Royal Statistical Society
2009 Conference
Edinburgh, Scotland
7-11 September 2009

Measuring Health Inequalities by an Approach Unaffected by the Overall Prevalence of an Outcome

James P. Scanlan
Attorney at Law
Washington, DC, USA
jps@jpscanlan.com

Subjects

1. The problem with standard binary measures of differences between outcome rates (relative differences, absolute differences, odds ratios):

   that all exhibit patterns of correlation with overall prevalence (i.e., among other things, they tend to change as overall prevalence changes)

2. An alternative approach that avoids the problem with standard measures:

   a measure that does not change as overall prevalence changes

References

- ***Measuring Health Disparities*** page (especially the ***Solutions*** tab) and ***Scanlan's Rule*** page on ***jpscanlan.com***

- Can We Actually Measure Health Disparities? (*Chance* 2006) (A12)

- Race and Mortality (*Society* 2000) (A10)

- The Misinterpretation of Health Inequalities in the United Kingdom (BSPS 2006) (B6)

Patterns by Which Relative Differences Between Outcome Rates Tend to be Correlated with the Overall Prevalence of an Outcome – Scanlan's Rule 1 (aka Heuristic Rule X, Interpretive Rule 1)

The rarer an outcome, the greater tends to be the relative difference in rates of experiencing it and the smaller tends to be the relative difference in rates of avoiding it.

Fig 1. Ratios of (1) Disadvantaged Group (DG) Fail Rate to Advantaged Group (AG) Fail Rate at Various Cutoff Points Defined by AG Fail Rate

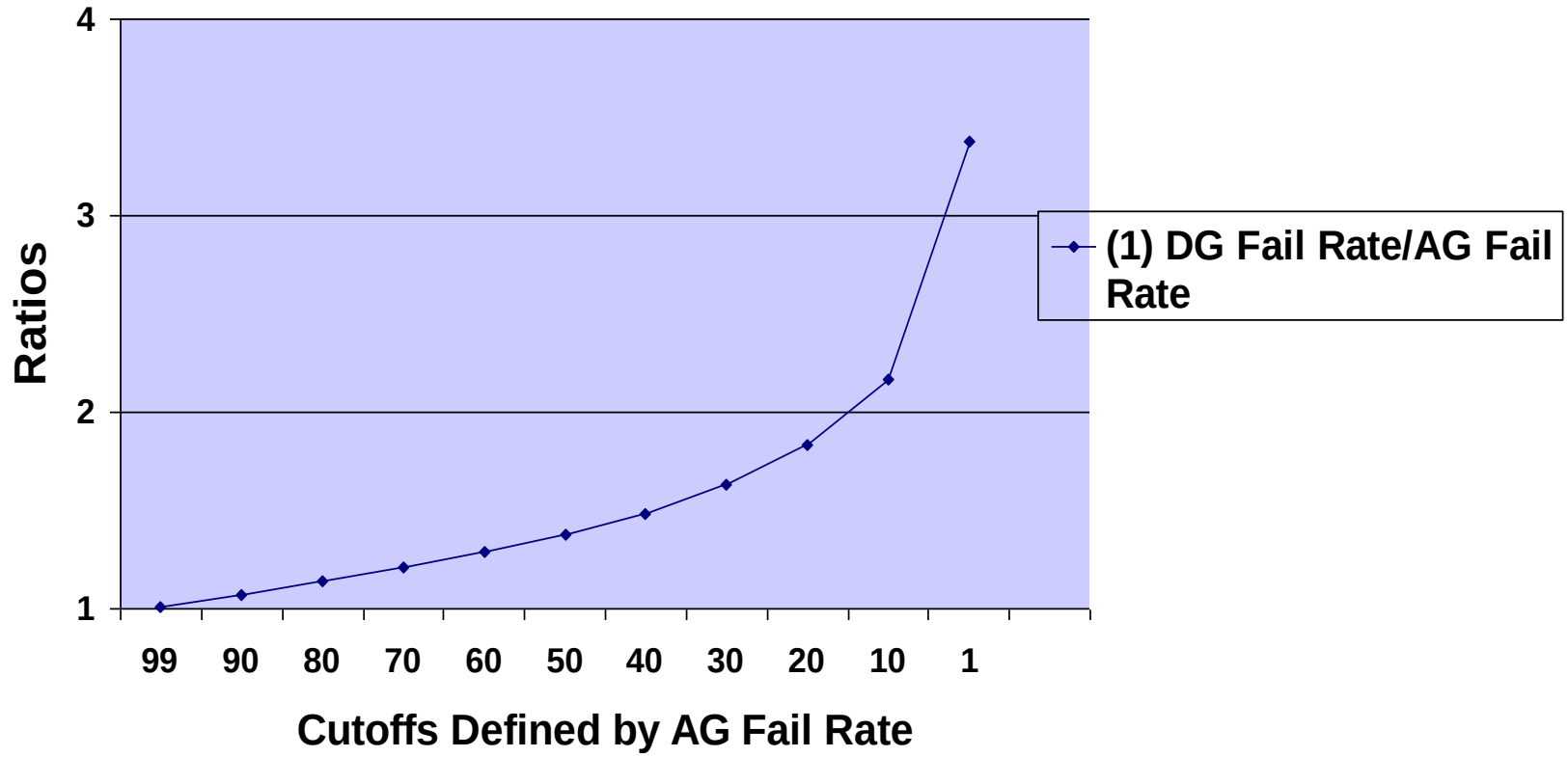
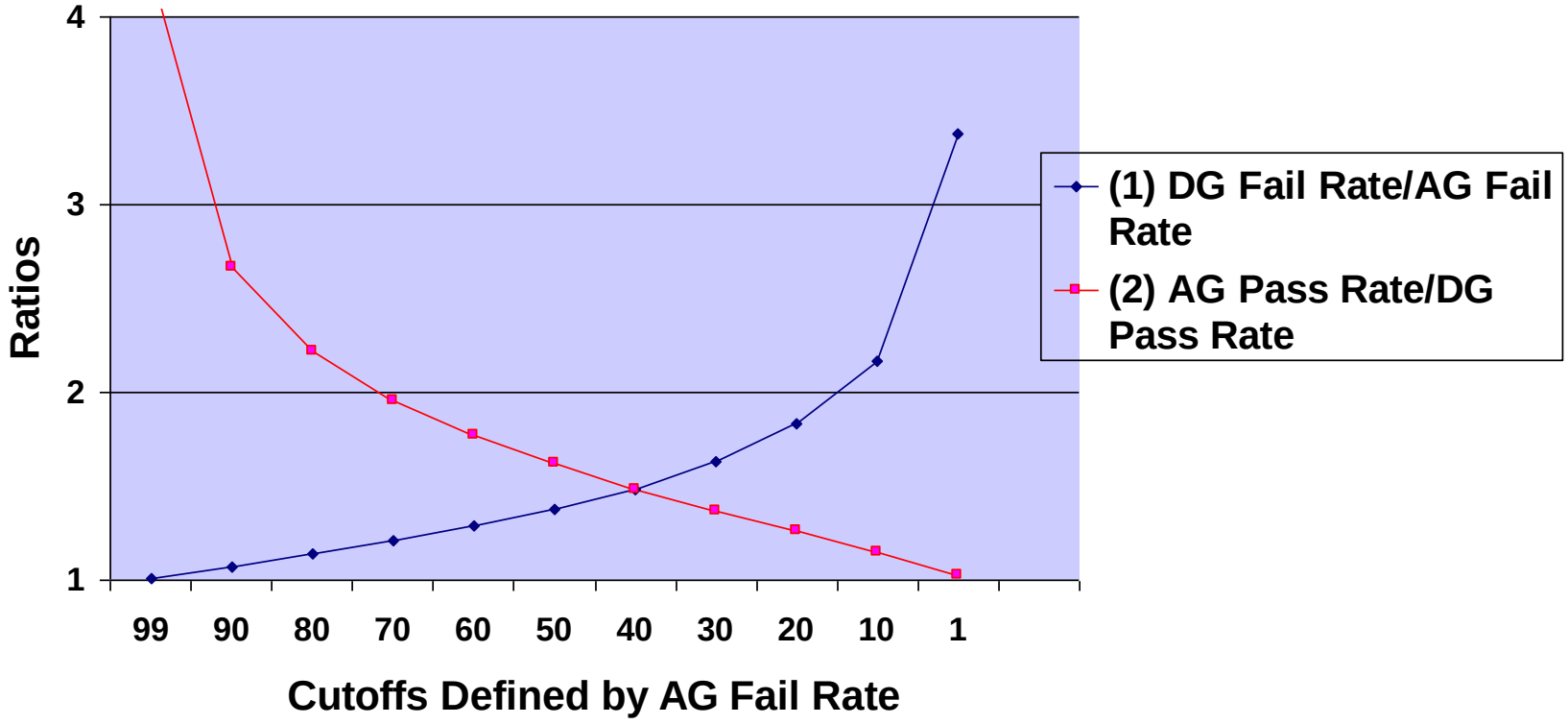


Fig. 2. Ratios of (1) DG Fail Rate to AG Fail Rate and (2) AG Pass Rate to DG Pass Rate at Various Cutoff Points Defined by AG Fail Rate



Patterns by Which Absolute Differences and Odds Ratios Tend to Change as the Overall Prevalence of an Outcome Changes – Scanlan's Rule 2

- As the overall prevalence of an outcome moves toward a range defined by a rate of 50% for one group (Point A) and 50% for the other group (Point B), absolute differences tend to increase; as prevalence moves away from the range so defined, absolute differences tend to decrease; within the range, the patterns are somewhat more complicated. See Scanlan's Rule page on jpscanlan.com.

- Odds ratios tend to change in the opposite direction of absolute differences.

Fig. 3. Absolute Differences Between Rates at Various Cutoff Points Defined by AG Fail Rate

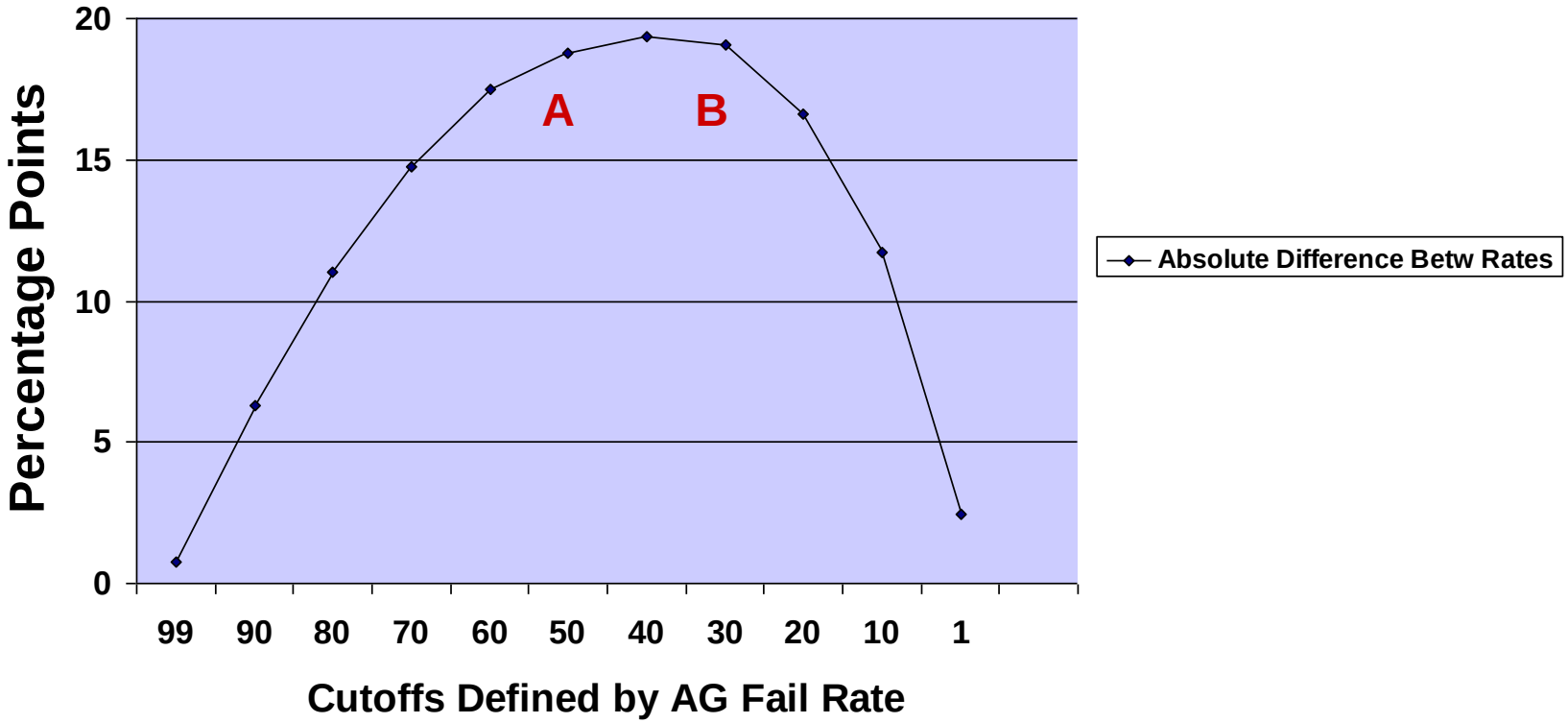


Fig 4. Ratios of DG Failure Odds to AG Failure Odds at Various Cutoff Points Defined by AG Fail Rate

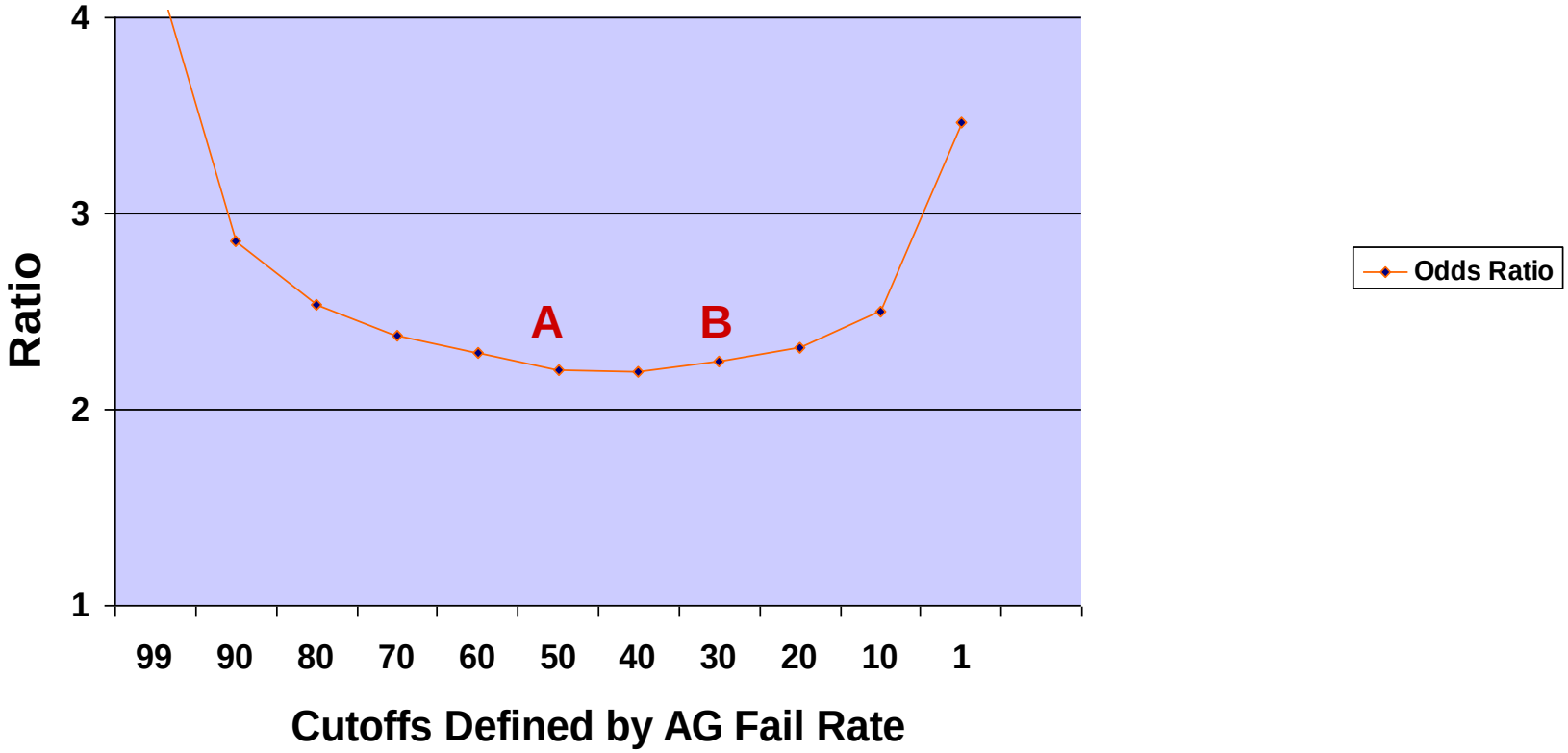


Fig. 5: Ratios of (1) DG Fail Rate to AG Fail Rate, (2) AG Pass Rate to DG Pass Rate, (3) DG Failure Odds to AG Failure Odds; and (4) Absolute Difference Between Rates

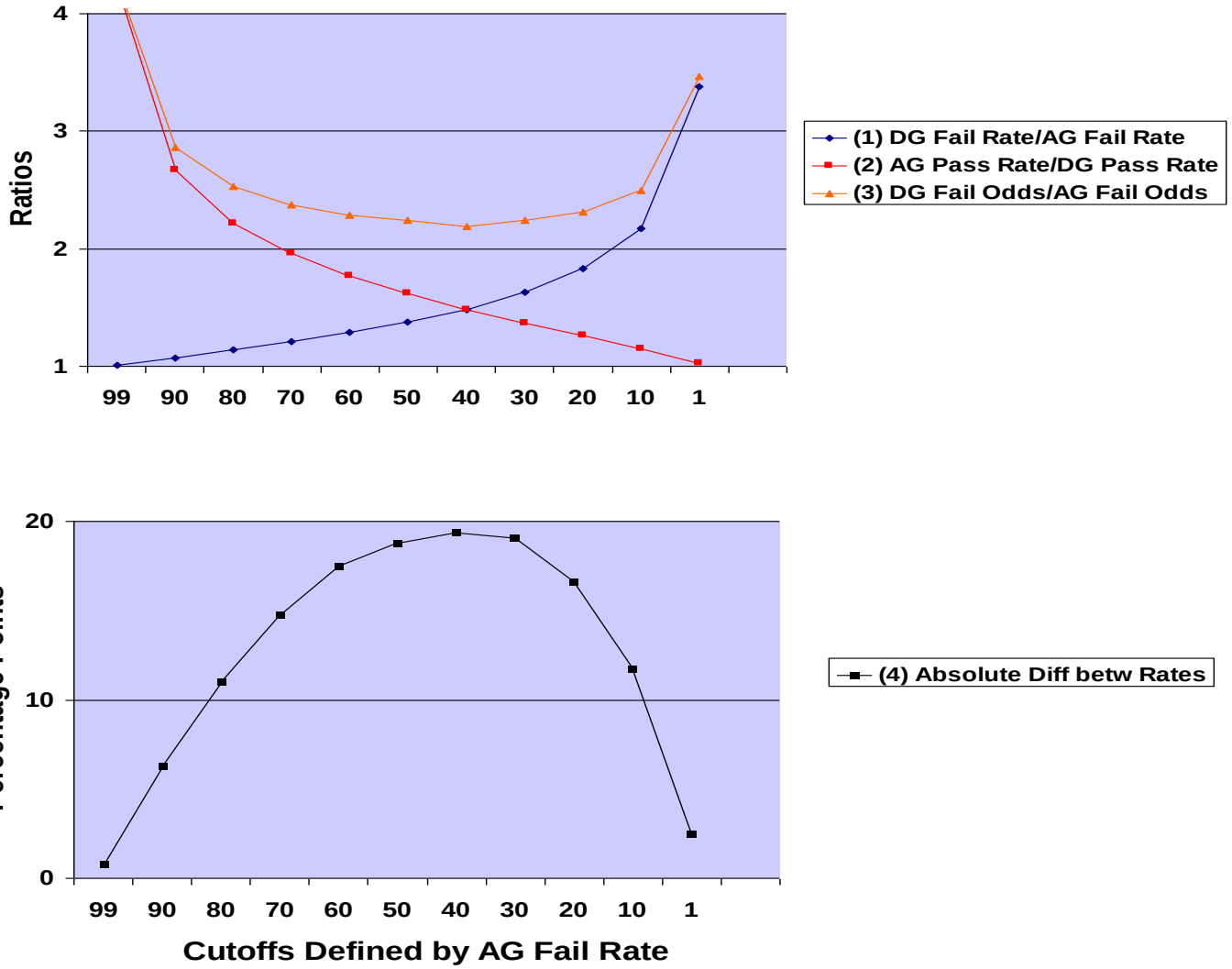


Fig. 6. Ratios of (1) Black to White Rates of Falling Below Percentages of Poverty Line, (2) White to Black Rates of Falling Above the Percentage, (3) Black to White Odds of Falling Below the Percentage: and (4)Absolute Differences Between Rates

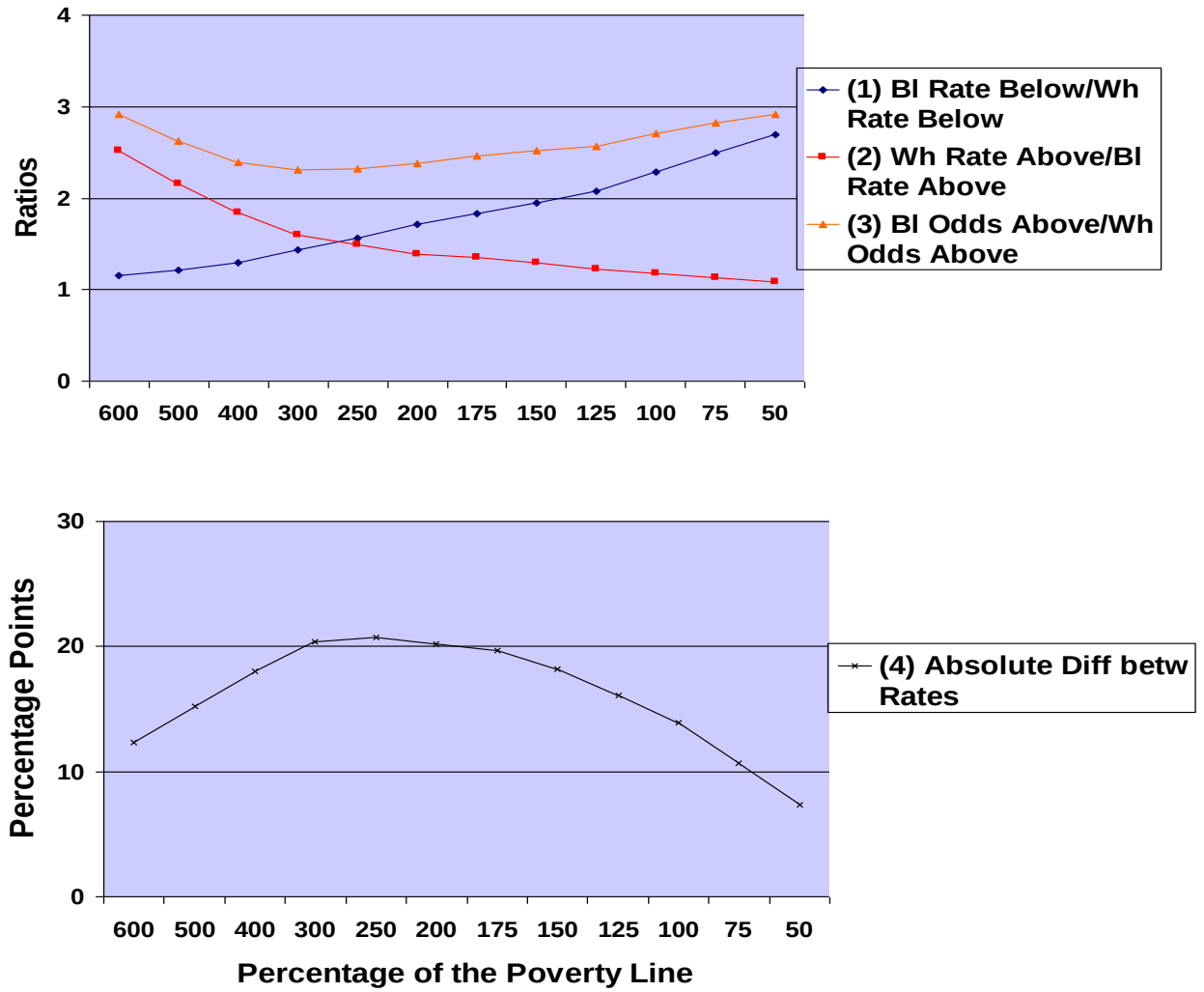
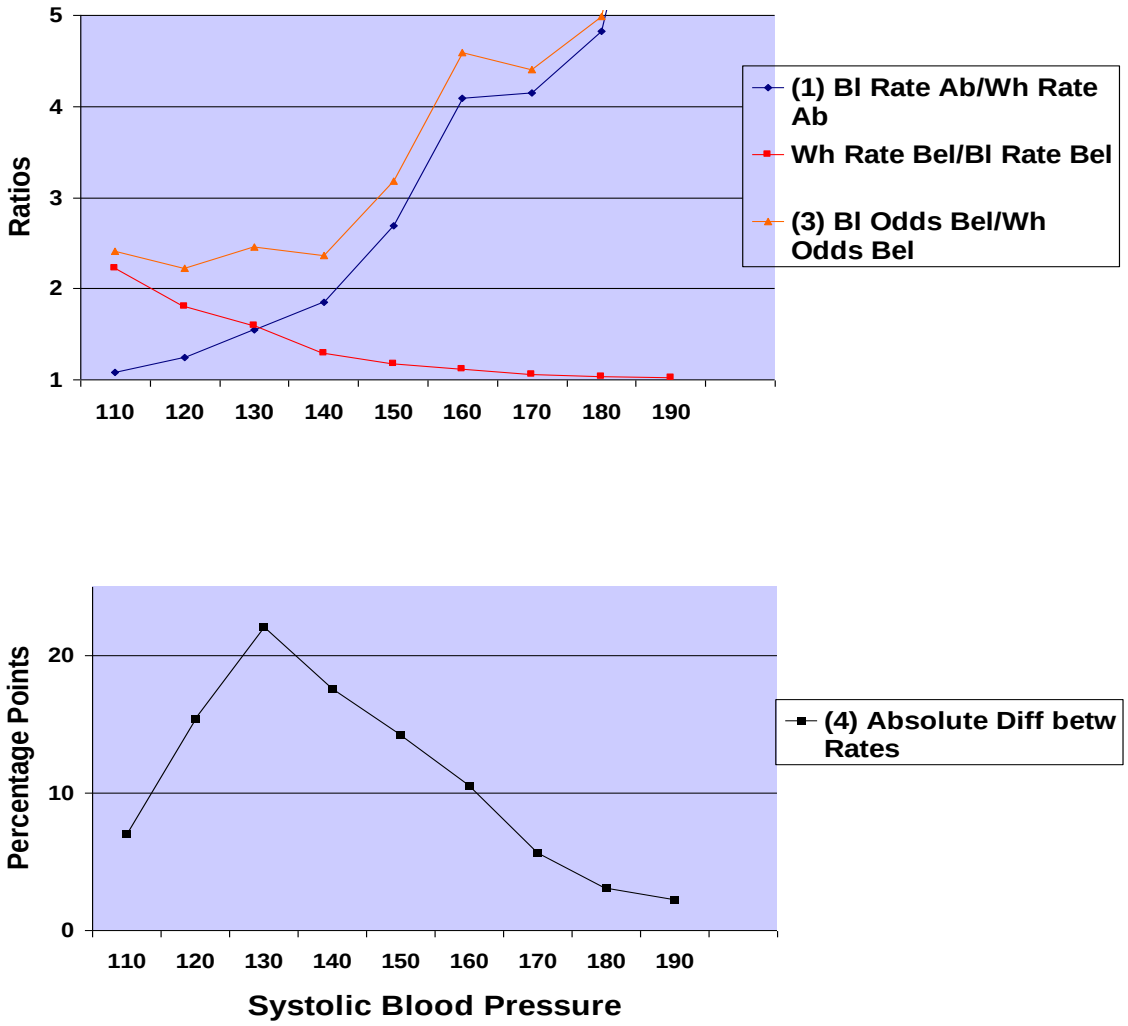


Fig. 7. Ratios of (1) Black to White Rates of Falling Above Various Systolic Blood Pressure Levels, (2) White to Black Rates of Falling below the Level, (3) Black to White Odds of Falling Above the Level; and (4) Absolute Difference Between Rates (NHANES 1999-2000, 2001-2002, Men 45-64)



Solution: Estimated Effect Size (EES)

Difference between means of hypothesized underlying normal distributions of risks of experiencing an outcome, in terms of percentage of a standard deviation, derived from any pair of outcome rates.

Table 1. Illustration of Meaning of Various Ratios at Different Prevalence Levels

Ratio	DGFailRate	AGFailRate	EES
1.2	60.0%	50.0%	0.26
1.2	18.4%	15.4%	0.12
1.5	75.0%	50.0%	0.68
1.5	45.0%	30.0%	0.39
2.0	40.0%	20.0%	0.59
2.0	20.0%	10.0%	0.44
2.0	1.0%	0.5%	0.24
2.5	24.2%	9.7%	0.60
2.5	7.4%	2.9%	0.44
3.0	44.0%	14.7%	0.90
3.0	14.4%	4.8%	0.60
3.0	2.7%	0.9%	0.44

Table 2. Illustration of UK Changes Over Time from Table 4.13 of *The Widening Gap* (rates per 100,000)

Cohort	Year	Class I	Class V	Mort Ratio	Survival Ratio	AbsDf	EES
55-64	1921	2247	3061	1.36	1.008397	814	0.14
55-64	1931	2237	2535	1.13	1.003058	298	0.06
55-64	1951	2257	2523	1.12	1.002729	266	0.05
55-64	1961	1699	2912	1.71	1.012494	1213	0.25
55-64	1971	1736	2755	1.59	1.010479	1019	0.21
55-64	1981	1267	2728	2.15	1.015020	1461	0.32
55-64	1991	953	2484	2.61	1.015700	1531	0.39

Table 3. Illustration of UK Differences across Age Groups from Table 4.13 of *The Widening Gap*

Year	Cohort	Class I	Class V	Mort Ratio	Survival Ratio	AbsDf	EES
1991	25-34	39	187	4.8	1.001483	148	0.47
1991	35-44	101	382	3.8	1.002821	281	0.42
1991	45-54	306	916	3.0	1.006156	610	0.39
1991	55-64	953	2484	2.6	1.015700	1531	0.39

Table 4. Illustration of Comparisons as to Different Conditions from Lawlor (*AJPH 2006*) (Aberdeen 1950 birth cohort) (rates are per 10,000) (see D28)

Cond	Class I	Class V	Adv Ratio	Fav Ratio	AbsDf	EES
CHD	8.30	20.50	2.5	1.001223	12.2	0.28
Stroke	2.30	7.80	3.4	1.000550	5.5	0.34

Table 5. Illustration of Age Group Comparisons in Whitehall Studies from Marang-van de Mheen (*JECH 2001)* (rates are per 1,000)

Age	HGMR	LGMR	MortRatio	SurvRatio	AbsDf	EES
55-59	6.80	13.90	2.05	1.0072001	7.1	0.27
60-64	11.30	19.90	1.76	1.0087746	8.6	0.22
65-69	17.50	28.10	1.61	1.0109065	10.6	0.20
70-74	30.90	47.50	1.54	1.0174278	16.6	0.20
75-79	50.60	70.00	1.38	1.0208602	19.4	0.16
80-84	78.30	107.60	1.38	1.0328328	29.3	0.19
85-89	144.30	181.60	1.26	1.0455767	37.3	0.16

Table 6. Illustration Based on Boström and Rosén (*SJPH* 2003) Data on Mortality by Occupation in Seven European Countries (see D43 caveat)

Country	EES 1980-84	EES 1990-94
Denmark	**0.14**	**0.13**
England and Wales	**0.11**	**0.15**
Finland	**0.16**	**0.23**
Ireland	**0.10**	**0.19**
Norway	**0.12**	**0.16**
Spain	**0.12**	**0.23**
Sweden	**0.14**	**0.17**

Problems with the Solution

- Always practical issues (we do not really know the shape of the underlying distributions)

- Sometimes fundamental issues (e.g., where we know distributions are not normal because they are truncated portions of larger distributions, see D43 on MHD); cf. BSPS 2007, Fig. 6

- Irreducible minimum issues (A10, B7 (BSPS 2006), D63, D43, Irreducible Minimums Issue page on MHD)

Conclusion

- If we are mindful of the problems, the approach provides a framework for cautiously appraising the sizes of differences between outcome rates.

- Regardless of problems, the approach is superior to reliance on standard binary measures of differences between rates without regard to the way those measures tend to be correlated with the overall prevalence of an outcome.