Acceptability criteria of fire – how big and how much is ok (£/$/€)?

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Dr David Rush
Miss Erin Mills
The BRE Centre for Fire Safety Engineering
University of Edinburgh

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Context

- Prescription → PBD
  - General engineering trend in UK and worldwide
  - Case by case basis – setting of performance objectives
    - **What is acceptable?**
    - **What is expected?**
  - *Prescriptive codes*
    - **implicit level** of safety and acceptability
    - Experience provides consensus on what is expected
  - *PBD*
    - **Explicit** statements of objectives and acceptability criteria

What we know - losses

- Guidelines – emphasis on life safety
  - **Property protection and business continuity rarely explicitly considered**
- Geneva association – indirect and direct losses of fire (estimates – 2008-2010)
  - Generalised – not specific for an industry of use type of the structures
  - Direct – direct result of damage from fire
  - Indirect – longer term impact

	Direct	%GDP	Indirect	%GDP
UK	£1.8Bn	0.13	£250M	0.008
US	$15bn	0.10	$2Bn	0.007
Germany	€2.8Bn	0.12	€630M	0.014

6-12% of direct

- Is this ok?
- **UK spends £3.3Bn/yr on fire protection**
  - (2.5% of building cost, 0.23% of GDP)
  - Is this acceptable?

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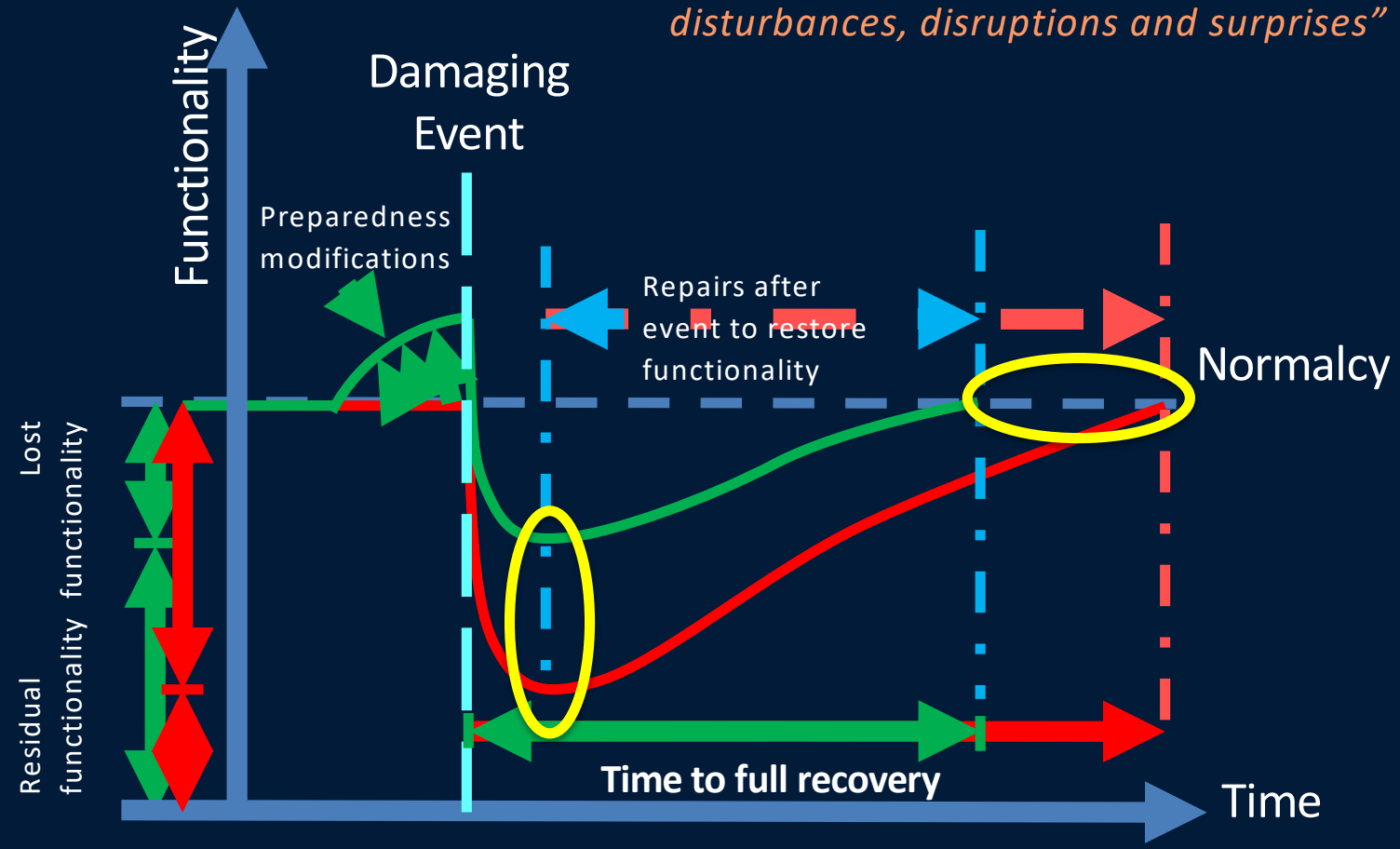
Resilience (engineering concept)

"the ability to sense, recognize, adapt, and absorb variations, changes, disturbances, disruptions and surprises"



1) how much damage is "ok"?;
2) how long to recover?

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Factors affecting public opinion

- Four main factors (Petersen et al 2016)
  1. Disaster experience
     - Experience → better expectations
  2. Information
     - Less well informed – greater expectations
  3. Demographics
     - Age, socio-economic status, gender, etc..
  4. Culture
     - Norms and practices can influence preparedness and response

What we did

- Gathered **publics expectations** of fire resilience of home/work
  - Online surveys
  - assess factors (mainly 1 and 3)
  - Determine appropriate **resilience timeframes**
  - Estimate the expected indirect losses
- Surveys
  - Standard set of qs about **demographics and fire history**
  - Qs abut home ownership, employment status and location
  - Qs about length of disruption for **three fixed levels of loss of functionality** (10%, 20%, 50% loss)

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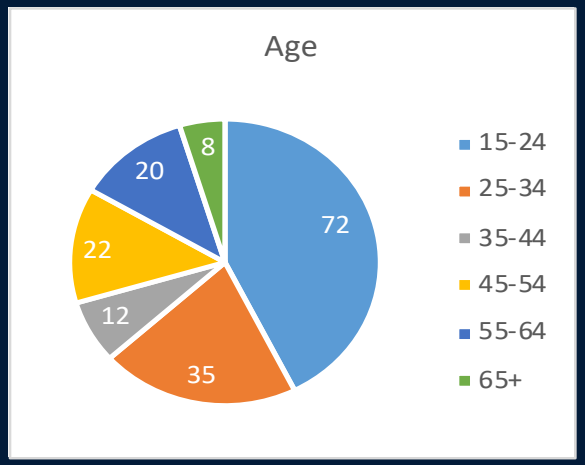
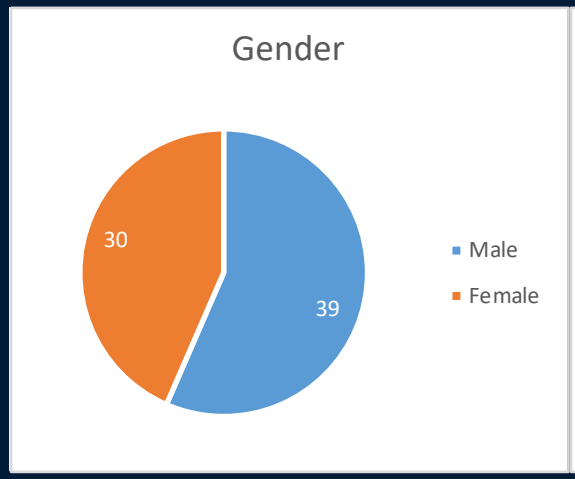
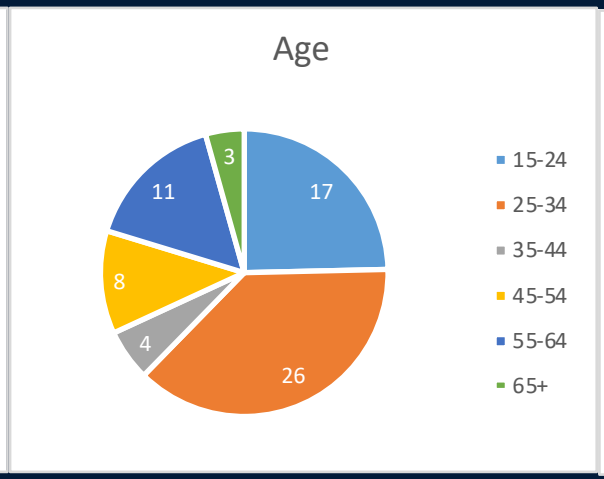
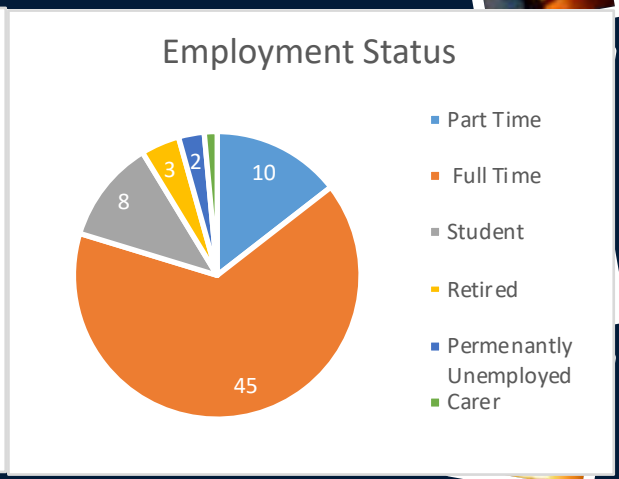
Participation stats

- Residential – **169 respondents**
  - 95% confidence in results with a ± 8% error
  - ≈ **50/50 split in**
    - Gender
    - Owned/Rented
    - Flat/House
  - Good distribution and response rate
- Workplace – **69 respondents**









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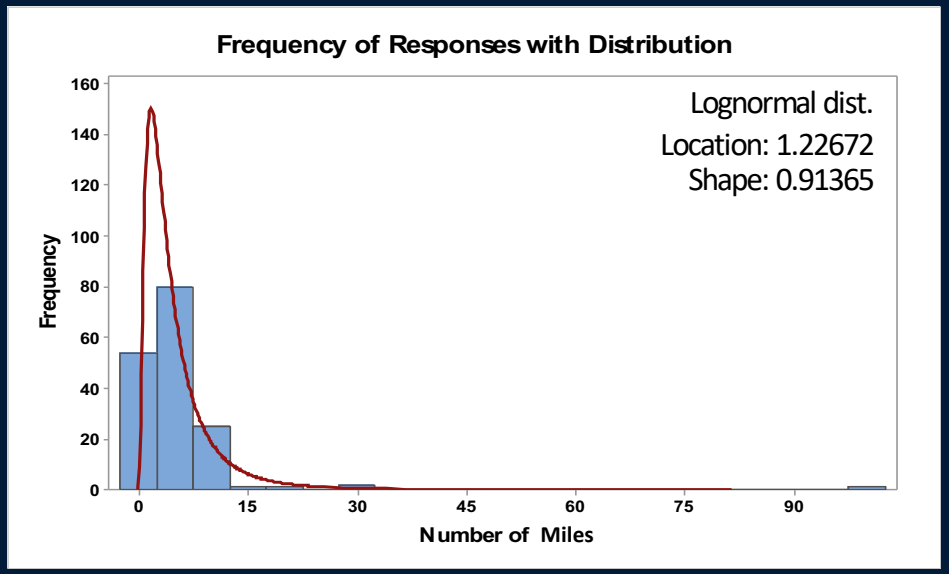
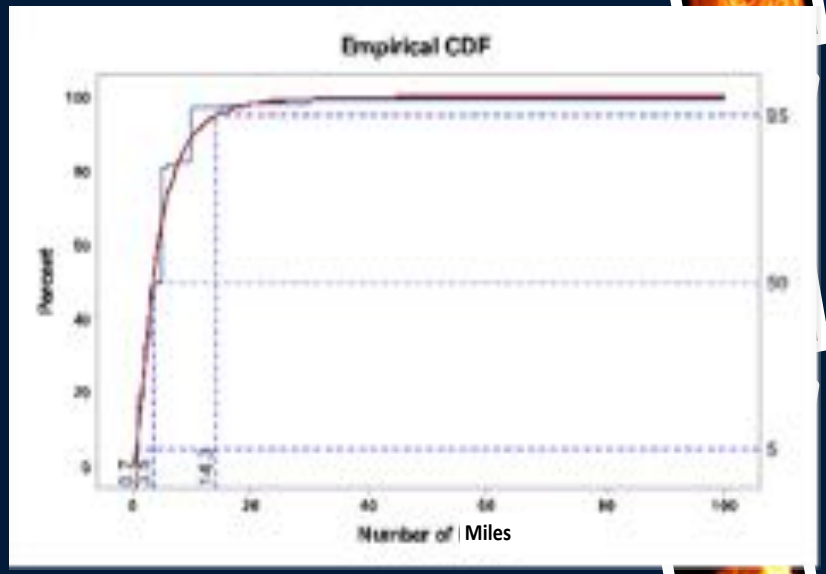
Results (1) – All Resi.

- Distance of relocation (no of miles)

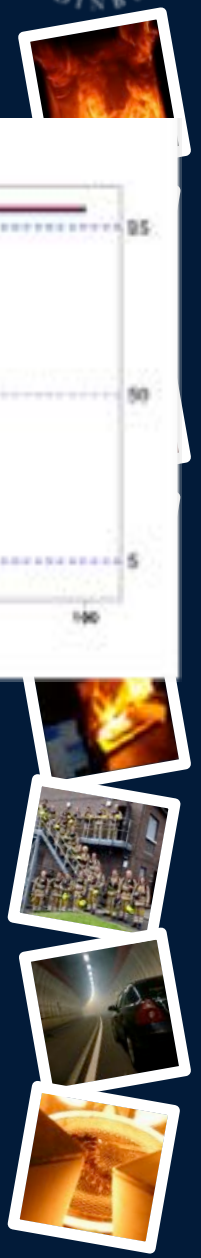




NOTE: All data is 2 weeks old, still fine tuning the analyses

- 5%ile - 0.7 miles;
- **50%ile - 3.5 miles**;
- 95%ile – 14.3 miles

- **£0.15 - £4.86 / day** extra – assuming round trip to work extra distance.



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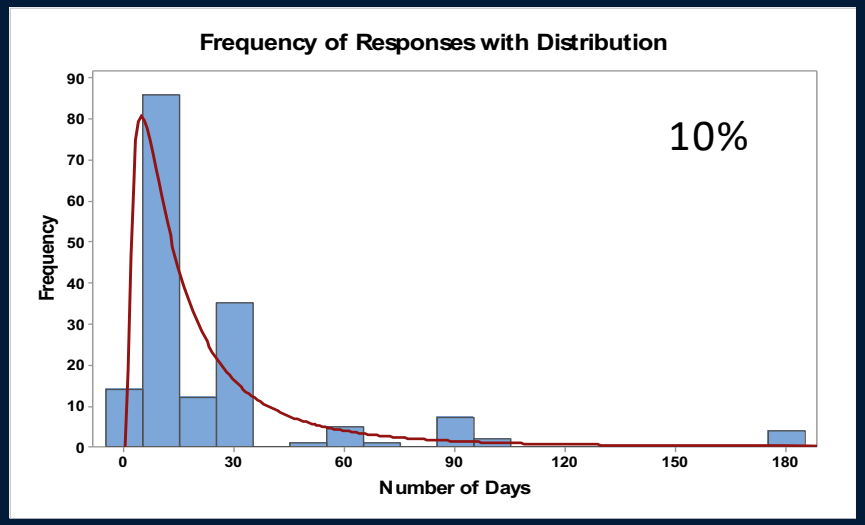
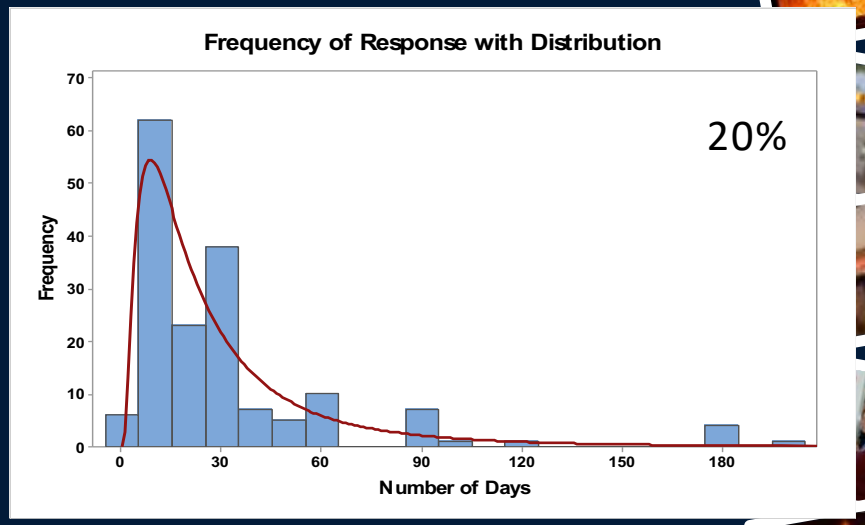
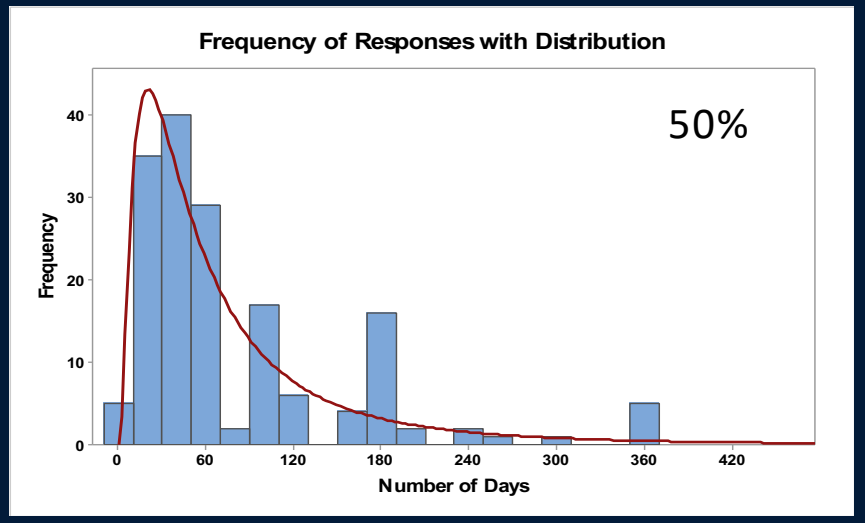
Results (2) – All Resi.

- Days out of home

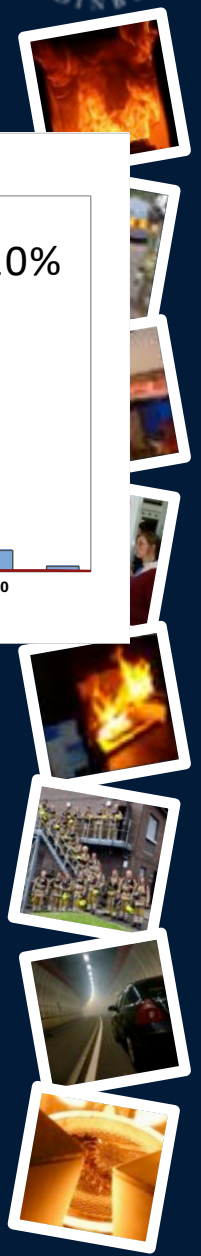






- Comparison
  - All **lognormal** but with shifting location and flattening of shape

	5%ile	50%ile	95%ile
10%	2.5	13.6	75.7
20%	4.3	20	92.6
50%	10.5	50.4	243.5



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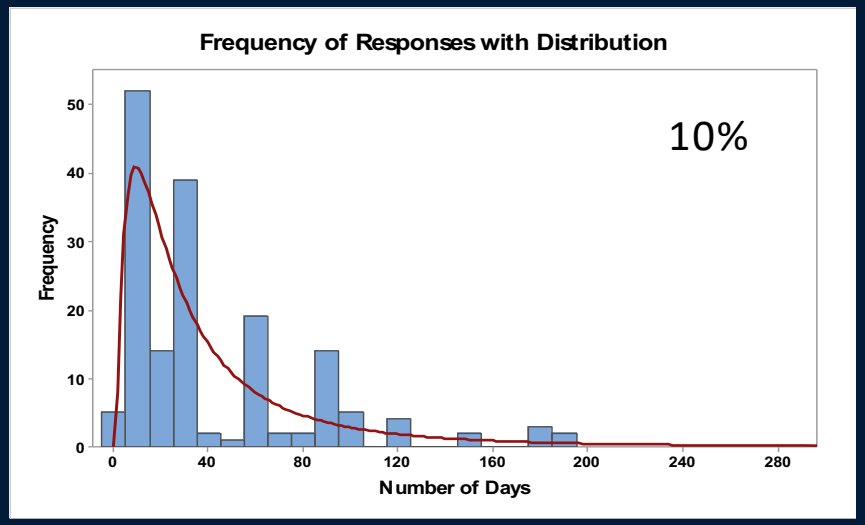
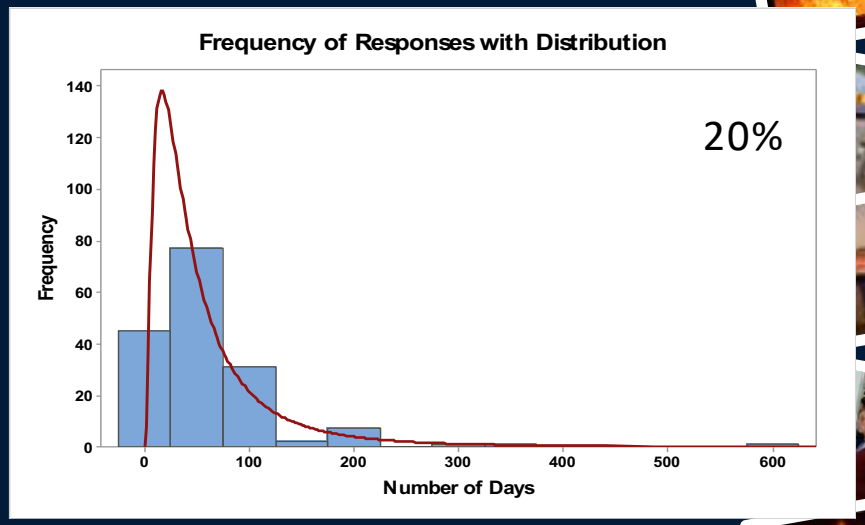
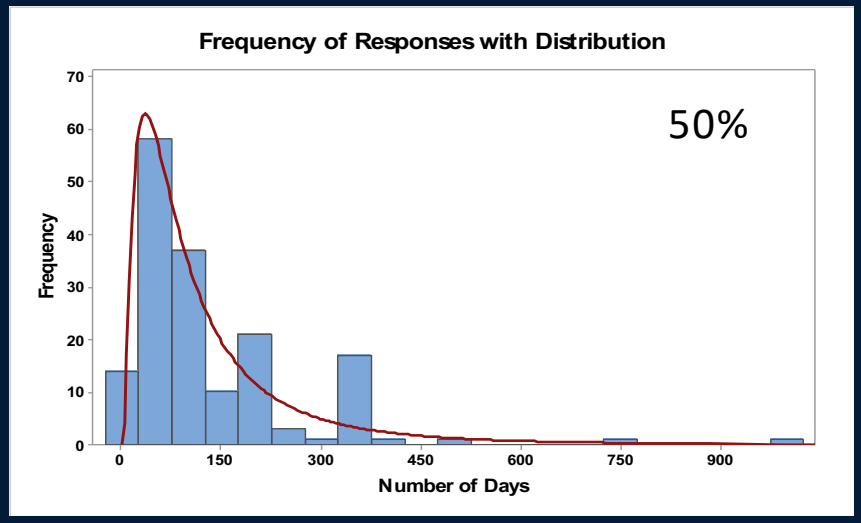
Results (3) – All Resi.

- Days back to normality

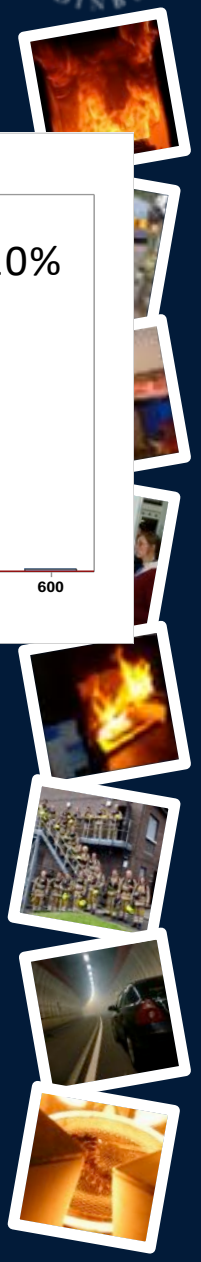






- Comparison
  - All **lognormal**
  - 1.5 - 2.0 times days out of home

	5%ile	50%ile	95%ile
10%	4.9	26.7	144.4
20%	8.5	39.3	182
50%	18	86	408



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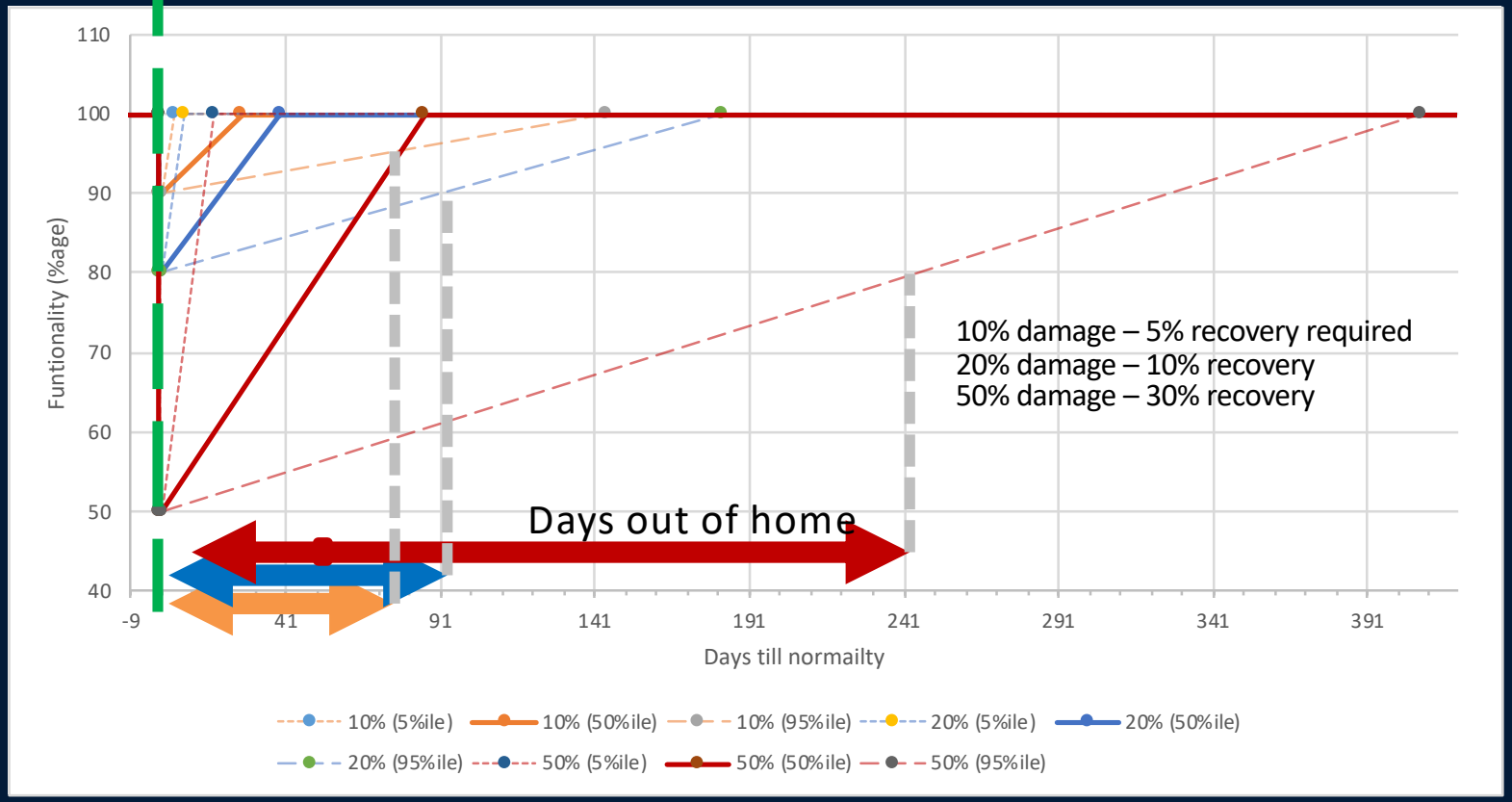
Resilience expectations

Damaging Event



Didn't ask what level of functionality required to come back into home, however looks as though the **more damage – greater acceptance of returning to live in a less functional home**

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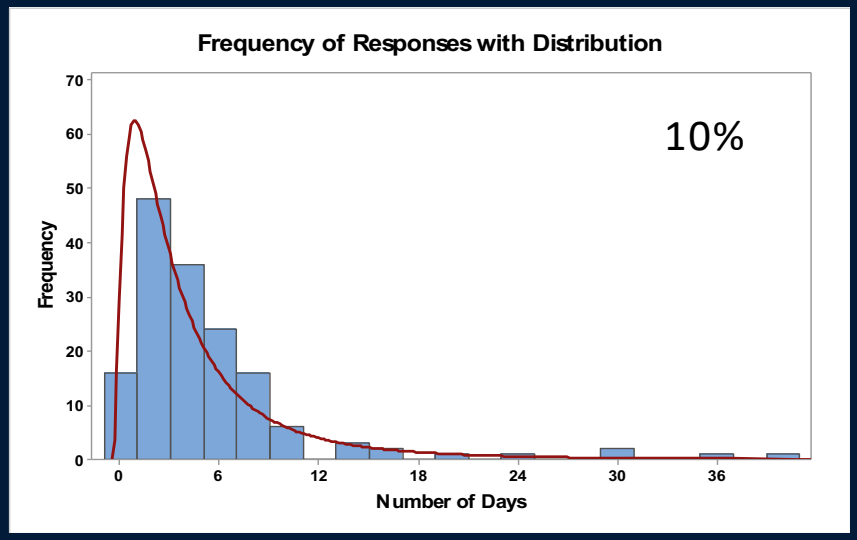
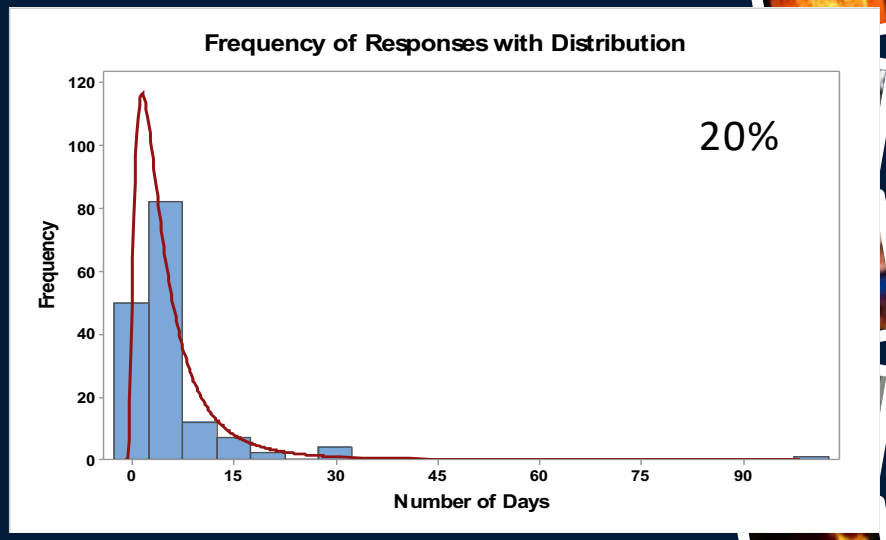
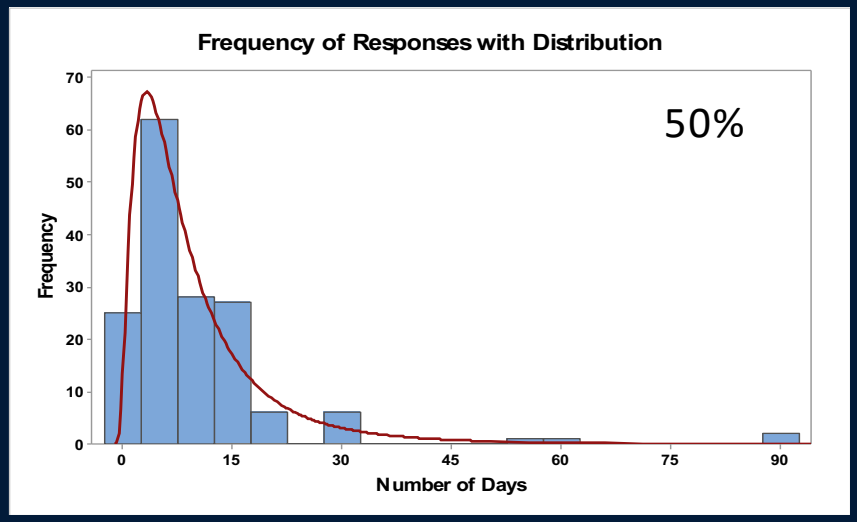
Results (4) – All Resi.

- Days off work







- Comparison
  - All **lognormal**
  - **10-20%** of days out of home

	5%ile	50%ile	95%ile
10%	0.18	2.78	14.97
20%	0.4	3.8	17.1
50%	1.1	6.9	28.8

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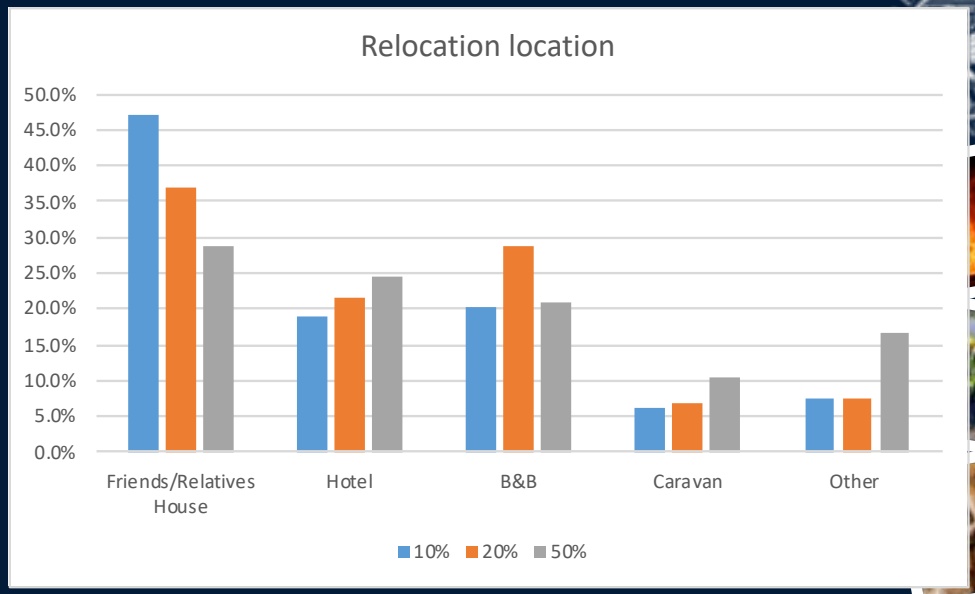
Results (5)

- Where to stay



Analysis (1)

Costs		
Hotel	60	£/night
B&B	40	£/night
Caravan	20	£/night
Friends/Relatives House	0	£/night
Other:		
Rented Accomodation	40	£/night
Other owned property	0	£/night
Petrol	119.96	p/litre
Diesel	123.58	p/litre
Salary	27271	£/year
	74.7150685	£/day

- Estimates – will need refining in the future
- Can now be used to examine indirect costs

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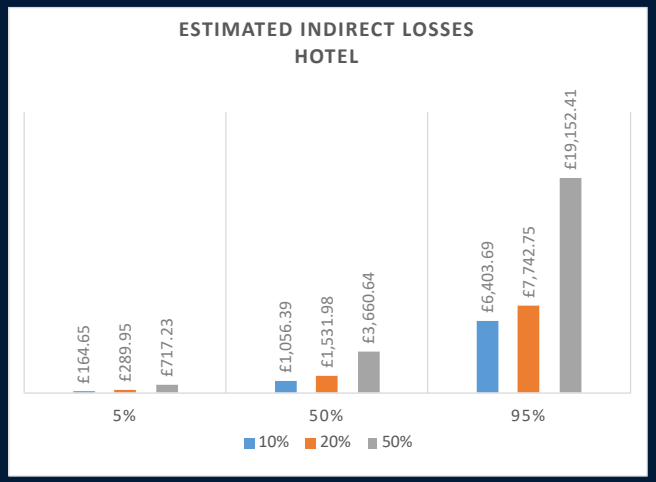
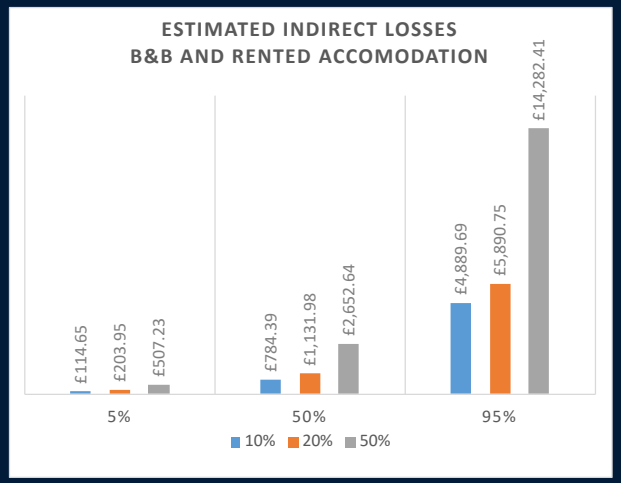
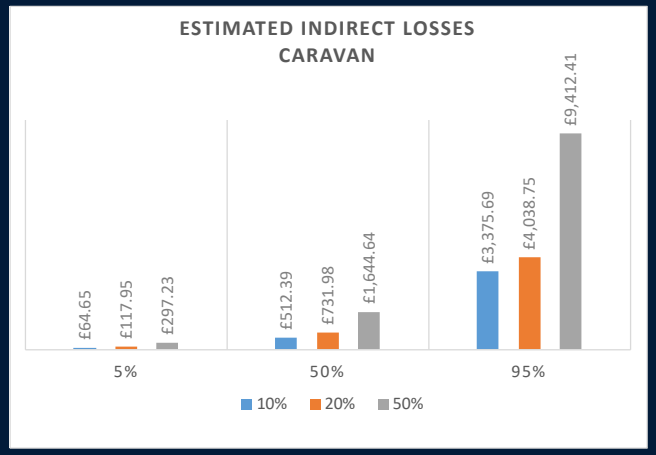
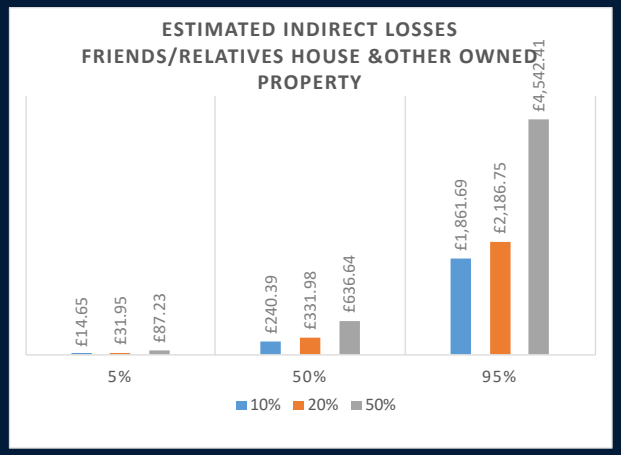
Analysis (2) - Indirect loss

- Total cost of each percentile =
- [((*Miles relocated* x journeys made per day)/Average miles per litre of fuel) x £ per litre] + [Days out of home x cost of accommodation]+ [Daily salary x days off work]









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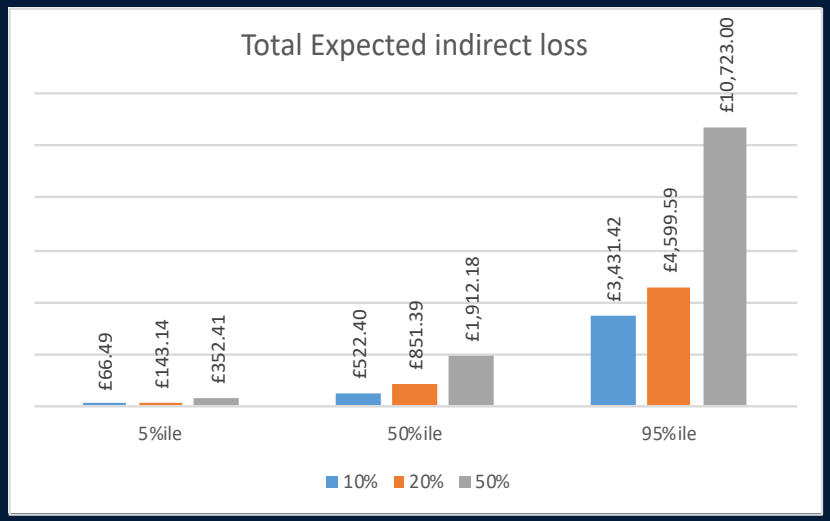
Analysis (3) - Total expected indirect losses

- Combination of estimated costs and percentages relocation locations



- Data from Fire incident meta-analysis (Manes and Rush 2017) – **cost of residential fires based on area damaged**
  - **Directs** - Approx £15k
  - **Indirects** of 6-12% = £0.9k – £1.8k
- Our estimates are slightly on the low side of band
  - only considering residential fires?
  - Estimates too low for costings?

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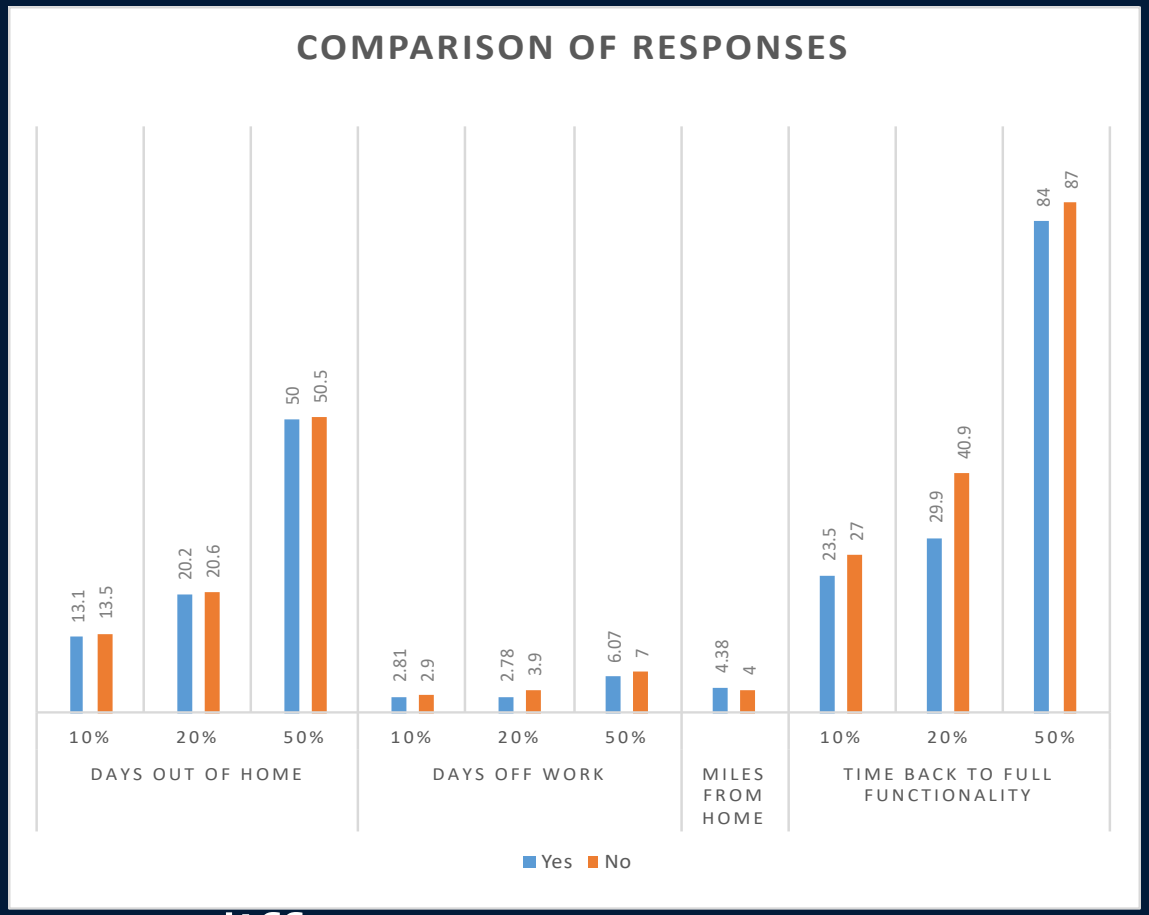
Does fire experience change perception?

- 10 of participants had experience of a residential fire



- Makes no difference to responses

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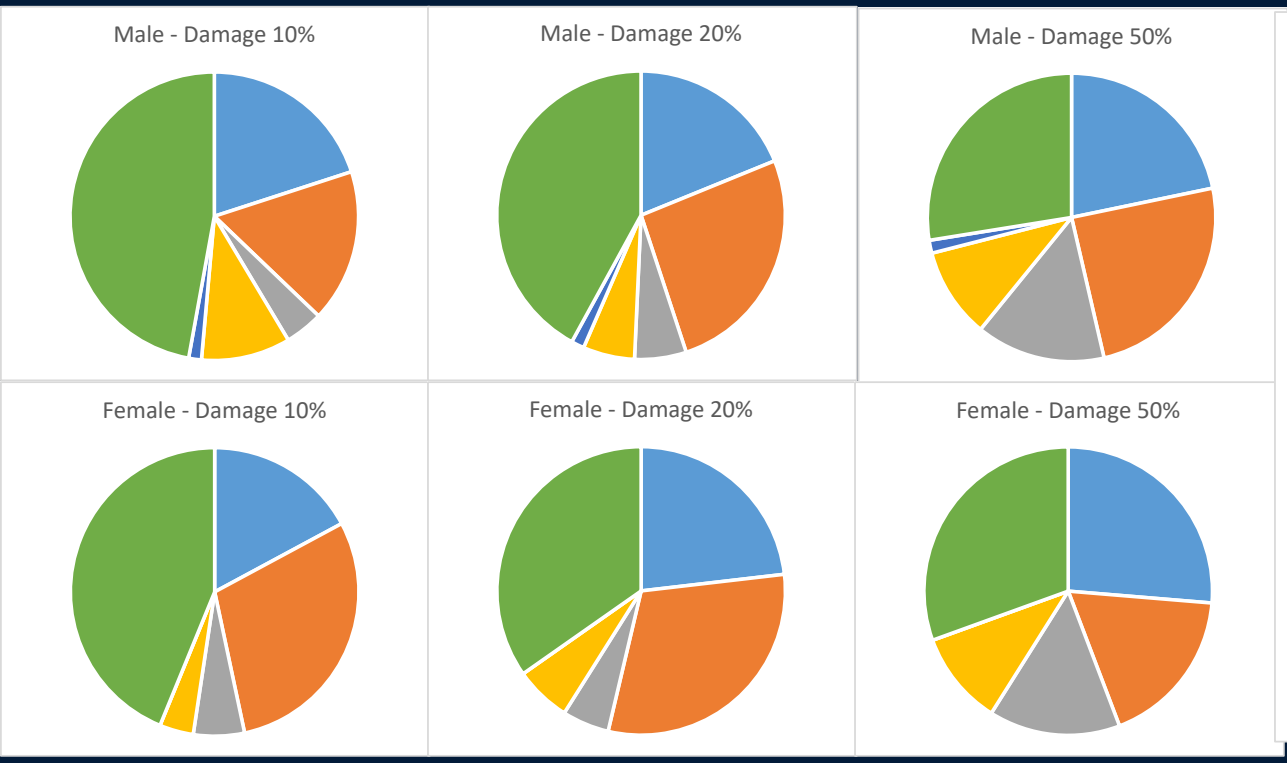
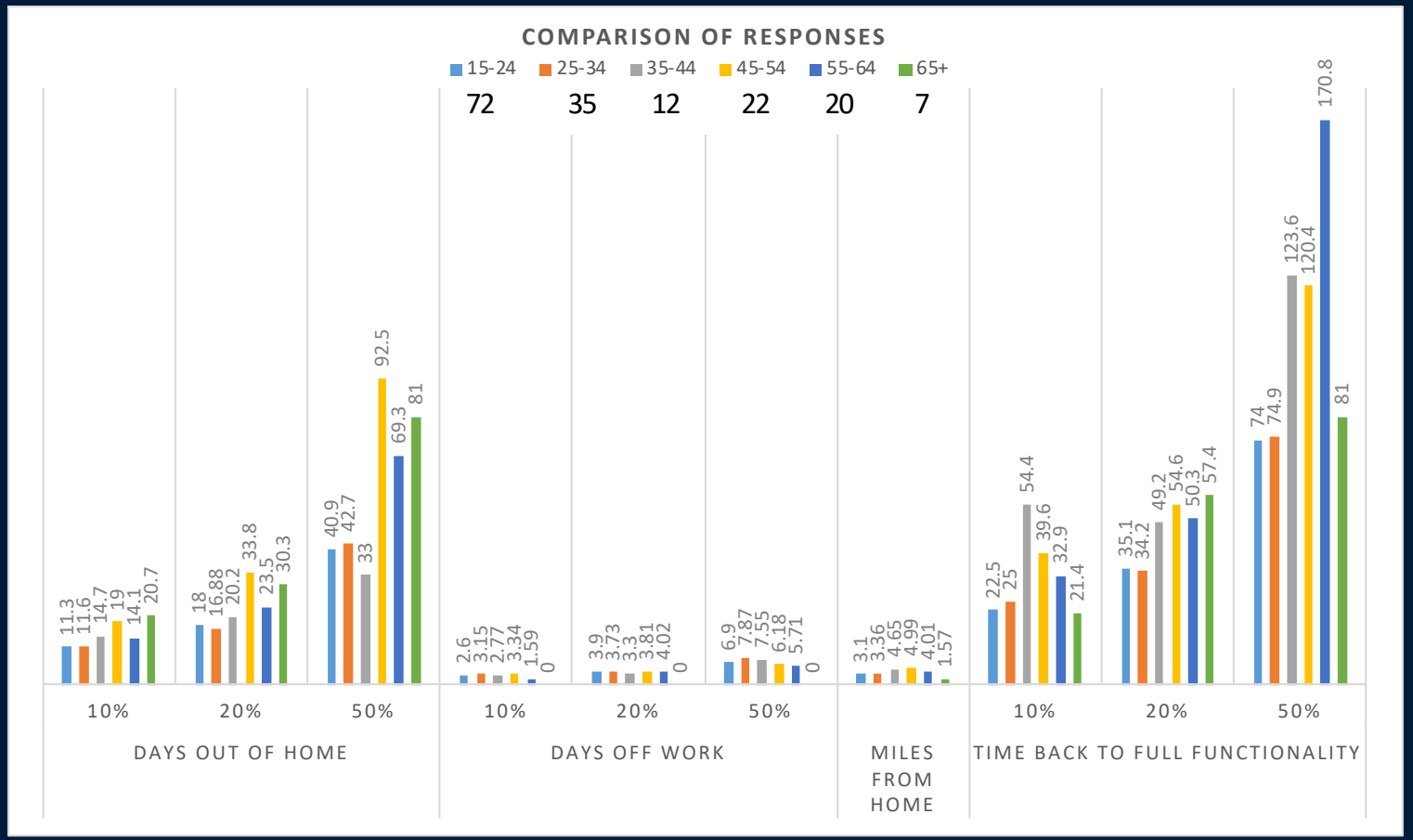
Does gender change perception?

- 71/98 male – female response ratio
- Similar trend to fire experience in terms of day estimations
- Slight variances in where they would stay



Does age change perception?

- Yes – in Days out of home and back to full functionality
- No – miles from home and time off work



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Conclusions (Resi.)

- Lots of analysis on the data still to do but..
  - Able to **quantify expected timeframes** after a fire in terms of
    - Days off work
    - Days out of home
    - Days back to full functionality
  - All **for different levels of lost functionality**
  - Able to stick numbers on resilience triangles
- Using coarse estimates of costs
  - Able to show that **expected indirects are about 6-12% of direct costs**
- Gender and fire experience have no affect on expectations
  - Age does – youth have speedier expectations

Thanks

If you have any queries – please do not hesitate to contact me

d.rush@ed.ac.uk

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