CONTENTS

▶ How we work in Barnsley

▶ How that helped us build a Vulnerability Index for CV-19

▶ How we built on that with Test & Trace

HOW WE WORK

▶ We are a centralized team within the council who work on Business Intelligence, formed in 2018, our focus is on:

  ▶ Changing our working practices to follow a defined and prescribed development pattern and encouraged business units to follow us.

  ▶ Building a corporate data warehouse.
    Microsoft SQL Server 2016 On Premise.

  ▶ Implementing PowerBI as a data visualisation tool and gaining the skills in developing reporting solutions.
    Desktop & On Premise server deployment.

  ▶ Introducing and developing a discipline around report development, so that our products became maintained solutions.

  ▶ Deploying an ETL tool to allow us to automate data manipulation processes.
    FME by Safe. Desktop & On Premise Server deployment.

WHAT WE'VE BUILT

▶ Since 2018 we've created hundreds of fully managed data flows

  ▶ We take data from the source systems

     APIs, Databases, Cloud Platforms, Eforms, Robotic Process Automation

  ▶ We apply business logic and fix data quality issues

  ▶ We store the data in the Warehouse in a way that allows us to maximise its re-use

  ▶ We create aggregated data sets of related data

  ▶ We schedule the automated updates, so the data is always timely

▶ As a result

  ▶ We've become the experts on Data in the council

     we have a working knowledge of all the councils' key datasets

  ▶ We can quickly respond to new requests for data driven solutions

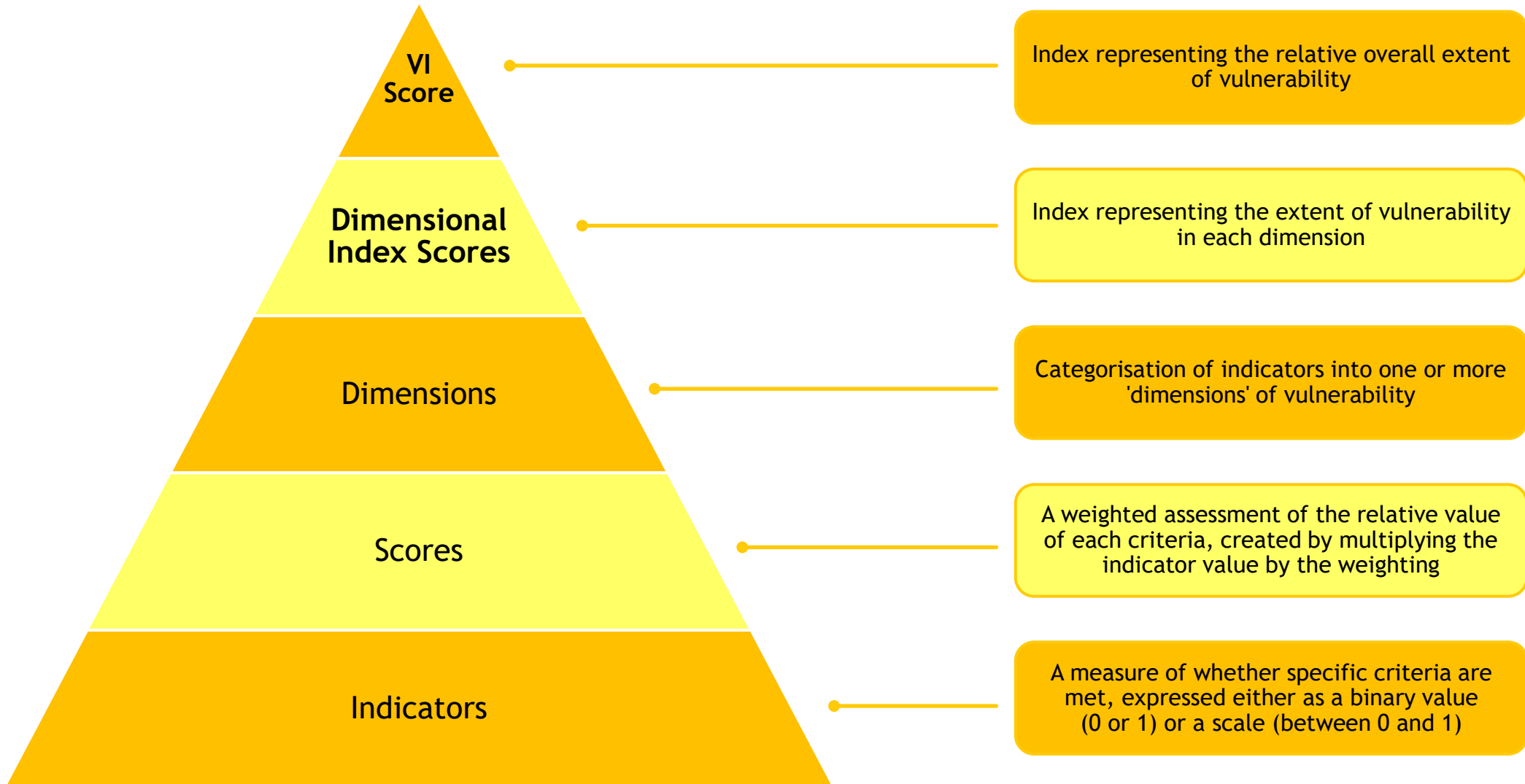 ▶ This put us in a very good place to respond to the Pandemic

VULNERABILITY INDEX

WHAT

▶ For every household in the Borough:

  ▶ The criteria they meet

  ▶ The household composition

  ▶ Their overall 'vulnerability score'

HOW

▶ 26 datasets, internally and externally sourced.

▶ Automated, cleansed, quality assured, matched to common identifiers.

▶ Cohort targeting – "find me properties which have A, B and C characteristics"

▶ Weighted measures, composite scores. "Which are the most vulnerable?"

▶ Robust methodology – cross correlation, deduplication and refinement.

▶ Significant progress in master data management, 'single view of customer.'

Who are our most vulnerable people?

COMPONENTS

VI Score — Index representing the relative overall extent of vulnerability

Dimensional Index Scores — Index representing the extent of vulnerability in each dimension

Dimensions — Categorisation of indicators into one or more 'dimensions' of vulnerability

Scores — A weighted assessment of the relative value of each criteria, created by multiplying the indicator value by the weighting

Indicators — A measure of whether specific criteria are met, expressed either as a binary value (0 or 1) or a scale (between 0 and 1)
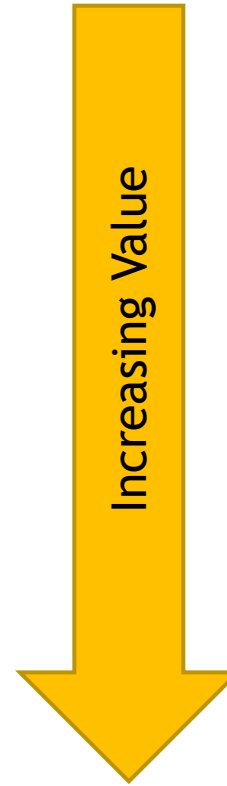
DATA SOURCES

▶ some existing sources from Data Warehouse

▶ many new sources added

▶ some sources provided by external organisations

▶ guidance from the LGA on possible sources of data

|				
NHS 'High Risk' / Shielded patient list (medical reasons)	Adult Social Care (clients and carers)	Berneslai Homes tenants	Waste Management Assisted Collections	CRM
Electoral Roll	Children's Social Care cases	CSC foster carers	Education – latest school census	Library borrowers
BMBC staff	Staff with enhanced DBS	Benefits claimants	Council Tax single person discounts	Free school meals
EHCP and SEND	0-19 service users	Pregnancy	C19CC Volunteers, Organisation and Individual Requests	Disabled Facilities Grant
0-19 'Extremely Vulnerable'	Yorkshire Water vulnerable people flags	Blue Badge holders	Council tax - single person discounts	Northern Power Grid vulnerability flags

PROCESS (PER DATA SOURCE)

▶ Data cleansing and standardisation

▶ **Match addresses to corporate gazetteer to get the UPRNs**

▶ Load to data warehouse

▶ Create as individual layer in GIS

▶ Create map views

▶ Create PowerBI summary

▶ Add to Vulnerability Index

Increasing Value

All data sources linked on the UPRN

WHAT HAPPENED AS A RESULT?

▶ We undertook targeted comms with our most vulnerable citizens

▶ Letters – Phone Calls - Visits

▶ 87% of the requests received by the emergency contact centre came from households which had been identified by the Vulnerability Index.

▶ Tracked the extent to which we've reached our vulnerable residents
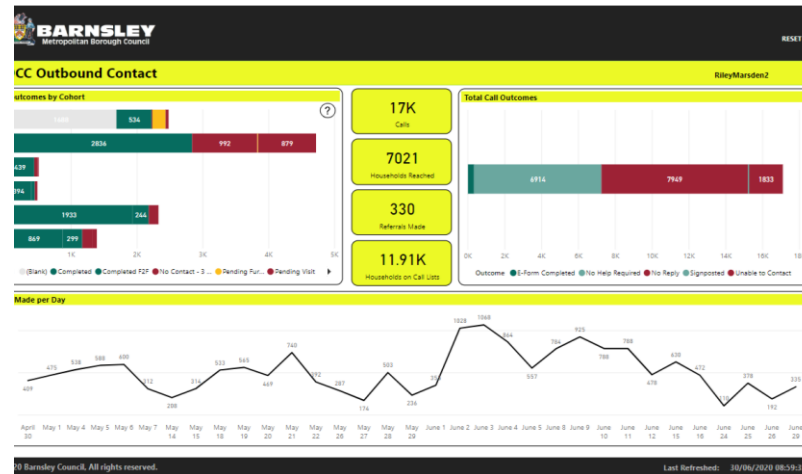
300+ households took up support who were ONLY identified through our data nothing else - some of them in critical need.

TEST AND TRACE

WHAT

▶ Case management system used and supported 7 days a week. Eliminates any need for interpretation of PHE provided data.

▶ Enables local contact tracing, welfare calls and rapid testing.

▶ Provides data for 'Daily SitRep' meetings, trend and pattern analysis – answering questions. Slicing test and case data by geography, time, deprivation, etc.

▶ Enables 'deep dive' by BI Advisors to support PH team – common exposures, activities, employers, care homes, household clusters etc.

HOW

▶ Very hard work, very complicated, ever changing. 8 national databases, 12 semi-automated workflows, and definitely the most complex PowerBI report we've built to date!

▶ Set up and ready to be extended to support local rapid testing programme within 3 days of being engaged in discussion.

How linking data facilitated our long term response

PROCESS

▶ Each day per data source

    ▶ Data cleansing and standardisation

    ▶ **Match addresses to corporate gazetteer to get the UPRNs**

    ▶ Load to data warehouse

▶ Each day across all datasets

    ▶ Link external and internal datasets

        PHE, NHS, Electoral Role, Council Tax, Deaths, Care Homes, Schools

    ▶ Create Cases in Case Management Tool

        Requestry: in house tool developed by IT Colleagues

    ▶ Update PowerBI reports

Increasing Value

UPRNs are a keystone in this process

WHAT HAPPENED AS A RESULT?

- We made thousands of outbound calls

- Both for Contact Tracing and Welfare

- We always had up to date and accurate data about the spread of the disease

- We were able to offer robust intelligence to Barnsley's respond to the pandemic

Regularly reached people on day 2 or 3 of their isolation who the National call centre couldn't reach, and enabled them to take up support services, claim payments etc.

WHAT WE DID NEXT

▶ In April 2021 a group of stakeholders met to discuss plans to development the vulnerability index for further use in the Barnsley Integrated Care Partnership.

▶ **Required a move from Household to Person Level data**

▶ 4 initial "use cases" for the Barnsley Vulnerability Index were identified:

Problem	Solution
Prioritise recovery in planned care.	Create a list of people with a vulnerability score that is matched against the hospitals patient waiting list. Then identify people that are most in need (NHS / Hospital).
Decision support at the point of care.	Looking at the system wide approach – identifying across the best placed service to provide the most appropriate support (NHS / BMBC / others).
Warm homes healthy people.	As part of the hospital discharge pathways, identifying those who would benefit most from support to improve housing to improve health and wider outcomes (BMBC / Berneslai Homes).
Proactive case finding for anticipatory care.	Significant work over recent years to improve health and care in care homes but most people who are frail are living in their own homes (BMBC – ASC).

KEY LESSONS LEARNED

▶ The importance of being asked to answer a question, or design a solution to a problem, rather than simply be asked to supply some data.

▶ The need to be adequately represented in strategic groups at the outset. When this happens, we can usually contribute to the formulation of a more effective strategy, than when requirements are 'fed down.'

▶ Maintaining and nurturing positive relationships with key individuals so they understand 'the art of the possible.'

▶ Experience of gathering, processing and matching individual level data within the data warehouse. Need for further standardisation.

▶ Methodologies for creating composite scores and the Vulnerability Index.

▶ Techniques for capturing and storing individual-level data to enable aggregation for rates, time-series analysis, multi-dimensional analysis.

▶ Methods for (and importance of) training and supporting users. In particular, remote demonstrations, recording of training sessions and use of MS Teams chat channels.

NOTES ON OUTPUTS

- We benefit hugely from having control over our own technology for data processing, storage and presentation, so can create highly customised solutions for users.

- Tools used were:

  - FME – our extract, transform and load tool.

  - Microsoft SQL Server – for database design and storage

  - Aligned Assets Gazetteer Management System – for matching datasets to our LLPG

  - StatMap GIS – for presenting map-based outputs

  - Microsoft PowerBI – for data visualisation and presentation

  - Requestry – in-house Case Management & E-Forms system

- Whilst the methodology behind the Index score was a little complex to explain, users trusted the overall score and found the 'markers' extremely useful for understanding residents needs.

- Access to the reports are strictly limited to staff handling calls in the emergency contact centre, and covered by a specific data sharing agreement.

- Staff are clearly and frequently reminded that the data is a **guide** to help understand resident needs, and should not be used to make decision. The Vulnerability Index is used to prioritise pro-active support offers to residents, for services which are available and promoted to all.

THANKS FOR YOUR TIME

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BARNSLEY
Metropolitan Borough Council

COVID VULNERABILITY INDEX

- Property level index of vulnerability built by creating 28 vulnerability 'flags' from source datasets.

- Each flag given a weighting from 1-5 (5 high) by subject matter experts.

- Flags multiplied by weightings and summed to create a total score.

- Score normalised on a scale of 1-100

- Scores of 0 removed

- Distribution analysed

- Index value created (scores above and below average of 100)

- Priority A, B, C and D categories defined.

NOTES ON METHODOLOGY

▶ Index is created by linking data at the household level via the UPRN.

▶ This creates a margin for error if addresses are inconsistently recorded, incorrectly matched, or are not temporally identical.

▶ But we determined that COVID-19 was intrinsically a 'household' issue, so the approach was valid.

▶ None of the team were particularly familiar with the techniques used here. Undoubtedly there will be better and more effective ways to create these outputs – we just had to go with what we knew and could get advice on.

COVID VULNERABILITY INDEX FLAGS

Flag ID	Flag type	Flag name	Source	Trigger	Hhold Count	Weighting	LGA Category	Physical Health	Mental Health	Social Isolation	Child Vulnerability	Financial Vulnerability
1	Age	FLAG_ELDERLY	Elections, benefits, BH, CRM	Any household that is identified on the Electoral Register, Benefits, Social Housing Tenants or CRM systems as containing someone over the age of 70	24957	4.75	People vulnerable to health risk of COVID-19				1	
2	Living Alone	FLAG_Lives_Alone	Adult Social Care, Elections, Benefits, BH, CRM	Any Household containing a person that is flagged in the Adult Social Care system as living alone, or can be identified as living alone from Elections, benefits or BH	41203	4.5	People already with some links into care and support systems				1	
3	Health	FLAG_YW_HIGH_RISK	Yorkshire Water	High Risk - Any Household flagged as High Risk on Yorkshire Water's Priority Service Register, usually due to requiring a permanent water supply due to medical equipment being on site (Dialysis machines etc.)	310	4.75	People vulnerable to health risk of COVID-19	1				
4	Health	FLAG_NPG_MEDICAL	Northern Power Grid	Any Household that is identified on the NPG Priority Service Register as requiring a permanent power supply due to medical equipment being onsite (Ventilators etc.)	3408	5	People vulnerable to health risk of COVID-19	1				
5	Health	FLAG_ASC_HealthCondition	Adult Social Care	Any Household containing a person that is flagged in the Adult Social Care system as having either a respiratory condition or health condition	2549	5	People vulnerable to health risk of COVID-19	1				

Microsoft Excel Worksheet

5 flags shown as example.

Each indicator was given a weighting based on the averages of a group of subject matter experts. Indicators were also classified into a range of 'dimensions' of vulnerability, which enabled us to create a separate index score for each dimension. This may be more useful in future.

COVID VULNERABILITY INDEX METHODOLOGY EXAMPLES

UPRN	FLAG_BH_PhysicalDisability	FLAG_BH_SensoryDisability	FLAG_BH_MentalHealthFlag	FLAG_NPG_MEDICAL	FLAG_NPG_MOBILITY	FLAG_BH_PhysicalDisability_SCORE	FLAG_BH_SensoryDisability_SCORE	FLAG_BH_MentalHealthFlag_SCORE	FLAG_NPG_MEDICAL_SCORE	FLAG_NPG_MOBILITY_SCORE	TOTAL SCORE	NORMALISED SCORE	INDEX	PRIORITY GROUP
1	0	0	0	1	1	0	0	0	5	3.25	33.25	100	304.5802	PRIORITY A
2	1	1	0	0	0	3.5	2.75	0	0	0	11	33.08271	100.7634	PRIORITY B
3	1	0	0	0	0	3.5	0	0	0	0	8.25	24.81203	75.57252	PRIORITY C
4	0	0	1	0	0	0	0	3.5	0	0	6	18.04511	54.96183	PRIORITY C
5	0	0	0	1	0	0	0	0	5	0	5	15.03759	45.80153	PRIORITY C
6	0	0	0	0	0	0	0	0	0	0	2	6.015038	18.32061	PRIORITY C

NB: Not all markers displayed, so totals don't match!

COVID VULNERABILITY INDEX
FLAG CORRELATIONS

	FLAG_BI	FLAG_BI	FLAG_BI	FLAG_NI	FLAG_NI	FLAG_NI	FLAG_NI	FLAG_0-	FLAG_PI	FLAG_YV	FLAG_YV	FLAG_YV	FLAG_EI	FLAG_W	FLAG_BI	FLAG_SI	FLAG_AS	FLAG_AS	FLAG_AS	FLAG_EI	FLAG_DI	FLAG_SI	FLAG_EI
FLAG_BH_PhysicalDisability	x	33%	24%	8%	8%	2%	1%	0%	0%	1%	7%	1%	1%	7%	13%	2%	10%	2%	0%	60%	1%	2%	3%
FLAG_BH_SensoryDisability	50%	x	23%	6%	6%	4%	1%	0%	0%	1%	8%	2%	1%	6%	10%	2%	11%	3%	0%	64%	1%	2%	3%
FLAG_BH_MentalHealthFlag	30%	20%	x	11%	9%	2%	7%	0%	1%	1%	7%	1%	3%	3%	8%	2%	6%	1%	1%	27%	1%	12%	12%
FLAG_NPG_MEDICAL	8%	4%	9%	x	1%	0%	1%	0%	1%	1%	4%	0%	7%	1%	6%	2%	5%	1%	0%	14%	7%	9%	10%
FLAG_NPG_MOBILITY	11%	6%	10%	1%	x	1%	0%	0%	1%	1%	5%	0%	6%	2%	8%	1%	6%	2%	0%	20%	9%	8%	8%
FLAG_NPG_SENSORY	9%	13%	6%	2%	3%	x	1%	0%	1%	1%	5%	2%	5%	3%	7%	2%	5%	3%	0%	32%	7%	8%	8%
FLAG_NPG_MENTAL_HEALTH	3%	3%	20%	2%	1%	1%	x	0%	2%	0%	3%	0%	5%	1%	4%	1%	3%	1%	1%	13%	4%	11%	11%
FLAG_0-19_HIGH_RISK	0%	1%	5%	13%	3%	1%	1%	x	6%	0%	2%	0%	23%	1%	9%	17%	7%	2%	0%	6%	7%	22%	25%
FLAG_PREGNANT	1%	1%	3%	3%	2%	1%	2%	0%	x	0%	2%	0%	3%	0%	3%	0%	0%	0%	0%	6%	2%	18%	10%
FLAG_YW_HIGH_RISK	12%	7%	9%	10%	9%	3%	1%	0%	1%	x	51%	15%	3%	6%	10%	5%	12%	3%	0%	44%	11%	5%	4%
FLAG_YW_VULNERABLE	9%	7%	7%	5%	5%	1%	1%	0%	1%	5%	x	2%	1%	3%	6%	1%	5%	1%	0%	37%	5%	7%	3%
FLAG_YW_SENSORY_IMPAIRMEI	20%	25%	13%	6%	8%	10%	2%	0%	1%	26%	40%	x	2%	9%	12%	2%	11%	5%	1%	52%	10%	3%	6%
FLAG_EDU_EHCP	2%	1%	4%	12%	8%	2%	3%	1%	2%	0%	2%	0%	x	0%	5%	1%	5%	2%	0%	7%	7%	21%	28%
FLAG_WM_PhysicalHealthFlag	22%	12%	6%	3%	6%	2%	1%	0%	0%	2%	7%	1%	1%	x	12%	2%	14%	3%	1%	85%	12%	1%	1%
FLAG_Blue_Badge	10%	6%	5%	4%	5%	1%	1%	0%	1%	1%	4%	0%	2%	3%	x	2%	6%	2%	0%	35%	7%	5%	4%
FLAG_Shielded	10%	6%	5%	8%	4%	1%	1%	2%	1%	2%	5%	0%	1%	2%	9%	x	5%	1%	0%	38%	6%	3%	2%
FLAG_ASC_HealthCondition	14%	11%	7%	7%	6%	1%	1%	0%	0%	1%	5%	1%	4%	6%	11%	2%	x	22%	4%	56%	15%	1%	3%
FLAG_ASC_DisabilityRegister	10%	13%	6%	7%	8%	3%	1%	0%	0%	1%	6%	1%	6%	5%	14%	1%	86%	x	1%	43%	18%	1%	2%
FLAG_ASC_MentalHealthTeam	3%	6%	24%	9%	2%	0%	7%	0%	0%	0%	7%	1%	1%	5%	2%	1%	87%	4%	x	26%	6%	4%	2%
FLAG_ELDERLY	9%	6%	3%	2%	2%	1%	1%	0%	0%	1%	4%	0%	1%	4%	6%	1%	6%	1%	0%	x	7%	2%	1%
FLAG_DFG	1%	0%	1%	7%	8%	1%	1%	0%	1%	1%	4%	0%	4%	4%	9%	2%	11%	3%	0%	48%	x	4%	3%
FLAG_SINGLE_PARENT_FAMILY	1%	1%	5%	4%	3%	1%	2%	0%	3%	0%	3%	0%	6%	0%	3%	0%	0%	0%	0%	6%	2%	x	29%
FLAG_EDU_FSM	3%	2%	8%	8%	5%	1%	3%	1%	3%	0%	2%	0%	13%	0%	5%	1%	2%	0%	0%	7%	3%	49%	x

Correlations used to identify indicators which might 'double count' a household – then used to adjust weightings

COVID VULNERABILITY INDEX DISTRIBUTION
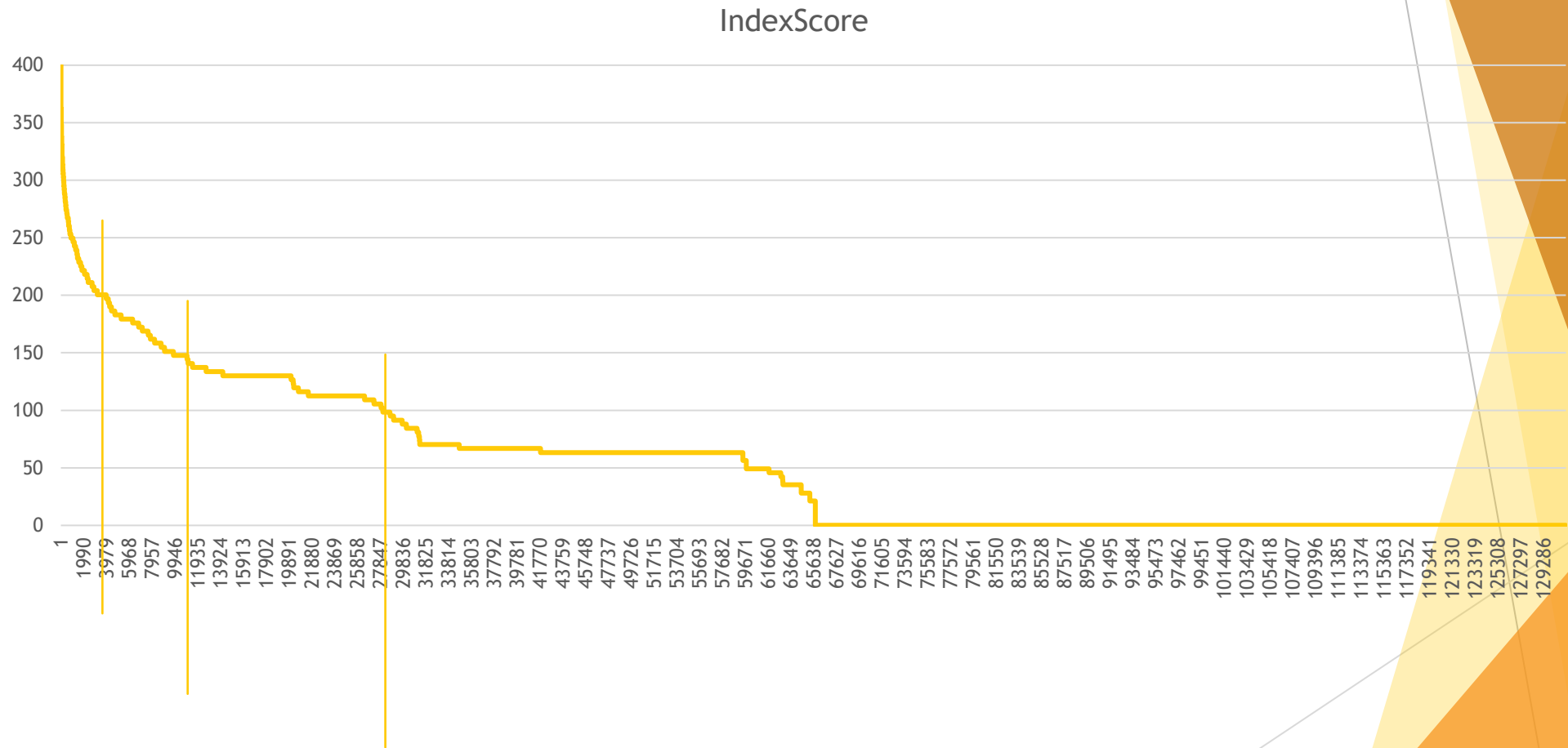
Index scores were ranked and plotted on a chart to understand distribution. There was no science applied here at all, we just picked what looked like natural break points in the distribution.

PRIORITY GROUPS IDENTIFIED

Priority Group	Description	Count	% of Vulnerable Households	% of All Households	Mean Total Index	Mean Physical Health Index	Mean Mental Health Index	Mean Social Isolation Index	Count for Contacts
Priority A - NHS Shielded	Households identified by the NHS Shielding Criteria	6586	10.01	5.02	145.68	132.27	91.32	100.54	6314
Priority A - Other	Households identified by BMBC criteria Index Score > 200 (more than twice the average, against all households identified as vulnerable) Multiple vulnerabilities across a range of criteria	2279	3.46	1.74	233.47	137.18	111.85	137.11	1470
Priority B	Households identified by BMBC criteria Index Score > 150 Vulnerabilities across a range of criteria or heavily weighted vulnerabilities in narrow criteria	4703	7.15	3.58	172.76	93.03	97.53	131.53	3985
Priority C	Households identified by BMBC criteria Index Score > 100 (above average) Vulnerabilities across a smaller number of criteria Includes households with residents aged over 70 and alone with no other criteria	17137	26.04	13.05	122.95	77.46	107.94	125.92	16551
Priority D	Households identified by BMBC criteria Index Score below 100 (below average, against all households identified as vulnerable) Vulnerabilities across a single criteria or a small number of lesser weighted criteria Includes households with residents aged over 70 who are not known to be living alone	35104	53.34	26.74	61.83	75.94	92.84	75.79	34578
Total		65809	131274.00	50.13					62898

Priority groups were used to plan outbound contact – first by letter then by telephone for specific identified groups.

Numbers shown are at the time the Index was created.