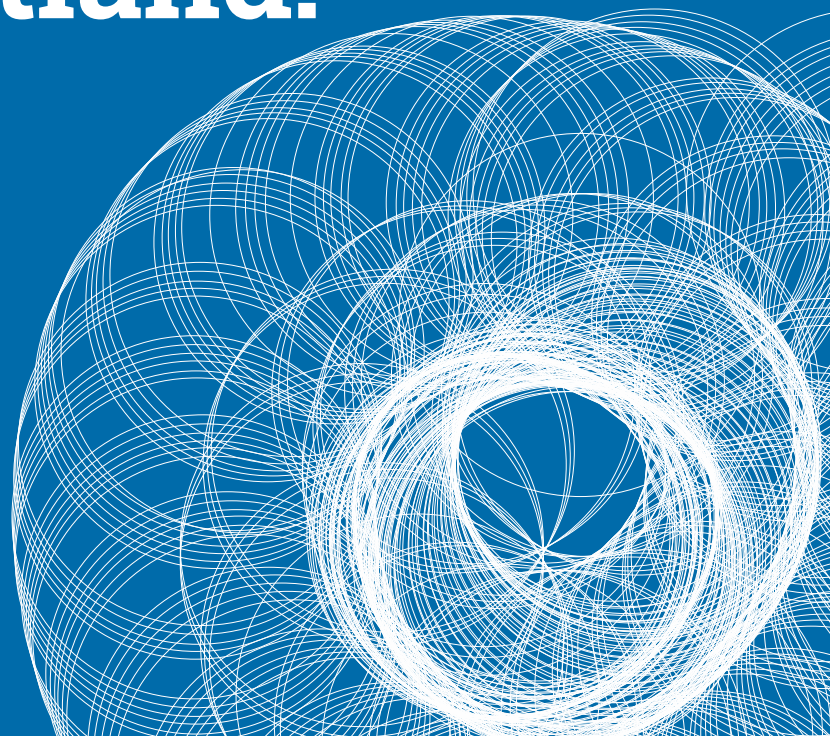# Scotianomics
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Community Risk Exposure to COVID-19 in Scotland:

Analysis and Strategy
at the National Level

Project leader Samuel MacKinnon
Researcher Emma Macfarlane

Contents

About Scotianomics

In the 21st century data is everywhere but it is the analysis that transforms data into valuable, actionable knowledge that is key to success.

Organisations, both in Scotland's private and public sectors, lack access to useful, reliable data and value-added analysis of the kind that most advanced countries take for granted. This creates a hidden but real disadvantage for Scottish business, limits public policy and disrupts the pursuit of shared prosperity.

Scotianomics aims to spark a knowledge revolution and inform the decision makers on Scotland's economy. We provide cutting-edge intelligence and strategic planning resources so that stakeholders can gain a wide view of the threats and opportunities in the world through our geopolitical, economic and policy analysis, unique historical datasets, risk and opportunity forecasts, Geographic Information System mapping solutions and strategic planning services.

Gordon MacIntyre-Kemp

Director

Executive summary

- This report introduces a new dataset identifying the level of exposure to COVID-19 in each of Scotland's 354 council wards.

- The dataset is built using data concerning community economic and social connectivity as well as community health data.

- This data can be used by government, local government and health officials concerned with public resource allocation and containment, community stakeholders building resilience and local response measures and individuals, to inform their behaviour in particular localities.

- We conclude that government strategy should focus on ensuring that the geographic spread of high-risk regions remains small while national health resources should be concentrated on high-risk regions to have the most impact in tackling the virus.

- When the time is right, it should be possible for the Scottish Government to consider a staged reopening of the country, beginning firstly with low-risk areas. It must be pointed out that although some areas are currently identified as low risk areas, this should not imply that people in those low-risk areas should now begin to unilaterally relax their compliance with social distancing / lockdown rules, as this could transform their communities into high-risk areas.

- Defining when the time is right to lift restrictions on movement and commerce will depend on further risk threshold analysis and a review of the capacity of the Scottish NHS to cope with a potential second wave of infections. Other nations are ahead of Scotland in terms of the progression of COVID-19 in their communities and data from those nations, as they begin to ease their own restrictions, will therefore be key to the analysis.

Introduction

As cases of COVID-19 and deaths related to the virus continue to rise in Scotland and as resources become increasingly stretched, the efficient allocation of those resources, for containment and treatment of people, is ever more essential. To achieve that, data is required on how exposed each community is in Scotland, to aid community stakeholders undertaking resilience measures and government officials managing state resources.

That is why we have created this resource, the COVID-19 Community Risks Index, which provides data for Scotland's 354 local authority wards. It is an intelligence resource that can aid organisations formulating strategies to address the pandemic, but it can also inform and encourage individuals on appropriate behaviour to protect their local communities. Our findings should serve as a guide to strategies for containment and resource allocation.

This is the first version of the index. Using two components — transmission probability and potential for fatalities — it compares the risk exposure of Scotland's council wards to the virus. As this is an early and experimental version, it will also be refined as the crisis unfolds, when new data/information becomes available.

Although this document provides the initial version of the index and a community comparison, users should consult the version on our website scotianomics.org as this will be updated as new information becomes available. This report will describe our methodologies and reasoning. However, because the virus moves so quickly, data will always be behind it. The data can and should be used to anticipate outcomes and to guide policy and resources allocation procedures.

Caution

Users of this data should be cautious. It is not a map of COVID-19 cases across Scotland and does not imply that some places necessarily have more cases than others. It is a map primarily of how easy the virus may spread in particular communities, due to their population, connectivity and economic characteristics.

This means that if an area that we have identified as high-risk currently has a low incidence of COVID-19 infections, we can predict that the propensity for the rapid spread of the disease in that area is higher than in others, especially if restrictions are lifted, either partially or in full.

These variables have the greatest weight in calculating the level of risk. Variables such as health and age structure also come into play: that is, the factors that determine how affected members of a community would be if they caught the virus. But these have a lesser weight as health issues matter less than the ability of the virus to spread.

The index is not built using data on the movement and behaviour of people during the virus, such as how seriously they have taken the lockdown; this data does not exist.

Most of the data used to construct this index, especially data related to connectivity, is taken from surveys published before the outbreak of the virus in Scotland. This is the most recent data available and is used to assume, depending on the levels of connectivity during the year of publishing, that these areas are still more connected today. This is a limitation, but it is one that cannot be overcome until new public data comes available on connectivity and the movement of people during the virus. Nonetheless, the index is still a reliable picture of how the COVID-19 virus and other future viruses may spread and the impact it can have across Scotland.

Methodology

Transmission probability

Transmission probability refers to the ability of the virus to spread through human interaction. Several variables, each weighted to reflect their importance, are used to calculate this. They are listed in order of importance, with descriptions underneath.

Existing COVID-19 cases as a share of local population

Using an average taken from relevant NHS boards, we determine how exposed a community is to the virus already.[1]

Population density

We measure how many people live in a community by its total area. More compact populations are assumed to more effectively facilitate the spread of the virus. The population input data is sourced from the National Records of Scotland and the land area data from the Office for National Statistics.[2]

Accessibility

This measure uses the accessibility ranking from the Scottish Index for Multiple Deprivation, which measures how close members of a community are to essential services.[3] While this includes health services, which a citizen may need to access sooner if they contract the virus, in this case better accessibility is assumed to facilitate the spread of the virus. This is because members of communities with greater accessibility are assumed to travel more and come into contact with one another more frequently.

1   Scottish Government (2020) 'Coronavirus (COVID-19): Tests and Cases in Scotland', Available Online: [https://www.gov.scot/publications/coronavirus-covid-19-tests-and-cases-in-scotland/?fbclid=IwAR0uHc-5MNfuMgmt47DH8DrtUPEXX6uTtqbv9AalWENZdF4M1I_5MJRlztJg].

2   National Records of Scotland (2020) 'Electoral Ward Population Estimates', Available Online: [https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/2011-based-special-area-population-estimates/electoral-ward-population-estimates]; Office for National Statistics (2020) 'Wards Full Clipped Boundaries in Great Britain', Available Online: [http://geoportal.statistics.gov.uk/datasets/07194e4507ae491488471c84b23a90f2_0].

3   Scottish Government (2020) 'Scottish Index of Multiple Deprivation', Available Online: [https://simd.scot/#/simd2020/BTTTFTT/9/-4.0000/55.9000/].

GDP per capita

Communities with higher GDP per capita are assumed to have more local economic activity, and thus more human interaction through trade. They are also assumed to trade more with people from outside their community — that is, importing and exporting with groups outside of their community, meaning there is greater potential for the virus to spread through the transportation or delivery of goods and services. The input data is sourced from the Office for National Statistics.[4]

Rail transport passengers relative to total population

Travellers on trains tend to be in close proximity to one another. Regions with greater numbers of travellers by rail are therefore assumed to be more at risk to the virus spreading. The data is sourced from Scottish Transport Statistics.[5]

Frequency of road travel

Road travel can be a more private mode of transport as community members may travel by car — although buses may be used. Nonetheless, more people travelling as a share of the population also means greater potential for the virus to spread. The data is sourced from Scottish Transport Statistics.[6]

Total population

Population size itself does not facilitate the spread of the virus, but the above factors combined with population size do. The data is produced by the National Records of Scotland.[7]

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4   Office for National Statistics (2019) 'Regional Gross Value Added (Balanced) Per Head and Income Components', Available Online: [https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/nominalregional-grossvalueaddedbalancedperheadandincomecomponents].

5   Scottish Government (2018) 'Scottish Transport Statistics – No 36 – Datasets: Chapter 7, Rail', Available Online: [https://www.transport.gov.scot/publication/scottish-transport-statistics-no-36-datasets/].

6   Scottish Government (2018) 'Scottish Transport Statistics – No 36 – Datasets: Chapter 5, Road Traffic', Available Online: [https://www.transport.gov.scot/publication/scottish-transport-statistics-no-36-datasets/].

7   National Records of Scotland (2020) 'Electoral Ward Population Estimates', Available Online: [https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-esti-mates/2011-based-special-area-population-estimates/electoral-ward-population-estimates].

Fatality probability

Potential for fatalities refers to how many members of a community are at risk of death if they were to contract the virus. This is calculated using two variables, also ranked according to importance and with description underneath.

Existing community health issues

Analysis has shown that people with existing health issues are more likely to die as a result of catching the virus. We identify community health by using the Scottish Index of Multiple Deprivation's health ranking.[8]

Community age structure

Analysis has also shown that older people are more likely to die from the virus. Thus, we calculate the probability of death of various age groups. Communities with older populations are more at risk of death if many of their members contracted the virus. Yet often older populations in Scotland are located in remote and peripheral regions. Therefore, they are also at less risk of catching it. The data is produced by the National Records of Scotland.[9]

Further research

Future publications of this index will offer more detailed analysis of the situation at the individual local authority level, offering recommendations to local governments on how to allocate their resources.

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8   Scottish Government (2020) 'Scottish Index of Multiple Deprivation', Available Online: [https://simd.scot/#/simd2020/BTTTFTT/9/-4.0000/55.9000/].

9   National Records of Scotland (2020) 'Electoral Ward Population Estimates', Available Online: [https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/2011-based-special-area-population-estimates/electoral-ward-population-estimates].

Results

The map below (Figure 1) summarises the distribution of risk across Scotland. Areas in red are the most at risk; areas in blue the least. Please note that "red" does not necessarily imply that the situation in an area has reached an extreme stage, that many people are dying or infected, or that the economy of that area has collapsed completely while other economies are functioning as normal.

The colours simply distinguish between particular levels of exposure. In a red area, it is more likely that it will be transmitted among a community's population and/or that more members of that community are at risk of dying or demonstrating severe symptoms if they catch it.

The high-risk areas in red were likely to be high-risk even during the early stages of crisis when there was an insignificant number of cases across the country. However, a high-risk designation does imply that members of that community should be more cautious in their daily activities.
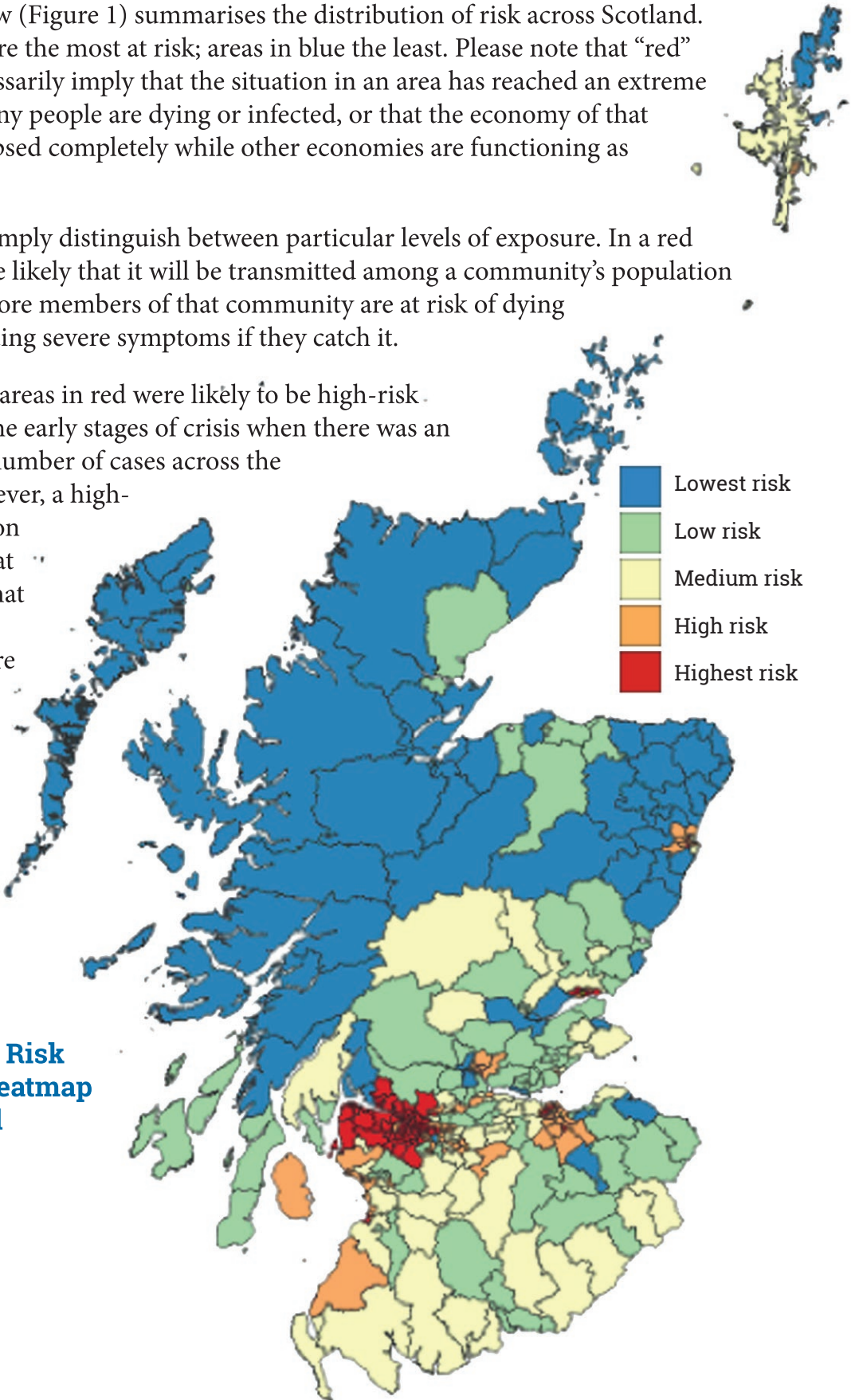
Figure 1. COVID-19 Community Risk Exposure Heatmap for Scotland

Lowest risk

Low risk

Medium risk

High risk

Highest risk

Analysis

The purpose of this report is to introduce this resource and provide a national overview. Further publications will look more specifically at regional issues, breaking down each local authority area. But it is worth taking a brief look at some of the regional insights.

Figure 2. Inverclyde and Glasgow Regions
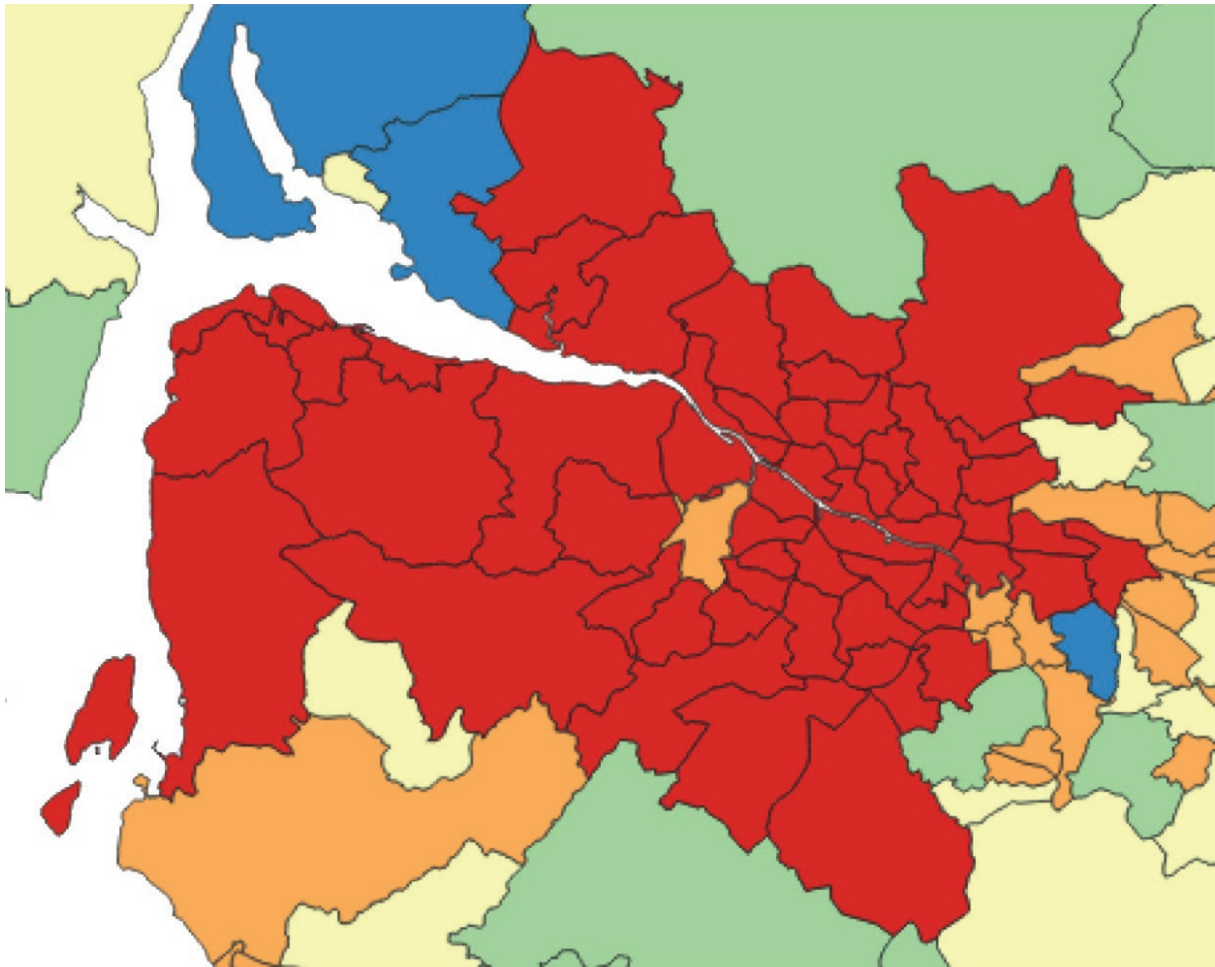
Most of the risk is concentrated in Scotland's more densely populated urban areas. Particularly at risk are areas around the Clyde: these communities have high levels of connectivity and population density, while existing health issues are more frequent, relative to the rest of Scotland, among their members. Due to their high levels of connectivity and larger populations, they also have had more numbers of cases of the virus, meaning more chance that it will be spread.

Figure 3. Highlands and Islands and North East Regions
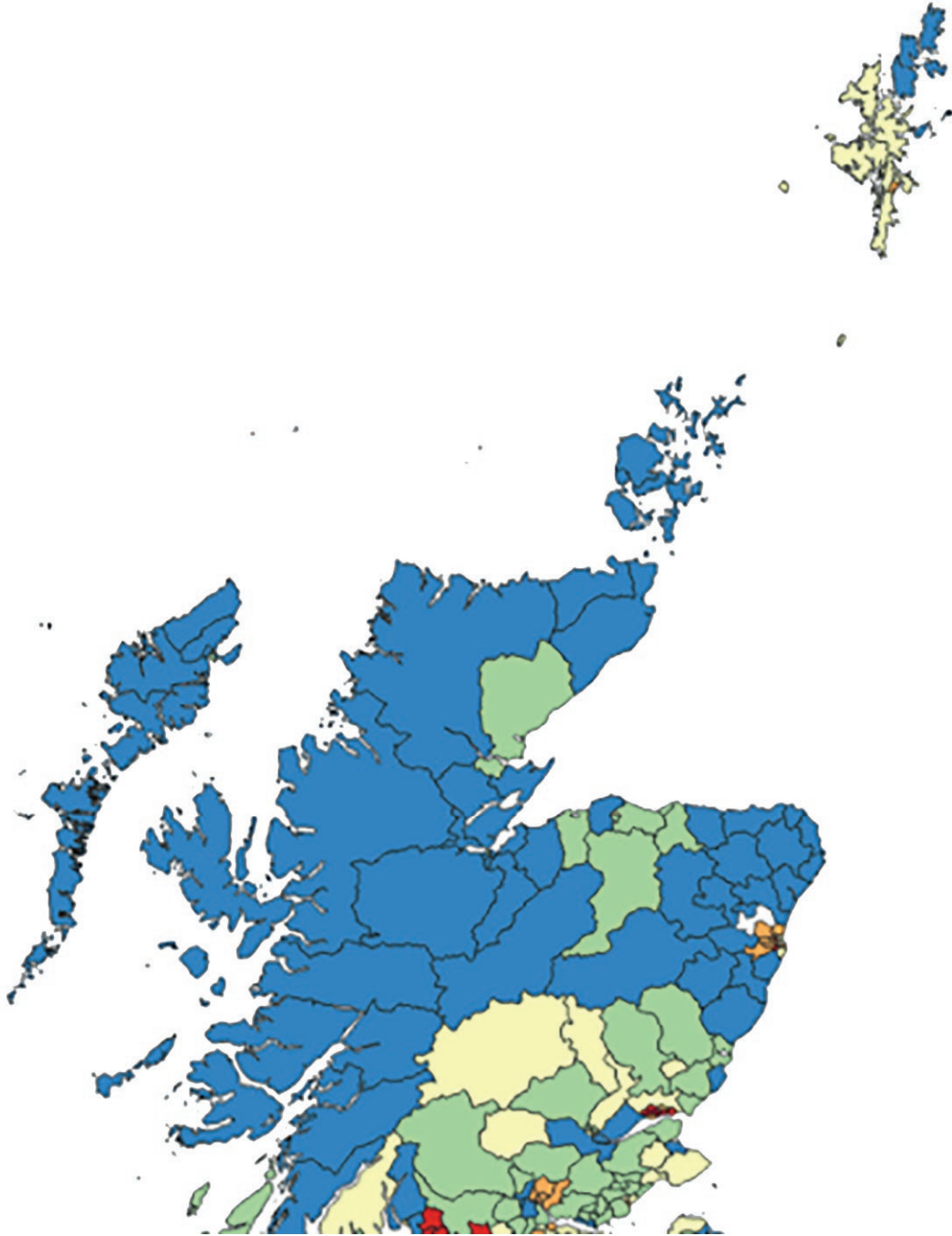
Scotland's northern rural regions, such as the Highlands and Islands and the North East, are least at risk. While their older population structure means that many of their members are vulnerable to the virus in the sense that, if they were to catch it, they could die, there is less risk of the virus spreading among their communities due to decreased levels of connectivity and their geographically spread-out populations. The one exception to this is Shetland which early on had a high number of cases relative to its population. This may be due to Shetland's increased contact with the rest of the UK as a result of the activities of the oil industry on the islands.

Figure 4. Regions Near the Scottish Borders
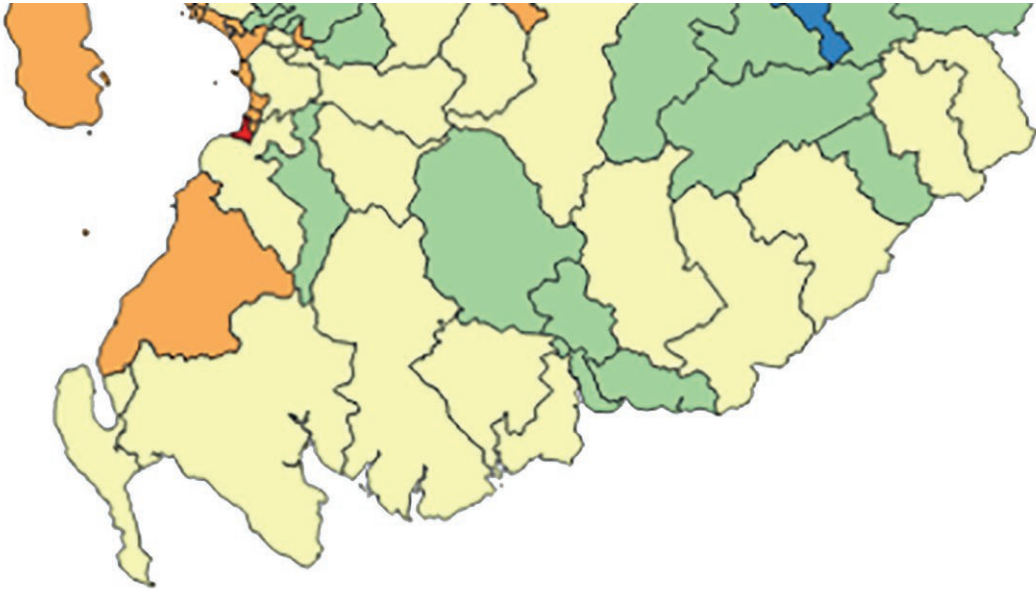
Regions south of the Central Belt also have higher levels of risk, as there is greater accessibility between them and the Central Belt, while they are also located at the bottleneck of Scotland's international and domestic trade routes.

Key conclusions and strategy

1. Government strategy should focus on maintaining the current distribution of risk across the country: that is, ensuring that low-risk areas remain low risk. By doing so, the crisis will be easier to manage, and resources will not become even more stretched.

2. To do this, public services such as the police and institutions concerned with transportation management should be used to contain the spread of the virus from high-risk urban areas to lower risk rural areas. This can be done through policies that manage flows of people at urban boundaries and thus need to be considered when travel restrictions are lifted and we enter a new potential stage of the virus's transmission in Scotland.

3. Meanwhile, the government should continue to concentrate on directing national health resources toward those more populated areas with high levels of risk and where the cases are being contained. If the geographic spread of risk remains concentrated in high-population areas and the maximum possible national health resources are targeted at these areas, this will have a positive impact on the efficiency of the response at a national level. The virus may eventually reach all parts of Scotland but at different timescales, so as the pressure on resources in the most populous areas reduces, resources will become available to meet the needs of the areas that were less at risk and therefore benefited most from the lockdown and social distancing rules.

4. This data also suggests, when the virus begins to be brought under control, that a gradual, regionally staged opening up of the country and loosening of restrictions is a possibility. Lower risk regions could see restrictions loosened at a faster pace than high-risk regions. An example would be the staged reopening of schools and childcare facilities in low-risk areas or construction work being phased back in with appropriate social distancing protections in place. This is not to say that such relaxations of the rules should be imminent or that people living in low-risk regions should begin to go about their ordinary lives at this time, as this could turn their communities into high-risk regions. Rather, it must be controlled, done in parallel to a mass testing programme and only when the government feels the time is right, after further research to establish risk thresholds.

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Appendix

COVID-19 Community Risk Rankings (Higher Scores are Worse)

Council Ward	Risk Score	Rank
Inverclyde North	112.7	1
Inverclyde West	112.4	2
Inverclyde East	112.0	3
Inverclyde South	111.7	4
Inverclyde East Central	111.4	5
Clydebank Central	111.1	6
Inverclyde Central	110.8	7
Clydebank Waterfront	110.4	8
Dumbarton	110.1	9
Lomond	109.8	10
Inverclyde South West	109.5	11
Partick East/Kelvindale	109.2	12
Kilpatrick	108.9	13
Leven	108.5	14
Langside	108.2	15
Garscadden/Scotstounhill	107.9	16
East Centre	107.6	17
The Ferry	107.3	18
Hillhead	106.9	19
Giffnock and Thornliebank	106.6	20
Cardonald	106.3	21
Bearsden South	106.0	22
Clarkston, Netherlee and Williamwood	105.7	23
Southside Central	105.4	24
Pollokshields	105.0	25
Victoria Park	104.7	26
Coldside	104.4	27
Leith Walk	104.1	28
Paisley Southeast	103.8	29
Paisley Northeast and Ralston	103.4	30
Drumchapel/Anniesland	103.1	31
Shettleston	102.8	32
Bearsden North	102.5	33
Ayr West	102.2	34
Maryhill	101.9	35

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Bishopbriggs South	101.5	36
Renfrew South and Gallowhill	101.2	37
Linn	100.9	38
Springburn/Robroyston	100.6	39
Calton	100.3	40
Newlands/Auldburn	99.9	41
Greater Pollok	99.6	42
Anderston/City/Yorkhill	99.3	43
Erskine and Inchinnan	99.0	44
North Coast and Cumbraes	98.7	45
Baillieston	98.4	46
Newton Mearns South and Eaglesham	98.0	47
Milngavie	97.7	48
Paisley Southwest	97.4	49
East End	97.1	50
Canal	96.8	51
Govan	96.4	52
Dennistoun	96.1	53
Johnstone South and Elderslie	95.8	54
Maryfield	95.5	55
Hilton/Woodside/Stockethill	95.2	56
Barrhead, Liboside and Uplawmoor	94.9	57
Corstorphine/Murrayfield	94.5	58
Renfrew North and Braehead	94.2	59
Bonnyrigg	93.9	60
Lochee	93.6	61
Bishopbriggs North and Campsie	93.3	62
Airyhall/Broomhill/Garthdee	92.9	63
Johnstone North, Kilbarchan, Howwood and Lochwinnoch	92.6	64
Bishopton, Bridge of Weir and Langbank	92.3	65
Lenzie and Kirkintilloch South	92.0	66
Paisley East and Central	91.7	67
Houston, Crosslee and Linwood	91.4	68
Strathmartine	91.0	69
Inverleith	90.7	70
Newton Mearns North and Neilston	90.4	71
Midlothian West	90.1	72
East Kilbride Central South	89.8	73
Penicuik	89.4	74

North East	89.1	75
Kirkintilloch East and North and Twechar	88.8	76
Paisley Northwest	88.5	77
Morningside	88.2	78
West End	87.8	79
Troon	87.5	80
East Kilbride Central North	87.2	81
Midlothian East	86.9	82
Forth	86.6	83
Clackmannanshire North	86.3	84
Northfield/Mastrick North	85.9	85
Prestwick	85.6	86
Ayr East	85.3	87
Ardrossan and Arran	85.0	88
Clackmannanshire South	84.7	89
Craigentinny/Duddingston	84.3	90
Southside/Newington	84.0	91
Saltcoats	83.7	92
Clackmannanshire Central	83.4	93
Clackmannanshire East	83.1	94
Rutherglen South	82.8	95
North Isles	82.4	96
Cumbernauld South	82.1	97
North East	81.8	98
Fountainbridge/Craiglockhart	81.5	99
Coatbridge West	81.2	100
Rutherglen Central and North	80.8	101
Dalkeith	80.5	102
Airdrie Central	80.2	103
Hamilton South	79.9	104
Sighthill/Gorgie	79.6	105
Liberton/Gilmerton	79.3	106
Irvine West	78.9	107
Portobello/Craigmillar	78.6	108
Midlothian South	78.3	109
Drum Brae/Gyle	78.0	110
Torry/Ferryhill	77.7	111
Wishaw	77.3	112
Hazlehead/Queens Cross/Countesswells	77.0	113
Falkirk South	76.7	114

Clackmannanshire West	76.4	115
City Centre	76.1	116
Girvan and South Carrick	75.8	117
Lower Deeside	75.4	118
Ayr North	75.1	119
Coatbridge North	74.8	120
Colinton/Fairmilehead	74.5	121
Lerwick South	74.2	122
Kirkcaldy Central	73.8	123
Dyce/Bucksburn/Danestone	73.5	124
Motherwell West	73.2	125
Dalry and West Kilbride	72.9	126
Midstocket/Rosemount	72.6	127
East Kilbride East	72.3	128
Bothwell and Uddingston	71.9	129
Grangemouth	71.6	130
Coatbridge South	71.3	131
Irvine South	71.0	132
Bridge of Don	70.7	133
Cambuslang West	70.3	134
Cumbernauld East	70.0	135
Motherwell South East and Ravenscraig	69.7	136
Murdostoun	69.4	137
Clydesdale North	69.1	138
Leith	68.8	139
Stevenston	68.4	140
Kilmarnock East and Hurlford	68.1	141
Thorniewood	67.8	142
Kingswells/Sheddocksley/Summerhill	67.5	143
Kilbirnie and Beith	67.2	144
North Berwick Coastal	66.8	145
Bellshill	66.5	146
Blantyre	66.2	147
Strathearn	65.9	148
George St/Harbour	65.6	149
Linlithgow	65.3	150
Kelso and District	64.9	151
Dee and Glenkens	64.6	152
Lerwick North	64.3	153
Motherwell North	64.0	154

Almond	63.7	155
Blairgowrie and Glens	63.3	156
Hamilton North and East	63.0	157
Kincorth/Nigg/Cove	62.7	158
Kilmarnock West and Crosshouse	62.4	159
Perth City South	62.1	160
Kilwinning	61.7	161
Broxburn, Uphall and Winchburgh	61.4	162
Whitburn and Blackburn	61.1	163
Falkirk North	60.8	164
Kyle	60.5	165
Annandale East and Eskdale	60.2	166
Tillydrone/Seaton/Old Aberdeen	59.8	167
Highland	59.5	168
East Neuk and Landward	59.2	169
Clydesdale South	58.9	170
Monifieth and Sidlaw	58.6	171
Cowal	58.2	172
Pentland Hills	57.9	173
Maybole, North Carrick and Coylton	57.6	174
Airdrie South	57.3	175
Larkhall	57.0	176
Strathmore	56.7	177
Stepps, Chryston and Muirhead	56.3	178
Kilsyth	56.0	179
Kirkcaldy North	55.7	180
Fortissat	55.4	181
Lower Braes	55.1	182
Annandale North	54.7	183
Livingston North	54.4	184
Hawick and Hermitage	54.1	185
Mid Galloway and Wigtown West	53.8	186
Cupar	53.5	187
East Kilbride South	53.2	188
Shetland South	52.8	189
Livingston South	52.5	190
Castle Douglas and Crocketford	52.2	191
Ballochmyle	51.9	192
Bo'ness and Blackness	51.6	193
Fauldhouse and the Breich Valley	51.2	194

Cumbernauld North	50.9	195
Abbey	50.6	196
Kilmarnock South	50.3	197
Mossend and Holytown	50.0	198
Shetland West	49.7	199
Leven, Kennoway and Largo	49.3	200
Clydesdale East	49.0	201
Shetland Central	48.7	202
Avondale and Stonehouse	48.4	203
Stranraer and the Rhins	48.1	204
Helensburgh Central	47.7	205
Clydesdale West	47.4	206
Elgin City North	47.1	207
Forfar and District	46.8	208
Cumnock and New Cumnock	46.5	209
Bathgate	46.2	210
Shetland North	45.8	211
Kirkcaldy East	45.5	212
Jedburgh and District	45.2	213
Arbroath West, Letham and Friockheim	44.9	214
Armadale and Blackridge	44.6	215
Irvine East	44.2	216
Keith and Cullen	43.9	217
Dunfermline North	43.6	218
Perth City Centre	43.3	219
Airdrie North	43.0	220
East Livingston and East Calder	42.7	221
Irvine Valley	42.3	222
Isle of Bute	42.0	223
Bonnybridge and Larbert	41.7	224
North West Dumfries	41.4	225
Mid Berwickshire	41.1	226
Annick	40.7	227
Selkirkshire	40.4	228
Nith	40.1	229
Musselburgh	39.8	230
Carnoustie and District	39.5	231
Buckie	39.2	232
Mid and Upper Nithsdale	38.8	233
Denny and Banknock	38.5	234

Carse, Kinnaird and Tryst	38.2	235
Doon Valley	37.9	236
Speyside Glenlivet	37.6	237
Forres	37.2	238
Brechin and Edzell	36.9	239
Howe of Fife and Tay Coast	36.6	240
East Sutherland and Edderton	36.3	241
Inverkeithing and Dalgety Bay	36.0	242
Montrose and District	35.6	243
Kirriemuir and Dean	35.3	244
Strathallan	35.0	245
Hamilton West and Earnock	34.7	246
Buckhaven, Methil and Wemyss Villages	34.4	247
Stirling West	34.1	248
Annandale South	33.7	249
East Berwickshire	33.4	250
Burntisland, Kinghorn and Western Kirkcaldy	33.1	251
Forth and Endrick	32.8	252
East Kilbride West	32.5	253
Haddington and Lammermuir	32.1	254
Cowdenbeath	31.8	255
Glenrothes North, Leslie and Markinch	31.5	256
Elgin City South	31.2	257
Kilmarnock North	30.9	258
Tweeddale West	30.6	259
Steòrnabhagh a Deas	30.2	260
Gartcosh, Glenboig and Moodiesburn	29.9	261
Fochabers Lhanbryde	29.6	262
Leaderdale and Melrose	29.3	263
Preston, Seton and Gosford	29.0	264
South Kintyre	28.6	265
Strathtay	28.3	266
Hawick and Denholm	28.0	267
Upper Braes	27.7	268
Kinross-shire	27.4	269
Trossachs and Teith	27.1	270
Dunblane and Bridge of Allan	26.7	271
Glenrothes Central and Thornton	26.4	272
Tay Bridgehead	26.1	273
Inverness Central	25.8	274

Dunoon	25.5	275
Tweeddale East	25.1	276
Lochgelly, Cardenden and Benarty	24.8	277
West Fife and Coastal Villages	24.5	278
Dunfermline South	24.2	279
Dunfermline Central	23.9	280
Lochar	23.6	281
Glenrothes West and Kinglassie	23.2	282
Perth City North	22.9	283
Kintyre and the Islands	22.6	284
Stirling East	22.3	285
Dunbar and East Linton	22.0	286
Na Hearadh agus Ceann a Deas nan Loch	21.6	287
Wester Ross, Strathpeffer and Lochalsh	21.3	288
Arbroath East and Lunan	21.0	289
Sgir'Uige agus Ceann a Tuath nan Loch	20.7	290
St Andrews	20.4	291
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