

Workshop: 1C

The Practical Application of Data to Target Damp & Mould

Speaker:

Ian Gardner

Assistant Director – Property Services

Wolverhampton Homes

Room: C



**NHMF
Maintenance
Conference
2024**



Customer Segmentation

- Segmentation is an important strategic tool to help us really understand our customers and support the design of our future services
- Each segment is a group of customers who are different to other customer segments with distinct and identifiable needs, attitudes, strengths and feelings.
- 1,100 customers responded. The survey contained over 50 statements and questions to gain insight into our customers' lives, experiences, personalities, strengths and challenges.
- 95% confidence level
- Evidence to suggest our customers needs are changing, but their individual needs and daily lives vary considerably

Customer Segmentation

Difficulties affecting the daily lives of our customers

More than two thirds of our customers have at least one condition that affects their day to day life, and 41% of customers have three or more conditions. This information highlights some of their main difficulties.

72% of customers have at least one condition that affects them on a daily basis



Physical conditions

Conditions affecting physical health including illness and diseases such as: *Arthritis, Fibromyalgia, Diabetes, Asthma, COPD, Heart disease*



Mental health conditions

Conditions affecting mental health and specific disorders such as: *Depression, Anxiety, OCD, PTSD, Eating disorders, Bipolar, Schizophrenia*

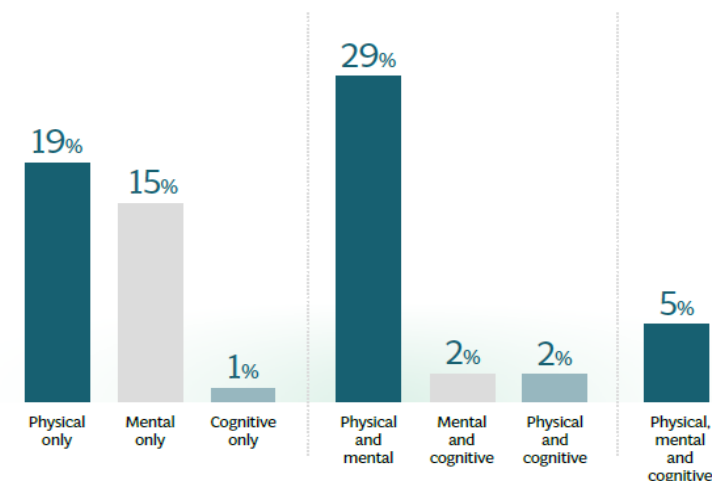


Cognitive conditions

Conditions affecting capability (can have mental and physical components) such as: *Learning Disabilities, Dyslexia; Developmental disorders, Autism, Asperger's, ADHD; Neurodegenerative diseases, Alzheimer's, Dementia; Neurological disability, brain injury, Aphasia*

72% experience physical, mental or cognitive conditions

23% use some kind of mobility aid

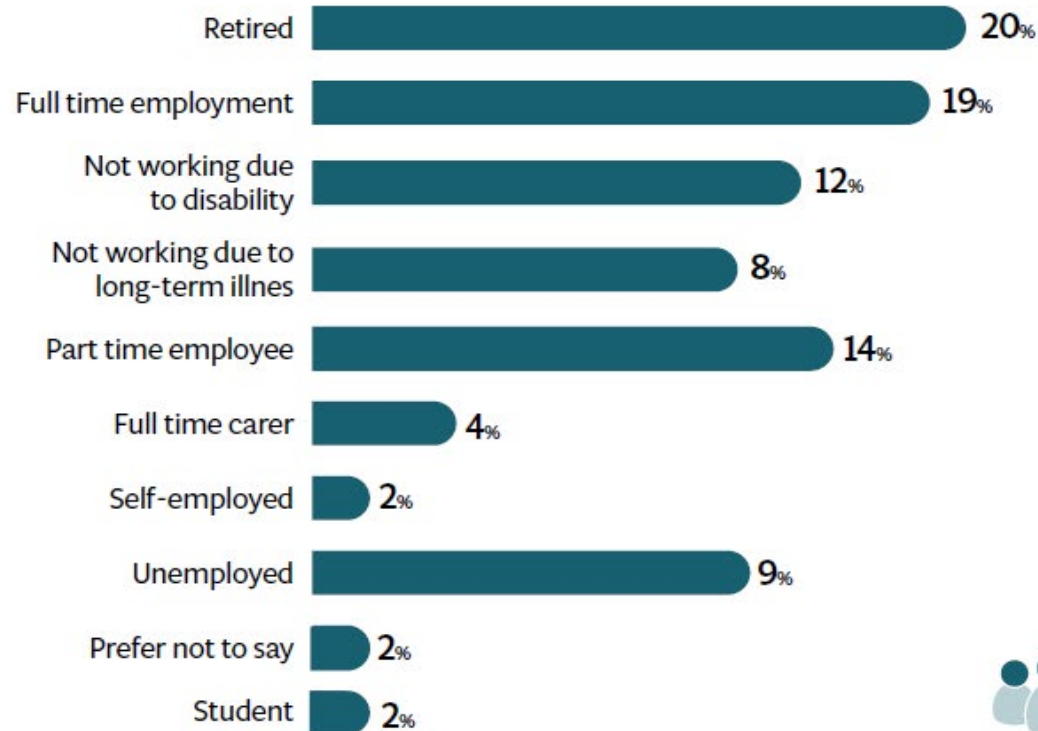


Customer Segmentation

#GOODTOGREAT

Identifying common themes

Employment status



Around **32%** have a household income of less than £10,000



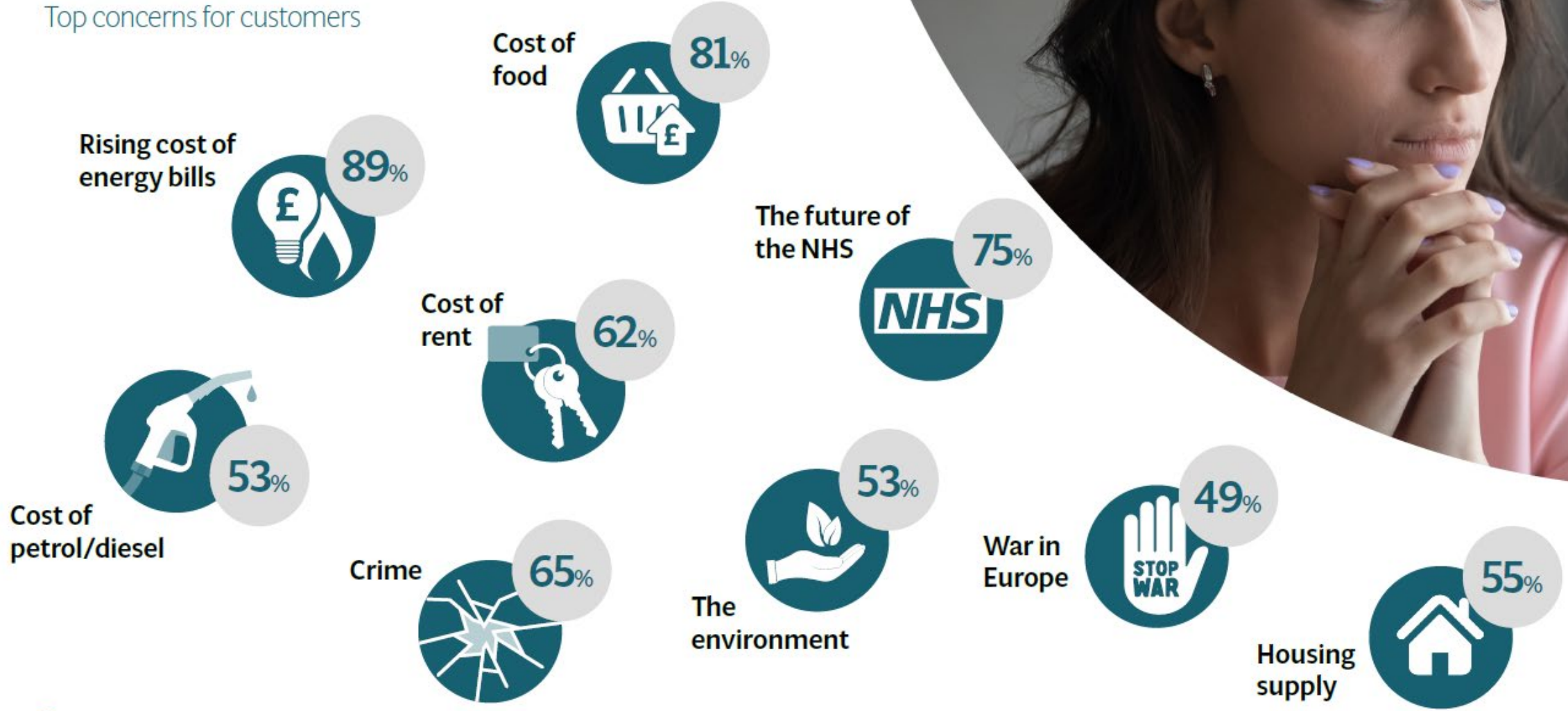
18% of customers are carers



Customer Segmentation

Identifying common themes

Top concerns for customers





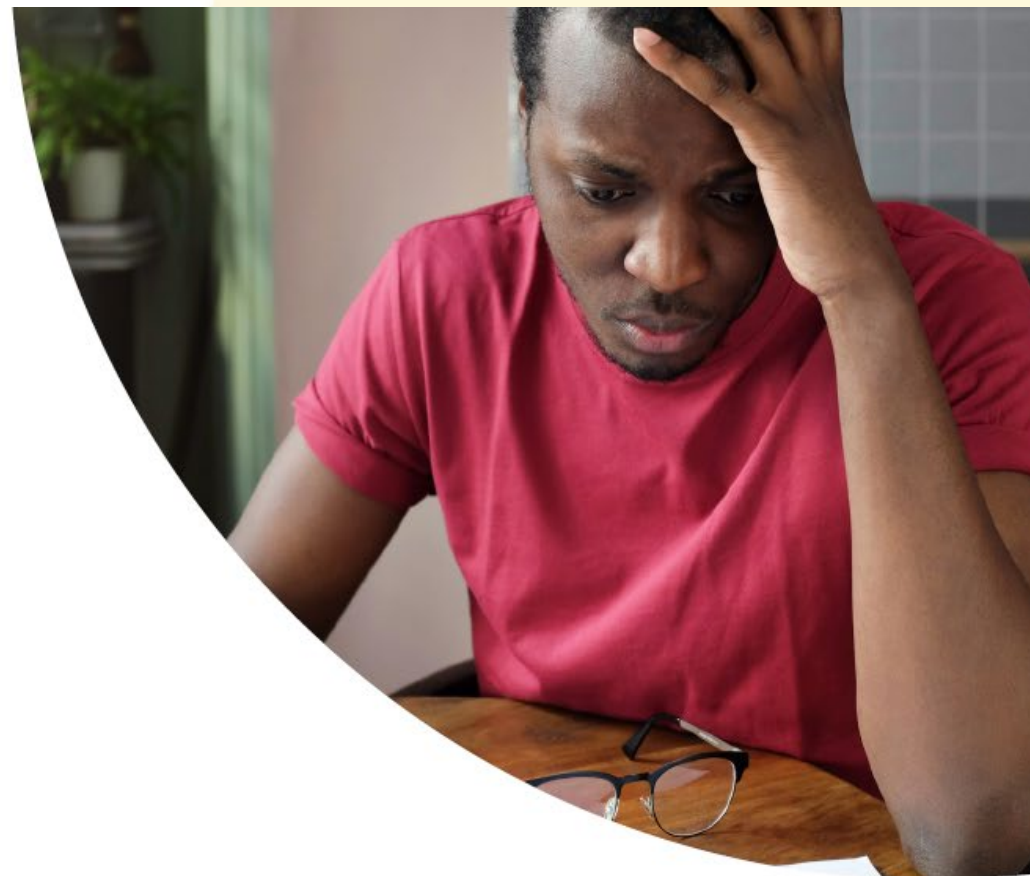
Personal feelings (%)

I feel anxious most of the time	53	6	31	45	89	91	98
I feel lonely a lot of the time	38	11	31	25	56	60	76
I find it easy to complain if I need to	57	81	70	68	37	38	17
I feel isolated in my home	24	2	20	11	37	39	69



Financial perspectives (%)

I struggle to pay my bills each month	33	6	19	35	50	37	75
I'm very good at managing my money	58	89	79	48	37	58	13
I am in debt and struggling to pay it off	30	7	10	35	55	20	75
I have little or no savings	69	37	61	79	83	77	90



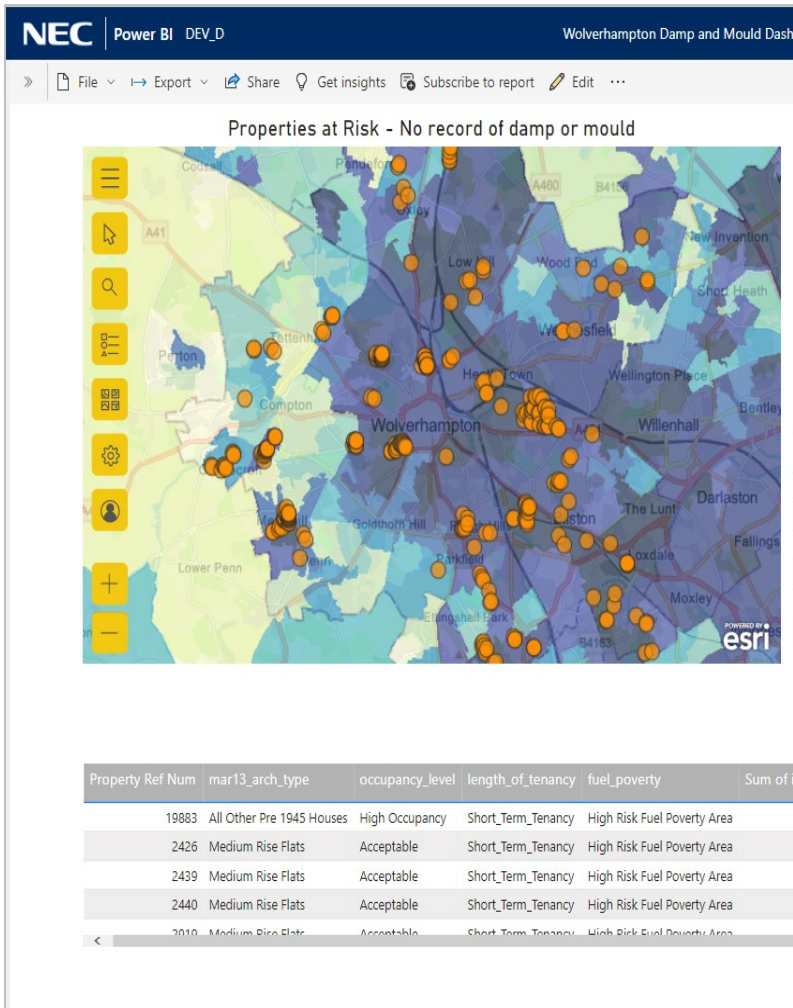
Customer Segmentation – next steps

#GOODTOGREAT

- Segmentation findings to be included in design of our new Resident Engagement Strategy (will also support the RES required for the Building Safety Act)
- Promote a wide range of channels for customers to advise us of their needs or vulnerabilities
- Development of tailored communication methods, App notifications, SMS, Letter, Face-to-Face, etc
- Service Planning & Policy development and reviews to consider options for variable service offers, subject to compliance with Equality Act
- Enhancing data and predicative analytics to consider probability of different 'segments' experiencing DMC related issues.

Predictive Analytics – finding the silence

#GOODTOGREAT



- Brand new module developed through collaboration with NEC and other RP's
- Full view of stock to identify damp and mould risk
- Multilayered structured and unstructured data sources;
 - Inspection – Yes/No outcomes, SOR's, Fuel poverty statistics (MHCLG) + Deprivation indices (ONS) + Flood risk (EA), sentiment, data mining,
- 134 elements of household and environmental data
- Mapping layers can be added e.g. Flooding Zones
- Example shows – Index of Multiple deprivation (IMD 2019) – Darker Blue = Greater deprivation
- Identify trends and correlations in property attributes e.g. lowest performing and best combinations to inform future investment

Predictive Analytics

Common Predictor variables for Damp and Mould



Property

- Age and condition of housing stock
- Architecture type (MRA13)
- Energy efficiency (EPC)/(SAP)
- Insulation / Damp Proofing
- Number of repairs Floor Level – Basements/Upper level



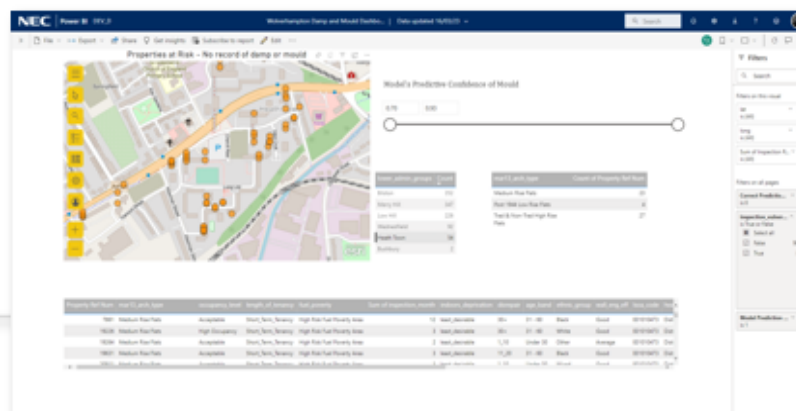
Places

- Deprivation Scores (IMD 2019)
- Indoors Deprivation – Sub-Domain (IMD)
- Lower Admin Units



People

- Household demographics –Age Group
- Employment Status of Tenant
- Fuel poverty indicators
- Rent Payment Activity
- Over Occupancy Indicator
- Sociodemographic Groups
- Vulnerability Flags
- Length of Tenancy



Live data feeds into machine learning model

Inspection Mould	Inspection Vulnerable	Inspection Report	Heating System	Property Arch Type	Indoors Deprivation	Inspection Severity	Tenant Occupancy Level	# of Tenants	Gender	Universal Credit	# of Repairs
True	False	Damp in kitchen by back door	Unknown	Pre 1945 Small Terraced House	2.00	False	Acceptable	1	M	N	16
False	False	Inspector required tenant requesting to see inspector about a new front door very old wooden door and frame starting to rot her partner is disabled and struggles to open and shut door	Gas Fired Heating	Post 1974 House	4.00	False	Acceptable	4	M	Y	20
False	False	Holes in lounge area and kitchen internally and holes in brickwork from rats externally, will need filling in	Unknown	Pre 1945 Small Terraced House	3.00	False	Acceptable	1	M	N	75
True	False	Please inspect damp in l/rm kitchen walls & bed 1 & 2 ceilings	Gas Fired Heating	Pre 1945 Small Terraced House	2.00	False	Acceptable	5	M	N	7

↑
Content analysis via tenant notepads

↑
Content analysis on inspection report

↑
Property elements

↑
External Statistical data e.g. fuel poverty / indoors deprivation (ONS-2019)

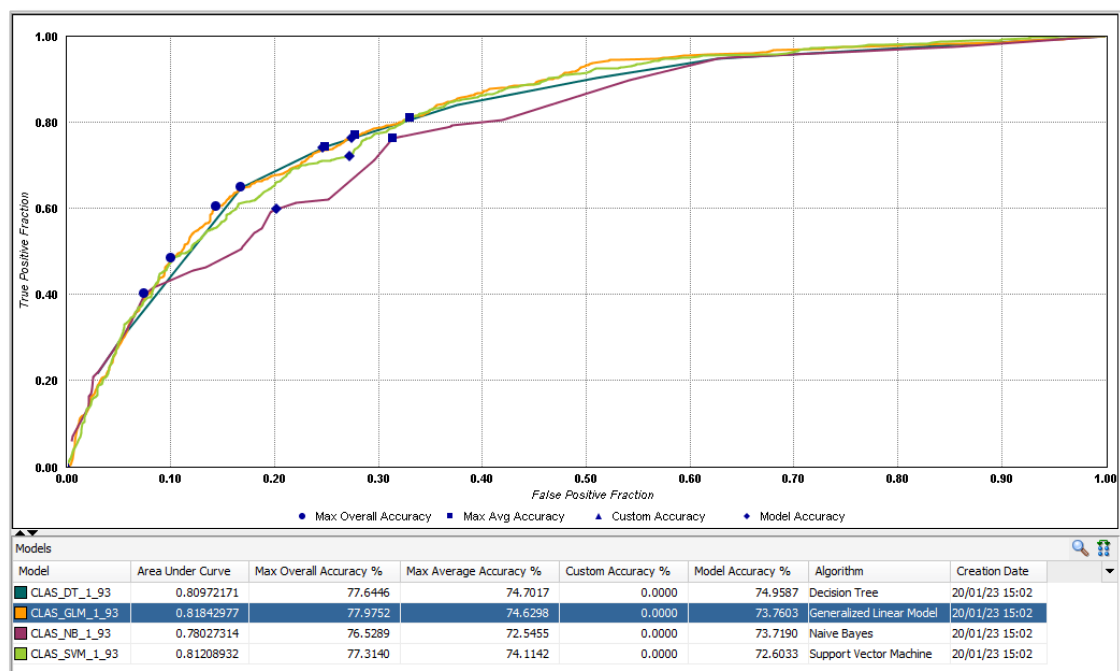
↑
Estates

↑
Rents
** In Stage 2 development*

↑
Repairs



Identified key predictive features for reported Damp & Mould and compare machine learning models performance for accuracy of data feeds



* Different machine learning models compared for accuracy. GLM model was selected

- 50+ potential variables used to prediction model
- 8 were statistically significant factors / good indicators of potential mould
- Prioritise properties with >70% probability of damp or mould

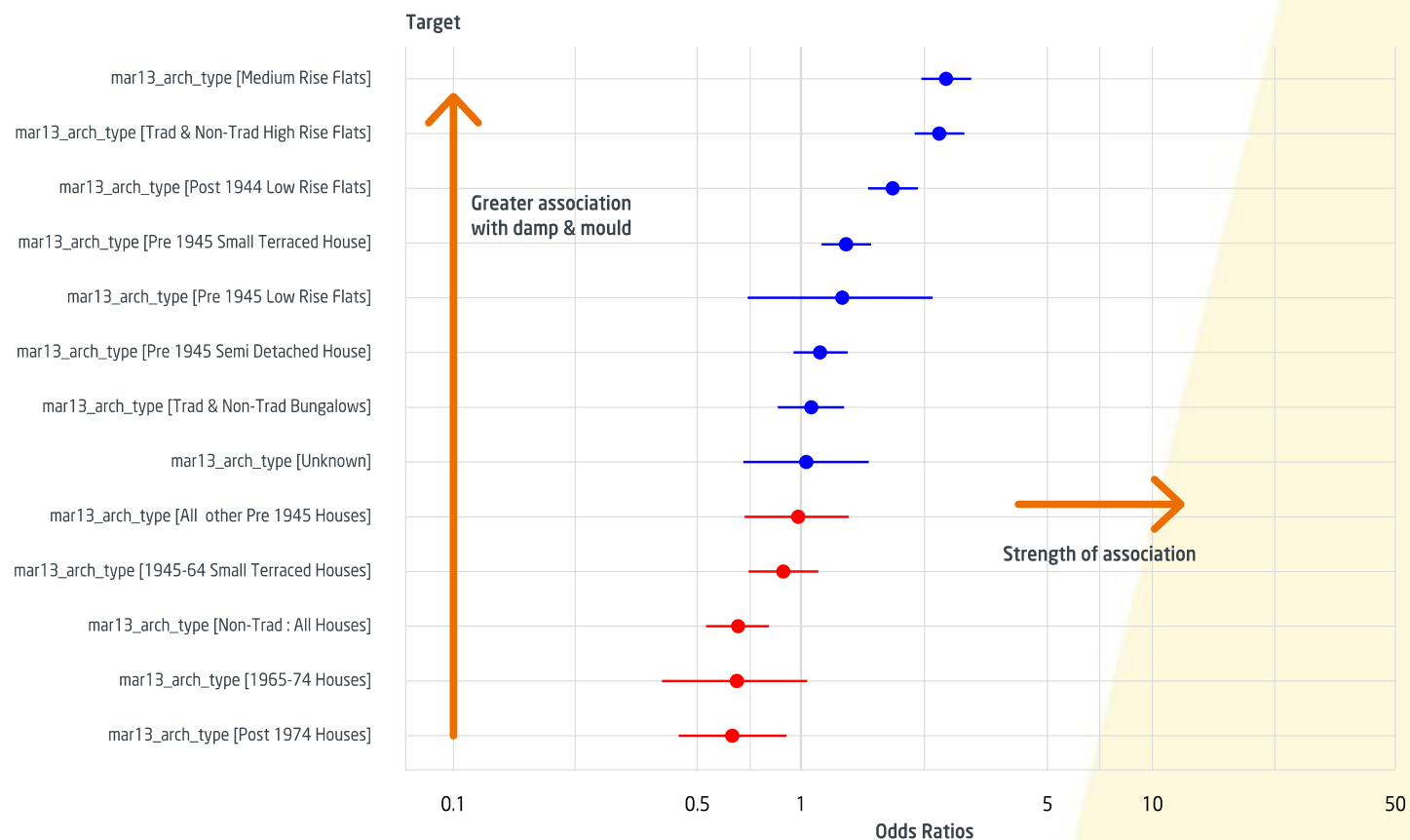
Statistically significant variables (examples)

- Architecture type (Medium rise flats)
- Heating type (*Electric / District*)
- Above average number of repairs
- High occupancy rates (ratio of #of tenants/rooms)
- Areas with Poor Indoors Deprivation (IMD 2019)
- Admin Units / Estates

We are not suggesting that the above variables drives the presence of Damp & Mould, only that the model identifies it as a **correlating factor** and thus one which has certain predictive power. Some variables will have greater association than others.

Live Probability/Odds Ratios determined for each potential variable

Damp and mould risk



Housing – Architecture type

High association with reports of damp & mould

- Medium rise flats
- Traditional & non-traditional high-rise flats
- Post 1944 low rise flats

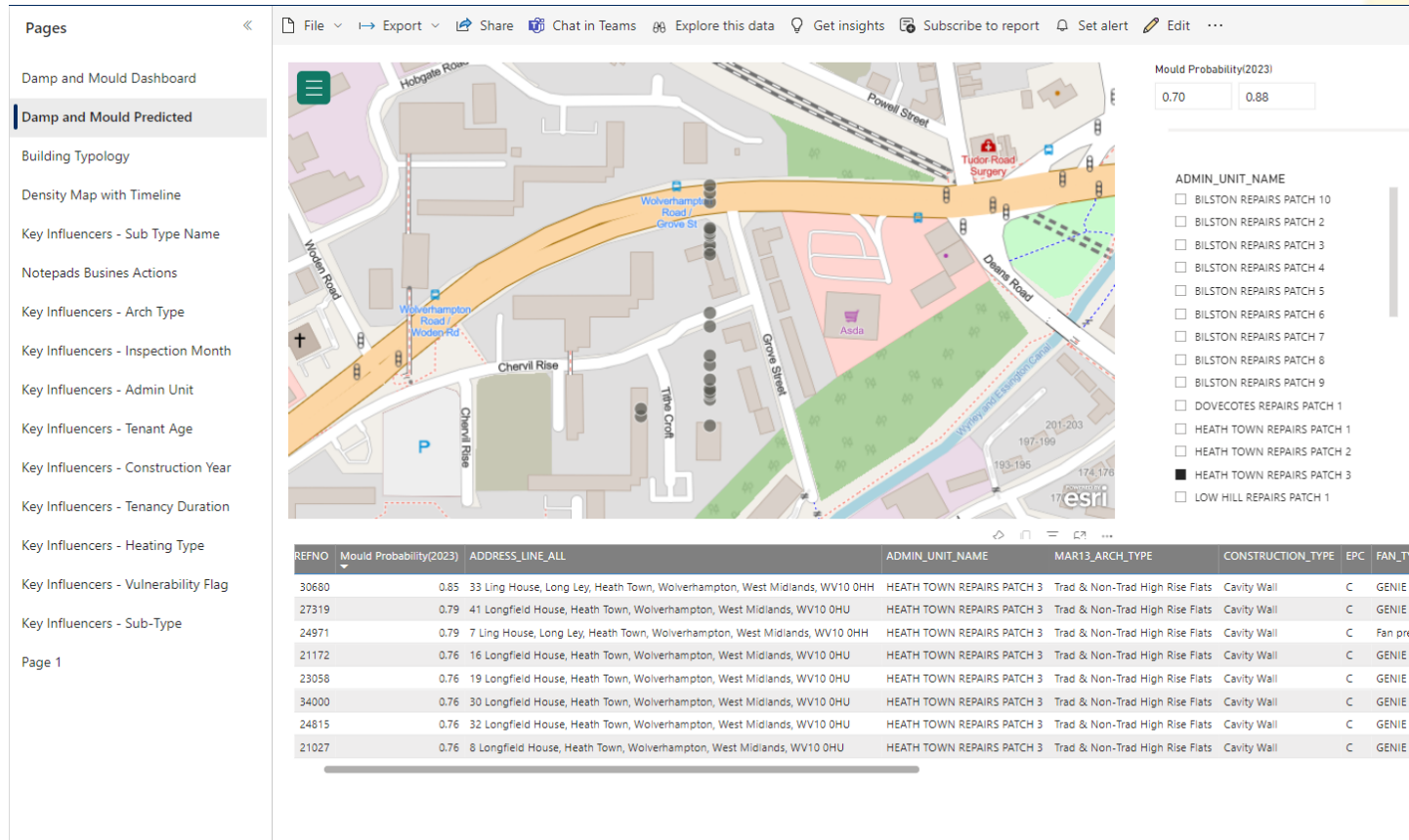
Low association with reports of damp & mould

- 1965 – 74 Houses
- Post 1975 Houses

Predictor Variables

Predictor Variable	Analysed & Significant assessment	Notes
Lower Admin Unit (Location)	Strong Significance	HT / MH areas with highest likelihood of damp and mould
Construction - Architype	Strong Significance	Medium Rise Flats / Pre 1944 Low rise flats / Trad and Non-Trad High Rise Flats significantly greater risk of damp/mould
Construction - Sub type	Strong Significance	High-Rise (6 storeys or more) / medium rise (3-5 storeys)
Construction - Year	Moderate Significance	Most likely damp and mould in construction years < 1950
EPC Certificate	Weak Significance	EPC Certificates D/E/F - more likely damp and mould -but weak significance - Potential data quality issues
Flood Risk by Postcode	tbc	tbc -additional work required but some correlation found in PA Housing
Floor Level - Ground/Basement or Top Floor Level)	Weak Significance	Weak significance / Ground floor flats most likely damp and mould
Heating System Type (Electric/Gas)	Moderate Significance	District Heating and Electric Heating more likely damp and mould
Length of Tenure	Moderate Significance	Mould least likely in longer term tenancies (above average length)
Loft Insulation Thickness (>200 mm) -	tbc	tbc (depth / mm recorded in only 4,500 properties)
Main Tenant Age	Moderate Significance	Older tenants (>59) least likely damp and mould. <30 most likely
Number of Reported Repairs (within 3 Years)	Moderate Significance	Mould most likely where repairs are above average (2 standard deviations)
Occupancy Level	Moderate Significance	Mould most likely where occupancy level is high (ratio of tenants/rooms)
Poverty indicator - Rent Amount	Moderate Significance	tbc - *preliminary analysis suggests a positive correlation to higher rents/damp and mould * see Rents Damp Mould
Primary Wall Structure	Strong Significance	
Remaining life of Ventilation component (bathroom/Kitchen Fan)	No Significance	Where fans 'remaining life' exceeded no significance to damp and mould was found
Socio-demogrphic profiling (LSOA)	tbc	tbc - *preliminary analysis suggests a higher risk in demographic clusters - 'Constrained Flat Dwellers/Inner City Ethnic Mix
Index of Multiple Deprivation - Sub Domain (Indoors domain)	Moderate Significance	Properties in areas of poor indoors deprivation (failing decent homes standard) greater risk of damp and mould

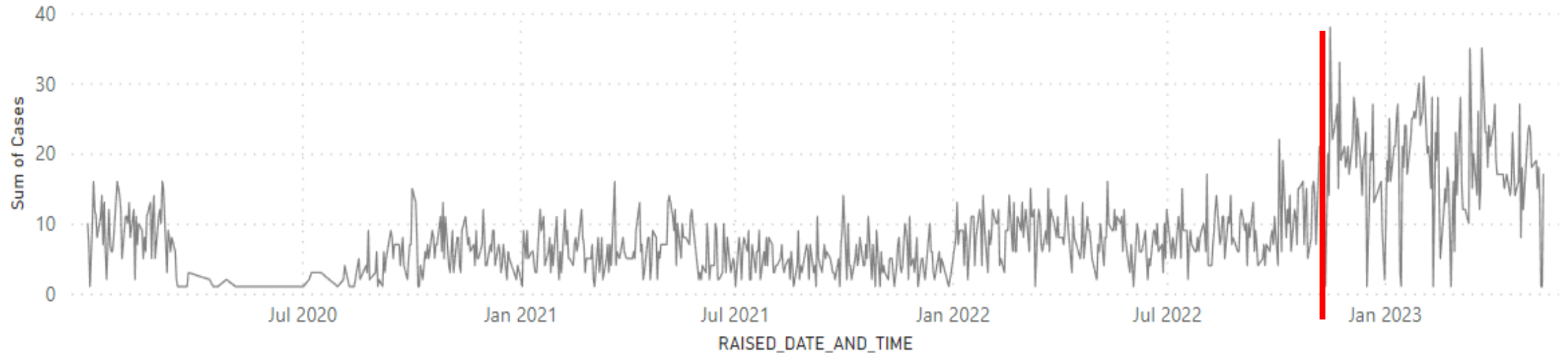
Damp & Mould – Predictive Modelling Dashboard



- Model Probability column displays the predictive risk score for damp and mould
- Model will be rerun at least yearly and predicted score compared against the previous time period. Evaluation of impact of investment.
- Filter/Slider adjusts the display according to model predictive confidence.
- Filters available for mentions of tenant vulnerability or Admin Units.



and what we found...



- Timeline confirmed what we already knew

D&M Dashboard (timeline) showing the volume of requests. Covid period can clearly be seen as well as the increase in reports when the issue was publicised by the regulator.
- Animated mapped timeline

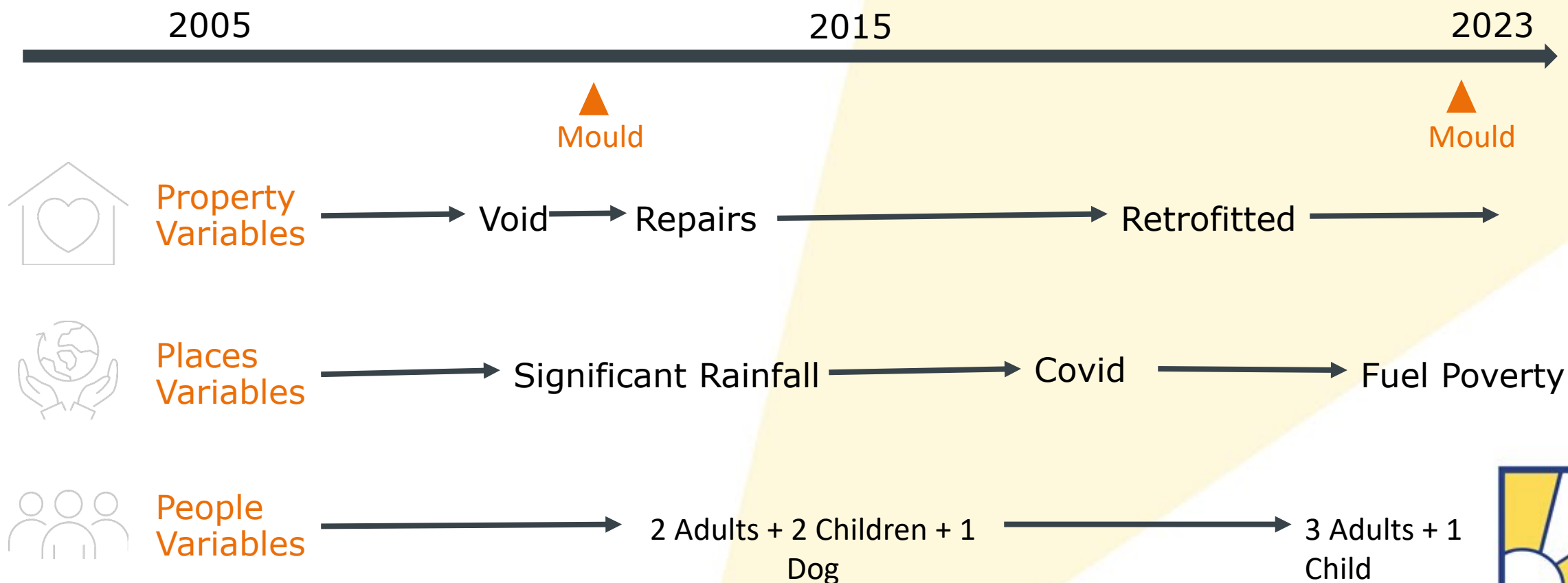
Allows you to see spatial changes in the reporting of mould cases and to spot areas of significance.
- Evidences Data Driven Decision

EG Multi-million-pound regeneration project was already underway to address this and other issues on the estate.

#GOODTOGREAT



Difficulty of attributing the 'cause' to one event. Complex interactions between built environment, tenant demographics and environmental features



Analysis.....

- **Key Influencer tabs highlight items for investigation**

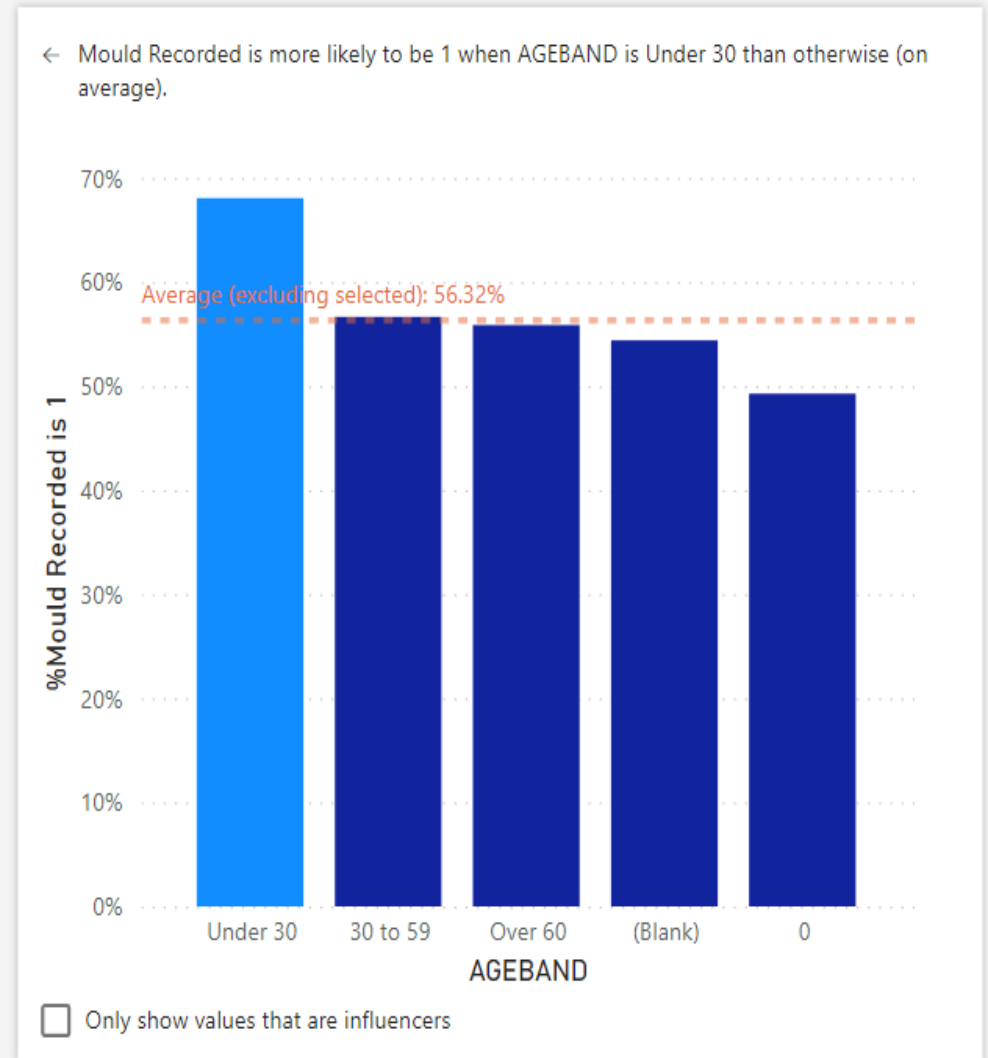
Investigation of this data led us to understand that people aged under 30 are more likely to experience DMC, e.g., younger people may have more showers, keep windows shut, dry clothes on radiators – all things which exacerbate DMC. Further investigation reveals that older people with longer tenancies are less likely to suffer DMC.

- **Advantages of having the technical officers on board**

Model highlighted top floor flats having an issue with DMC. Our Strategic Asset Manager quickly pointed out that the top floor flats are likely to have leaks, but the property may not have DMC – allowing us to adjust the model to take account of this.

- **Real World Model Test**

We used the dashboard to highlight the top 50 properties most likely to have DMC and the 50 least likely to have DMC. Condition surveys were undertaken to 'prove' the model.



Younger Tenants (<30) more likely to experience damp and mould compared to older Tenants (>60)

NEC Damp, mould and condensation Power Bi Dashboard

Key Influencer – Property Archetypes

#GOODTOGREAT

When...

...the likelihood of Mould Recorded being 1 increases by

MRA13_PROPERTY_ARCH...
is Medium Rise Flats

1.37x

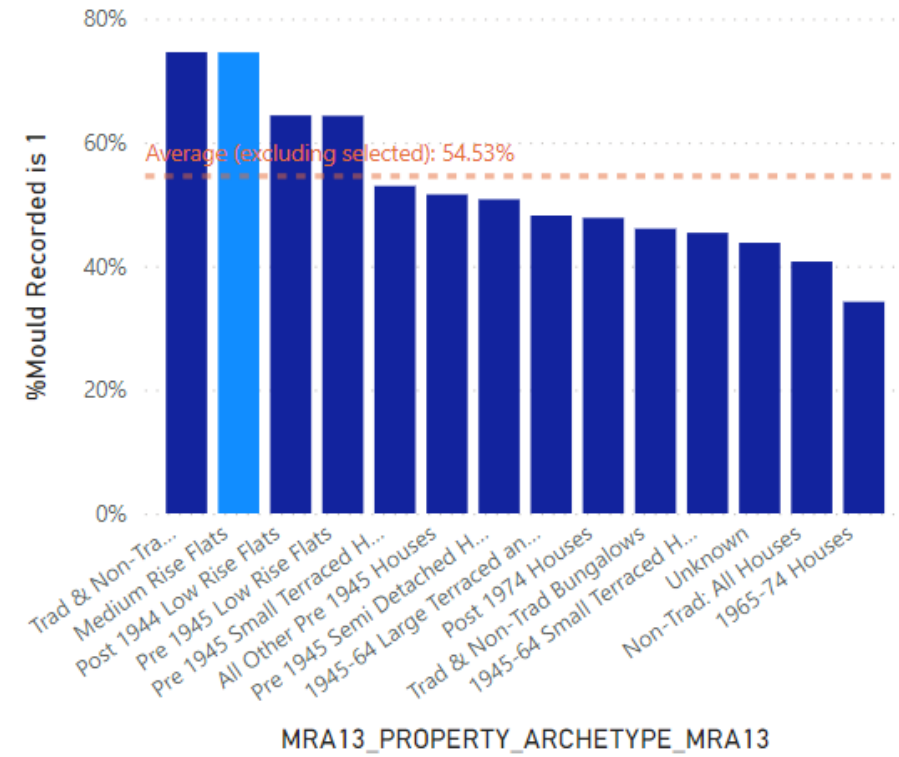
MRA13_PROPERTY_ARCHE...
is Trad & Non-Trad High
Rise Flats

1.35x

MRA13_PROPERTY_ARCHE...
is Post 1944 Low Rise Flats

1.16x

← Mould Recorded is more likely to be 1 when MRA13_PROPERTY_ARCHETYPE_MRA13 is Medium Rise Flats than otherwise (on average).


 Only show values that are influencers

Predictive Analytics – Case Management

▼ Caseload Summary Categories

Q ▾ Go 1. Intelligent caseload ▾

Actions ▾

▶ Intelligent caseload ☆ 4 Selected, Poor payers Intellig..., Good payer Intellige..., Intelligent interven...

Sel	Category	Description	No. ↓	Processed	Left	No. In Category
Include	INTEIGOOD	Early intervention good payers in arrears getting worse	158	0	158	544
Mandatory	DAMP	Damp works predicted in coming month	158	0	158	4991
-	EPCRATES	Accounts regardless of balance linked to property with poor EPC rating A being best G being lowest	158	0	158	21017
-	CURRENT	Current REN residential accounts	158	0	158	21263
-	VGITMON15	INTELLIGENT CASELOAD: Very good credit monthly 28 payer	158	0	158	4520
-	NOCONOVOAR	No Contact within 14 days and no Arrears Arrangement VOAR	20	0	20	1624
-	5WEEKS	Accounts in arrears 5 weeks or more net rent no arrears arrangement no UC indicator and payment method of CR	3	0	3	219
-	HBMISSED	HB recipient with HB stopped and payment CR	1	0	1	73

1 - 8

What's next?

- **Feedback and refine**

Ongoing feedback from our Healthy Homes Advisors and will tweak the model accordingly.

- **Update and install Version 2**

- Expanded to our full stock portfolio – (Completed Jan 2024)
- Include External Wall Insulation and Extractor Fan information
- Implement new tabs which allow us to see the impact of improvements made to properties – i.e. the impact the new continuous trickle fans have on the DMC risk assessment
- Development of API's with IoT dashboard and Smart Meter data

- **Proactive surveys**

- Summer programme to visit higher risk properties
- Inform Stock Condition Survey Programme

Summary & Benefits

Customer Confidence

Provide confidence to customers, Board, RSH and HO that we're **proactive** in our approach to disrepair and working on **preventing problems** before they may even be noticed or reported

Full View of Risk

Build a better view of our stock where there is a risk of damp and mould. **Accurately report** and **provide evidence** of what we are doing to mitigate risk and make data driven stock investment decisions

Trend Analysis & Feedback Loop

Identify trends and correlations in property attributes for **scenario modelling** and to **inform future builds**, e.g. real world performance of heating systems example, ventilation, etc how they perform within different architypes

Reduce Complaints and Claims

Reduce complaints claims and assist with managing **tenant perception** of damp and mould by **providing better advice** on how to manage their home

ian.gardner@wolverhamptonhomes.org.uk
07971 021420