

The Actuarial Profession
making financial sense of the future

The Neighbourhood health Economy

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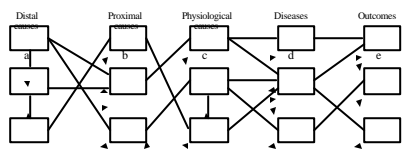
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Concepts

- Health and social risks
- Data about localities
- Risk framework
- Case study
- Conclusions

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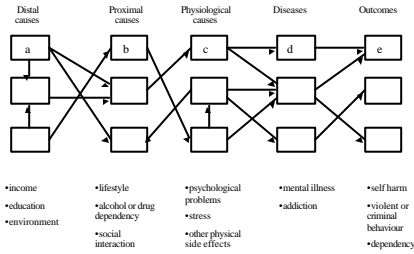
Concepts: Chains of exposure leading to disease
Example 1



- income
- education
- housing
- smoking
- alcohol intake
- diet
- inactivity
- high cholesterol
- blood pressure
- obesity
- stroke
- coronary heart disease
- diabetes
- disability
- death
- dependence

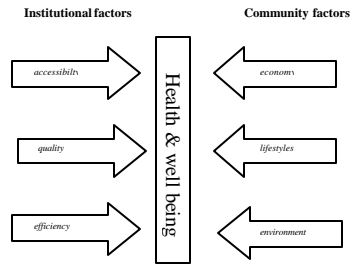
Adapted Adapted from WHO

Concepts: Chains of exposure leading to disease
Example 2



Adapted from WHO

Concepts: Taking it down to local level



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Data considerations: Data sources

- official statistics
- surveys
- administrative data

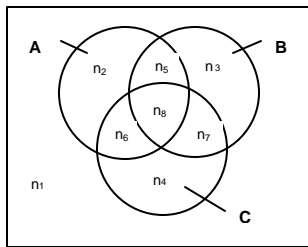
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Data considerations: Examples of data sets

- local property data base
- educational data
- crime data
- health data
- social services

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Risk framework: Venn diagram of 3 risk factors



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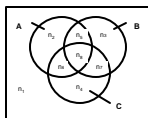
Risk framework: Risk hierarchy

$$\frac{A \cap B \cap \bar{C}}{B \cap \bar{C}} = \frac{n_5}{n_5 + n_3}$$

Risk of A occurring with B with C absent

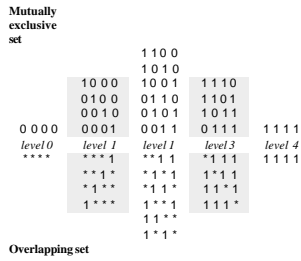
$$\frac{A \cap B}{B} = \frac{n_5 + n_6}{n_5 + n_6 + n_3 + n_7}$$

Risk of A occurring with B regardless of whether C present



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Risk framework: Risk hierarchy



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Data considerations: Data analysis

- risk ladders
- relative risk
- regression analysis
- GIS maps

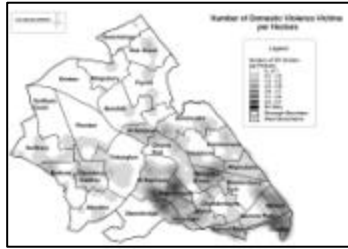
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Case study: Domestic violence

- why this topic?
- what factors are involved
- data sets used
- methodology

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Case study: Concentration of reported domestic violence in Brent



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Case study: Risk ladder

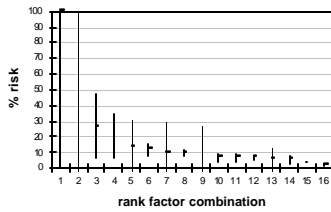
Risk Level	Case a Households	Case b Households	Noise Complaint	Mental Health	Social Housing	Drug Offence	Free school Meals	%risk of DV ^a	%risk of DV ^b
3	2	2	Y		Y		Y	100.0	100.0
2	3	13		Y		Y		33.3	15.4
2	19	53				Y	Y	26.3	22.6
3	34	34			Y	Y	Y	20.6	20.6
3	15	15		Y	Y		Y	13.3	13.3
2	323	367			Y	Y		11.8	12.5
3	10	10		Y	Y	Y		10.0	10.0
2	1265	1316			Y		Y	9.6	10.1
2	11	26		Y			Y	9.1	11.5
1	405	794				Y		6.9	10.1
2	366	393		Y	Y			6.8	7.1
1	1209	2558			Y		Y	6.7	8.6
2	35	39	Y					5.7	10.3
1	374	783		Y				5.3	6.4
1	23944	25996			Y			3.8	4.2
0	74356	102427						1.8	2.5
1	49	93	Y					0	4.3
2	2	0	Y	Y				0	0.0
2	3	5	Y				Y	0	40.0
3	2	0	Y	Y	Y			0	0.0

a: mutually exclusive case

b: overlapping case

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Case study: Confidence intervals around risk estimates



Case a: mutually exclusive case

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Case study: Relative risk

ABCDEF	0001	0010	0011	0101	0110	0111	0100	0000	0001	0000	0100	0001	0000	0000	0010	0000
10	3.0	3.8	4.9	7.5	8.5	10.0	10.4	11.0	14.5	14.6	14.9	17.5	18.7	26.5	55.3	
03	1.0	1.3	1.6	2.5	2.8	3.3	3.5	3.7	4.8	4.9	5.0	5.8	6.2	8.8	18.4	
05	0.8	1.0	1.3	2.0	2.2	2.6	2.7	2.9	3.8	3.9	3.9	4.6	4.9	7.0	14.6	
02	0.6	0.8	1.0	1.5	1.8	2.1	2.1	2.3	3.0	3.0	3.1	3.6	3.9	5.5	11.4	
01	0.4	0.5	0.6	1.0	1.1	1.3	1.4	1.5	1.9	2.0	2.0	2.3	2.5	3.5	7.4	
01	0.4	0.4	0.6	0.9	1.0	1.2	1.2	1.3	1.7	1.7	1.8	2.1	2.2	3.1	6.5	
01	0.3	0.4	0.5	0.8	0.9	1.0	1.0	1.1	1.4	1.5	1.5	1.8	1.9	2.7	5.5	
01	0.3	0.4	0.5	0.7	0.8	1.0	1.0	1.1	1.4	1.4	1.4	1.7	1.8	2.6	5.3	
01	0.3	0.3	0.4	0.7	0.8	0.9	0.9	1.0	1.3	1.3	1.4	1.6	1.7	2.4	5.0	
01	0.2	0.3	0.3	0.5	0.6	0.7	0.7	0.8	1.0	1.0	1.0	1.2	1.3	1.8	3.8	
01	0.2	0.3	0.3	0.5	0.6	0.7	0.7	0.8	1.0	1.0	1.0	1.2	1.3	1.8	3.8	
01	0.2	0.3	0.3	0.5	0.6	0.7	0.7	0.8	1.0	1.0	1.0	1.2	1.3	1.8	3.7	
01	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.8	0.8	0.9	1.0	1.1	1.1	1.5	3.2	
01	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.6	0.8	0.8	0.8	0.9	1.0	1.4	3.0	
00	0.1	0.1	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.6	0.7	0.7	1.0	2.1	
00	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.5	1.0	

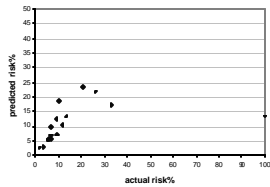
A household in the social housing sector with a drug offender and a school aged child is 5.5 times more at risk of DV than one in the social housing sector alone.

α: mutually exclusive case

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Case study: Regression analysis using logit model

$$\hat{L} = \ln \left[\frac{\hat{r}}{1 - \hat{r}} \right] = b_0 + b_1 x_i + u_i$$



α: mutually exclusive case

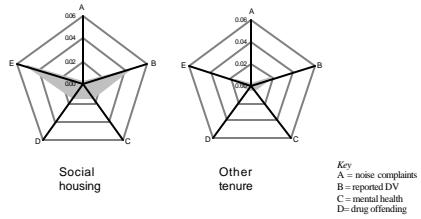
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Case study: Other regression results - odds

	Noise	Mental Health	Social Housing	Drug Offending	Free school Meals
Mutually exclusive	2.0	2.0	1.1	3.9	2.6
significance	*	**		**	**
Overlapping	1.8	1.5	1.2	2.7	2.5
significance	**	**	*	**	**

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Case study: Risk split by housing tenure



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Case study: Risk factors by neighbourhood



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Conclusions

- Method for overcoming data deficiencies at local level
- Method for organising large data sets
- Framework for systematically analysing key health and social issues in a risk framework
- Offers wider potential for the insurance industry where risk is also a core concept
- Capable of development
