

# Ordinal Regression Models in Epidemiological Research

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# Problem

- Cohort of 574 junior hairdressers
- Response (hand eczema) recorded on a 4-point ordinal scale (none, mild, moderate, severe)
- Information on several endogeneous and exogeneous risk factors
- Looking for regression model that assesses the influence of the risk factors on the outcome simultaneously

# Standard Solution: Altering the scale of the response

- Dichotomize response and use logistic regression  
Drawbacks: Loss of information, choice of cutpoint arbitrary
- Consider response to be continuous and use linear regression  
Drawbacks: Assumption of equal distance between consecutive levels, Assumption of homogeneous variances

# Proportional Odds Model (I)

- Inherent ordinality of the data is retained
- Interpretation of parameters in terms of odds ratios
- Adjustment for confounding and interaction
- Statistical derivation by assuming an underlying continuous response that can only be observed in ordered categories

# Proportional Odds Model (II)

- Validity of model assumptions can be tested
- Sample size calculations are available
- Parameters are invariant under combination of contiguous categories and simply change sign if order of categories is reversed

# Results

	Parameter	OR	95%-CI
Endogeneous Riskfactors			
Atopic skin diathesis	0.325	1.38	[1.15, 1.67]
Respiratory atopy	-0.347	0.71	[0.45, 1.09]
History of HE	0.369	1.45	[0.79, 2.65]
Dyshidrosis	0.786	2.19	[1.37, 3.50]
History of flexural eczema	0.503	1.65	[0.65, 4.19]
Nickel sensitivity	-0.161	0.85	[0.59, 1.21]
Exogeneous Riskfactors			
Permanent wave (>1h/d)	0.437	1.55	[1.07, 2.24]
Wet work (>4h/d)	0.298	1.34	[0.93, 1.95]
Skin protection			
Skin protection	-0.04	0.96	[0.86, 1.06]
Change in skin protection	0.438	1.55	[1.39, 1.72]

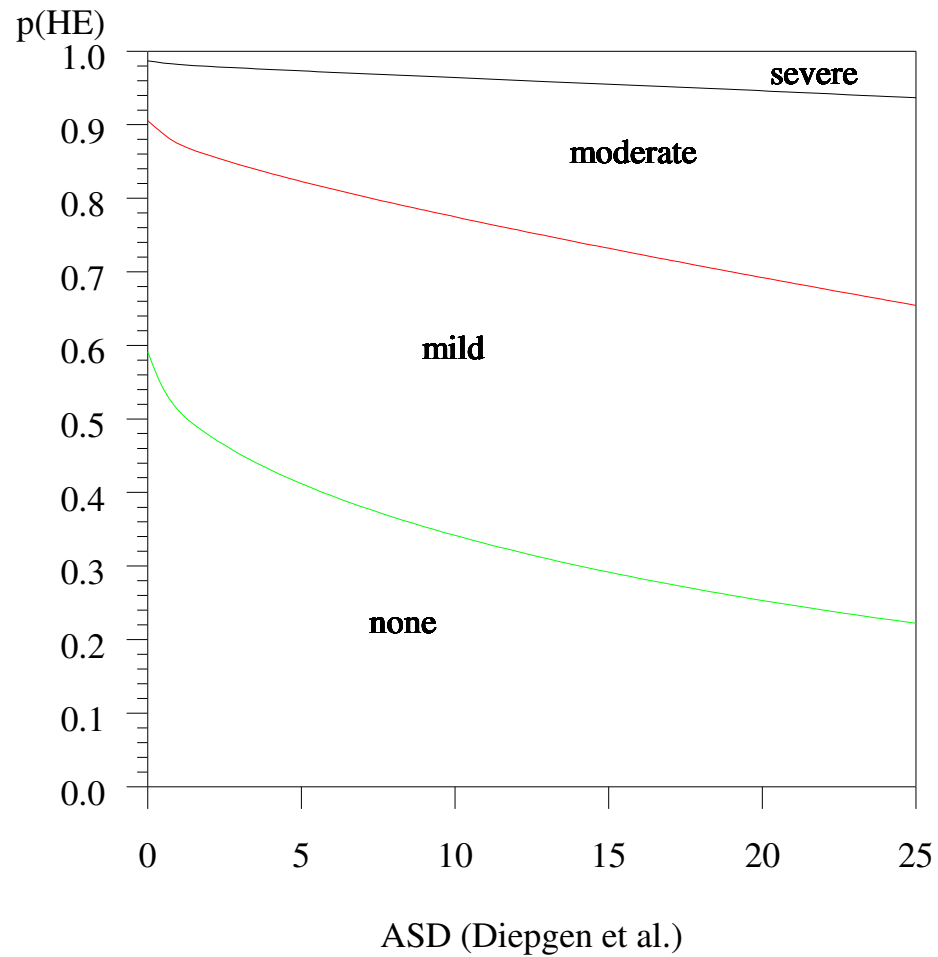
(Adjusted for age, sex and center)

# Interpretation of the OR

Possible Dichotomizations of the response	Cutpoint
no HE vs. mild/moderate/severe HE	1
no/mild HE vs. moderate/severe HE	2
no/mild/moderate HE vs. severe HE	3

- Calculate binary logistic regressions for the different dichotomizations of the response
- Odds Ratio from the proportional odds model is a summary of the odds ratios from these regressions
- Homogeneity of binary ORs = Proportional Odds

# Risk of developing a HE of the respective grade for an "average" hairdresser



# Summary

With the help of the proportional odds model we were able to:

- detect relevant risk factors for HE in junior hairdressers and quantify their influence in a convenient way
- avoid information loss by altering the scale of the response
- adjust for other risk factors and confounders

# Literature

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