sample was broken out into sampling points using Census 2011 Output Areas (OAs). with approximately 12 interviews per point. Quotas were set to be reflective of the UK households with children. Interviews were on average 30 to 15 minutes long and were conducted using face-to-face recruitment and in-home CAPI interviews. Critical Research supported the questionnaire design, design of the sample, undertook the CAPI scripting, the design and distribution of all interview materials, and project managed the fieldwork. Critical undertook data checking and provided the data to the team in SPSS format.

These responses garnered separate data on:

- 2605 adults with parental responsibility
- 300 other adults
- 891 secondary school children
- 1162 primary school children
- 681 pre-school children

Therefore providing data on a total of 4616 individuals in the 1582 households. There is considerable variation in household composition for households with children in our data set and in the UK population as a whole. As Figure 1.1 implies, meeting the MDLS depends on household composition in terms of both equipment and skills. A considerable amount of data preparation was therefore needed to assess the extent to which each component was held for each household. In this report, we have not broken results down into finer detail, especially around skills. Rather we have focused on measuring and assessing whether our sample households with children meet the MDLS and the implications from our sample for the wider UK. Later work will look at the details of elements of MDLS in relation to our key variables and geodemographics.

1.4.2 Questionnaire

The questionnaire was designed by the team through iterative project meetings, in consultation with our advisory board and with expert input from Critical on practicalities and the complex routing required to collect data on very varied household compositions. A copy of the questionnaire can be found in Appendix 3. Separate from the MDLS data on equipment and skills we collected the following demographic data on the household or the respondent through the questionnaire:

- Gender
- Age
- Urban context - urban or rural, and town size
- UK nation
- UK region
- Socio-economic grade (National Readership Scale)
- House ownership or rental status
- Receipt of state benefits
- Employment status of the main income earner
- Respondent's health or disability affecting everyday life
- Respondent's declared ethnicity

1.5 Geodemographic data

Through the matching of postcodes and UPRN data for households, we were able to link all cases to a set of geodemographic data sets for the area where the household was located. This data was provided by the Consumer Data Research Centre. These include:

- Output Area 2011 Code
- Lower Layer Super Output Area 2011 Code
- Middle Layer Super Output Area 2011 Code
- Output Area 2021 Code
- Lower Layer Super Output Area 2021 Code
- Middle Layer Super Output Area 2021 Code
- Output Area Classification Supergroup
- Output Area Classification Group
- Output Area Classification Subgroup
- London Output Area Classification Supergroup
- London Output Area Classification Group
- Index of Multiple Deprivation total rank

- Internet User Classification Group
- Proportion of houses built post-1945
- Proportion of houses built post 2016
- Mode of Age Band
- Median Age band
- Median House price in 2020-03
- Median House price in 2021-03
- Median Download Speed (MBit/sec)
- Access to Healthy Assets and Hazards Index
- Energy Performance Certification Energy Efficiency Band/Rating

We will use a number of these variables in the following analyses.

1.6 Analytic tools

All of the analyses were undertaken using either R (v4.3.2) running under R-studio (v2023.12.0+369) or IBM SPSS (v28.0.1.1). The R packages listed in Table 1.1 were used for analysis and the team has developed bespoke code for reporting results.

Data analytic tasks	R packages used
Data import and manipulation	dplyr (1.3.1); haven (2.5.4)
Survey weightings	survey (4.2-1); questionr (0.7.8)
Factor and PCA analysis	factoextra (1.07); FactoMineR (2.9); FactoInvestigate (1.9); psych (2.3.12)
Plotting results	ggplot2 (3.4.4); ggpubr (0.6.0); corrplot (0.92); ggsurvey (0.7.8)
Latent Class Analysis	poLCA (1.6.0.1)
Regression and cross-tabulations	glm(r-base); svyglm(4.2-1); svychisq (4.2-1)
Reporting data tables and results	xtable(1.8-4); report (0.5.8); stargazer (5.2.3); effects (4.2-2)

Table 1.1: Main R packages used in this analysis

Access to data can be provided on request within requirements of ethical re-use. Analytic scripts in R are provided in Appendix 3 of this report.

1.7 Further information and links

MDLS Project page:

- www.mdls.org.uk

An interim report details the research done with deliberative groups to develop the definition and identify the goods, services, skills, and understanding required to meet MDLS.

- [https://www.lboro.ac.uk/media/www/lboroacuk/content/crsp/downloads/reports/MDLS UK report Final.pdf](https://www.lboro.ac.uk/media/www/lboroacuk/content/crsp/downloads/reports/MDLS%20UK%20report%20Final.pdf)

Separate reports cover the recommendations and research findings from a project commissioned by the Welsh Government to develop a Minimum Digital Living Standard for Wales, undertaken by the MDLS project team with Cwmpas, Swansea University, and Digital Inclusion Alliance Wales:

- <https://www.gov.wales/towards-welsh-minimum-digital-living-standard-final-report-summary-html>
- <https://www.llyw.cymru/tuag-y-safon-ofynnol-ar-gyfer-bywyd-digidol-adroddiad-terfynol-crynodeb-html>
- <https://www.gov.wales/towards-welsh-minimum-digital-living-standard-citizen-and-stakeholder-perspectives-html>
- <https://www.llyw.cymru/tuag-y-safon-ofynnol-ar-gyfer-bywyd-digidol-safbwyntiau-dinasyddion-rhanddeiliaid>

Chapter 2

Devices and services

2.1 Introduction

This section of the report details the extent to which UK households with children have access to the required equipment set out within the Minimum Digital Living Standard. It reviews the extent to which households meet MDLS requirements for equipment as set out in Figure 1.1. The section concludes with two different measures for meeting the MDLS equipment requirements. One that looks only at whether our sampled households fully meet the requirements given their composition. The second takes our sampled households as indicative of underlying latent groups in the population who are more or less likely to meet the MDLS in full or part and provides a model of their likely composition.

2.2 Large Screen Device

The MDLS expects that households with children should have a minimum number of large-screen devices, such as a laptop, PC, or tablet, depending on the composition of the household. The MDLS requires one large-screen device for the adults with parental responsibility and the first child. The household then needs a further large-screen device for each additional school-age child. For example:

- A single parent with one child would require one large-screen device
- A dual-parent household with three children would require three large-screen devices

Table 2.1 indicates that 10% of UK households **do not** meet MDLS criteria for the number of large-screen devices they own.

Large screen devices	percent
Not adequate	10.30
Adequate	89.70

Table 2.1: MDLS adequate large screen devices (%)

2.3 Smart Phone

The MDLS requires that all adults with parental responsibilities and all secondary school-age children have individual personal access to a basic smartphone. Table 2.2 indicates that 7% of UK households with children **do not** meet this requirement.

Smartphone	percent
Not adequate	7.00
Adequate	93.00

Table 2.2: MDLS adequate smartphones (%)

2.4 Broadband access, broadband speed, and data packages

MDLS requires that households with children have broadband access and speeds that allow all household members to use the internet at the same time. MDLS also expects minimum data allowances for adults and secondary school-age

children. Prior evidence, including anecdotal evidence from our qualitative fieldwork, indicated that a large number of respondents may not accurately know their monthly data allowances or those of other household members. We therefore asked if respondents or household members ran out of data regularly. Taking this as an indicator of **not having** adequate data per month. Table 2.3 indicates that 7% of UK households with children **do not** have access to broadband and table 2.4 indicated that 20% **do not** have adequate broadband for all household members to use it at the same time. Table 2.5 indicates that 10% of UK households with children have members who **do not** have adequate mobile data each month.

Broadband access	Percent
Not MDLS adequate	6.80
<i>MDLS adequate</i>	93.20

Table 2.3: Percentage of households with children with access to broadband

Broadband speed	Percent
Not MDLS adequate	20.40
<i>MDLS adequate</i>	79.60

Table 2.4: Percentage of households with children with an adequate broadband speed

Smartphone data packages	Percent
Not MDLS adequate	10.10
<i>MDLS adequate</i>	89.90

Table 2.5: Percentage of households with children with adequate data packages for household members

2.5 Gaming

The MDLS requires that households with children have access to a gaming device. This may be a console (e.g., Xbox, PlayStation, Nintendo Switch etc.), a PC or a Laptop. The MDLS includes a requirement that households also have the capacity for members to play games over the Internet with friends and family. Table 2.6 indicates that 11% of households with children **do not** have gaming-capable devices. Table 2.7 indicates that 65% of households with children **do not** have access to an online gaming service. This result contrasts with Ofcom Figures where 35% of adults (16+) and 57% of children (5-15) regularly play games online¹. Though percentages of households and individuals are not directly comparable we believe that our survey result reflects households stating that they pay for formal services (e.g., Steam, Xbox Live etc.,) and not the level of actual online gaming within households. Many games provide online gaming options without using dedicated services such as Xbox Live. In future surveys, we will ask if household members play games online, rather than ask if the household pays for a gaming service.

Gaming device	Percent
Not MDLS adequate	8.80
<i>MDLS adequate</i>	91.20

Table 2.6: Percentage of households with children with access to gaming-capable devices

Gaming service	Percent
Not MDLS adequate	65.30
<i>MDLS adequate</i>	34.70

Table 2.7: Percentage of households with children with access to gaming services

2.6 Smart TV and TV services

MDLS requires that households with children have access to a Smart TV and at least one digital TV service. Table 2.8 indicates that 6% of households with children **do not** have access to a Smart TV. Table 2.9 indicates that 16% of UK

¹<https://www.ofcom.org.uk/research-and-data/online-research/online-nation>

households with children **do not** have access to a digital TV service.

Smart TV	Percent
Not MDLS adequate	6.20
<i>MDLS adequate</i>	93.80

Table 2.8: Percentage of households with children with access to a Smart TV

Digital TV service	Percent
Not MDLS adequate	16.30
<i>MDLS adequate</i>	83.70

Table 2.9: Percentage of households with children with access to a digital TV service

2.7 Smart speaker

The initial measure of MDLS equipment included a requirement for a smart speaker. This was based on prior MIS research, more recent work has removed the smart speaker from the MIS basket of goods. Also, as we will note further in section 2.10, many households with children that would otherwise meet the MDLS equipment requirements fall out of scope if the smart speaker requirement is retained. We have therefore removed this from the MDLS definition. Table 2.10 is therefore included for completeness and indicates that 44% of UK households with children do not have a smart speaker.

Smart speaker	Percent
Not MDLS adequate	42.60
<i>Adequate</i>	57.40

Table 2.10: Percentage of households with children with access to a smart speaker

2.8 MDLS equipment totals and absolute cut off

As a first assessment of households with children meeting the MDLS, table 2.11 presents the total number of MDLS equipment requirements met by different households with children. The table also shows the proportions of UK households holding each total. With a small number only holding one and some holding all 10. This total includes games services and smart speakers. Removing the games service and smart speaker gives table 2.12 where the maximum is now 8. As a result, we find in table 2.13 that 48% of UK households with children **do not** meet the MDLS equipment requirements.

Number of MDLS equipment items	Percent
1	0.10
2	0.70
3	1.00
4	1.90
5	4.00
6	6.00
7	13.70
8	26.30
9	30.00
10	16.10

Table 2.11: Percentage of households MDLS totals - all equipment

Number of MDLS equipment items	Percent
1	0.10
2	0.80
3	1.00
4	2.50
5	4.70
6	12.20
7	26.20
8	52.40

Table 2.12: MDLS equipment (no smart speaker or games service)

	Percent
Not MDLS adequate	47.60
Adequate MDLS	52.40

Table 2.13: Percentage of households meeting absolute MDLS equipment requirements

2.9 How we get to 48%?

That 48% of households with children do not meet a rigid interpretation of the MDLS equipment requirement may seem a high proportion given that on some individual measures such as broadband access the majority of cases (90+%) do meet the criteria. This is of course a combined multi-element measure and there are at least eight criteria on which an individual household can fall out of the MDLS. Table 2.14 details how adding each equipment criterion lowers the number of households meeting the MDLS equipment requirement.

Removing those without adequate:	Percent
Smartphones	93.00
Smartphone data	83.30
Broadband access	78.40
TV service	67.60
Broadband speed	58.80
Large screen devices	54.80
Smart TV	54.80
Gaming	52.40

Table 2.14: Percentage of households with children meeting MDLS equipment requirements removing and item at a time

2.10 MDLS LCA results

However, MDLS is a complex measure, as much designed to help assess and understand individual households or types of households as to provide an overall national measure. There is, as a result, a good bit of variation in how individual households might meet the criteria. For example, all of the following would meet or exceed the **minimum** equipment requirement for large screen devices:

- A single parent with two children with two tablet devices
- A dual-parent household and two children with one laptop and one tablet device
- A dual-parent household and two children with one PC, two laptops, and a tablet device

Clearly, these households do not have the same digital capabilities but they all meet or exceed the minimum. Similarly, a household may not have a gaming device as there is a child with a visual impairment who does not do gaming. Though there are of course gamers who are blind and online blind gaming communities. The key point is that in a large population such as our sample and the UK as a whole, households may fall out of the general MDLS for valid specific reasons that are not captured in our data. Conversely, some households may have greater needs, for example, higher specification devices and screen readers for a blind child. Given this variation, we can take an alternative view of our MDLS equipment data. We can view our survey responses as samples taken from underlying (latent) groups with different probabilities of

having each of the various pieces of equipment and services. There may be a group likely to have all the requirements in some combination. Another group where specific things are missing, such as broadband or large screen devices. There may be a group with very little. Identifying these underlying (latent) groups may be a more valid measure of meeting the MDLS than a strict interpretation.

We can use Latent Class Analysis to look for these underlying (latent) groups that may sit behind our survey data in the overall UK population of households with children. We, therefore, undertook a latent class analysis of the survey with the following binary variables, each measuring whether the household met or not the MDLS criteria:

- Broadband access
- Broadband speed
- Gaming device
- Large screen devices
- Smartphones
- Smartphone data
- Smart TV
- TV digital service

The analysis was undertaken in R-studio using the polCA package (v1.6.0.1) The following table (Table 2.15) of results and graphs (Figure 2.2 and Figure 2.1) indicate that 5 groups optimises information for the smallest number of groups (using lowest Bayesian Information Criteria score as the selection criteria).

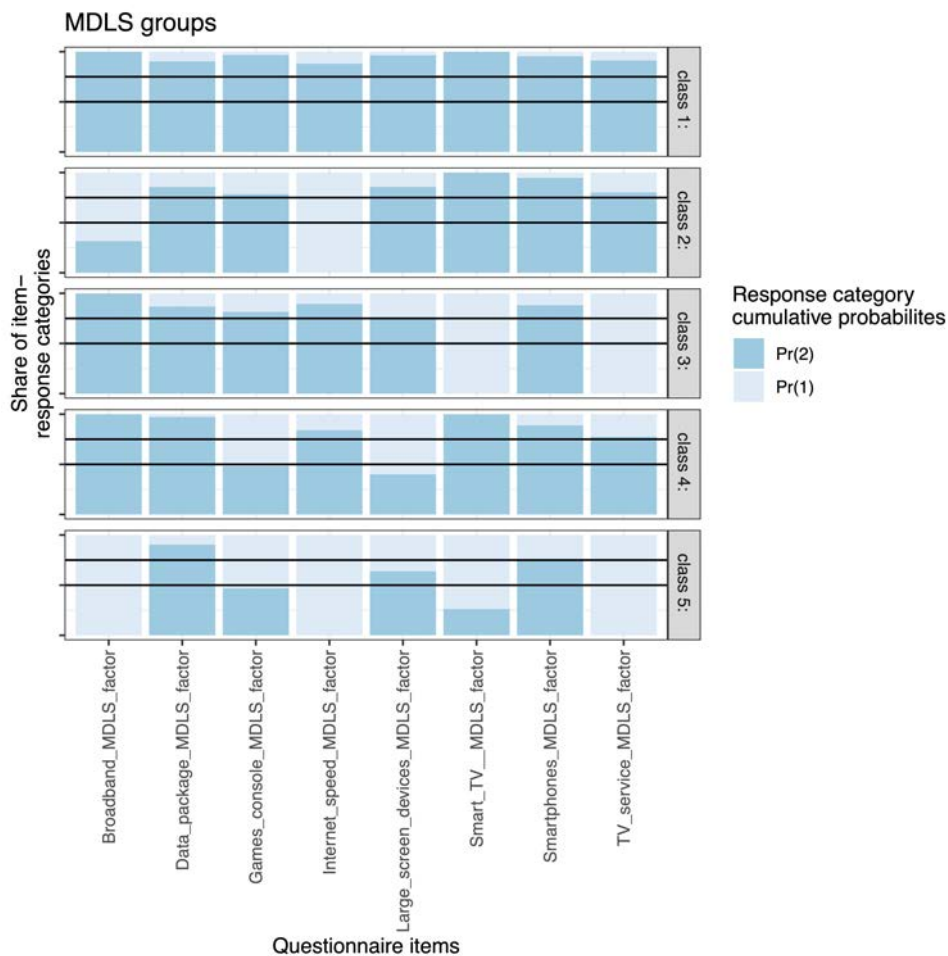


Figure 2.1: Latent class groups

NoClasses	ll	df	BIC	AIC	ll ratio	Chi	entValue
2	-4042.77	238.0	8210.78	8119.55	598.22	860.39	0.75
3	-3886.64	229.0	7964.81	7825.28	285.95	381.36	0.87
4	-3836.86	220.0	7931.55	7743.72	186.39	246.5	0.81
5	-3801.15	211.0	7926.43	7690.31	114.97	123.03	0.77
6	-3787.78	202.0	7965.98	7681.56	88.23	95.53	0.81
7	-3779.14	193.0	8015.0	7682.28	70.95	76.59	0.7
8	-3776.23	184.0	8075.48	7694.46	65.13	70.56	0.63

Table 2.15: LCA results for 8 models

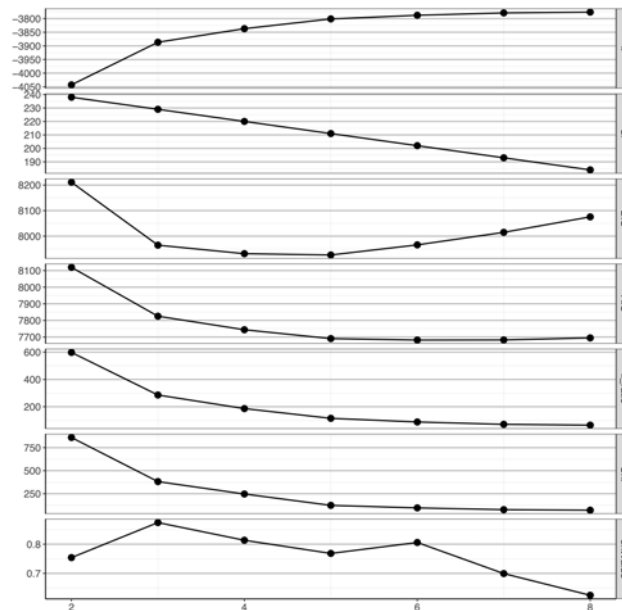


Figure 2.2: Plot of LCA results

2.10.1 MDLS LCA Proportions

The percentage of people in each group is presented in Table 2.16 and we have provided some names to describe each of these groups. In this case, we find the total households with children 'probably' meeting the equipment requirements for MDLS in the UK population is 81%. The LCA also provides evidence of how different groups fall short of the MDLS. With the majority lacking good broadband (6%), one group lacking access to smart TV and digital services (5%), one group that lacks large screen devices (4%), and one that fall short on all criteria (3%).

Group	Description	percent
1	Fully MDLS	81.48
2	Partial MDLS – poor broadband via 4G/5G	6.01
3	Partial MDLS – lacks smart TV access	4.8
4	Partial MDLS – lacks enough devices (large screen / gaming)	4.24
5	Significantly below MDLS	3.48

Table 2.16: LCA proportions

We therefore have two potential measures of the number of households with children meeting MDLS equipment criteria that give two very different results. The absolute figure of 50% provides a simple clear starting point but as Table 2.12 indicates 25% of cases miss the MDLS equipment requirement by one item. The LCA analysis therefore provides a more nuanced take on meeting the MDLS criteria. We will use both of these measures to explore how meeting the MDLS equipment criteria corresponds and correlates with key socio-demographics and also with MDLS skills requirements.

Chapter 3

Skills

3.1 Introduction

The MDLS measure contains both equipment and skills. Skills are split into two groups which we can broadly describe as functional and critical skills. To assess skills quickly in a survey context we asked respondents to evaluate how confidently they or other household members could undertake specific activities. We accept that both self-reports and reports about others in the household are less reliable than direct testing. We are also aware that interpretations of skills, skill levels, and tasks are relative. However, this approach was the most pragmatic to allow a reasonable administration of an in-home survey of all household members within a reasonable time frame. Given the extensive list of skill requirements in the MDLS we could not practically cover all skills in a reasonable survey interview session of 30 to 60 minutes. Especially as we were asking questions about all household members. We therefore undertook a smaller pilot survey using all skill questions to assess which skills were most representative of the data sets for each household member group (parents, secondary school children, primary school children) and skill area (functional or critical). This data, analysis and details on the selection of skills can be found in Appendix 1. From this work, we reduced the skills to be assessed to the following sets of functional and critical skills.

- Adult functional
 - Save a document on a computer or laptop
 - Look for information online using Google or Bing
 - Create an email account
 - Make online payments or cashless payments (e.g. through Apple Pay or Google Pay)
 - Manage mobile phone data usage
 - Use apps to communicate between parents and schools/ check on child's homework etc.
- Secondary school functional
 - Save a document on a computer or laptop?
 - Look for information online using sites like Google or Bing
 - Create an email account
 - Make online payments or cashless payments (e.g. through Apple Pay or Google Pay)
 - Manage mobile phone data usage
- Primary school functional
 - Save a document on a computer or laptop
 - Look for information online using sites like Google or Bing
 - Connect a tablet or smartphone to the internet
 - Fully turn off devices like laptops, mobile phones or tablets
- Adult critical and secondary school critical
 - Think about whether online friend requests are genuine (e.g. is the person who they say they are)
 - Think about what personal information should and should not be shared online
 - Identify risks online (e.g. scams, unsafe links or inappropriate/ offensive content etc.)

- Manage online pressures when online (e.g. pressures to always be online, to respond immediately, to use social media)
 - Think about the quality of the information found online (e.g. is it true, could it be misinformation or unrealistic)
 - Know how to report inappropriate or offensive things online
 - Can understand that everything that is posted online will leave a mark or 'digital footprint'
 - Know how to set up parental controls
- Primary school critical
 - Think about whether online friend requests are genuine (e.g. is the person who they say they are)
 - Identify risks online (e.g. scams, unsafe links or inappropriate/ offensive content etc.)
 - Think about the quality of the information found online (e.g. is it true, could it be misinformation or unrealistic)
 - Know how to avoid inappropriate or offensive things online

We have taken any level of confidence (Fairly or Very) as a marker of the respondent or household member having the skill. We have then assessed if each adult or child in the household is considered to be confident (Fairly or Very) in all of the functional or critical skills.

3.2 Functional skills

Table 3.1 to Table 3.8 indicate the percentage of households with children where the parental adults, secondary school, and primary school children have the full set of functional skills.

3.2.1 Parental skills

We have assessed the functional skills of all adults with parental responsibility in the household. In the case of single-parent households, this would only be the survey respondent. In other households, this would cover the respondent and one other adult. Table 3.1 to Table 3.3 detail the extent to which the individual adults and then the combined adults within the household meet the MDLS functional skills requirements. Notably, 25% of respondents and 22% of other adults with parental responsibility do not meet the MDLS requirements. However, in combination, this leads to 83% of households having at least one parent who meets the parental requirements.

Respondent (parent) functional	Percent
Not adequate Functional	25.09
Adequate Functional	74.91

Table 3.1: Respondent - adult with parental responsibilities - Functional skills

Other parent functional	Percent
Not adequate Functional	21.51
Adequate Functional	78.49

Table 3.2: Other adult with parental responsibilities (if present) - Functional skills

Parental functional skills - Breakdown

Overall parental functional	Percent
Not adequate Functional	17.32
Adequate Functional	82.68

Table 3.3: Combined adults with parental responsibilities - Functional skills

Skill	MDLS	Percentage
Save a document	Not MDLS adequate	11.90
	<i>MDLS adequate</i>	88.10
Look for information online	Not MDLS adequate	3.26
	<i>MDLS adequate</i>	96.74
Create an email account	Not MDLS adequate	8.98
	<i>MDLS adequate</i>	91.02
Make online payments	Not MDLS adequate	8.56
	<i>MDLS adequate</i>	91.44
Manage mobile phone data usage	Not MDLS adequate	8.87
	<i>MDLS adequate</i>	91.13
Use apps to communicate between parents and school	Not MDLS adequate	14.20
	<i>MDLS adequate</i>	85.80

Table 3.4: MDLS Parents functional skills breakdown

3.2.2 Secondary school children - Functional skills

Notably, the survey respondents (adults with parental responsibility) are likelier to score the secondary-school children highest on skills. The primary school measure here is challenging. MDLS has a nuanced and age-based approach to skills for pre-secondary school-age children that is condensed in this survey measure. As a result, our primary school measure covers children expected to have few skills (e.g., those age 5) through to ones close to secondary school age who are expected to have a larger set. However, from our pilot work, we have selected only 4 fundamental functional skills for this group to take this variation into account. However, it is notable that between 21% (secondary school) and 43% (primary school children) **do not** have the MDLS-required functional skills.

Overall secondary school functional	Percent
Not MDLS adequate	18.20
<i>MDLS adequate</i>	81.80

Table 3.5: Overall Secondary school children - Functional skills

Older secondary school children - Functional skills breakdown

If we look at a breakdown of older secondary school children's functional skills, then we should note that the two with the lowest results are making online payments (78%) and managing mobile data (85%). As we will note later an ability to manage mobile data and costs is key for low-income families.

Skill	MDLS	Percentage
Save a document	Not MDLS adequate	7.06
	<i>MDLS adequate</i>	92.94
Look for information online	Not MDLS adequate	3.63
	<i>MDLS adequate</i>	96.37
Create an email account	Not MDLS adequate	10.69
	<i>MDLS adequate</i>	89.31
Make online payments	Not MDLS adequate	21.57
	<i>MDLS adequate</i>	78.43
Manage mobile phone data usage	Not MDLS adequate	15.12
	<i>MDLS adequate</i>	84.88

Table 3.6: Older SS children functional skills breakdown

Younger secondary school children - Functional skills breakdown

If we look at a breakdown of younger secondary school children's functional skills, then we should note that the two with the lowest results are making online payments (52%) and creating an email account (69%). We would note that children at Key Stage 3 are already of an age (11-13) where they will be under pressure to join social media, if they have not already, and will need to be capable of setting up and managing platform accounts.

Skill	MDLS	Percentage
Save a document	Not MDLS adequate	13.92
Save a document	<i>MDLS adequate</i>	86.08
Look for information online	Not MDLS adequate	7.09
	<i>MDLS adequate</i>	92.91
Create an email account	Not MDLS adequate	30.89
	<i>MDLS adequate</i>	69.11
Make online payments	Not MDLS adequate	47.59
	<i>MDLS adequate</i>	52.41

Table 3.7: Younger SS children functional skills breakdown

3.2.3 Primary school children - Functional skills

Overall, we find that only 68% of primary school age children meet the functional skills requirements for MDLS. Remembering that these are skills which both parents and secondary school age children thought necessary at Key Stages 1 and 2 of primary education. Looking at the breakdown of skills there are a number of basic actions that up to 60% of primary school age children are seen as being 'not confident' in by their parents.

Overall primary school functional	Percent
Not MDLS adequate	32.00
<i>MDLS adequate</i>	68.00

Table 3.8: Primary school children - Functional skills

Older primary school children - Functional skills breakdown

Skill	MDLS	Percentage
Save a document	Not MDLS adequate	54.24
	<i>MDLS adequate</i>	45.76
Look for information online	Not MDLS adequate	32.41
	<i>MDLS adequate</i>	67.59
Connect a device the internet	Not MDLS adequate	42.42
	<i>MDLS adequate</i>	57.58
Fully turn off devices	Not MDLS adequate	27.54
	<i>MDLS adequate</i>	72.46

Table 3.9: Older PS children functional skills breakdown

Younger primary school children - Functional skills breakdown

Skill	MDLS	Percentage
Fully turn off devices	Not MDLS adequate	62.84
	<i>MDLS adequate</i>	37.16

Table 3.10: Younger PS children functional skills breakdown

3.3 Critical skills

3.3.1 Parents critical skills

The results for parents, secondary school, and primary school children are presented in Table 3.11 to Table 3.18. As with functional skills, a notable proportion of respondents (37%) and other adults with parental responsibility (30%) did not meet the MDLS criteria. However, as with functional skills, in combination 73% of households had at least one parental adult with the required critical skills.

Respondent (parent) critical	Percent
Not MDLS adequate	37.29
<i>MDLS adequate</i>	62.71

Table 3.11: Other adult with parental responsibilities - Critical skills

Other parent critical	Percent
Not MDLS adequate	30.11
<i>MDLS adequate</i>	69.89

Table 3.12: Other adult with parental responsibilities - Critical skills

Overall parental critical	Percent
Not MDLS adequate	27.24
<i>MDLS adequate</i>	72.76

Table 3.13: Combined adults with parental responsibilities - Critical skills

Parents critical skills breakdown

Skill	MDLS	Percentage
Whether online friend requests are genuine	Not MDLS adequate	14.20
	<i>MDLS adequate</i>	85.80
What personal information should be shared	Not MDLS adequate	11.48
	<i>MDLS adequate</i>	88.52
Identify risks online	Not MDLS adequate	16.20
	<i>MDLS adequate</i>	83.80
Manage online pressures	Not MDLS adequate	13.93
	<i>MDLS adequate</i>	86.07
Think about the quality of information online	Not MDLS adequate	16.16
	<i>MDLS adequate</i>	83.84
Know how to report things online	Not MDLS adequate	17.35
	<i>MDLS adequate</i>	82.65
Understand 'digital footprints'	Not MDLS adequate	15.01
	<i>MDLS adequate</i>	84.99
How to set up parental controls	Not MDLS adequate	16.43
	<i>MDLS adequate</i>	83.57

Table 3.14: MDLS Parents critical skills breakdown

3.3.2 Secondary school children's critical skills

We see a similar pattern with critical skills we saw with functional skills where secondary school children are seen to be the most skilled. Looking at the break down there is a consistent 75% to 25% split in older secondary school children's skills. For younger Secondary school children this is more consistently at 55/60% to 45/40% split. These are important skills for young people moving onto and using digital platforms. Such results raise the concern that young people are potentially not well prepared for this transition and that a notable proportion may be operating online without skills they and their parents have identified as being necessary to be online both safely and confidently.

Secondary school critical	Percent
Not MDLS adequate	30.60
<i>MDLS adequate</i>	69.40

Table 3.15: Secondary school children - Critical skills

Older secondary school children - Critical skills breakdown

Skill	MDLS	Percentage
Whether online friend requests are genuine	Not MDLS adequate	23.79
	<i>MDLS adequate</i>	76.21
What personal information should be shared	Not MDLS adequate	22.58
	<i>MDLS adequate</i>	77.42
Identify risks online	Not MDLS adequate	31.05
	<i>MDLS adequate</i>	68.95
Manage online pressures	Not MDLS adequate	29.64
	<i>MDLS adequate</i>	70.36
Think about the quality of information online	Not MDLS adequate	28.28
	<i>MDLS adequate</i>	71.72
Know how to report things online	Not MDLS adequate	28.02
	<i>MDLS adequate</i>	71.98
Understand 'digital footprints'	Not MDLS adequate	23.99
	<i>MDLS adequate</i>	76.01

Table 3.16: Older SS children critical skills breakdown

Younger secondary school children - Critical skills breakdown

Skill	MDLS	Percentage
Whether online friend requests are genuine	Not MDLS adequate	41.77
	<i>MDLS adequate</i>	58.23
What personal information should be shared	Not MDLS adequate	37.22
	<i>MDLS adequate</i>	62.78
Identify risks online	Not MDLS adequate	46.33
	<i>MDLS adequate</i>	53.67
Manage online pressures	Not MDLS adequate	44.81
	<i>MDLS adequate</i>	55.19
Think about the quality of information online	Not MDLS adequate	46.68
	<i>MDLS adequate</i>	53.32
Know how to report things online	Not MDLS adequate	41.77
	<i>MDLS adequate</i>	58.23

Table 3.17: Younger SS children critical skills breakdown

3.3.3 Primary school children's critical skills

These results indicate that only half of the primary school children in the survey were seen as being confident in the MDLS critical skills that parents, and secondary school children considered necessary for their age. These results also raise the concern that younger children may be operating online without the skills needed to be safe and confident in what they are doing.

Primary school critical	Percent
Not MDLS adequate	49.50
<i>MDLS adequate</i>	50.50

Table 3.18: Primary school children - Critical skills

Older primary school children - Critical skills breakdown

Skill	MDLS	Percentage
Whether online friend requests are genuine	Not MDLS adequate	74.97
	<i>MDLS adequate</i>	25.03
Identify risks online	Not MDLS adequate	77.33
	<i>MDLS adequate</i>	22.67
Think about the quality of information online	Not MDLS adequate	78.16
	<i>MDLS adequate</i>	21.84
B2c09	Not MDLS adequate	71.21
B2c09	<i>MDLS adequate</i>	28.79

Table 3.19: Older PS children critical skills breakdown

Younger primary school children - Critical skills breakdown

Skill	MDLS	Percentage
Identify risks online	Not MDLS adequate	93.02
	<i>MDLS adequate</i>	6.98

Table 3.20: Younger PS children critical skills breakdown

3.4 Overall household skills

Combining these results we find that 62% of households meet the MDLS criteria for overall skills. With 5% not meeting the skills requirement at all, 24% only meeting it for the children, and 9% for parents only.

	Overall household skills factor
Not adequate Skills	4.80
Only children Have Adequate Skills	23.70
Only parents Have Adequate Skills	9.40
Household Has Adequate Skills	62.20

Table 3.21: Overall household skills

Chapter 4

Combining results

4.1 Introduction

MDLS calls for households to have a combination of both the required equipment and skills. In the next two sections, we look at combining skills and equipment. Section 4.2 cross-tabulates our absolute MDLS equipment measure with household skills. Section 4.3 does the same for our LCA-based measure.

4.2 MDLS absolute equipment and overall household skills

Table 4.1 presents results of a cross-tabulation of our absolute measure of MDLS equipment with our assessment of household digital skills. From this, we could conclude that 71% of households that meet the MDLS equipment requirement also meet the skills requirement. This would give only 37% of UK households with children meeting the MDLS standard combining absolute equipment requirement with household skills.

	Not MDLS adequate	MDLS adequate
Not adequate Skills (obs.)	59.00	16.00
(row%)	78.30	21.70
(col.%)	7.90	2.00
Children Have Adequate Skills (obs.)	222.00	152.00
(row%)	59.30	40.70
(col.%)	29.50	18.40
Parents Have Adequate Skills (obs.)	78.00	71.00
(row%)	52.30	47.70
(col.%)	10.30	8.50
Household Has Adequate Skills (obs.)	394.00	589.00
(row%)	40.10	59.90
(col.%)	52.40	71.10

Table 4.1: Overall household skills factor by MDLS2 factor ($\chi^2(3, 1582) = 72.779, p = 0,$ Cramer's V = 0.214)

4.3 MDLS LCA equipment and overall household skills

Undertaking the same analysis with the more nuanced LCA model of MDLS equipment we get Table 4.2. These results indicate that 65% households with adequate equipment also meet the MDLS skills criteria. This implies that on this measure 55% of households are probably within the MDLS.

MDLS Equipment (LCA)	Fully MDLS	Part MDLS: poor BB	Part MDLS: No STV	Part MDLS: Low Dev	Sig below MDLS
Not adequate Skills (obs.)	58.00	3.00	6.00	6.00	2.00
(row%)	76.60	4.60	7.30	8.50	3.00
(col.%)	4.40	4.40	8.10	10.00	5.60
Children Have Adequate Skills (obs.)	269.00	35.00	27.00	18.00	25.00
(row%)	71.80	9.30	7.20	4.90	6.80
(col.%)	20.20	44.30	39.50	28.60	61.80
Parents Have Adequate Skills (obs.)	133.00	4.00	4.00	6.00	1.00
(row%)	89.80	2.40	2.90	4.00	0.90
(col.%)	10.00	4.50	6.30	9.20	3.30
Household Has Adequate Skills (obs.)	870.00	37.00	32.00	33.00	12.00
(row%)	88.40	3.80	3.20	3.40	1.20
(col.%)	65.40	46.80	46.10	52.10	29.40

Table 4.2: Overall household skills factor by MDLS LCA factor short ($\chi^2(12, 1582) = 81.024$, $p = 0$, Cramer's $V = 0.131$)

4.4 Combining MDLS Equipment and Skills

We therefore have two potential measures of the MDLS based on our survey data. First, one based on an absolute application of the MDLS rules for equipment combined with a factor-based measure of household skills. We will refer to this as the absolute MDLS measure. This gives 37% of UK households with children falling within the MDLS (see Table 4.3). Second, one based on Latent Class Analysis model of MDLS equipment combined with a factor-based measure of household skills. We will refer to this as the LCA-based MDLS measure. This gives 55% of UK households with children falling within the MDLS (see Table 4.4).

For a variety of reasons, we favour the LCA-based MDLS. Though the absolute MDLS measure applies the equipment measure fully to each sample household it has to rely on our factor-based approach to measuring skills. It is therefore a hybrid measure mixing a rule-based and a statistical approach to measuring the MDLS. Our LCA-based MDLS takes a statistical approach to both aspects of the MDLS. It makes the assumption that our survey sample, though nationally representative in terms of location, basic socio-economics and household composition is itself a sample taken from a population with a broader set of national variation in terms of households' social and technological contexts. As such both the LCA approach to the equipment and our factor-based skills measures reflect a statistical model of this underlying variation. This said we will include analyses of both measures in chapters 5 and 6 where we will explore the correspondence of MDLS measures with key variables and build a statistical model of households with children meeting the MDLS.

Absolute MDLS	Pct
Not MDLS adequate	62.70
<i>MDLS adequate</i>	37.30

Table 4.3: Absolute MDLS proportions

LCA based MDLS	Pct
Not MDLS adequate	45.00
<i>MDLS adequate</i>	55.00

Table 4.4: LCA-based MDLS proportions

Chapter 5

Categorising households

5.1 Introduction

In this section, we will explore meeting (or not) the MDLS for equipment and skills, and then in combination against a range of measures. The goal is to understand how the elements of the MDLS and the overall measure correspond with key variables. Given prior research has noted clear correspondence with socio-economic and geographic factors we are not expecting the MDLS to vary greatly from these prior findings. We will compare:

- Absolute MDLS equipment
- Latent class MDLS equipment
- Household skills
- Overall MDLS

Against key variables such as:

- Household socio-economic status
- Household composition
- Household employment status, health, benefits status, and ethnicity
- Broadband speed for location
- Household and demographic categories

5.2 Socio-economic status

We have two measures of socio-economic status. From the survey, we have NRS social grade for each household. We also have, from the appended geographic data, a combined index of deprivation ranking for household location. Looking first at NRS social grade we find the following results. Not unexpectedly those not meeting the absolute are more likely to be in social grades C2 (65%) and D or E (79%) the inverse being true for those meeting the MDLS (see Table 5.1).

	Not MDLS adequate	MDLS adequate
AB (obs.)	220.00	199.00
(row%)	52.50	47.50
(col.%)	22.20	33.80
C1 (obs.)	252.00	189.00
(row%)	57.10	42.90
(col.%)	25.40	32.10
C2 (obs.)	228.00	121.00
(row%)	65.30	34.70
(col.%)	23.00	20.60
DE (obs.)	292.00	80.00
(row%)	78.50	21.50
(col.%)	29.40	13.50

Table 5.1: SEG factor by MDLS Abs Equipment Skills factor ($\chi^2(3, 1582) = 65.414, p = 0$, Cramer's V = 0.203)

A comparable result occurs when we look at the LCA model of MDLS compared to social grade. Once again the majority of people below MDLS (65%) are in social grades D and E (see Table 5.2) compared to 32% for grades A and B. Both of these results can also be seen in Figures 5.1 and 5.2.

	Not MDLS adequate	MDLS adequate
AB (obs.)	136.00	283.00
(row%)	32.40	67.60
(col.%)	19.10	32.60
C1 (obs.)	176.00	266.00
(row%)	39.80	60.20
(col.%)	24.70	30.50
C2 (obs.)	163.00	187.00
(row%)	46.60	53.40
(col.%)	22.90	21.50
DE (obs.)	238.00	134.00
(row%)	63.90	36.10
(col.%)	33.40	15.40

Table 5.2: SEG factor by MDLS LCA Equipment Skills factor ($\chi^2(3, 1582) = 85.669, p = 0$, Cramer's V = 0.233)

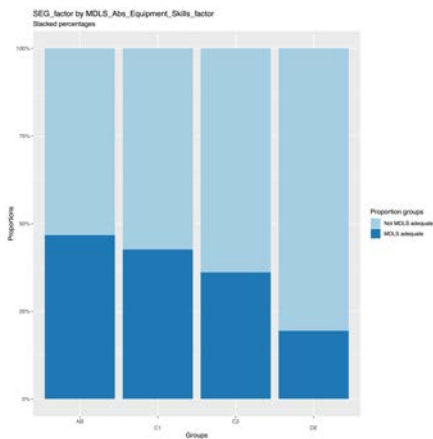


Figure 5.1: Proportions plot of NRS Grade by MDLS (Abs.)

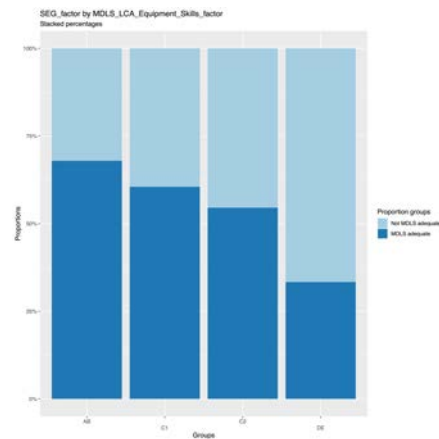


Figure 5.2: Proportions plot of NRS Grade by MDLS (LCA)

Similarly, if we look solely at meeting the LCA-based *equipment* requirement, ignoring skills, we find that 91% of social grades A and B meet the MDLS equipment criteria compared to 71% for grades D and E. However, the other categories are more evenly distributed across C1, C2, and DE (see Table 5.3).

MDLS Equipment (LCA)	Fully MDLS	Part MDLS: poor BB	Part MDLS: No STV	Part MDLS: Low Dev	Sig below MDLS
AB (obs.)	382.00	13.00	13.00	9.00	3.00
(row%)	91.10	3.10	3.10	2.10	0.60
(col.%)	28.70	16.20	18.90	13.60	6.40
C1 (obs.)	392.00	15.00	17.00	11.00	7.00
(row%)	88.80	3.40	3.80	2.60	1.50
(col.%)	29.50	19.10	24.20	17.60	16.00
C2 (obs.)	291.00	20.00	18.00	15.00	7.00
(row%)	83.10	5.70	5.00	4.30	2.00
(col.%)	21.90	25.00	25.60	23.30	16.60
DE (obs.)	265.00	31.00	21.00	29.00	25.00
(row%)	71.20	8.40	5.80	7.80	6.70
(col.%)	19.90	39.70	31.30	45.40	61.00

Table 5.3: SEG factor by MDLS LCA factor short ($\chi^2(12, 1582) = 82.491, p = 0$, Cramer's V = 0.132)

If we look at household skills by social grade we have a similar result. Social grade AB households are far more likely (74%) to have all the required skills as compared to social grade DE (45%) (see table 5.4).

Household skills	Not Adequate Skills	Children Have Adequate Skills	Parents Have Adequate Skills	Household Has Adequate Skills
AB (obs.)	10.00	55.00	43.00	311.00
(row%)	2.30	13.20	10.40	74.20
(col.%)	12.70	14.80	29.30	31.60
C1 (obs.)	21.00	90.00	36.00	294.00
(row%)	4.80	20.50	8.10	66.60
(col.%)	28.00	24.10	24.20	29.90
C2 (obs.)	20.00	73.00	44.00	212.00
(row%)	5.80	21.00	12.60	60.70
(col.%)	26.50	19.60	29.70	21.60
DE (obs.)	25.00	155.00	25.00	167.00
(row%)	6.70	41.80	6.70	44.80
(col.%)	32.80	41.50	16.70	16.90

Table 5.4: SEG factor by Overall household skills factor ($\chi^2(9, 1582) = 120.187, p = 0$, Cramer's $V = 0.159$)

If we look at our combined index of multiple-deprivation rank we find, unsurprisingly, the same result. Figure 5.3 shows that households not meeting the MDLS are more likely to live in an area with a higher level of deprivation (lower rank). An ANOVA analysis of this data is statistically significant ($F(1, 1555) = 46.2, p = 0$). Interestingly, as Figure 5.4 shows, even within social grade groups those living in relatively lower areas of deprivation are more likely to meet the MDLS than not. All of these results make clear that socio-economic grade is a key variable determining the likelihood of being within the MDLS.

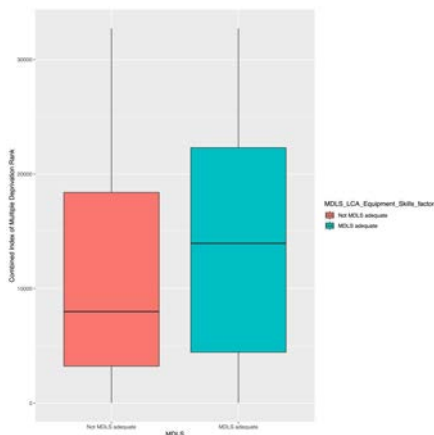


Figure 5.3: IMD rank for household's location by MDLS (LCA)

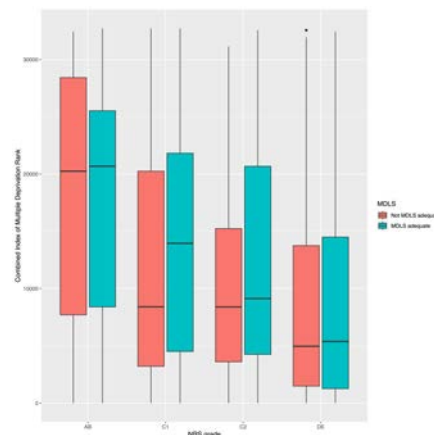


Figure 5.4: IMD rank for household's location by NRS and MDLS (LCA)

5.3 Household Type

If we look at the household type we find that those households below the absolute equipment MDLS are more likely to be single-parent households or households with more than two children (see Table 5.5). A similar pattern holds for the LCA-based measure (see Table 5.6) with single-parent households once again being more likely to be below the MDLS. Tables only show row percentages to reduce complexity.

	Not MDLS adequate	MDLS adequate
1 adult and 1 child (row%)	73.00	27.00
1 adult and 2 children (row%)	80.80	19.20
1 adult and more than 2 children (row%)	89.20	10.80
2 adults and 1 child (row%)	51.70	48.30
2 adults and 2 children (row%)	57.00	43.00
2 adults and more than 2 children (row%)	76.70	23.30
More than 2 adults in HH and 1 child (row%)	72.00	28.00
More than 2 adults in HH and 2 children (row%)	61.50	38.50
More than 2 adults in HH and 2+ children (row%)	100.00	0.00

Table 5.5: HTYPE factor by MDLS Abs Equipment Skills factor (Row Percentages) ($\chi^2(8, 1582) = 91.703, p = 0, \text{Cramer's } V = 0.241$)

	Not MDLS adequate	MDLS adequate
1 adult and 1 child (row%)	57.50	42.50
1 adult and 2 children (row%)	62.10	37.90
1 adult and more than 2 children (row%)	62.10	37.90
2 adults and 1 child (row%)	34.30	65.70
2 adults and 2 children (row%)	39.50	60.50
2 adults and more than 2 children (row%)	58.60	41.40
More than 2 adults in HH and 1 child (row%)	51.90	48.10
More than 2 adults in HH and 2 children (row%)	42.00	58.00
More than 2 adults in HH and 2+ children (row%)	87.40	12.60

Table 5.6: HTYPE factor by MDLS LCA Equipment Skills factor (Row Percentages) ($\chi^2(8, 1582) = 84.801, p = 0, \text{Cramer's } V = 0.232$)

5.4 Social and health demographics

We have in our survey data a range of other social, health, and employment demographics. In particular:

- Whether the household receives at least one state benefit
- Whether the chief income earner is working
- Whether the survey respondent has a health issue affecting daily activity
- Whether the survey respondent identifies as ethnically white or non-white

The following sections look at each of these in turn.

5.4.1 Household receiving state benefits

Table 5.7 and Table 5.8 detail the proportion of households with children who receive at least one state benefit and whether they meet the absolute or LCA-based MDLS. Notably, those receiving at least one state benefit are far more likely **not** to meet the absolute (77%) nor the LCA-based (62%) MDLS measures. Conversely, those not on at least one benefit are more likely to meet either MDLS measure (43% and 62% respectively). Both of these results can also be seen in Figures 5.5 and 5.6.

	Not MDLS adequate	MDLS adequate
Not on any benefits (obs.)	639.00	486.00
(row%)	56.80	43.20
(col.%)	64.40	82.40
Receives at least one state benefit (obs.)	353.00	104.00
(row%)	77.30	22.70
(col.%)	35.60	17.60

Table 5.7: Benefits factor by MDLS Abs Equipment Skills factor ($\chi^2(1, 1582) = 58.1, p = 0, \text{Cramer's } V = 0.192$)

	Not MDLS adequate	MDLS adequate
Not on any benefits (obs.)	429.00	696.00
(row%)	38.10	61.90
(col.%)	60.20	80.00
Receives at least one state benefit (obs.)	284.00	174.00
(row%)	62.00	38.00
(col.%)	39.80	20.00

Table 5.8: Benefits factor by MDLS LCA Equipment Skills factor ($\chi^2(1, 1582) = 75.138$, $p = 0$, Cramer's V = 0.218)

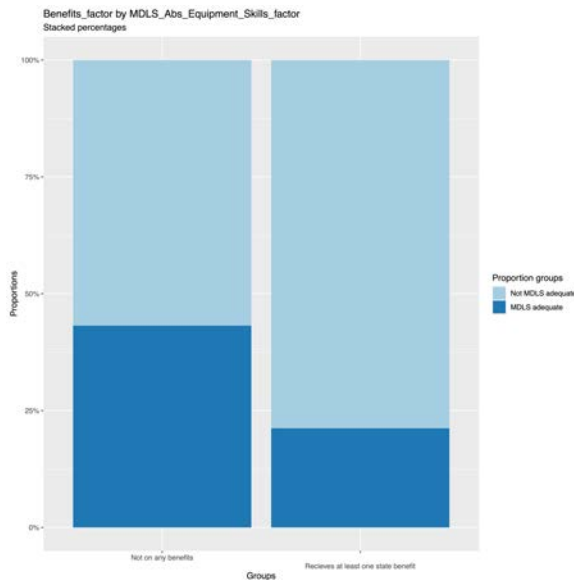


Figure 5.5: Benefits by Abs. MDLS

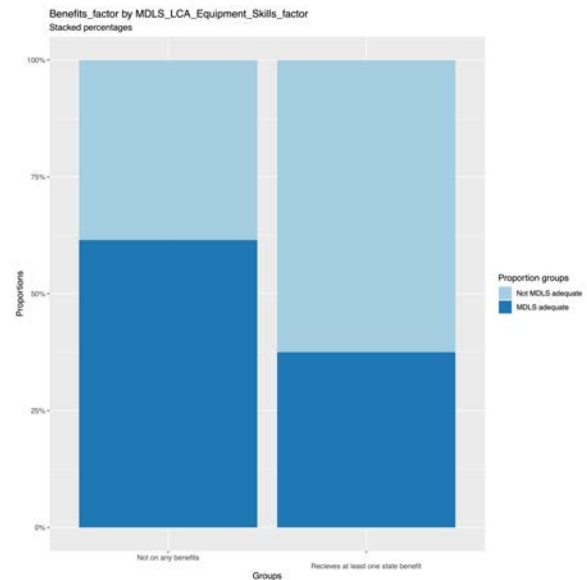


Figure 5.6: Benefits by LCA-based MDLS

5.4.2 Household employment

Table 5.9 and Table 5.10 detail the proportion of households where the main income earner is working or not and whether they meet the absolute or LCA-based MDLS. Notably, those not working are more likely **not** to meet the absolute (81%) nor the LCA-based (68%) MDLS measures. For the absolute measure, those working are more likely to meet the absolute MDLS (40% against 17%), though this is clearer for the LCA-based MDLS (60% against 30%). Both of these results can also be seen in Figures 5.7 and 5.8.

	Not MDLS adequate	MDLS adequate
Chief income earner not working (obs.)	212.00	51.00
(row%)	80.50	19.50
(col.%)	21.30	8.70
Chief income earner working (obs.)	781.00	538.00
(row%)	59.20	40.80
(col.%)	78.70	91.30

Table 5.9: Working factor by MDLS Abs Equipment Skills factor ($\chi^2(1, 1582) = 42.809$, $p = 0$, Cramer's V = 0.164)

	Not MDLS adequate	MDLS adequate
Chief income earner not working (obs.)	180.00	83.00
(row%)	68.40	31.60
(col.%)	25.30	9.60
Chief income earner working (obs.)	532.00	787.00
(row%)	40.40	59.60
(col.%)	74.70	90.40

Table 5.10: Working factor by MDLS LCA Equipment Skills factor ($\chi^2(1, 1582) = 69.595, p = 0$, Cramer's V = 0.21)

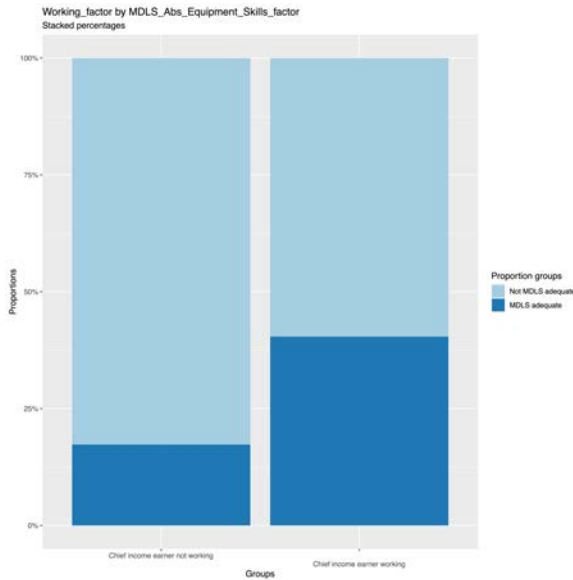


Figure 5.7: Employment by Abs. MDLS

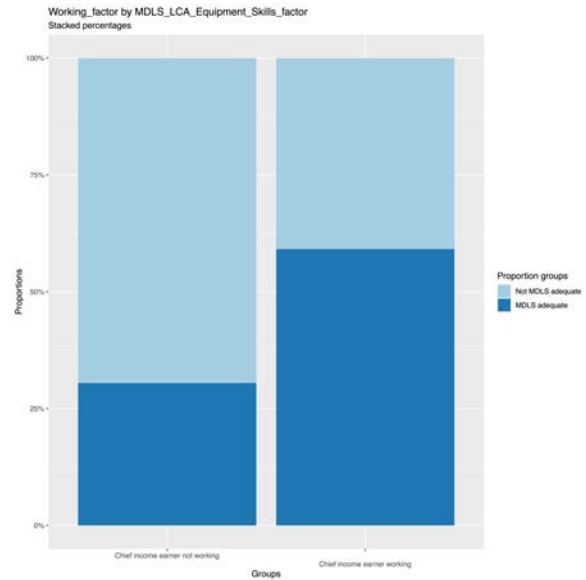


Figure 5.8: Employment by LCA-based MDLS

5.4.3 Health and disability

Table 5.11 and Table 5.12 detail the proportion of households with children where the respondent had a health condition or disability affecting daily life and whether they meet the absolute or LCA-based MDLS. Notably, those with a health issue or disability are more likely **not** to meet the absolute (80%) nor the LCA-based (66%) MDLS measures. For the absolute measure, those without a condition affecting daily life are more likely to meet the absolute MDLS (40% against 19%) and the LCA-based MDLS (58% against 34%). Both of these results can also be seen in Figures 5.9 and 5.10.

	Not MDLS adequate	MDLS adequate
Respondent has no health issue affecting daily activity (obs.)	818.00	547.00
(row%)	59.90	40.10
(col.%)	82.40	92.80
Respondent has a health issue affecting daily activity (obs.)	174.00	43.00
(row%)	80.30	19.70
(col.%)	17.60	7.20

Table 5.11: Health limitation factor by MDLS Abs Equipment Skills factor ($\chi^2(1, 1582) = 33.348, p = 0$, Cramer's V = 0.145)

	Not MDLS adequate	MDLS adequate
Respondent has no health issue affecting daily activity (obs.)	569.00	796.00
(row%)	41.70	58.30
(col.%)	79.90	91.50
Respondent has a health issue affecting daily activity (obs.)	143.00	74.00
(row%)	66.00	34.00
(col.%)	20.10	8.50

Table 5.12: Health limitation factor by MDLS LCA Equipment Skills factor ($\chi^2(1, 1582) = 44.631, p = 0, \text{Cramer's } V = 0.168$)

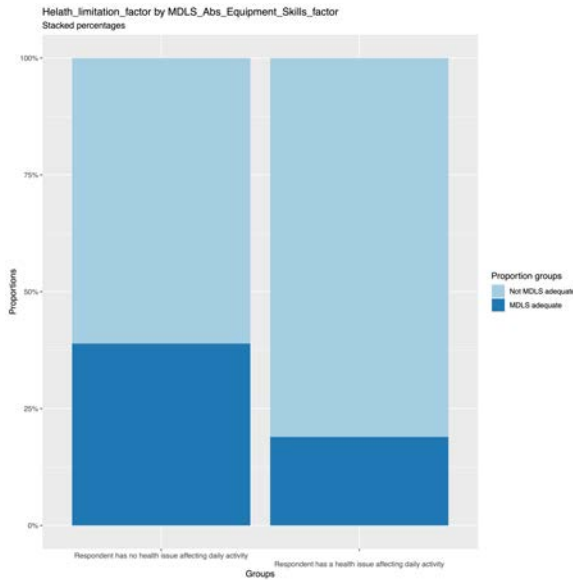


Figure 5.9: Health by Abs. MDLS

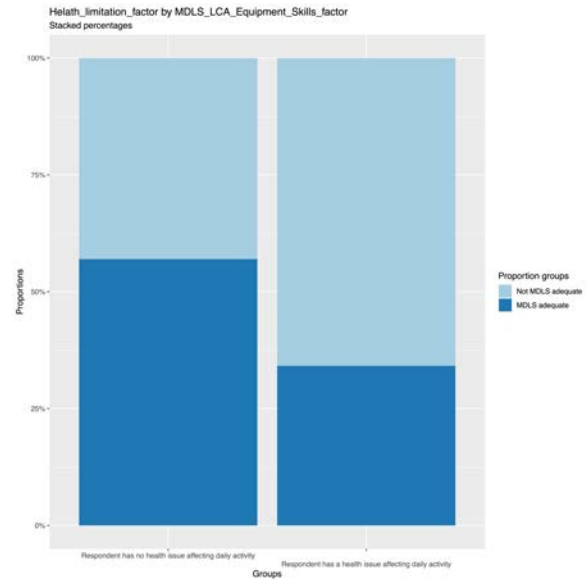


Figure 5.10: Health by LCA-based MDLS

5.4.4 Ethnicity

Exploring ethnicity is challenging as in a survey of this size exploring specific ethnic backgrounds, for example, 'Black Caribbean', is limited by the smaller (though representative) number of cases in the data set. This makes it very difficult to statistically assess potential correspondences and correlations at this level. Especially when in combination with other variables therefore making cell sizes much smaller. The likelihood of over or underestimating the impact of ethnicity at this level of fidelity therefore becomes too high leading to misrepresentations. We have therefore reduced our ethnicity measure to a very simple binary one as to whether the respondent identified as white (British, Irish, or Other) or identified as any of the non-white categories. We accept that this may be too simplistic but further work, either a large sample survey or qualitative with community members is needed to assess the relevance of ethnicity to the MDLS.

Table 5.13 and Table 5.14 detail the proportion of households where the respondent identified as white or non-white and whether they meet the absolute or LCA-based MDLS. Notably, those identifying as non-white are more likely **not** to meet the absolute (60%) nor the LCA-based (55%) MDLS measures. For the absolute measure, those identifying as white are more likely to meet the absolute MDLS (40% against 28%) and the LCA-based MDLS (58% against 46%). Both of these results can also be seen in Figures 5.11 and 5.12.

	Not MDLS adequate	MDLS adequate
Respondent identifies as ethnically white (British, Irish, Other) (obs.)	711.00	480.00
(row%)	59.70	40.30
(col.%)	71.60	81.40
Respondent identifies as ethnically non-white (obs.)	282.00	110.00
(row%)	72.00	28.00
(col.%)	28.40	18.60

Table 5.13: Ethnicity factor by MDLS Abs Equipment Skills factor ($\chi^2(1, 1582) = 19.094, p = 0, \text{Cramer's } V = 0.11$)

	Not MDLS adequate	MDLS adequate
Respondent identifies as ethnically white (British, Irish, Other) (obs.)	499.00	692.00
(row%)	41.90	58.10
(col.%)	70.00	79.50
Respondent identifies as ethnically non-white (obs.)	213.00	178.00
(row%)	54.50	45.50
(col.%)	30.00	20.50

Table 5.14: Ethnicity factor by MDLS LCA Equipment Skills factor ($\chi^2(1, 1582) = 19.01, p = 0$, Cramer's V = 0.11)

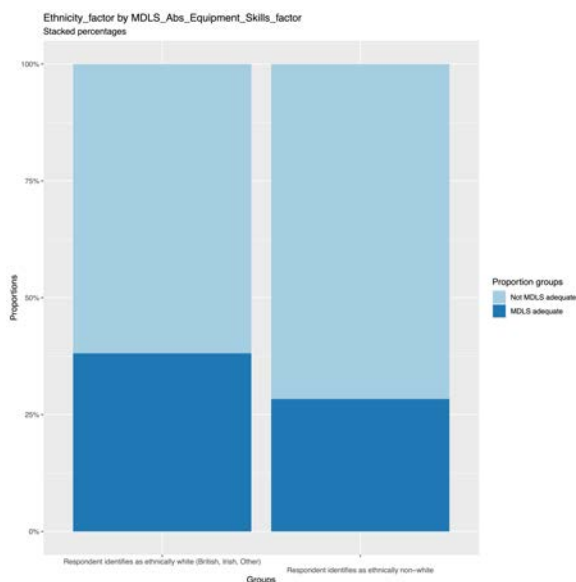


Figure 5.11: Broadband by Abs. MDLS

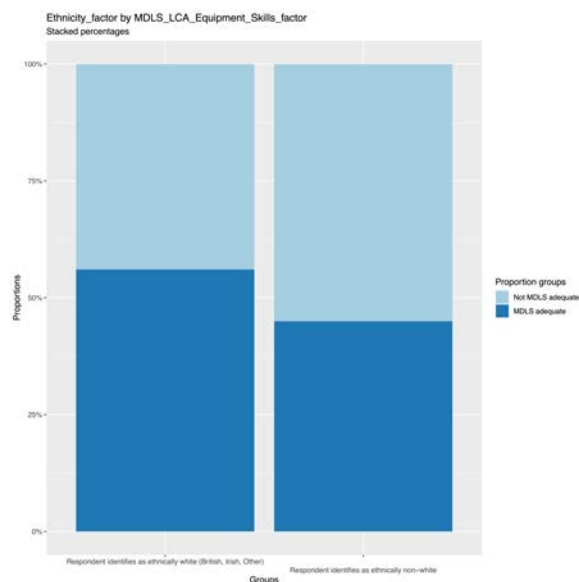


Figure 5.12: Broadband by LCA-based MDLS

5.5 Broadband access and speed

From our geographic data, we have an average broadband speed for each household location. Interestingly, we find that being in an area above or below the UK average broadband speed (69.4 Mbps) does not correspond with whether households meet either the absolute or LCA over MDLS measure. Table 5.15 and Table 5.16 present these comparisons with neither showing a statistically significant correspondence. This result can be seen in Figures 5.13 and 5.14. Running an ANOVA on the actual average download speeds for household areas against both MDLS measures also gives non-significant results ($F(1, 1512) = 0.643, p = 0.423$, and $F(1, 1512) = 0.637, p = 0.425$). Even looking specifically at those households stating that they do not have MDLS adequate internet we find a non-significant result for local average broadband speeds ($F(1, 1512) = 3.00, p = 0.084$). Given the size of the data set, we would have expected even a very weak correspondence to have been statistically significant. This would appear to imply that the quality of infrastructure in a household's area does not correspond with meeting or not meeting the MDLS.

	Not MDLS adequate	MDLS adequate
Below average broadband speed (obs.)	408.00	265.00
(row%)	60.70	39.30
(col.%)	41.10	44.90
Above average broadband speed (obs.)	585.00	325.00
(row%)	64.30	35.70
(col.%)	58.90	55.10

Table 5.15: Broadband factor by MDLS Abs Equipment Skills factor ($\chi^2(1, 1582) = 2.175, p = 0.172$, Cramer's V = 0.037)

	Not MDLS adequate	MDLS adequate
Below average broadband speed (obs.)	291.00	381.00
(row%)	43.30	56.70
(col.%)	40.90	43.80
Above average broadband speed (obs.)	421.00	488.00
(row%)	46.30	53.70
(col.%)	59.10	56.20

Table 5.16: Broadband factor by MDLS LCA Equipment Skills factor ($\chi^2(1, 1582) = 1.381, p = 0.275, \text{Cramer's } V = 0.03$)

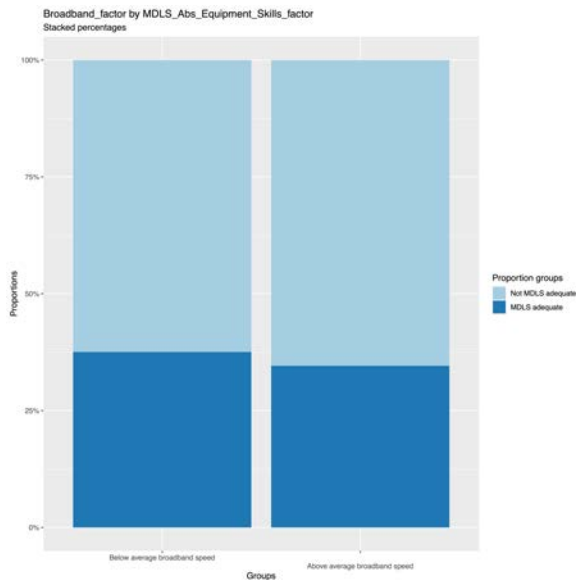


Figure 5.13: Broadband by Abs. MDLS

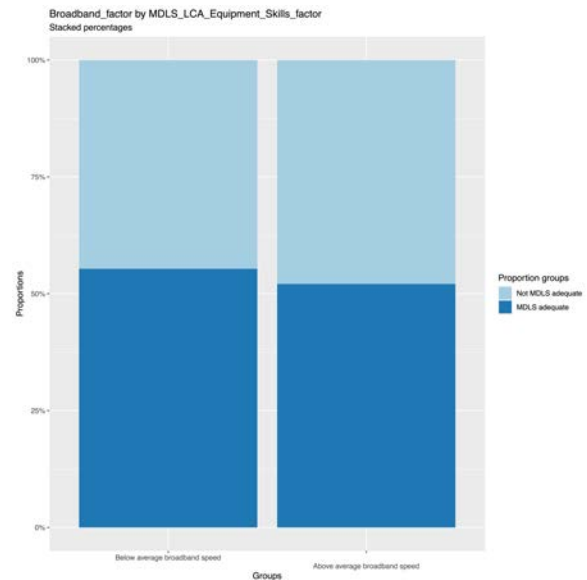


Figure 5.14: Broadband by LCA-based MDLS

5.6 Geography

5.6.1 Urban vs rural

If we look at a simple measure of urban vs rural location we do find an exceedingly weak correspondence for both our absolute (non-significant, $p = 0.175, \text{Cramer's } V = 0.037$) and LCA (significant, $p = 0.012, \text{Cramer's } V = 0.067$) models between being in a rural location and being within the LCA-based MDLS (see Tables 5.17 and 5.18). Looking in more detail at the size of town we find that for households with children, those **not** meeting the MDLS are more likely to be in large cities or larger towns whereas those meeting the MDLS are more likely to be in medium or small towns and rural areas (see Table 5.19). Both of these results can also be seen for our LCA measure in Figures 5.15 and 5.16. Many of the following measures have a large number of levels. We have therefore only presented row percentages about meeting the LCA-based MDLS. All the results in full can be found in Appendix 2.

	Not MDLS adequate	MDLS adequate
Urban (obs.)	883.00	510.00
(row%)	63.40	36.60
(col.%)	88.90	86.50
Rural (obs.)	110.00	80.00
(row%)	57.90	42.10
(col.%)	11.10	13.50

Table 5.17: urban rural factor by MDLS Abs Equipment Skills factor ($\chi^2(1, 1582) = 2.137, p = 0.175, \text{Cramer's } V = 0.037$)

	Not MDLS adequate	MDLS adequate
Urban (obs.)	644.00	748.00
(row%)	46.30	53.70
(col.%)	90.40	86.00
Rural (obs.)	68.00	121.00
(row%)	36.00	64.00
(col.%)	9.60	14.00

Table 5.18: urban rural factor by MDLS LCA Equipment Skills factor ($\chi^2(1, 1582) = 7.145, p = 0.012, \text{Cramer's } V = 0.067$)

	Not MDLS adequate	MDLS adequate
Large city (obs.)	135.00	134.00
(row%)	50.30	49.70
(col.%)	19.00	15.40
Smaller city or large town (obs.)	149.00	112.00
(row%)	57.00	43.00
(col.%)	20.90	12.90
Medium town (obs.)	243.00	319.00
(row%)	43.20	56.80
(col.%)	34.10	36.60
Small town (obs.)	117.00	183.00
(row%)	39.00	61.00
(col.%)	16.40	21.10
Rural area (obs.)	68.00	121.00
(row%)	36.00	64.00
(col.%)	9.60	14.00

Table 5.19: urban size factor by MDLS LCA Equipment Skills factor ($\chi^2(4, 1582) = 29.489, p = 0, \text{Cramer's } V = 0.136$)

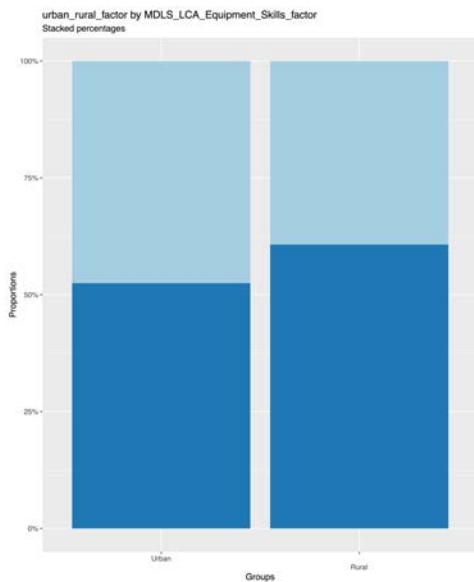


Figure 5.15: Urbanity by LCA-based MDLS

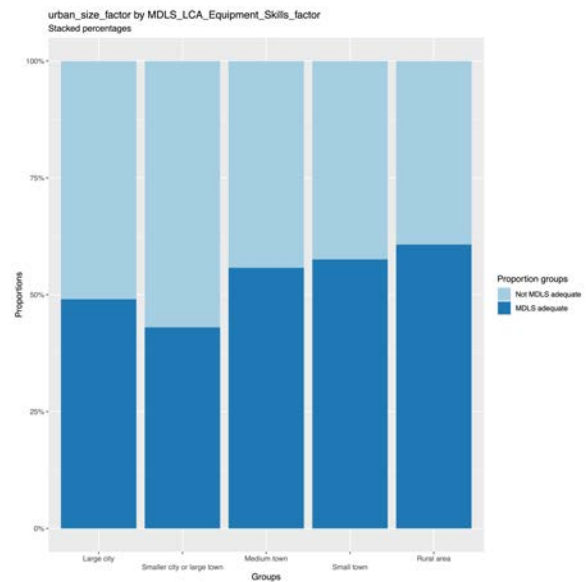


Figure 5.16: Town size by LCA-based MDLS

5.6.2 UK Region

Looking at MDLS (LCA) by UK region (see Table 5.20 and Figure 5.17) we find that those households not meeting the MDLS are more likely to be in:

- North East
- North West

- Northern Ireland
- Scotland

Whereas those households meeting the MDLS are more likely to be in:

- West Midlands
- East of England
- South East
- Wales

	Not MDLS adequate	MDLS adequate
North East (row%)	46.50	53.50
North West (row%)	55.80	44.20
Yorkshire and The Humber (row%)	43.90	56.10
East Midlands (row%)	44.20	55.80
West Midlands (row%)	36.60	63.40
East of England (row%)	31.20	68.80
London (row%)	46.70	53.30
South East (row%)	40.50	59.50
South West (row%)	49.90	50.10
Wales (row%)	36.60	63.40
Northern Ireland (row%)	58.00	42.00
Scotland (row%)	55.80	44.20

Table 5.20: REGION factor by MDLS LCA Equipment Skills factor (Row Percentages) ($\chi^2(11, 1582) = 36.54, p = 0.001, \text{Cramer's } V = 0.152$)

5.6.3 Output area classification

However, if we look at the broader set of definitions provided by our Output Area Classification geodemographic¹ we find that there is a correspondence between the demographics of areas and meeting the MDLS. Table 5.21 provides percentages of each area type by LCA-based MDLS. Looking at the residuals and contributions underlying this data indicates that those households **not** meeting the MDLS are more likely to be in areas defined as:

- Low-Skilled, Migrant, and Student Communities
- Legacy Communities

Whereas those meeting the LCA-based MDLS are in the areas defined as:

- Retired Professionals
- Suburbanites and Peri-Urbanities
- Ethnically Diverse Suburban Professionals

This geodemographic will form the basis of our later mapping of MDLS (LCA).

	Not MDLS adequate	MDLS adequate
Retired Professionals (row%)	33.50	66.50
Suburbanites and Peri-Urbanities (row%)	40.60	59.40
Multicultural and Educated Urbanites (row%)	42.10	57.90
Low-Skilled Migrant and Student Communities (row%)	56.00	44.00
Ethnically Diverse Suburban Professionals (row%)	30.80	69.20
Baseline UK (row%)	47.80	52.20
Semi-and Un-Skilled Workforce (row%)	44.40	55.60
Legacy Communities (row%)	71.80	28.20

Table 5.21: oac21SG factor by MDLS LCA Equipment Skills factor (Row Percentages) ($\chi^2(7, 1582) = 52.03, p = 0, \text{Cramer's } V = 0.181$)

¹<https://data.cdrc.ac.uk/dataset/output-area-classification-2021>

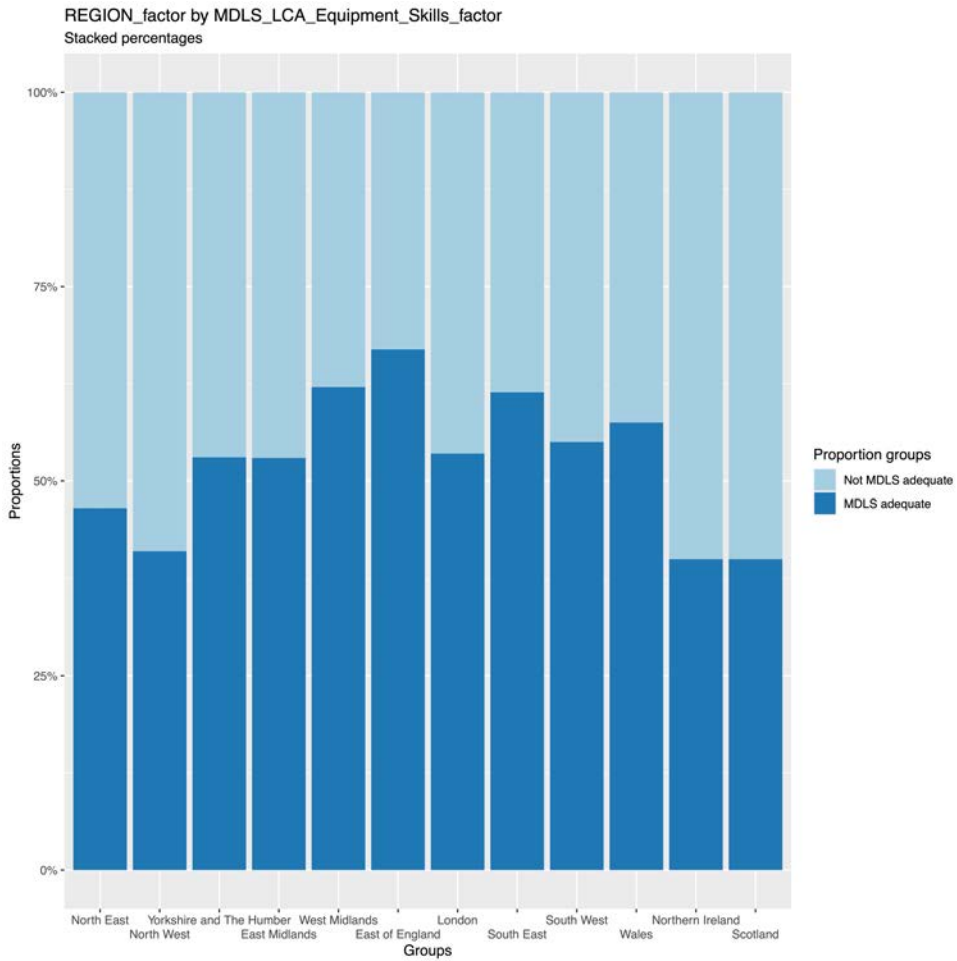


Figure 5.17: LCA-based MDLS by region

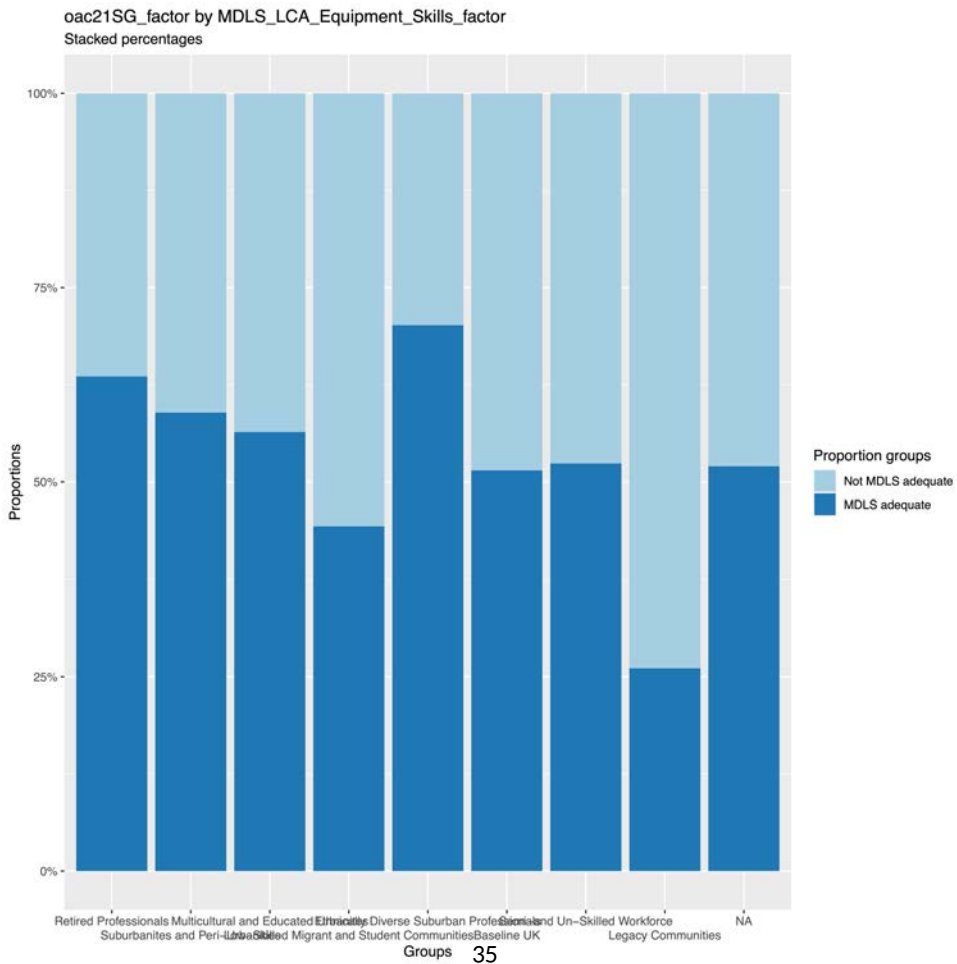


Figure 5.18: LCA-based MDLS by output area classification

5.6.4 Internet user type geodemographic

Looking at our LCA-based MDLS measure against Internet user type² (see Table 5.22), we find that households that do **not** meet the MDLS are likely to be in areas defined as:

- e-Withdrawn
- Youthful Urban Fringe

Whereas those meeting the MDLS are in areas defined as:

- e-Rational Utilitarians
- e-Veterans
- Settled Offline Communities

We note that Settled Offline Communities are normally areas of older close to or post-retirement adults who own their own homes. Our survey data only contains households with children. We assume that this result indicates households with children living in areas defined by an older settled homeownership community are more likely to meet MDLS.

	Not MDLS adequate	MDLS adequate
Digital Seniors (row%)	41.60	58.40
e-Cultural Creators (row%)	100.00	0.00
e-Mainstream (row%)	43.70	56.30
e-Professionals (row%)	42.50	57.50
e-Rational Utilitarians (row%)	35.70	64.30
e-Veterans (row%)	37.40	62.60
e-Withdrawn (row%)	54.90	45.10
Passive and Uncommitted Users (row%)	47.40	52.60
Settled Offline Communities (row%)	30.70	69.30
Youthful Urban Fringe (row%)	57.40	42.60

Table 5.22: iuc GRP LBLr factor by MDLS LCA Equipment Skills factor (Row Percentages)
 $(\chi^2(9, 1582) = 37.153, p = 0, \text{Cramer's } V = 0.153)$

5.7 Conclusion

What can we conclude from the data presented in the prior sections? None of the results are particularly surprising. We know from much prior research that meeting the MDLS or not was always going to have strong correspondences with key socio-economic factors such as social class and deprivation. We also know from the same research that factors such as health status and employment strongly correspond with material and skills-based assessments of digital inclusion. Regional location has also been found to be a consistent factor in UK studies with the north of England, Scotland, Wales and Northern Ireland being locations where more people are digitally excluded. It would, in fact, be surprising if the MDLS did not follow a similar pattern.

Two results appear to go against expectations. First, urbanity and region, those meeting the MDLS are more likely to be out of major cities in the more affluent suburbs and in rural locations. London as a region is an exception though as the mapping below will show there are clear disparities within London. we need to be cognisant of the fact that we are only looking at households with children and this may impact the rural/urban split of our data. Further work that includes households with older adults or younger adults without children may change the overall picture. This MDLS is a mean measure for households with children, not **all** households. Second, the finding that being above or below average broadband speed for an area does not seem to correspond with the meeting or not the MDLS. Taken together the fact that being Rural does not correspond with **not** meeting the MDLS, might imply that factors other than the availability of infrastructure are more important, for example cost of access.

²<https://data.cdrc.ac.uk/dataset/internet-user-classification>

Chapter 6

Modeling MDLS

6.1 Introduction

In this section, we will look to build a statistical model of meeting (or not) the MDLS. We will do this in stages exploring the the link between the variables identified in Section 5. The following sections present the results of a logistic regression undertaken to see if the listed variables predict meeting or not both our absolute and LCA-based MDLS measures.

6.2 Socio-economic factors

We undertook a set of stepped binary regression analyses to explore the predictors of our LCA-based MDLS measure and build up an overall predictive model. For the first analysis, we put the following factor variables into a simple regression model as predictors of both the absolute and LCA-based MDLS:

- NRS social grade
- Household composition
- Deprivation

<i>Dependent variable:</i>	
MDLS_Abs_Equipment_Skills	
NRS grade C1	−0.042 (0.160)
NRS grade C2	−0.359** (0.170)
NRS grade DE	−0.838*** (0.191)
Single parent	−0.467*** (0.101)
2+ children	−0.728*** (0.139)
Combined IMD rank	0.00002*** (0.00001)
Constant	−1.092*** (0.185)
Observations	1,582
Log Likelihood	−997.651
Akaike Inf. Crit.	2,009.303

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 6.1: Regression with S and E varibales on absolute MDLS

Table 6.1 and Table 6.2 list those elements found to be statistically significant predictors of meeting or not the absolute and LCA-based MDLS. Not unexpectedly in both cases, given the results so far, being in NRS Grades C2 and DE, a low score on our index of multiple deprivation ranking, being a single-parent household and a larger household size are all predictors of not meeting the MDLS equipment requirements.

<i>Dependent variable:</i>	
MDLS_LCA_Equipment_Skills	
NRS grade C1	−0.222 (0.164)
NRS grade C2	−0.476*** (0.172)
NRS grade DE	−1.046*** (0.180)
Single parent	−0.341*** (0.091)
2+ children	−0.555*** (0.118)
Combined IMD rank	0.00001* (0.00001)
Constant	0.052 (0.176)
Observations	1,582
Log Likelihood	−1,036.800
Akaike Inf. Crit.	2,087.600

Note: *p<0.1; **p<0.05; ***p<0.01

Table 6.2: Regression with S and E variables on LCA-based MDLS

6.2.1 Demographic factors

Looking next at another set of demographic factors we put the following factor variables into a simple regression model as predictors of the LCA-based MDLS:

- Whether or not the household receives state benefits
- Whether or not the main income earner is in employment
- Whether or not the respondent has a health condition or disability that affects daily life
- Whether or not the respondent identifies as ethnically white or non-white

Table 6.3 presents the results. All the variables are significant with receiving state benefits, the income-earner not being in work, the respondent having a health issue or disability and the respondent being ethnically non-white all predicting **not** meeting the LCA-based MDLS.

<i>Dependent variable:</i>	
MDLS_LCA_Equipment_Skills	
Receives at least one state benefit	−0.682*** (0.138)
Chief income earner working	0.639*** (0.165)
Respondent has a health issue affecting daily activity	−0.625*** (0.180)
Respondent identifies as ethnically non-white	−0.657*** (0.133)
Constant	0.115 (0.177)
Observations	1,582
Log Likelihood	−1,031.406
Akaike Inf. Crit.	2,072.811

Note: *p<0.1; **p<0.05; ***p<0.01

Table 6.3: Regression with demographic covariates on LCA-based MDLS

6.2.2 Geodemographic variables

We have then looked at four geographic variables as predictors of the LCA-based MDLS:

- Type of urban or rural location
- UK region
- Output Area Classification - those items identified by χ^2 as significantly corresponding with LCA-based MDLS
- Internet User Type - those items identified by χ^2 as significantly corresponding with LCA-based MDLS

Table 6.4 presents these results. Both our urban variable and our regional variable are statistically significant. As with the cross-tabulation χ^2 results in Section 5.6.2 living outside a large town gives a higher likelihood of meeting the MDLS. Similarly living outside London makes a household less likely to meet the MDLS, with the four least likely locations being Scotland, North East, North West and Northern Ireland. Only four items from our Output Area Classification categories proved significant:

- Low-Skilled, Migrant, and Student Communities
- Legacy Communities
- Retired Professionals
- Ethnically Diverse Suburban Professionals

None of our area-based internet user classification categories proved significant here. Items will fall out of the analysis as their effects are better explained by the other items in the regression.

	<i>Dependent variable:</i>
	MDLS_LCA_Equipment_Skills
Smaller city or large town	0.939* (0.556)
Medium town	1.350** (0.552)
Small town	1.587*** (0.544)
Rural area	1.463*** (0.566)
EE	-1.136* (0.608)
WM	-1.183** (0.597)
SE	-1.415** (0.594)
YH	-1.445** (0.608)
W	-1.317** (0.626)
SW	-1.951*** (0.612)
EM	-1.625*** (0.621)
S	-1.769*** (0.554)
NE	-1.818*** (0.652)
NW	-2.008*** (0.602)
NI	-2.363*** (0.638)
Low-Skilled, Migrant, and Student Communities	-0.434** (0.198)
Legacy Communities	-1.046*** (0.314)
Retired Professionals	0.560** (0.232)
Suburbanites and Peri-Urbanities	0.045 (0.183)
Ethnically Diverse Suburban Professionals	0.500** (0.248)
e-Withdrawn	-0.143 (0.196)
Youthful Urban Fringe	-0.373 (0.262)
e-Rational Utilitarians	0.057 (0.263)
e-Veterans	-0.015 (0.209)
Settled Offline Communities	0.222 (0.289)
Constant	0.474** (0.204)
Observations	1,582
Log Likelihood	-1,047.525
Akaike Inf. Crit.	2,147.051
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 6.4: Regression with geographic covariates on LCA-based MDLS

6.2.3 Overall model

As a final step, we have put all the items we have found so far to have statistically significant effects in an overall regression model to predict LCA-based MDLS. This resulted in these items being removed from the analysis as they proved non-significant:

- Legacy Communities
- Retired Professionals

The final model is presented in Table 6.6. We can conclude the following from this model the factors that most influence **not** meeting the LCA-based MDLS are:

- Likely to be social grades C2, D or E
- Single-parent households
- Have more than 2 children in the household
- Live in an area of higher multiple deprivations
- Receive at least one state benefit
- Having the main income earner unemployed
- The survey respondent has a health issue affecting their daily activity
- The survey respondent identified as ethnically non-white
- Living outside a large city
- Living outside London with the South West, North East, Scotland, Northern Ireland and North West having the lowest probability
- Living in a low-Skilled, Migrant, or Student Community **Not** living in an Ethnically Diverse Suburban Professionals

The effects of each of these variables are presented in Figures 6.2 to 6.10.

6.2.4 Goodness of fit and multicollinearity

Hosmer and Lemeshow test (binary model) ($\chi^2 = 5.7865$, $df = 8$, $p\text{-value} = 0.6711$) is non-significant indicating no evidence of poor fit. A variance inflation factor (VIF) test was used to detect the extent of multicollinearity in the regression analysis. We find that all the variables in the regression have VIF scores below 2 (acceptable range 1 to 5) indicating that multicollinearity is not an issue in this analysis (see Table 6.5).

Variable	VIF
SEG	1.401
Single parent	1.209
Two plus children	1.058
IMD Ranks	1.348
Benefits	1.565
Working	1.429
Health limitation factor	1.231
Ethnicity	1.200
URBAN	1.225
REGION	1.110
oac21SG	1.193

Table 6.5: VIF scores

6.2.5 Regression equation

From this result, we have a predictive regression model with moderate predictive power of the form:

$$\begin{aligned}
 MDLS(LCA) = & 0.793 - 0.267 * C1 - 0.569 * C2 \\
 & - 0.774 * DE - 0.271 * Singleparent - 0.521 * 2 + children \\
 & - 0.162 * IMDrank - 0.318 * Receivesbenefit(s) \\
 & + 0.363 * Chiefincomeearnerworking - 0.698 * Respondenthasahealthissue \\
 & - 0.698 * Respondentidentifiesasnon - white + 0.866 * Smaller city or large town \\
 & + 1.237 * Mediumtown + 1.550 * Smalltown + 1.417 * Ruralarea \\
 & - 0.932 * EE - 1.144 * WM - 1.370 * SE - 1.290 * YH - 1.404 * W \\
 & - 2.046 * SW - 1.461 * EM - 2.102 * S - 1.651 * NE - 1.978 * NW \\
 & - 2.478 * NI - 3.944 * LowSkilledMigrantandStudentCommunities \\
 & + 3.699 * EthnicallyDiverseSuburbanProfessionals
 \end{aligned} \tag{6.1}$$

6.2.6 Regression model coefficients

	<i>Dependent variable:</i>
	MDLS.LCA.Equipment.Skills
NRS grade C1	-0.267 (0.174)
NRS grade C2	-0.569*** (0.183)
NRS grade DE	-0.774*** (0.212)
Single parent	-0.271** (0.106)
2+ children	-0.521*** (0.125)
Combined IMD rank	-0.00002* (0.00001)
Receives at least one state benefit	-0.318* (0.163)
Chief income earner working	0.363* (0.196)
Respondent has a health issue affecting daily activity	-0.698*** (0.191)
Respondent identifies as ethnically non-white	-0.698*** (0.159)
Smaller city or large town	0.866 (0.561)
Medium town	1.237** (0.558)
Small town	1.550*** (0.546)
Rural area	1.417** (0.573)
EE	-0.932 (0.605)
WM	-1.144* (0.598)
SE	-1.370** (0.598)
YH	-1.290** (0.605)
W	-1.404** (0.635)
SW	-2.046*** (0.611)
EM	-1.461** (0.619)
S	-2.102*** (0.551)
NE	-1.651** (0.654)
NW	-1.978*** (0.608)
NI	-2.478*** (0.655)
Low-Skilled, Migrant, and Student Communities	-0.394** (0.197)
Ethnically Diverse Suburban Professionals	0.370 (0.264)
Constant	0.793** (0.341)
Observations	1,582
Log Likelihood	-973.519
Akaike Inf. Crit.	2,003.038

Note: *p<0.1; **p<0.05; ***p<0.01

Table 6.6: Final regression with all covariates on LCA-based MDLS

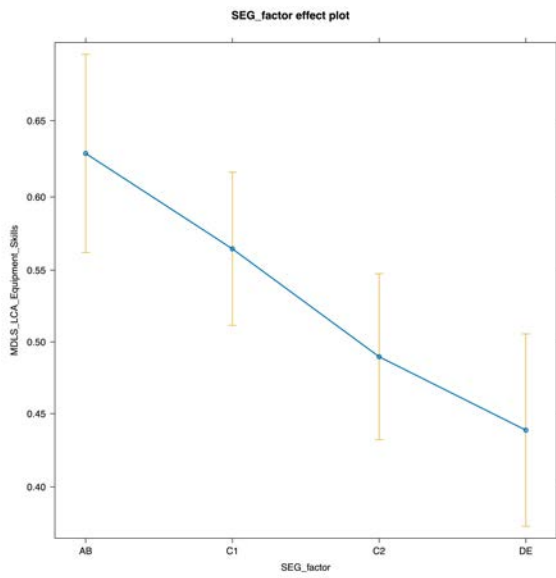


Figure 6.1: SEG regression effects plot

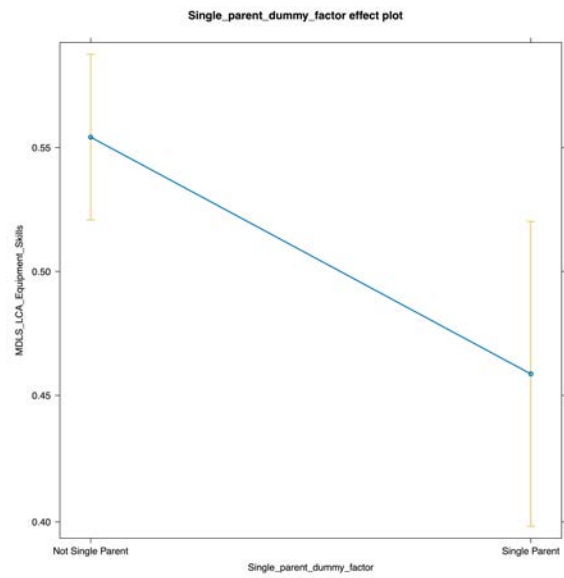


Figure 6.2: Single parent regression effects plot

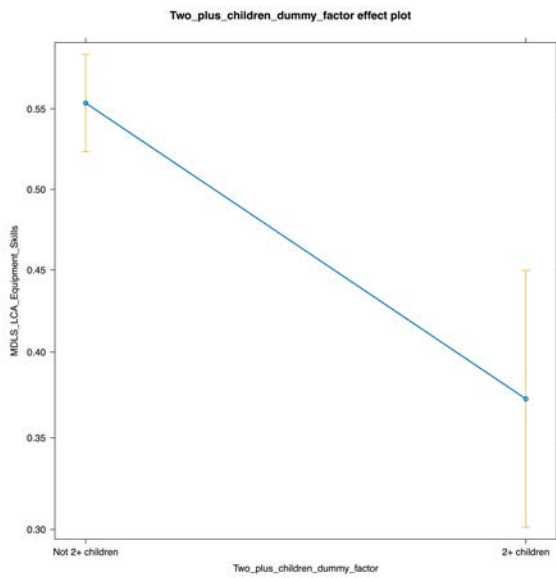


Figure 6.3: 2+ children regression effects plot

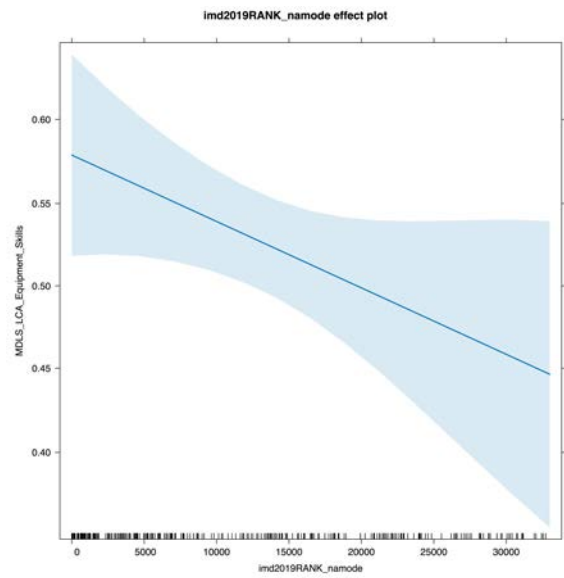


Figure 6.4: IMD rank regression effects plot

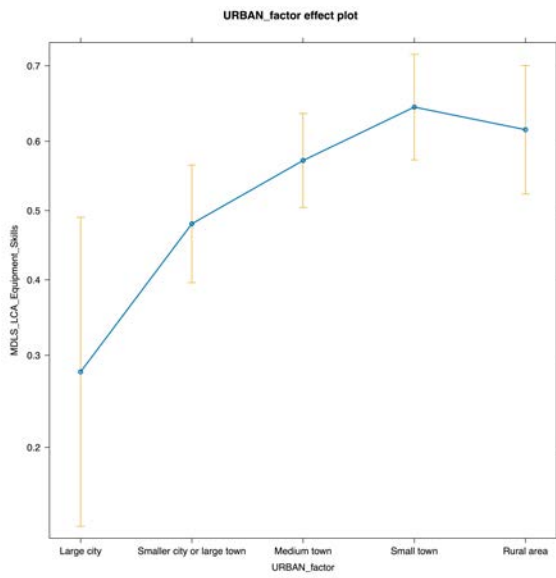


Figure 6.5: Town size regression effects plot

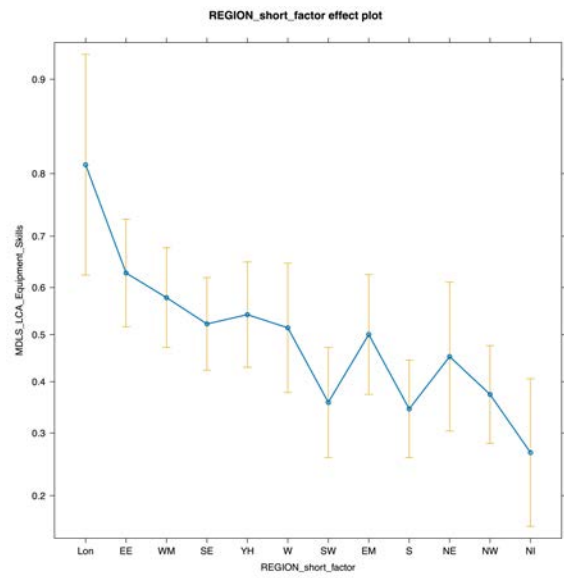


Figure 6.6: Location regression effects plot

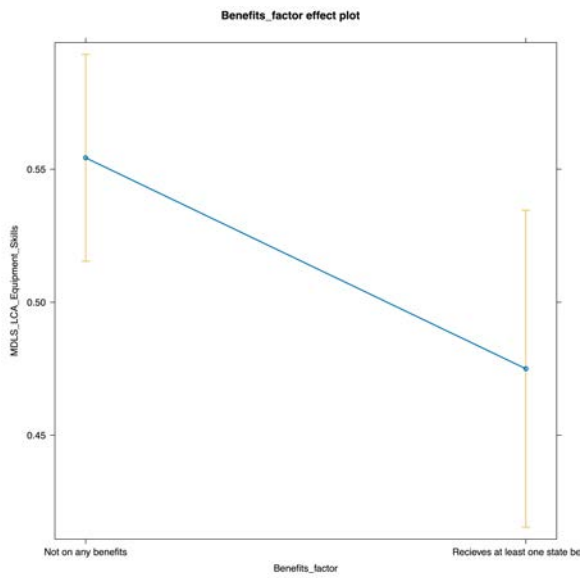


Figure 6.7: Benefits regression effects plot

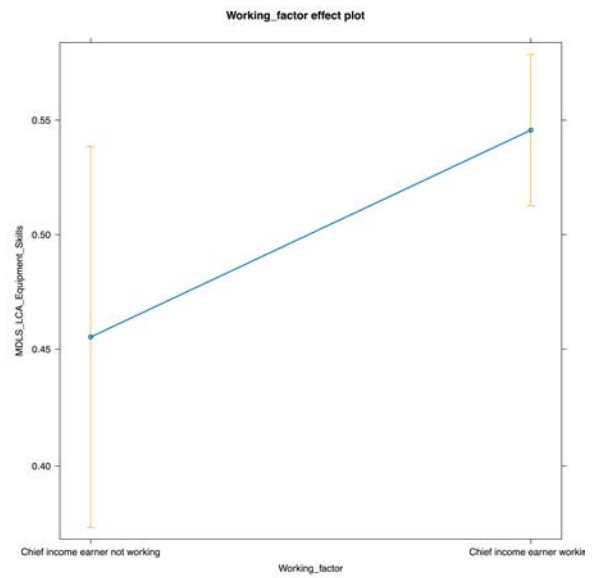


Figure 6.8: Employment regression effects plot

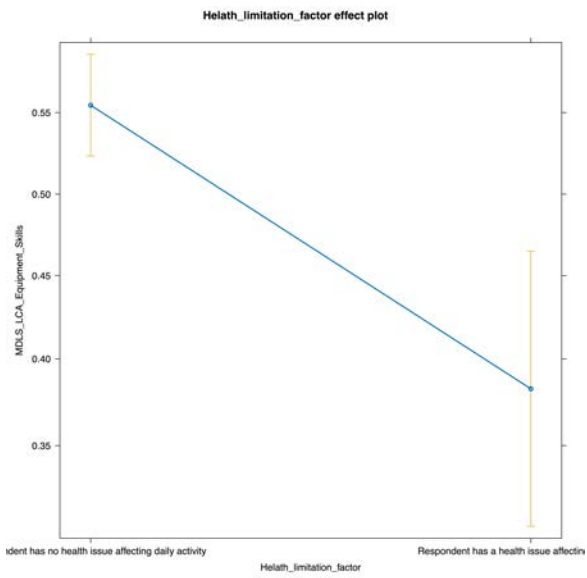


Figure 6.9: Health regression effects plot

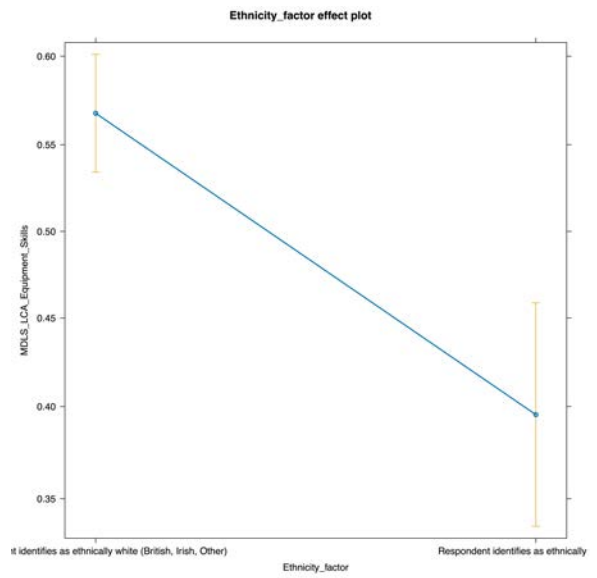


Figure 6.10: Ethnicity regression effects plot

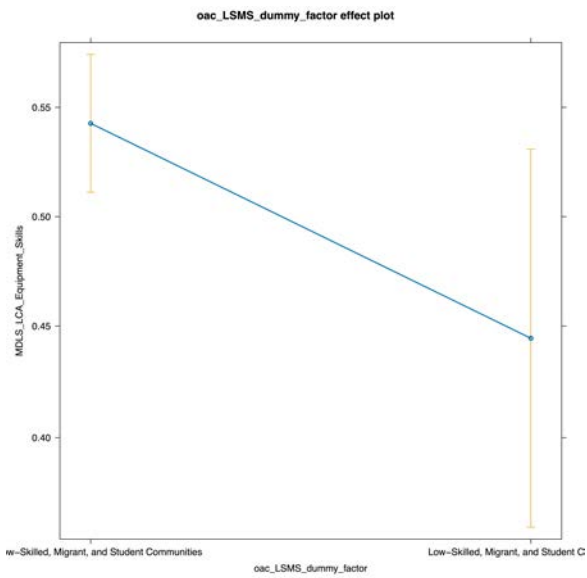


Figure 6.11: Output Area Classification regression effects plot

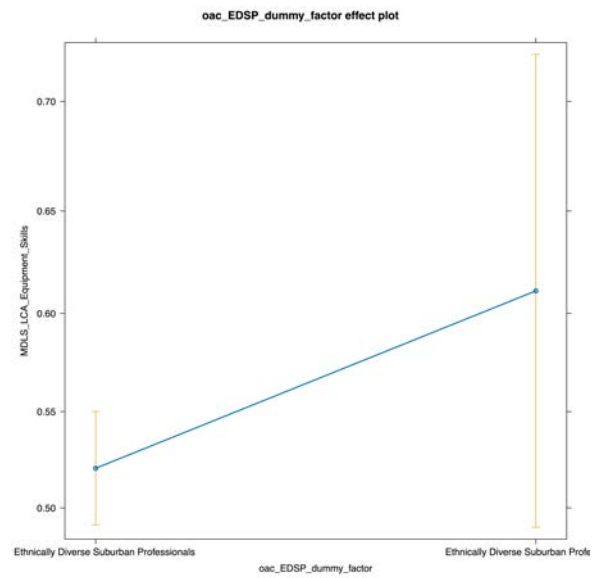


Figure 6.12: Output Area Classification regression effects plot

Chapter 7

Mapping

7.1 Introduction

We have taken the data from the MDLS survey and explored a range of methods to map the outcomes across the UK. The survey was not large enough to undertake a method such as multi-level regression and post-stratification (MRP) modelling for small area estimates. We have instead explored the distribution and representativeness of our data against existing geodemographic measures.

7.2 MDLS by OAC2021

We have found that our results are well distributed across the Output Area Classification. The box-plot below (Figure 7.1) shows the distribution of MDLS survey sample in each of the SG/G/SUBG levels. The bar charts (Figures 7.2 to 7.5 show sample distribution across OAC.

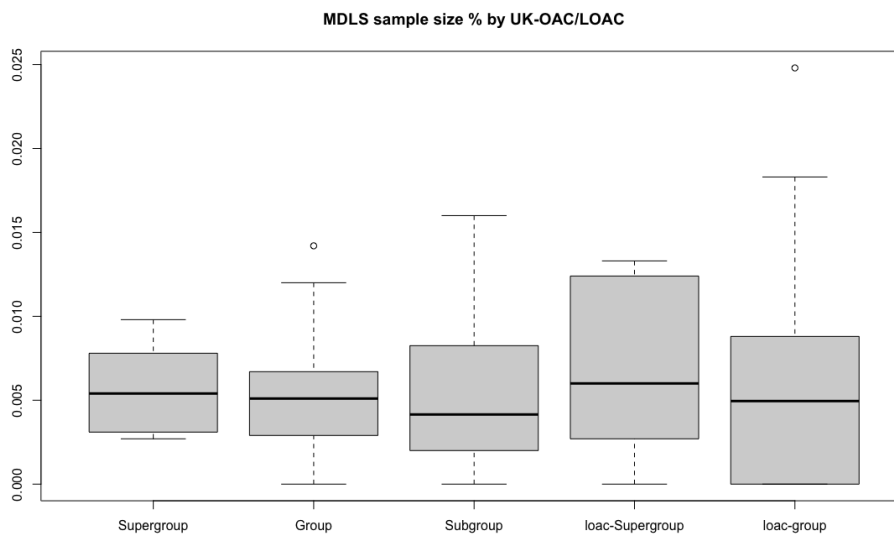


Figure 7.1: Box plot of sample distribution across OAC and LOAC classifications

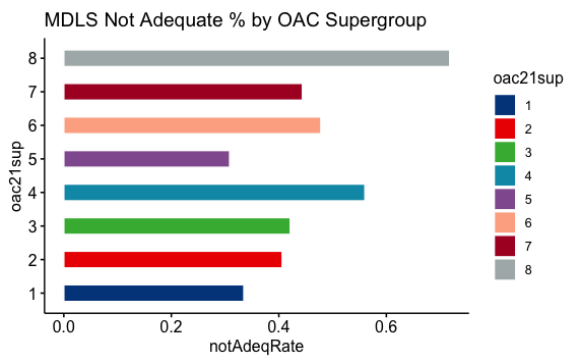


Figure 7.2: Histogram of OAC supergroup distribution

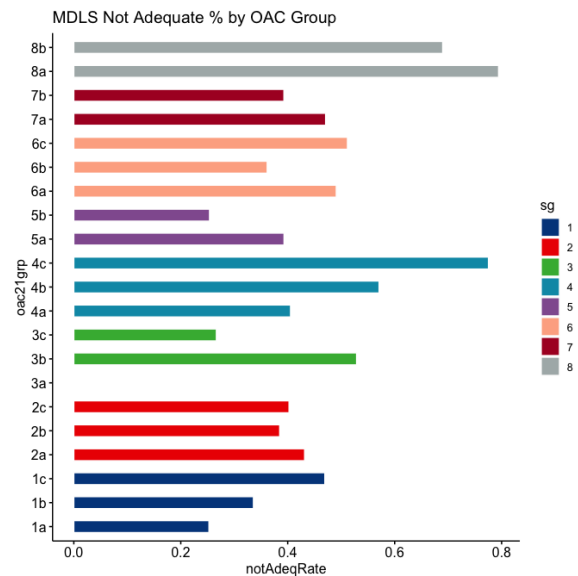


Figure 7.3: Histogram of OAC group distribution

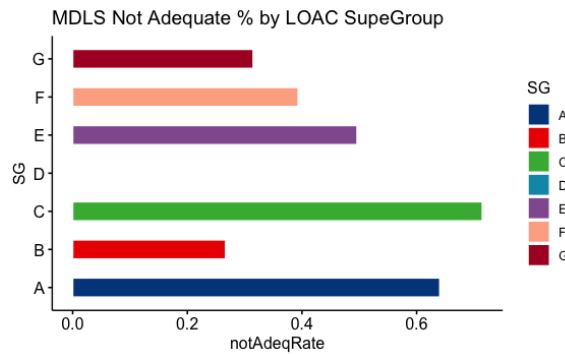


Figure 7.4: Histogram of OAC subgroup distribution

The only missing OAC classifications in our survey sample are:

- Two elements of 3: Multicultural and Educated Urbanites
 - 3a: Student Living and Professional Footholds
 - 3c1: Centrally Located Professionals
- One element of 5: Ethnically Diverse Suburban Professionals
 - 5a2: Suburban Empty Nesters
- Two elements of 8: Legacy Communities
 - 8a1: Retirement Residences
 - 8b3: Young Families and Neighbourhood Turnover

All but 8b3 represent area demographics where you are unlikely to find households with children. Therefore their omission is unlikely to impact our mapping of MDLS status for households with children. 8b3 includes young families who are living in areas of high residential turnover (an example being rented accommodation in Scarborough). With this one exception, we therefore have survey data from all other relevant OAC groups. For London, we have used the London OAC and we find that we have data for all but group D (see Figure 7.4). Group D areas are 'Central Connected Professionals and Managers' and are found to contain few families with dependent children. Overall both OAC and LOAC therefore provide a good basis for mapping as we have data and can calculate average likelihoods of being in or out of MDLS for each area.

We have therefore used OAC, LOAC, and the weighted survey data to calculate averages of being outside the MDLS for each OAC category. From this, we have calculated the aggregate average likelihood of not meeting the MDLS for both the UKs Middle Layer Super Output Areas (MSOA) and local authority (LA) areas. We present these MSOA and LA maps for the following UK areas below:

- Whole of UK
- Scotland
- Wales
- London
- Greater Manchester Combined Authority
- Liverpool City Region

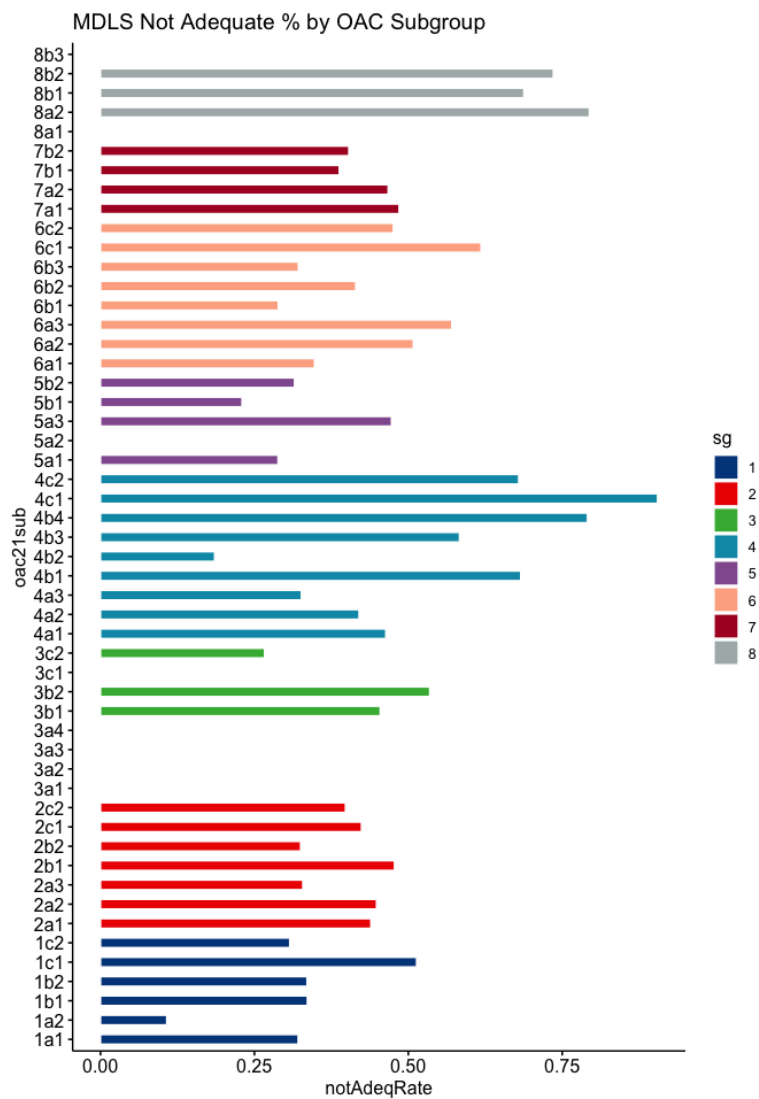


Figure 7.5: Histogram of LOAC supergroup distribution

7.3 Whole of UK

7.3.1 UK MSOA

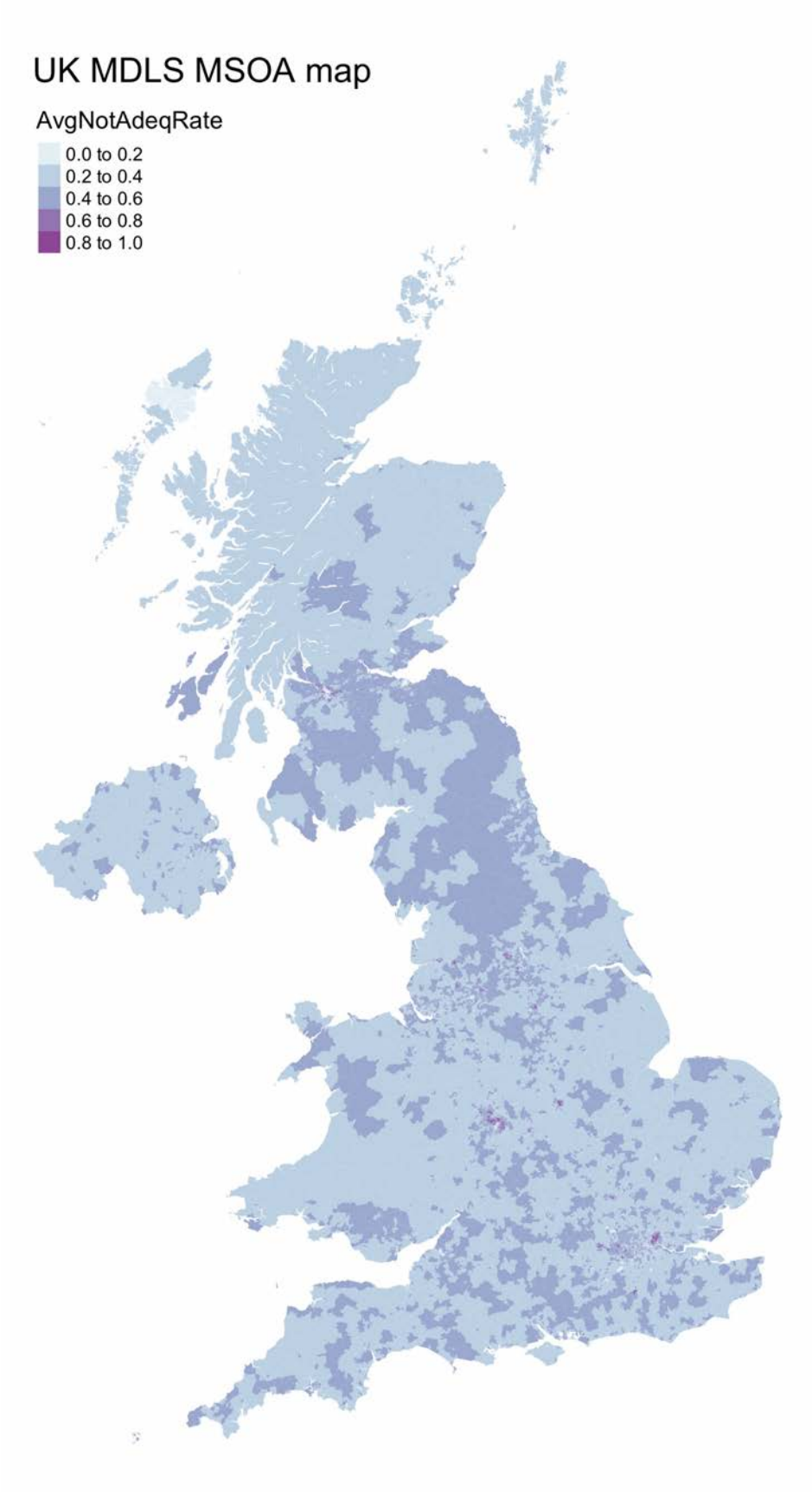


Figure 7.6: **not** Meeting MDLS (LCA) - UK MSOA

UK MDLS LAD map

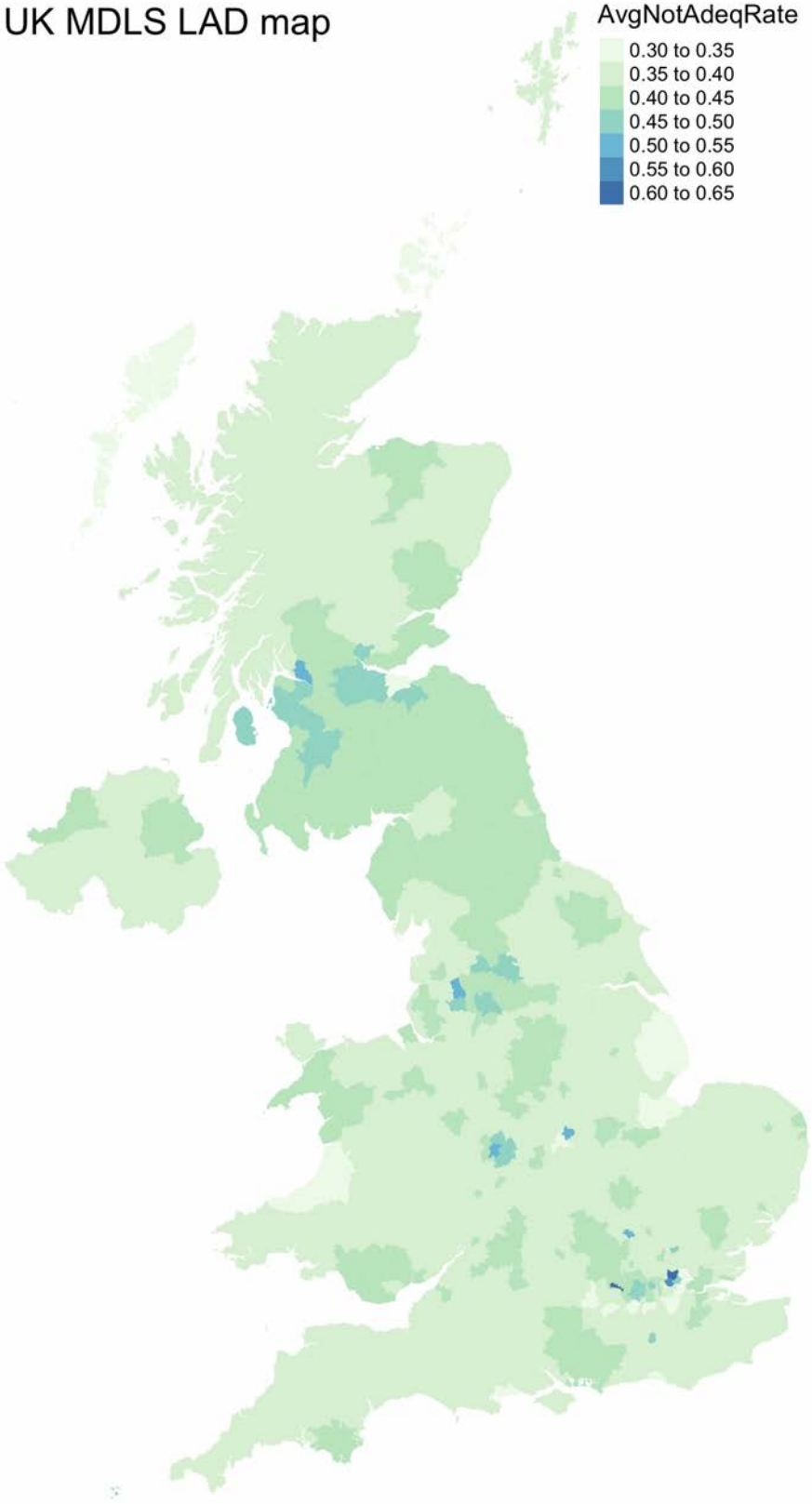


Figure 7.7: not Meeting MDLS (LCA) - UK LA

7.4 Scotland

7.4.1 Scotland MSOA

Scotland MDLS MSOA map

AvgNotAdeqRate

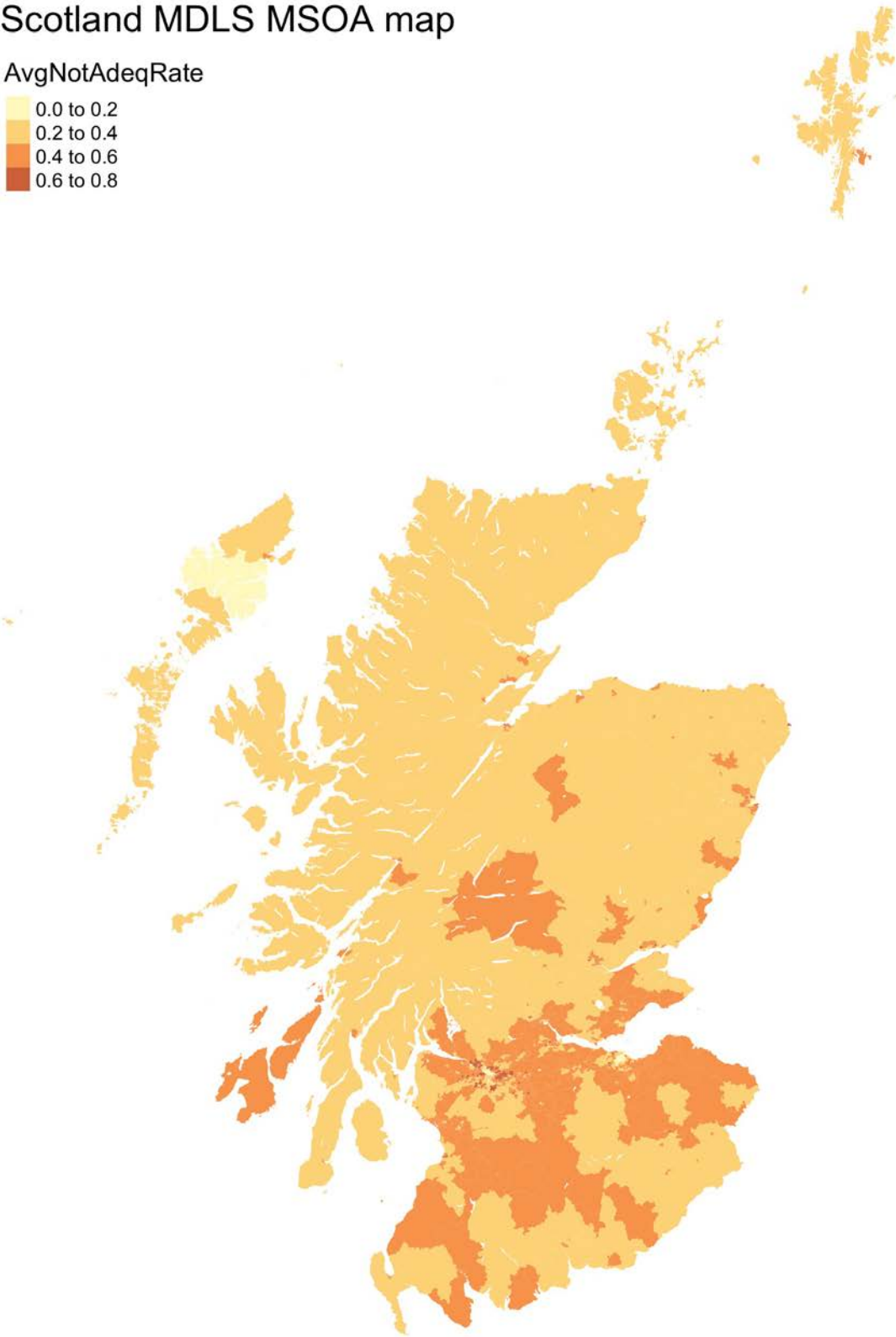
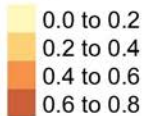


Figure 7.8: **not** Meeting MDLS (LCA) - Scotland MSOA

7.4.2 Scotland LA

Scotland MDLS LAD map

AvgNotAdeqRate

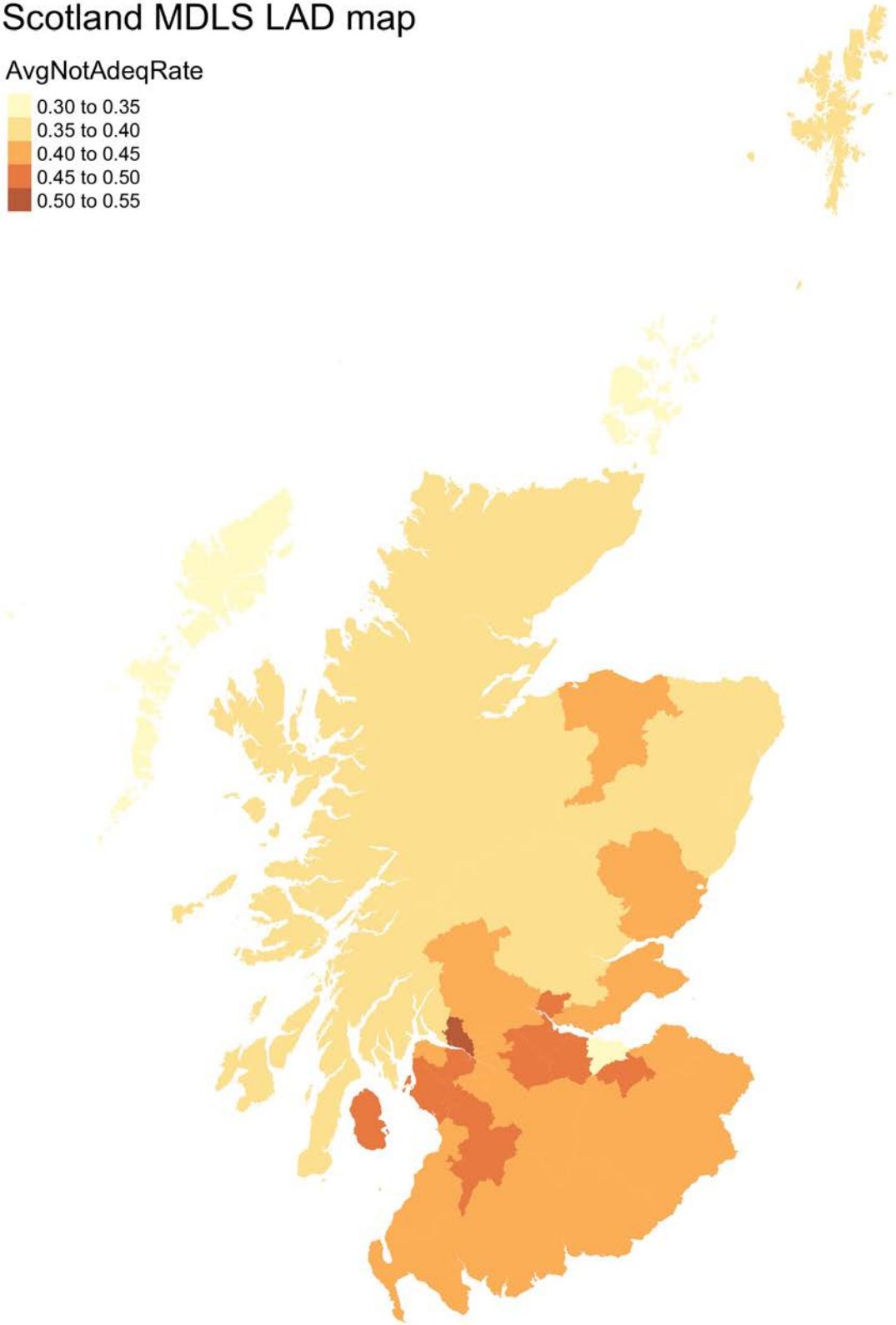
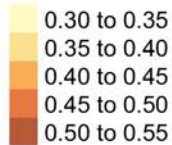


Figure 7.9: **not** Meeting MDLS (LCA) - Scotland LA

7.5 Wales

7.5.1 Wales MSOA

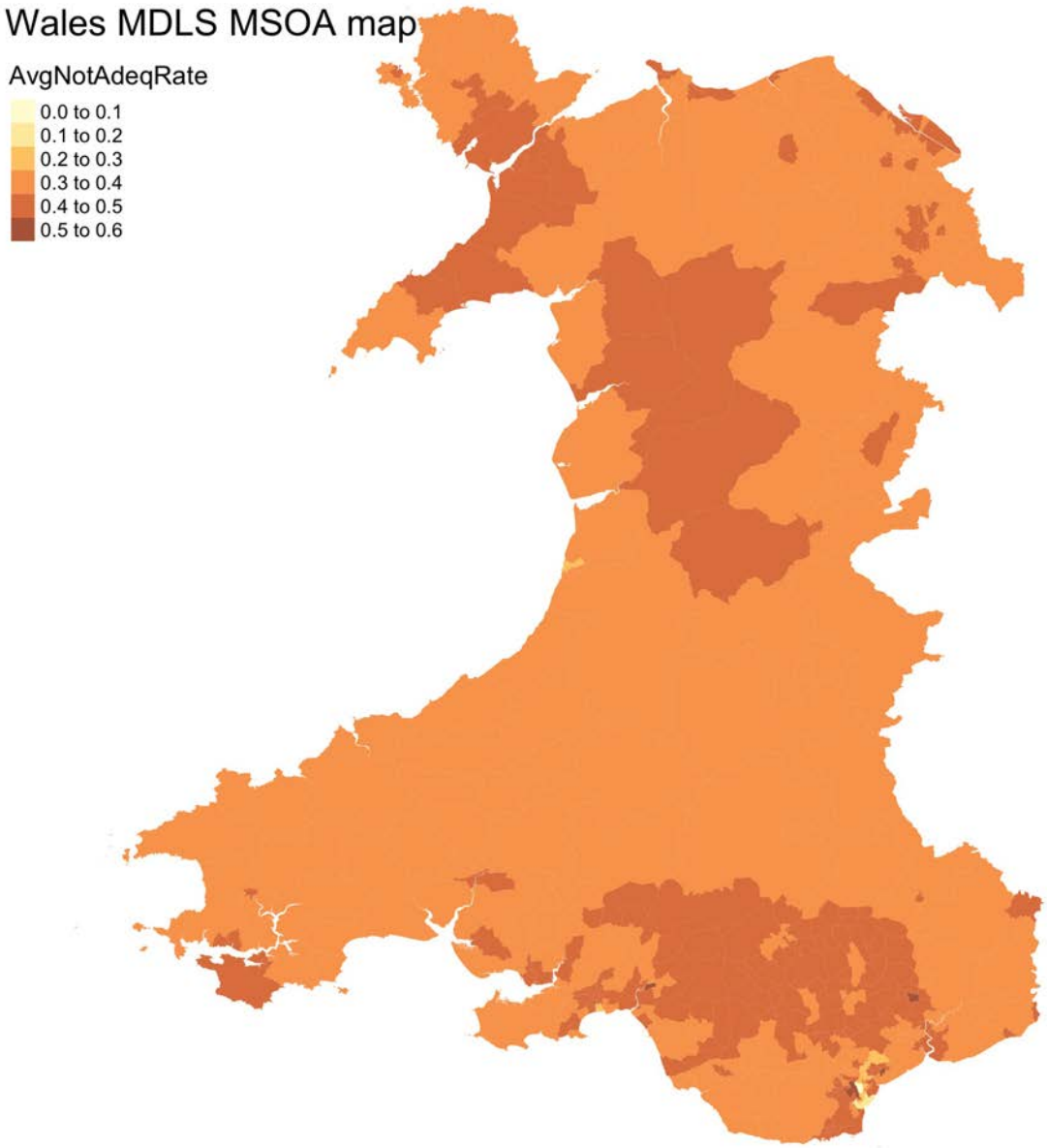


Figure 7.10: not Meeting MDLS (LCA) - Wales MSOA

7.5.2 Wales LA

Wales MDLS LAD map

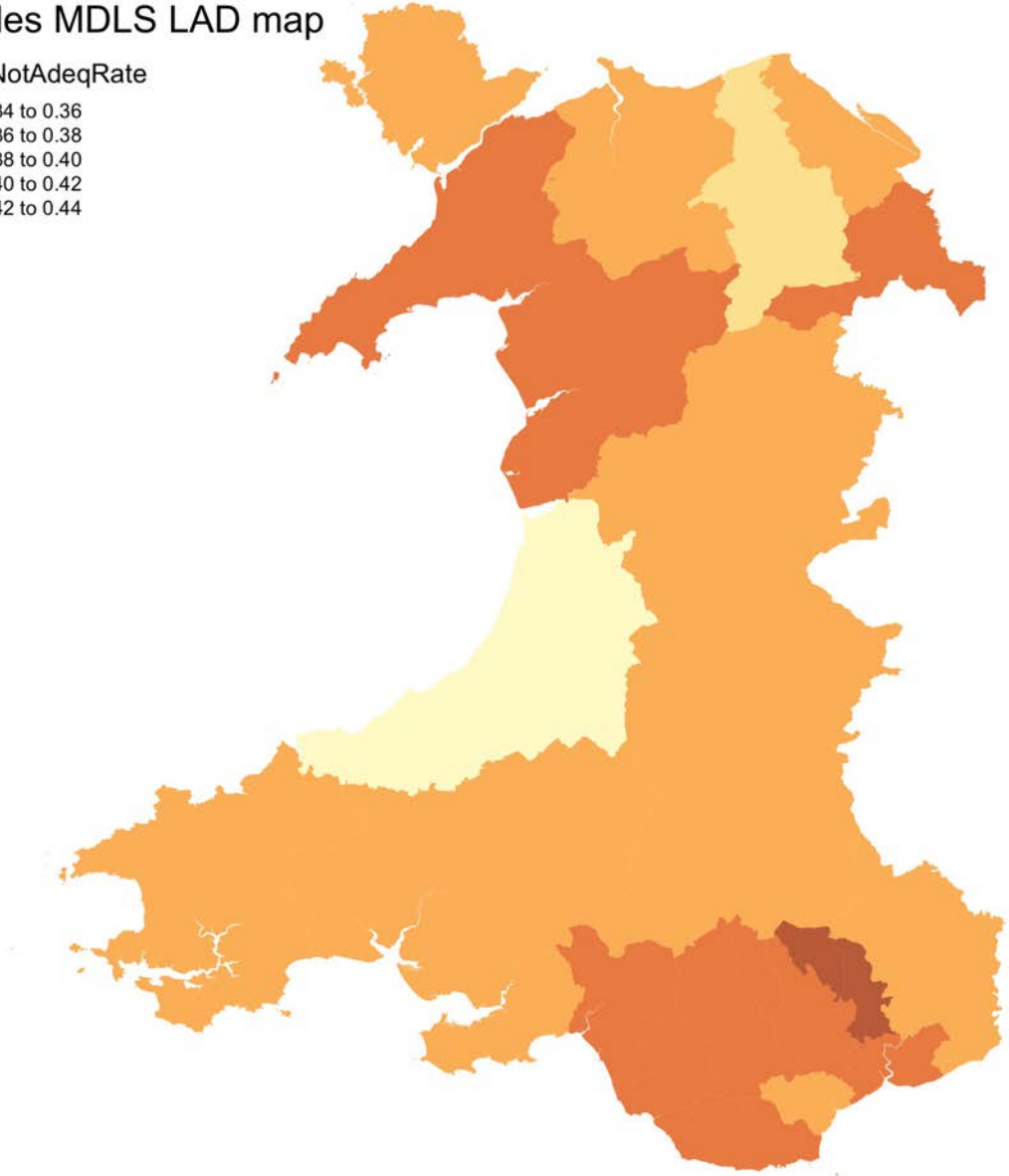
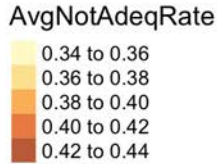


Figure 7.11: **not** Meeting MDLS (LCA) - Wales LA

7.6 London

7.6.1 London MSOA

London MDLS MSOA map

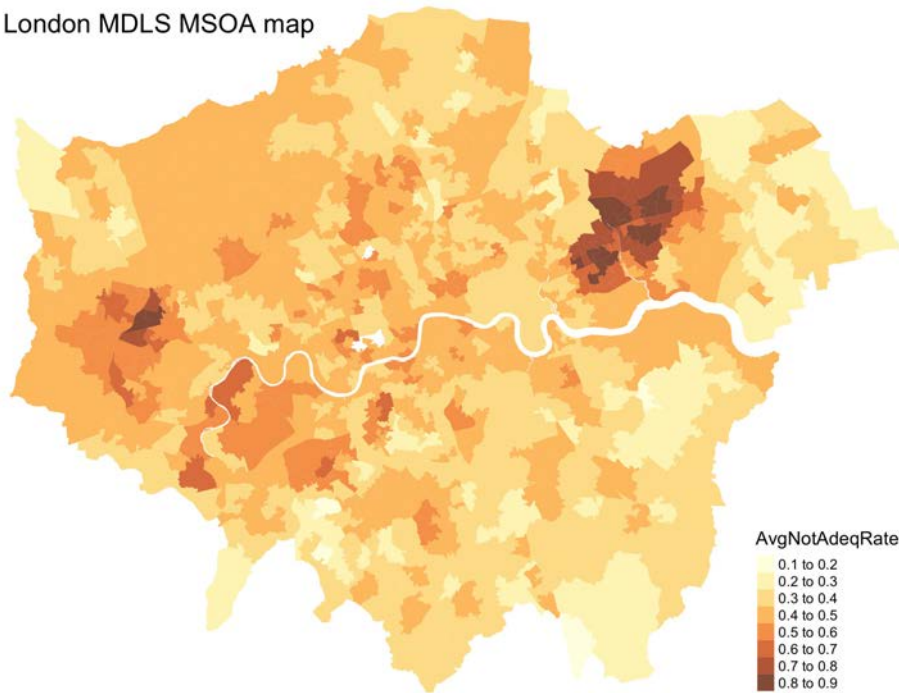


Figure 7.12: **not** Meeting MDLS (LCA) - London MSOA

7.6.2 London LA

London MDLS LAD map

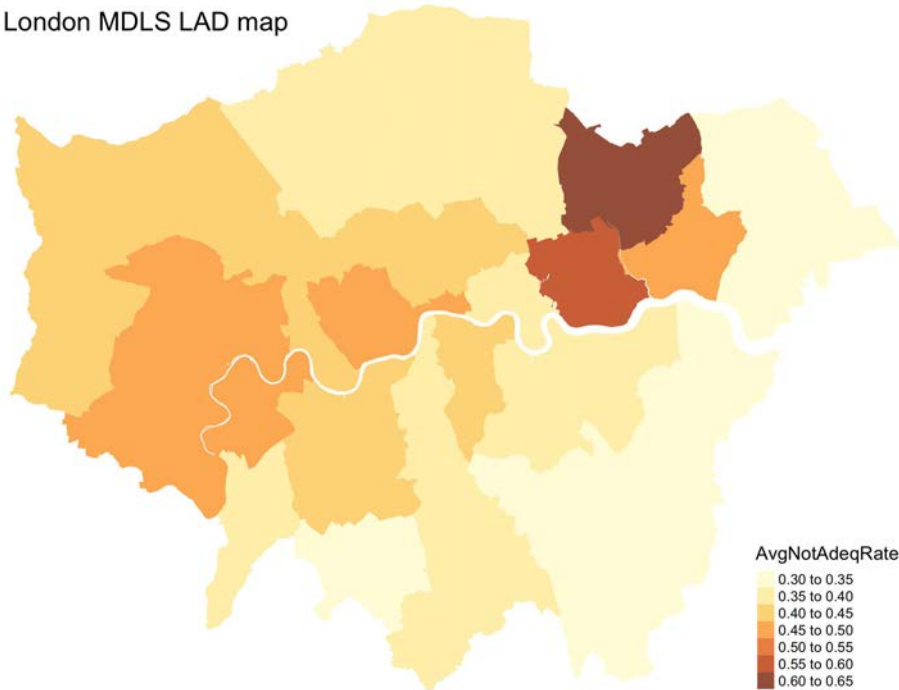


Figure 7.13: **not** Meeting MDLS (LCA) - London LA

7.7 Greater Manchester Combined Authority (GMCA)

7.7.1 GMCA MSOA

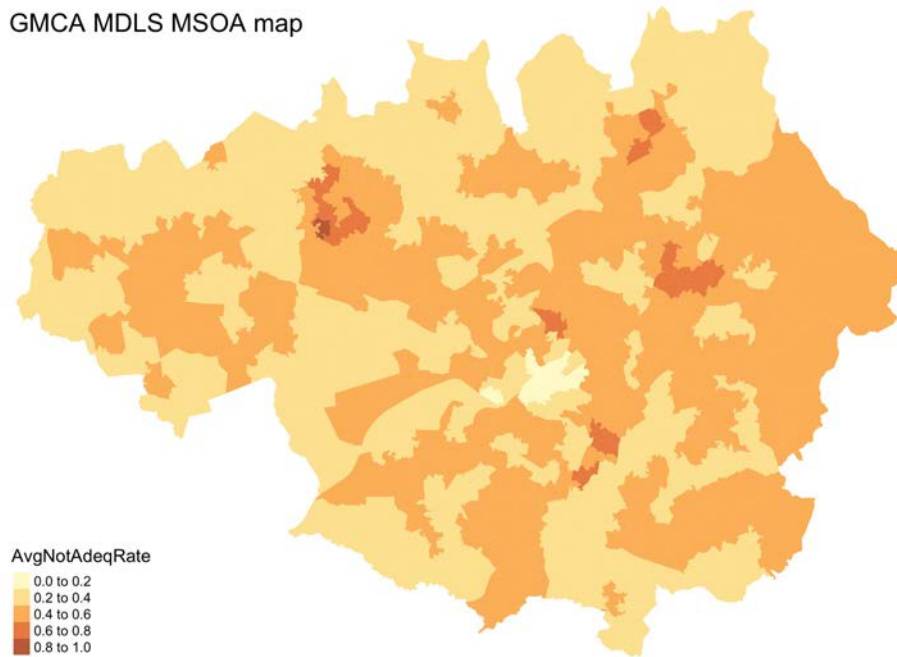


Figure 7.14: **not** Meeting MDLS (LCA) - GMCA MSOA

7.7.2 GMCA LA

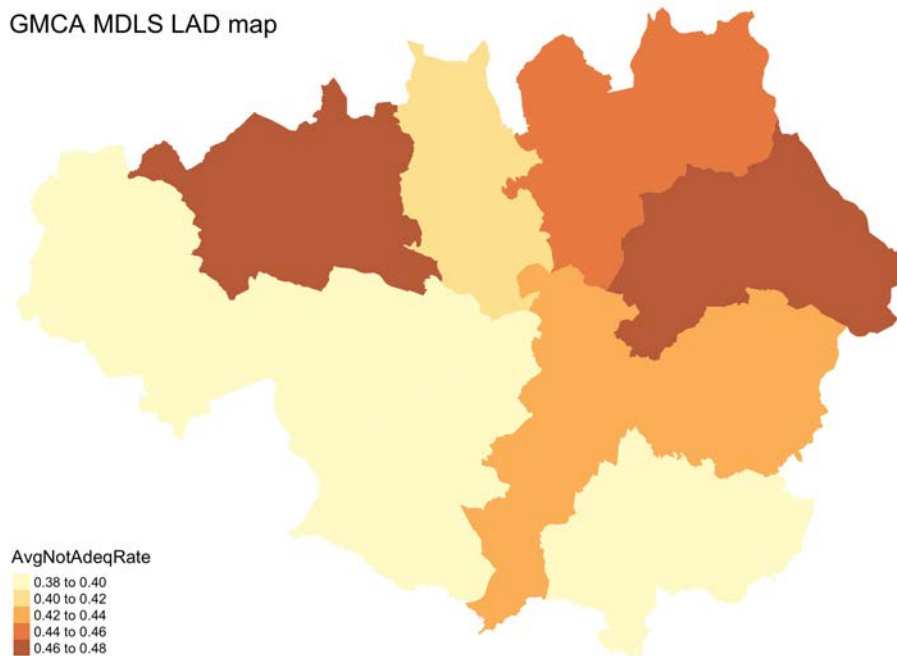


Figure 7.15: **not** Meeting MDLS (LCA) - GMCA LA

7.8 Liverpool City Region (LCR)

7.8.1 not Meeting MDLS (LCA) - LCR MSOA

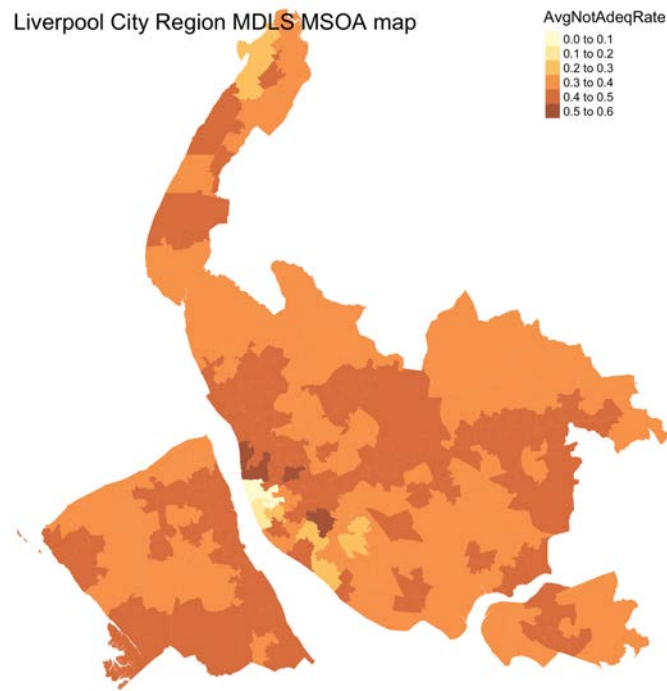


Figure 7.16: not Meeting MDLS (LCA) - LCR MSOA

7.8.2 LCR LA

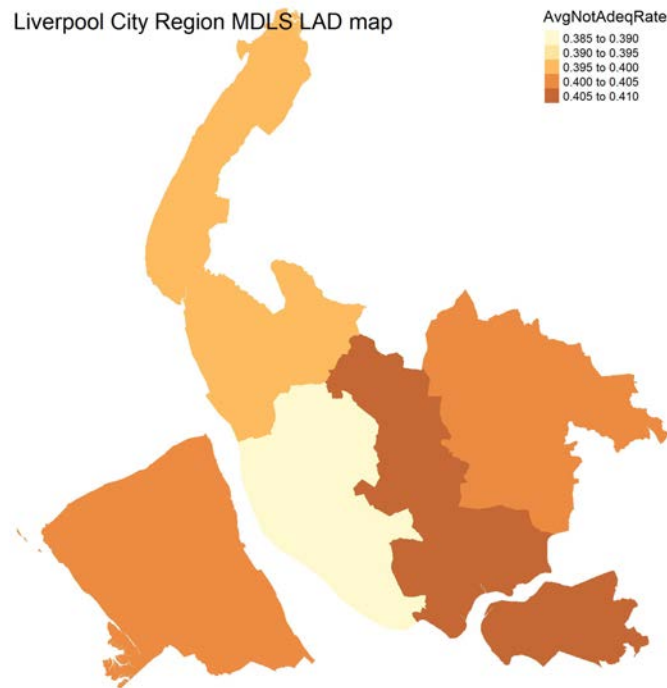


Figure 7.17: not Meeting MDLS (LCA) - LCR LA

Chapter 8

Conclusion

8.1 What does not meeting the MDLS mean?

We have found that only 55% of UK households with children meet the MDLS that they themselves defined

LCA based MDLS	Pct
Not MDLS adequate	45.00
MDLS adequate	55.00

Table 8.1: LCA-based MDLS proportions

Looking in more detail, we find that the following proportions of all households with children fail to meet the MDLS following reasons:

- 8.3% of households specifically lack skills for children (mix of all ages and skills).
- 17.0% of households specifically lack skills for adults (mix of skills).
- 7.2% of households specifically lack equipment.
- 12.5% of households lack a mix of skills and equipment.

What to conclude from from this? First, meeting the MDLS is a challenge for many households with children. With a large proportion of households falling short on either equipment, skills, or both what households with children **themselves set** as the minimum. To fall short of the MDLS implies not meeting a standard of living that "includes, but is more than, having accessible internet, adequate equipment, and the skills, knowledge and support people need". It implies that household members may not be "able to communicate, connect and engage with opportunities safely and with confidence". Not meeting the MDLS is therefore about not having the equipment, skills, or both to engage **safely and with confidence** with both the benefits of our digital society and the hazards. It is to be excluded in part or in full from leading a life you value in a digital world.

8.2 Why 45% of households?

Taking our LCA-based MDLS measure we have 45% of UK households with children not meeting the MDLS. This means they are not meeting the MDLS definition that representatives of these types of households deliberately agreed on. We should maybe not be surprised by this figure. First, existing research¹ indicates that around 30% of UK citizens are off-line or limited users and that another 20% focus on activities that are smart device based, lacking access to or not often using 'large-screen devices'. Ofcom figures also show that 30% of households are struggling with broadband costs², a number that has been rising during the UK cost-of-living-crisis. We also know that:

- 29% of UK households with children are in absolute poverty (JRF)³

¹Yates, S. J., Kirby, J., & Lockley, E. (2015). Digital media use: Differences and inequalities in relation to class and age. *Sociological Research Online*, 20(4), 1-21.; Yates, S.J., & Lockley, E. (2018). Social media and social class. *American Behavioral Scientist*, 62(9), 1291-1316.; Yates, S.J., & Lockley, E. (2020). Digital Engagement and Class: Economic, Social, and Cultural Capital in a Digital Age. In S.J. Yates & R. Rice (Eds.) *The Oxford Handbook of Digital Technology and Society* (pp. 426-448) Oxford: Oxford University Press.

²<https://www.ofcom.org.uk/research-and-data/multi-sector-research/affordability-tracker>

³<https://www.jrf.org.uk/uk-poverty-2024-the-essential-guide-to-understanding-poverty-in-the-uk>

- 44% of UK single-parent households are in absolute poverty (CPAG)⁴
- 42% of children are living in households with incomes below MIS⁵

Our results seem very much in line with these existing findings.

8.3 Policy

Thinking about policy interventions we need to consider where households fall short of the MDLS. In our LCA-based MDLS measure we have identified four main issues regarding equipment (see Section 4.3 and Table 2.16).

1. Poor broadband via 4G/5G
2. Smart TV access
3. Lacking enough devices
4. Significantly below MDLS

As noted in Section 5.5 it does not appear to be the case that poor or absent broadband is an infrastructure issue. Rather it appears to be a function of being 4G/5G dependent. This is likely to be driven by the affordability, or rather un-affordability of connectivity. Issues of affordability, social tariffs, and broadband costs as a proportion of low-income households available spend are issues of current policy debate. Lacking smart TV access may not be an area for policy intervention but it does highlight how digital exclusion also cuts into other forms of exclusion, including cultural exclusion. Having enough large-screen devices is important for many reasons but especially for education. Lacking access to such devices puts children at a significant disadvantage compared to their peers. Policy interventions may need to come from education providers or DfE, but may also come through such things as device banks. Those households significantly below the MDLS are likely to face multiple and significant daily challenges dealing with a digital society.

On skills, we note issues for both parents and children we have three challenging circumstances:

1. Households who **do not** have adequate skills at all
2. Households where **only children** have adequate Skills
3. Households where **only parents** have adequate Skills

It is clear that older secondary school children are picking up a majority of the required skills - or at least their parents (survey respondents) believe so. That said a notable portion of secondary school children and a larger proportion of primary school children are not seen by their parents (survey respondents) as meeting MDLS requirements. The obvious point of intervention for the development of these skills is formal education and the MDLS indicates the school stages that MDLS deliberative groups felt children should acquire these skills. The area of policy challenge is adult skills. Here again, our results are in line with other findings with a notable proportion of the UK workforce not having core 'essential digital skills. Further recent work⁶ has indicated the challenges of effectively intervening to develop skills, especially critical skills, to adults post-formal education.

⁴<https://cpag.org.uk/child-poverty/poverty-facts-and-figures>

⁵Padley, M., Stone, J. and Robinson, E. (2024) Households living below a Minimum Income Standard: 2008-2022. York: Joseph Rowntree Foundation.

⁶https://assets.publishing.service.gov.uk/media/6511619206e1ca00d616116/media_literacy_uptake_among_hard_to_reach_citizens.pdf



Digital Media and Society Institute

Department of Communication & Media
University of Liverpool
School of the Arts
19 Abercromby Square
Liverpool
L69 7ZG

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