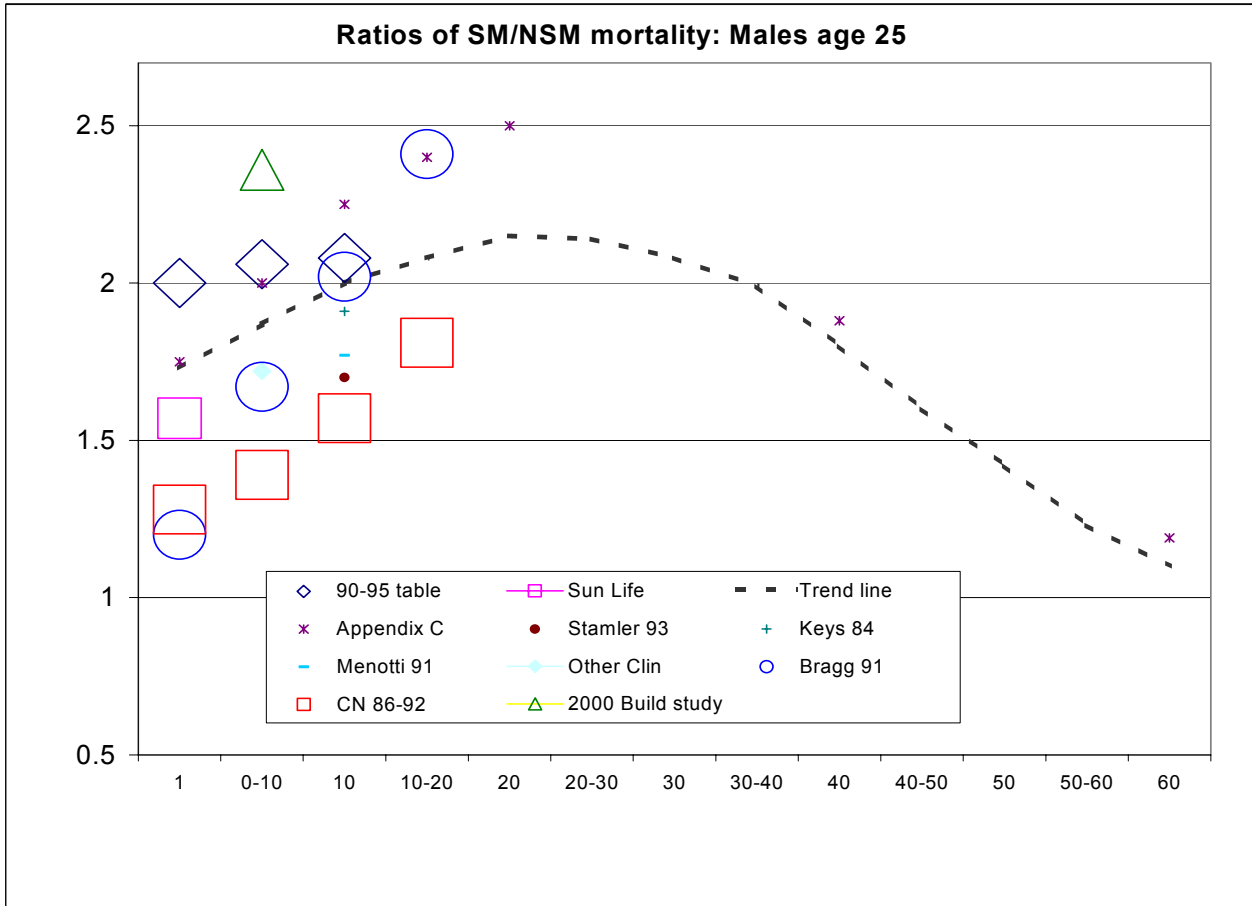


Individual Life Insurance Valuation Mortality Table Research Task Force

Appendix A

NONSMOKER/SMOKER MORTALITY

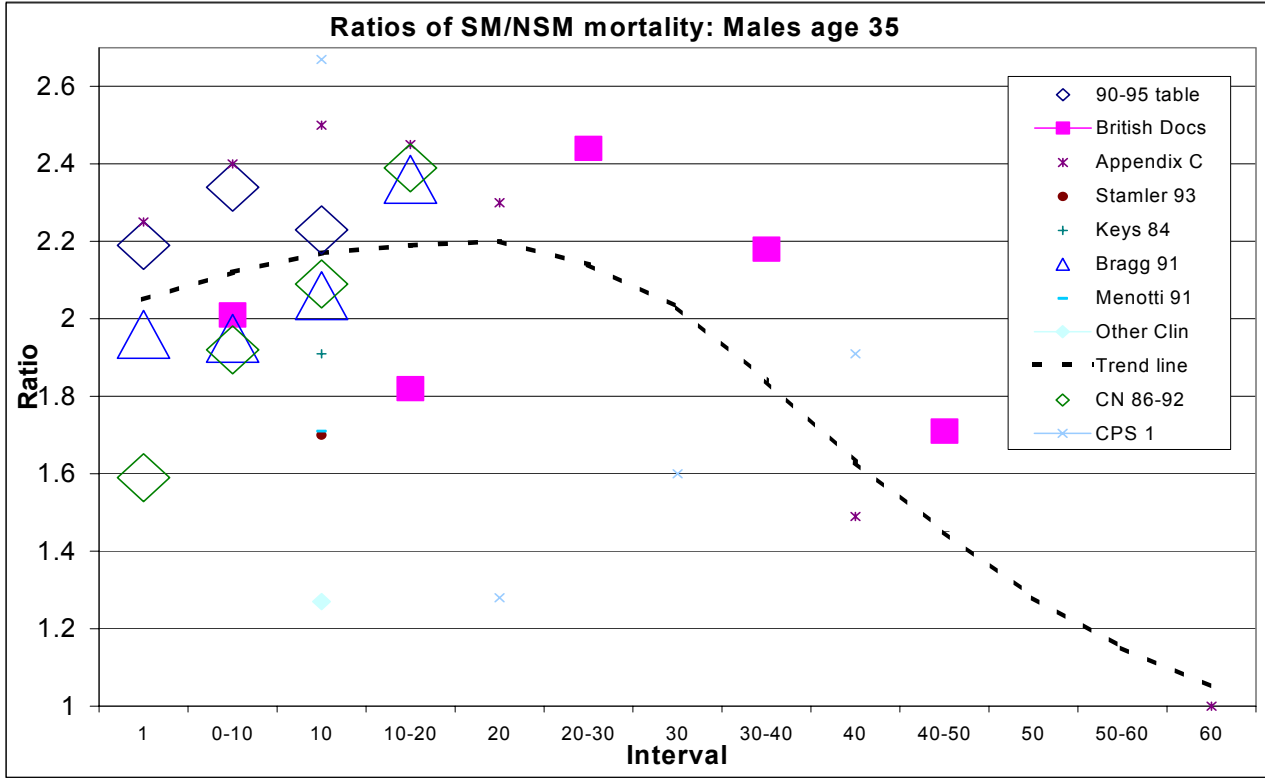
The following are graphs that contain relevant data on the ratio of smoker/nonsmoker mortality discussed in Section III of the report. The size of the points on the graphs represent relative amounts of data. Larger points represent relatively more data. Conversely, smaller points represent relatively less data. From these studies, trend lines have been developed and utilized in the development of relative risk estimates between smoker and nonsmoker mortality.



Durational Ratios Age 25 Male	Ref: 1 90-95 Table	2 Sun Life	3 1982 Reports App. C	5 Stamler 93	6 Keys 84	7 Bragg 91	8 Menotti 91	9 Other Clin	10 CN 86-92	Trend Line
1	2	1.57	1.75			1.2			1.28	1.73
0-10	2.06		2			1.67		1.72	1.39	1.87
10	2.08		2.25	1.7	1.91	2.02	1.77		1.57	2.00
10-20			2.4			2.41			1.81	2.08
20			2.5							2.15
20-30										2.14
30										2.08
30-40										1.99
40			1.88							1.80
40-50										1.60
50										1.42
50-60										1.23
60			1.19							1.10

References

- 1 1990-95 Basic Mortality Tables, SM/NSM q's
- 2 Sun Life Mortality Experience by age at issues: Standard Med-Paramed Issues of 1965-76; 73-77 Anniversaries (<21 cigs/day) in SOA Transactions Vol 32 1980 p. 226
- 3 Appendix C, Report of the Task Force on smoker/nonsmoker mortality, SOA 1982 Ratios for subsequent durations represent the age specific ratios from the table (duration 10 estimate for males age 25 assumed to be equivalent to the age 35 value in the table)
- 5 Relationship of baseline major risk factors to coronary and all-cause mortality (24 year follow-up, summary risk estimate assumed to correspond to average risk at approximately 12 years) Stamler J et al., *Cardiology* 1993;82:191-222
- 6 The seven countries study: 2289 deaths in 15 years (age range of cohort 40-59, risk equation provided and used to estimate risk at 20years, summary risk estimate assumed to correspond to average risk at approximately 10 years) Keys A, et al., *Preventive Medicine* 13, 141-154 1984
- 7 1991 SM NSM Bragg table
- 8 All cause mortality and its determinants in middle aged men in Finland the Netherlands, and Italy in a 25 year follow-up (Risk equation for Netherlands used, age range of cohort 40-59, summary risk estimates assumed to correspond to average risk at approximately 12 years, plotted at 10 year risk point) Menotti A, et al., *Journal of Epidemiology and Community Health* 1991; 45:125-130
- 9 The mortality of smokers and nonsmokers (derived from table 8 page 89, risk estimate for 20-24yo males, 6.5 years of follow-up) Dorn, HF *Proc Soc Stat Sect Amer Stat Assn* 34-71, 1958
in Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service
- 10 1986-92 Canada CIA Basic table by gender and smoking status

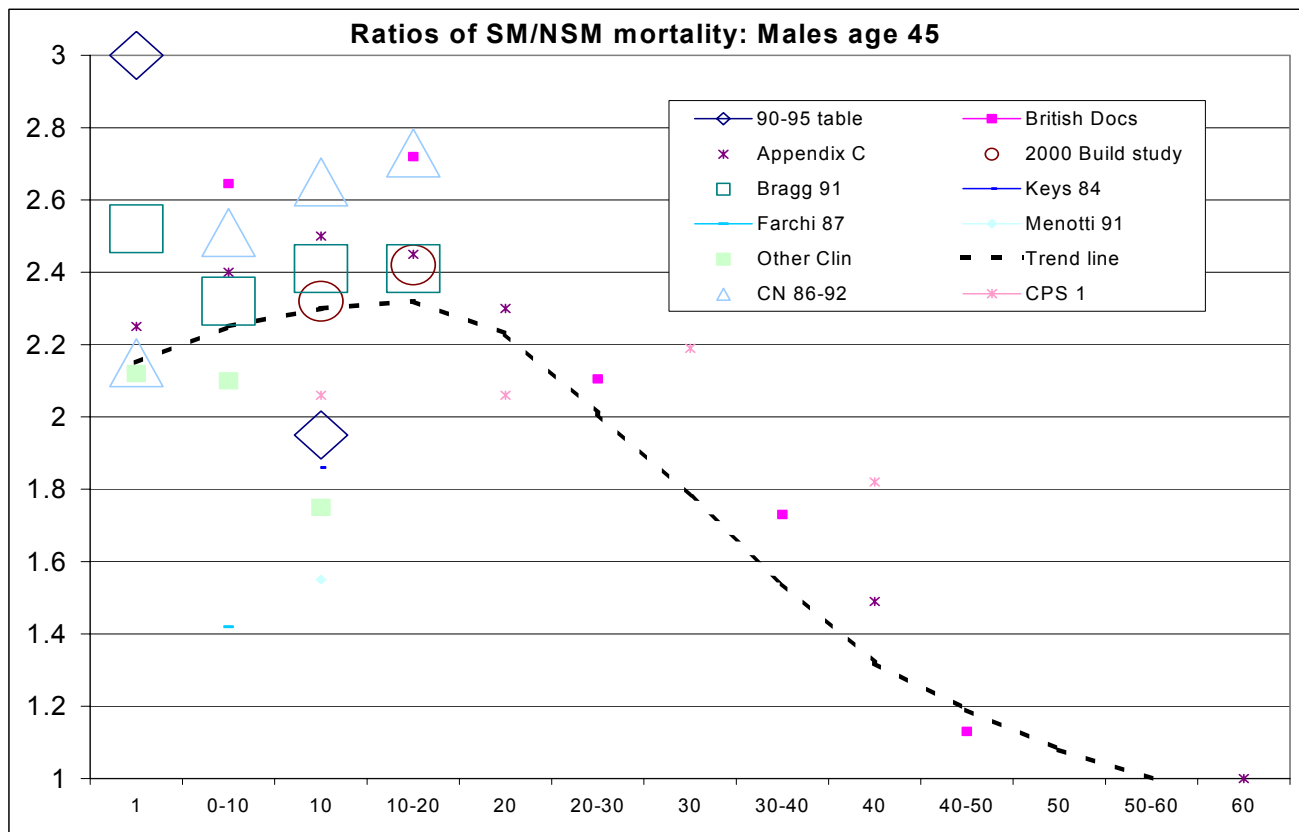


Durational Ratios Age 35 Males	Ref: 1 90-95 Table	11 British Docs	3 1982 Reports App. C	5 Stamler 93	6 Keys 84	7 Bragg 91	8 Menotti 91	12 Other Clin	10 CN 86-92	13 CPS 1	Trend Line
1	2.19		2.25			1.96			1.59		2.05
0-10	2.34	2.01	2.4			1.95			1.92		2.12
10	2.23		2.5	1.7	1.9	2.06	1.71	1.27	2.09	2.67	2.17
10-20		1.82	2.45		1	2.36			2.39		2.19
20			2.3							1.28	2.20
20-30		2.44									2.14
30										1.6	2.03
30-40		2.18									1.84
40			1.49							1.91	1.63
40-50		1.71									1.45
50											1.28
50-60		0.92									1.15
60			1								1.05

References

1, 3, 5-8, as noted above

- 11 Mortality in relation to smoking: 40 years' observations on male British Doctors (estimate calculated from figures included in report)
Doll R, et al., *British Medical Journal* 1994;309:901-11
- 12 Smoking and Health, Report of the Surgeon General, 1979, Chapt. 2 table 5 p. 17(16 yr FU, 30-34 yo male smoking 10-20 cigs/day)
in *SOA Transactions Vol 31, 1980 page 195*
- 13 Smoking cessation and mortality trends among 118,000 Californians, 1960-97 (May represent ratios of attained age death rates)
Enstrom JE, et al., *Epidemiology* 1999 10:500-12



Comparison s of Ratios 25	Ref: 1 90-95 Table	11 British Docs	3 1982 Reports App. C	7 Bragg 91	6 Keys 84	14 Farchi 87	8 Menotti 91	15 Other Clin	10 CN 86-92	13 CPS 1	Trend Line
1	3		2.25	2.52				2.12	2.15		2.15
0-10		2.645	2.4	2.32		1.42		2.1	2.51		2.25
10	1.95		2.5	2.41	1.86		1.55	1.75	2.65	2.06	2.30
10-20		2.72	2.45	2.41					2.73		2.32
20			2.3							2.06	2.23
20-30		2.105									2.01
30										2.19	1.78
30-40		1.73									1.54
40			1.49							1.82	1.32
40-50		1.13									1.19
50											1.08
50-60											1.00
60			1								

References

1, 3, 6-7, 10-11, 13 as noted above

- 14 Coronary Risk Factors and Survival probability for Coronary and Other Causes of Death (age range of cohort 40-59, risk equation provided and used to estimate risk at 10 years) Farchi G et al., *AM Journal of Epidemiology*, 1987;128:400-8
- 15 Dur. 1 est. (1 Special report to the Surgeon General's Advisory Committee on Smoking and Health (age 40-49, 22 months for FU for 10-19 cigs/day) Hammond, EC (Late 50's-60's) in *Smoking and Health*: p 87
Report of the Advisory Committee to the Surgeon General of the Public Health Service

Dur 0-10 Several studies provided risk estimates corresponding to this age and Duration. An average of these values was used.

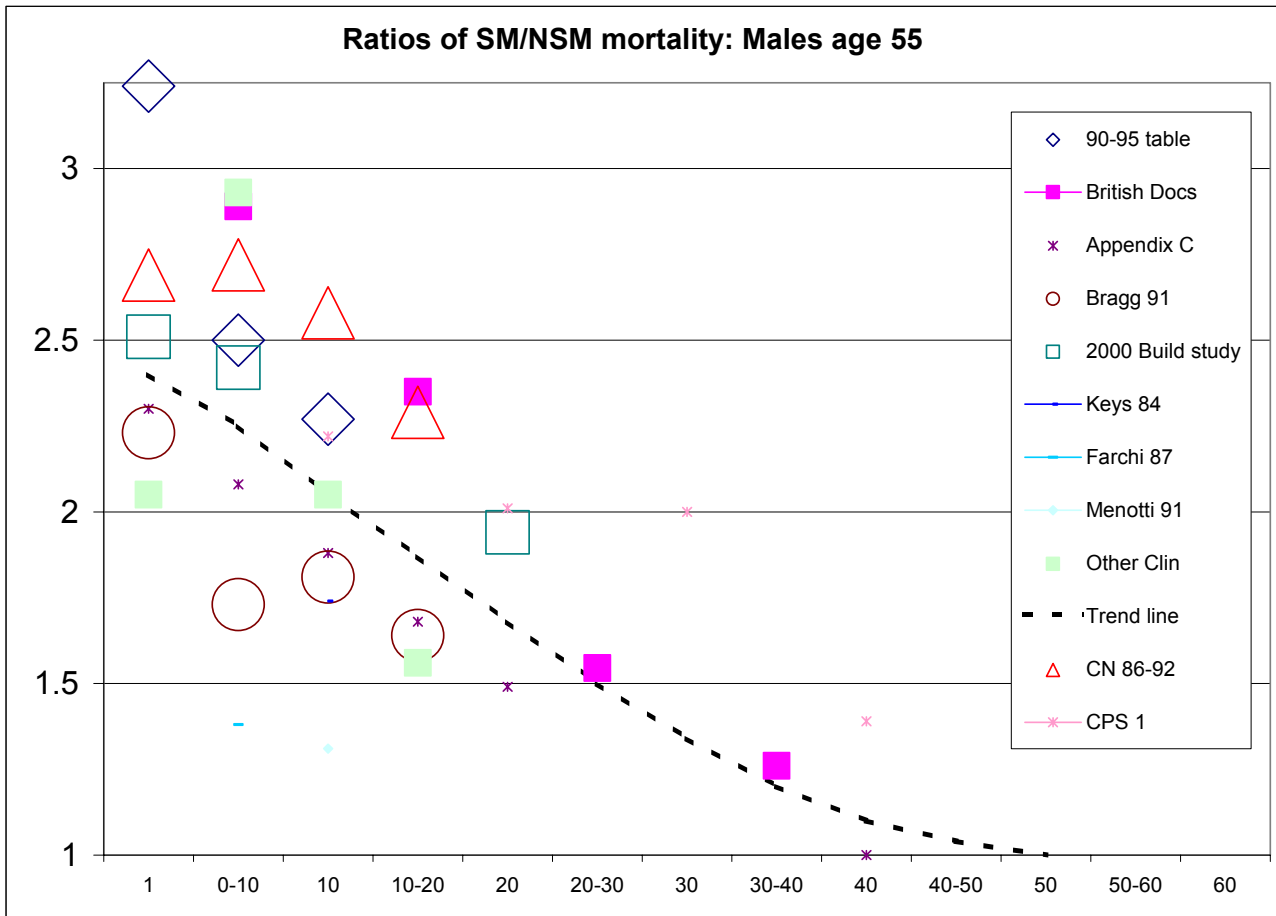
(15e) Upper bound: The mortality of smokers and nonsmokers (estimated from figure 1 p. 88, 6.5 years of follow-up, RR 2.22 Dorn, HF Proc Soc Stat Sect Amer Tat Assn 34-71, 1958 in *Smoking and Health: Report of the Advisory Committee to the Surgeon General of the PublicHealth Service*

(15b) Lower bound: Do cardiovascular disease risk factors predict all-cause mortality? (RR 1.89 after 9 years of follow-up) Norris A, et al., *Int J Epi* 24(5): 906-14

Dur 10 (0-20) Several studies provided risk estimates corresponding to this age And duration. An average of these values was used

(15c) Upper bound: Smoking cessation and mortality trends among 2 US populations (RR age 35-44: 2.08) Enstrom JE, *J Clin Epidemil* 52, 9:813-825, 1999

(15d) Lower bound: Factors predictive of long-term coronary heart disease mortality among 10,059 male Israeli civil servants and municipal employees (RR age 40+: 1.42) A 23 year mortality F/U in the Israeli Ischemic Heart Disease Study. Goldbourt U, et al., *Cardiology* 1993;82-100-121



Comparisons of Ratios 55	Ref: 1 90-95 Table	11 British Docs	3 1982 Reports App. C	7 Bragg 91	6 Keys 84	14 Farchi 87	8 Menotti 91	16 Other Clin	10 CN 86-92	13 CPS 1	Trend Line
1	3.24		2.3	2.23				2.05	2.96		2.40
0-10	2.5	2.89	2.08	1.73		1.38		2.93	2.72		2.25
10	2.27		1.88	1.81	1.74		1.31	2.05	2.58	2.22	2.05
10-20		2.35	1.68	1.64				1.56	2.29		1.87
20			1.49							2.01	1.68
20-30		1.545									1.50
30										2	1.34
30-40		1.26									1.20
40			1							1.39	1.10
40-50		0.98									1.04
50											1.00
50-60											
60											

References

1, 3,6-8, 10-11, 13

As noted above

16 Dur. 1 est. Reference 15a (RR 2.05)

Dur 0-10 Several studies provided risk estimates corresponding to this age and duration. An average of these values was used.

Upper bound: Reference 15c (RR age 45-54: 3.93)

Lower bound: Reference 15e (RR 1.92)

Dur 10 (0-20) Several studies provided risk corresponding to this age and duration. An average of these values was used

Upper bound: Reference 15c (RR age 45-54: 2.57)

16(a) Lower bound: Health consequences of cigarettes and the internist's role in smoking cessation (20 yr FU, RR age 45-74: 1.52)

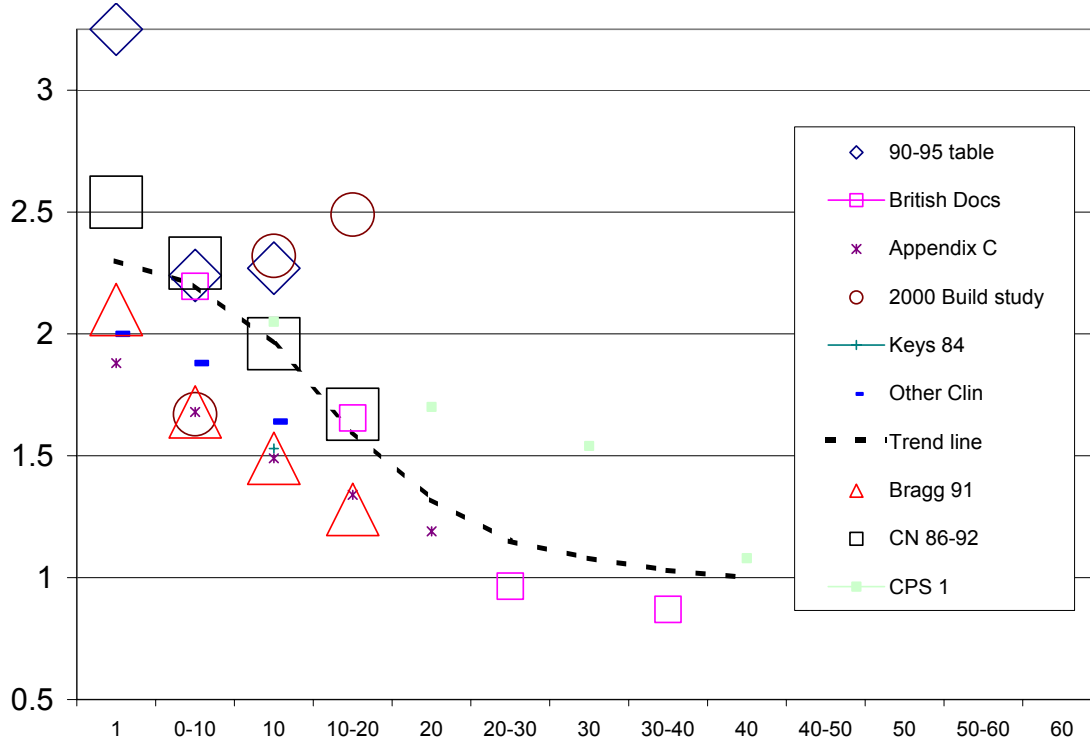
Stokes J. et al., Adv Intern Med 33:431, 1988

Dur 30 (1 Coronary disease mortality and risk factors in Black and White men (30 yr FU, RR age 35-74: 1.56)

Results from the combined Charleston SC and Evans county Heart Studies

Kelli JE, Arch Intern Med 1995; 155:1521-1527

Ratios of SM/NSM mortality: Males age 65

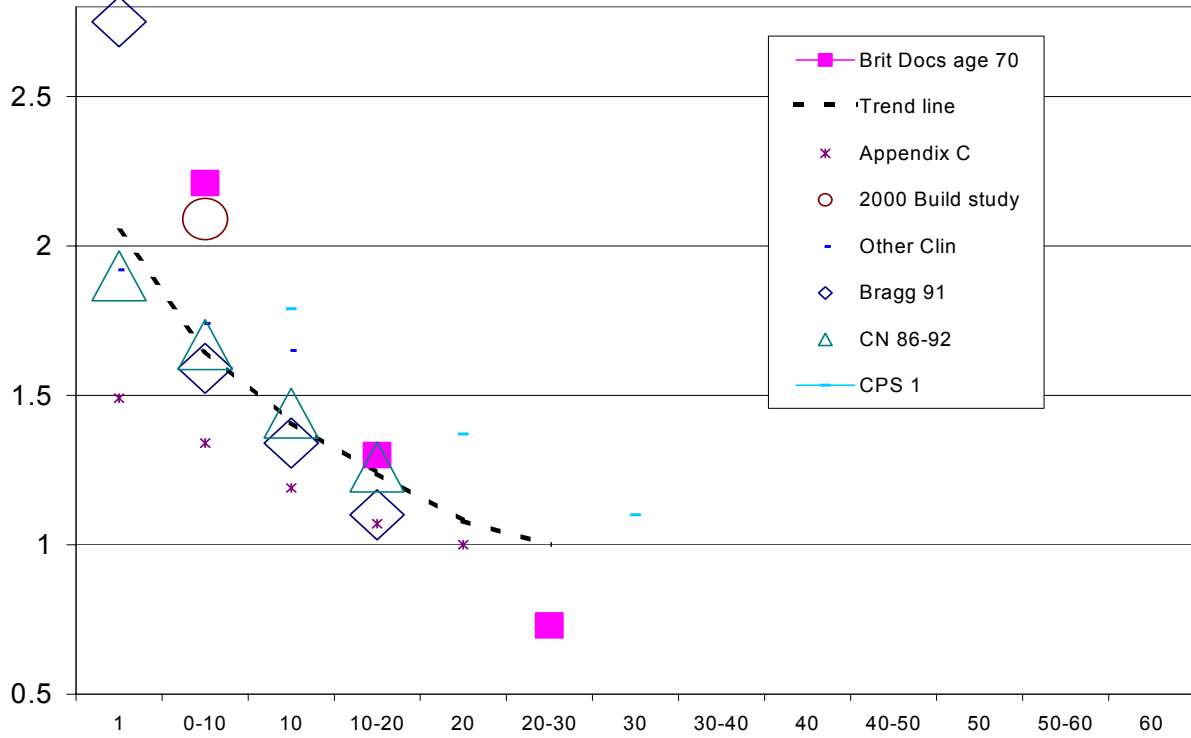


Comparisons of Ratios 65	Ref: 1 90-95 Table	11 British Docs	3 1982 Reports App. C	7 Bragg 91	6 Keys 84	17 Other Clin	10 CN 86-92	13 CPS 1	Trend Line
1	3.25		1.88	2.1		2.00	2.54		2.30
0-10	2.24	2.195	1.68	1.68		1.88	2.29		2.20
10	2.27		1.49	1.49	1.53	1.64	1.96	2.05	1.96
10-20		1.655	1.34	1.28			1.67		1.60
20			1.19					1.7	1.32
20-30		0.965							1.15
30								1.54	1.08
30-40		0.87							1.03
40								1.08	1.00
40-50									
50									
50-60									
60									

References

- 1, 3, 6-7, 10-11, 13 As noted above
- 17 Dur 1 Several studies provided risk estimates corresponding to this age and duration. An average of these values was used
- 17(a) Upper bound: Smoking and mortality among older men and women in 3 communities (5 yer FU, RR age 65-69: 2:3)
La Croix AZ, et al., NEJM 1991; 324:1619-25
- Lower bound: Reference 15a (22 month FU, RR age 60-69: 1.69 at 10-19cigs/day)
- Dur 0-10 Several studies provided risk estimates corresponding to this age and Duration. An average of these values was used
Upper bound: Reference 15c (RR age 55-64: 2.05)
Lower bound: Reference 15e (RR 1.7)
- Dur 10 (0-20) Several studies provided risk estimates corresponding to this age and Duration. An average of these values was used.
Upper bound: Reference 15c (RR age 55-64: 1.88)
- 17(b) Lower bound: Factors associated with survival to 75 years of age in middle aged men and women (Study designed to estimate risk at 20 years and attained age 75+, RR 1.39).
Goldberg RJ, Arch Intern Med 1996; 156:505-09

Ratios of SM/NSM mortality: Males age 75



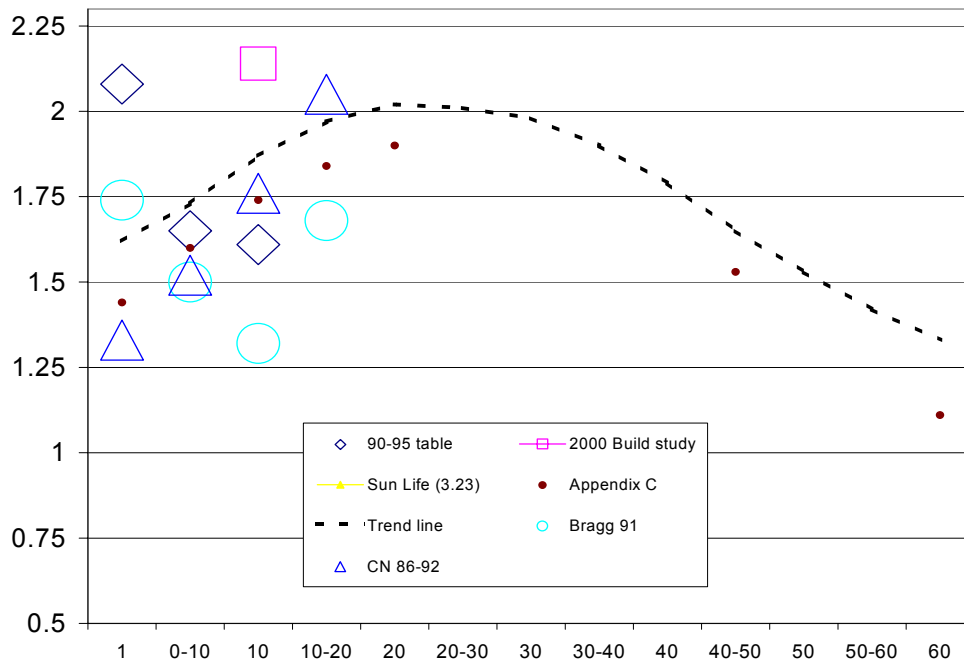
Comparisons of Ratios 75	11 British Docs Age 70	3 Appendix C	7 Bragg 91	18 Other Clin	10 CN 86-92	13 CPS 1	Trend Line
1		1.49	2.75	1.92	1.9		2.05
0-10	2.21	1.34	1.59	1.74	1.67		1.65
10		1.19	1.34	1.65	1.44	1.79	1.41
10-20	1.3	1.07	1.1		1.26		1.24
20		1				1.37	1.08
20-30	0.73						1.00
30						1.1	
30-40							
40							
40-50							
50							
50-60							
60							

References

3, 7, 10-11, 13 As noted above

- 18 Dur 1 Several studies provided risk estimates corresponding to this age and duration. An average of these values was used
Upper bound: Reference 17a (5yr FU, RR [averaged] age 70-74 And 75+: 2:35)
Lower bound: Reference 15a (22month FU, RR age 70-79: 1.50 at 10-19 cigs/day)
- Dur 0-10 Several studies provided risk estimates corresponding to this age and duration. An average of these values was used.
Upper bound: Reference 15c (RR age 65-74: 1.9)
Lower bound: Reference 15e (RR 1.57)
- Dur 10 (0-20) Several studies provided risk estimates corresponding to this age and duration. An average of these values was used
Upper bound: Reference 15c (RR age 65-74: 2.0)
Lower bound: Reference 12 (age 65-74, 16 yr FU; RR 1.57)

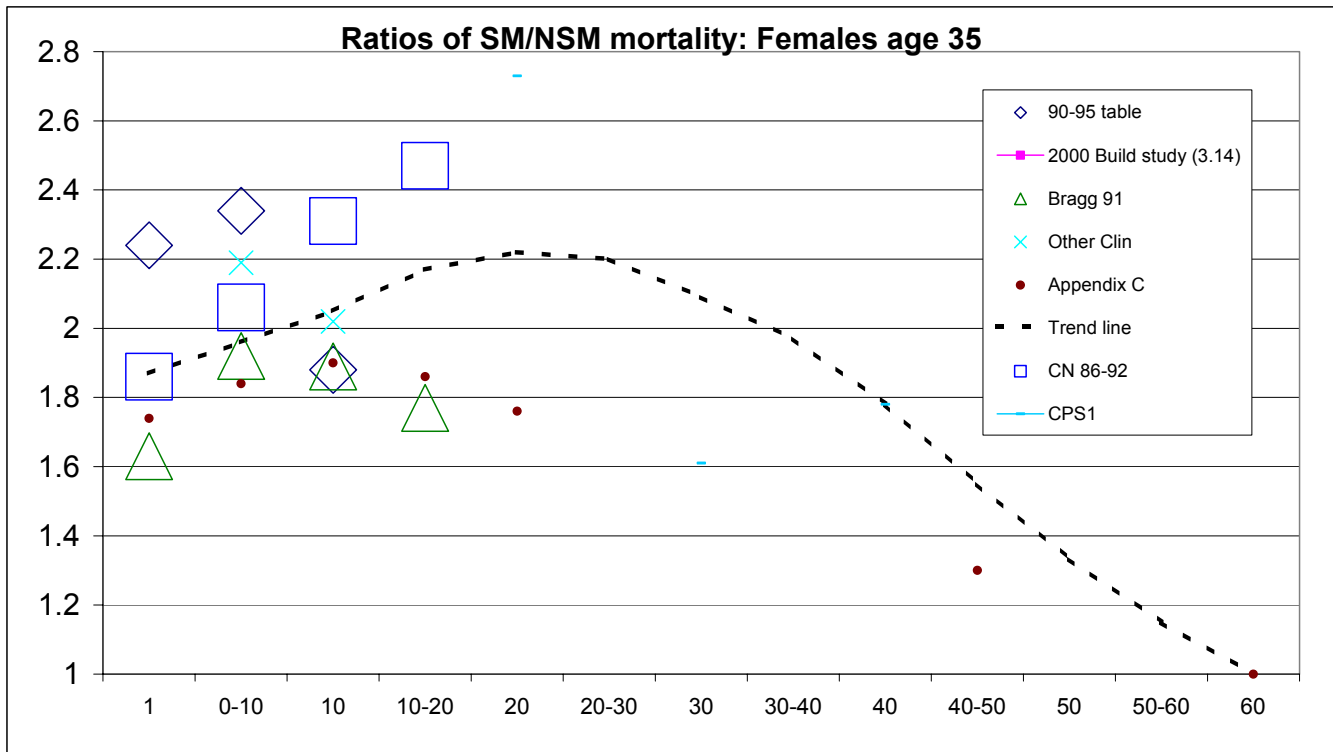
Ratios of SM/NSM mortality: Females age 25



Comparisons of Ratios of 25	Ref: 1 90-95 Table	2 Sun Life	7 Bragg 91	3 1982 Reports App. C	10 CN 86-92	Trend Line
1	2.08	3.23	1.74	1.44	1.33	1.62
0-10	1.65		1.5	1.6	1.52	1.73
10	1.61		1.32	1.74	1.76	1.87
10-20			1.68	1.84	2.05	1.97
20				1.9		2.02
20-30						2.01
30						1.98
30-40						1.90
40						1.79
40-50				1.53		1.65
50						1.53
50-60						1.42
60				1.11		1.33

References

1-3, 7, 10 As noted for males



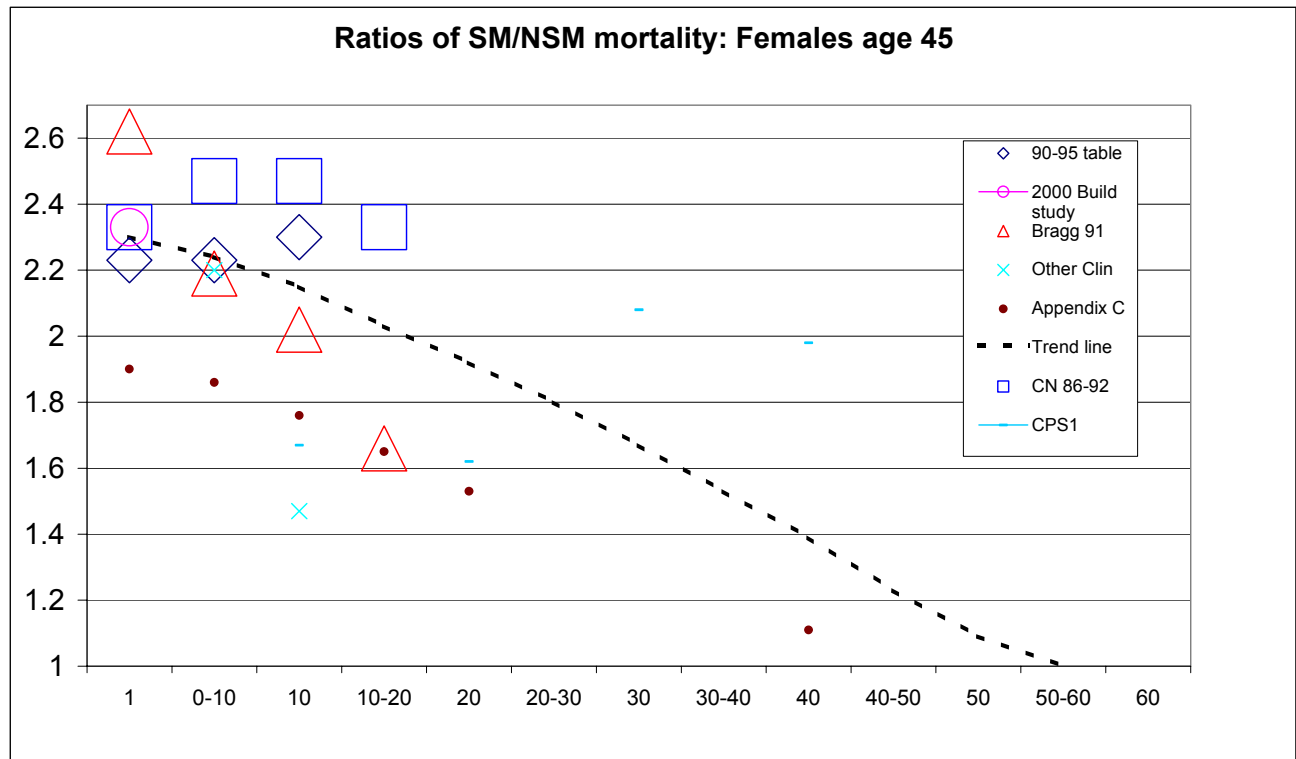
Comparisons of Ratios 35	Ref: 1 90-95 Table	7 Bragg 91	19 Other Clin	3 Appendix C	10 CN 86-92	13 CPSI	Trend Line
1	2.24	1.63		1.74	1.86		1.87
0-10	2.34	1.92	2.19	1.84	2.06		1.96
10	1.88	1.89	2.02	1.9	2.31		2.05
10-20		1.77		1.86	2.47		2.17
20				1.76		2.73	2.22
20-30							2.20
30						1.61	2.09
30-40							1.97
40						1.78	1.78
40-50				1.3			1.55
50							1.33
50-60							1.15
60				1			1.00

References

1, 3, 7, 10, 13

As noted for males

19 Reference 15c



Comparisons of Ratios 45	Ref: 1 90-95 Table	7 Bragg 91	20 Other Clin	3 1982 Reports App. C	10 CN 86-92	13 CPSI	Trend Line
1	2.23	2.62		1.9	2.33		2.30
0-10	2.23	2.19	2.2	1.86	2.47		2.24
10	2.3	2.02	1.47	1.76	2.47	1.67	2.15
10-20		1.66		1.65	2.33		2.03
20				1.53		1.62	1.92
20-30							1.80
30						2.08	1.67
30-40							1.53
40				1.11		1.98	1.39
40-50							1.23
50							1.09
50-60							1.00
60							

References

1, 3, 7, 10, 13

As noted for males

20 Dur 0-10 (20a)

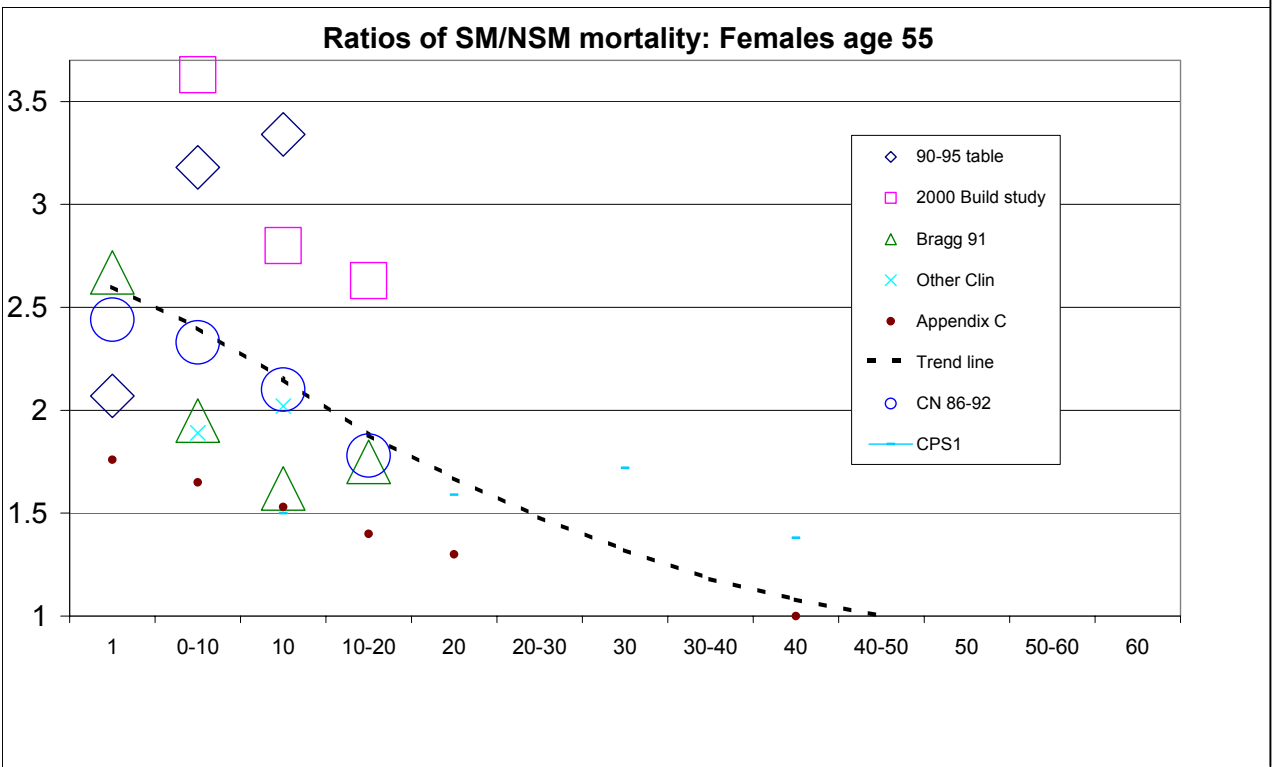
Mortality in middle-aged smokers and nonsmokers
(11yr FU, age 35-54)
Friedman CD, et al, NEJM 300:213-217, 1979

Dur 10 (0-20)

Several studies provided risk estimates corresponding to this age and duration. An average of these values was used

(20b)

Upper bound: Impact of multiple risk factor profiles on determining cardiovascular disease risk (age 25-75, @20 yr FU, RR 1.6)
Yusuf HR, et al, Preventive Med 27, 1-9 1998
Lower bound: Reference 15c (RR age 35-44: 1.34)



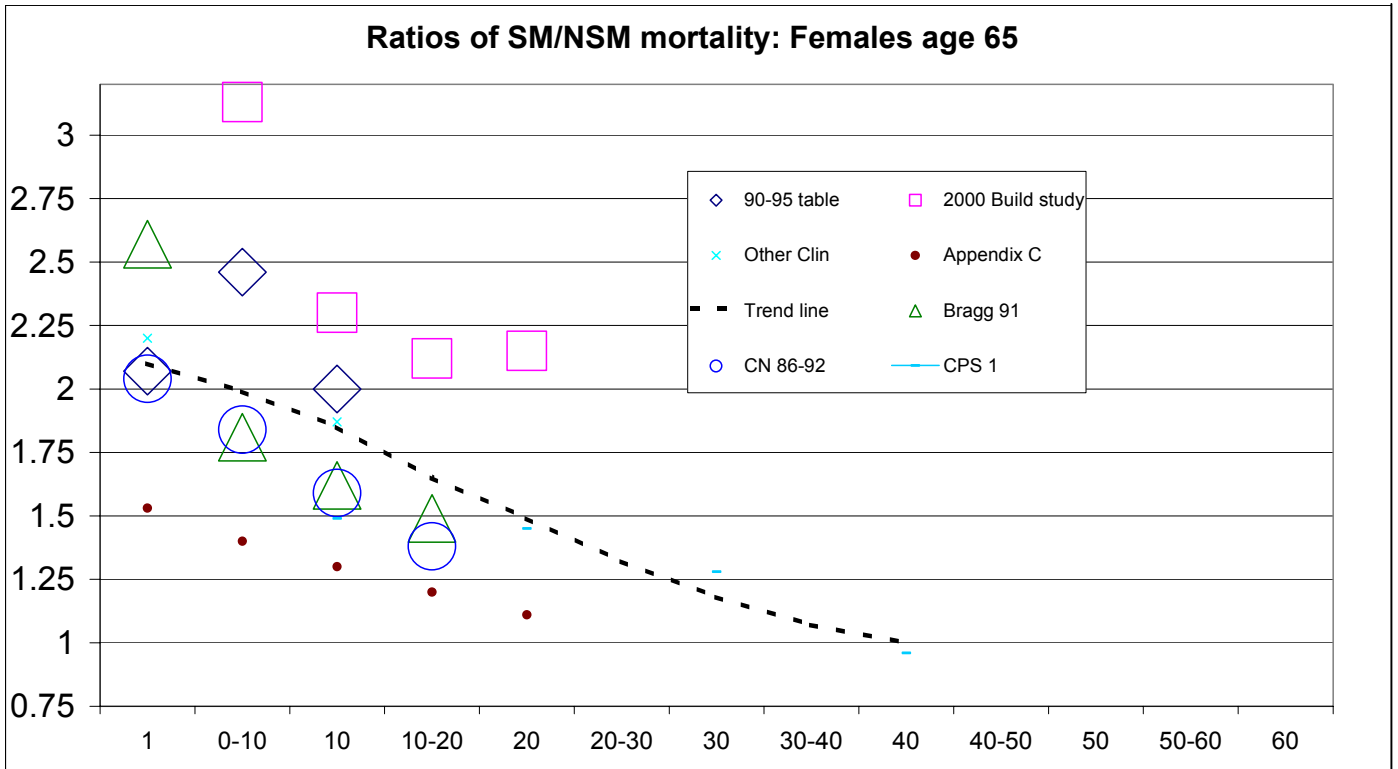
Comparisons of Ratios 55	Ref: 1 90-95 Table	7 Bragg 91	21 Other Clin	3 Appendix C	10 CN 86-92	13 CPS1	Trend Line
1	2.07	2.67		1.76	2.44		2.60
0-10	3.18	1.95	1.89	1.65	2.33		2.40
10	3.34	1.62	2.02	1.53	2.1	1.5	2.15
10-20		1.75		1.4	1.78		1.88
20				1.3		1.59	1.67
20-30							1.48
30						1.72	1.32
30-40							1.18
40				1		1.38	1.08
40-50							1.00
50							
50-60							
60							

References

1, 3, 7, 10, 13

As noted for males

- 21 Dur 0-10 Several studies provided risk estimates corresponding to this age and duration. An average of these values was used
Upper bound: Reference 15c (RR age 45-54: 2.07)
21(a) Lower bound: Classical risk factors and their impact on incident non-fatal and fatal myocardial infarction and all-cause mortality in southern Germany (age 45-64, 8yr FU, RR 1.7) Results from the MONICA Augsburg cohort study 1984-92
Keil U, Eur heart J 1998; 19: 1197-1207
- Dur 10 (0-20) Several studies provided risk estimates corresponding to this age and duration. An average of these values was used
Upper bound: Reference 15c (RR age 45-54: 2.41)
Lower bound: Reference 16a (RR age 45-74: 1.62)



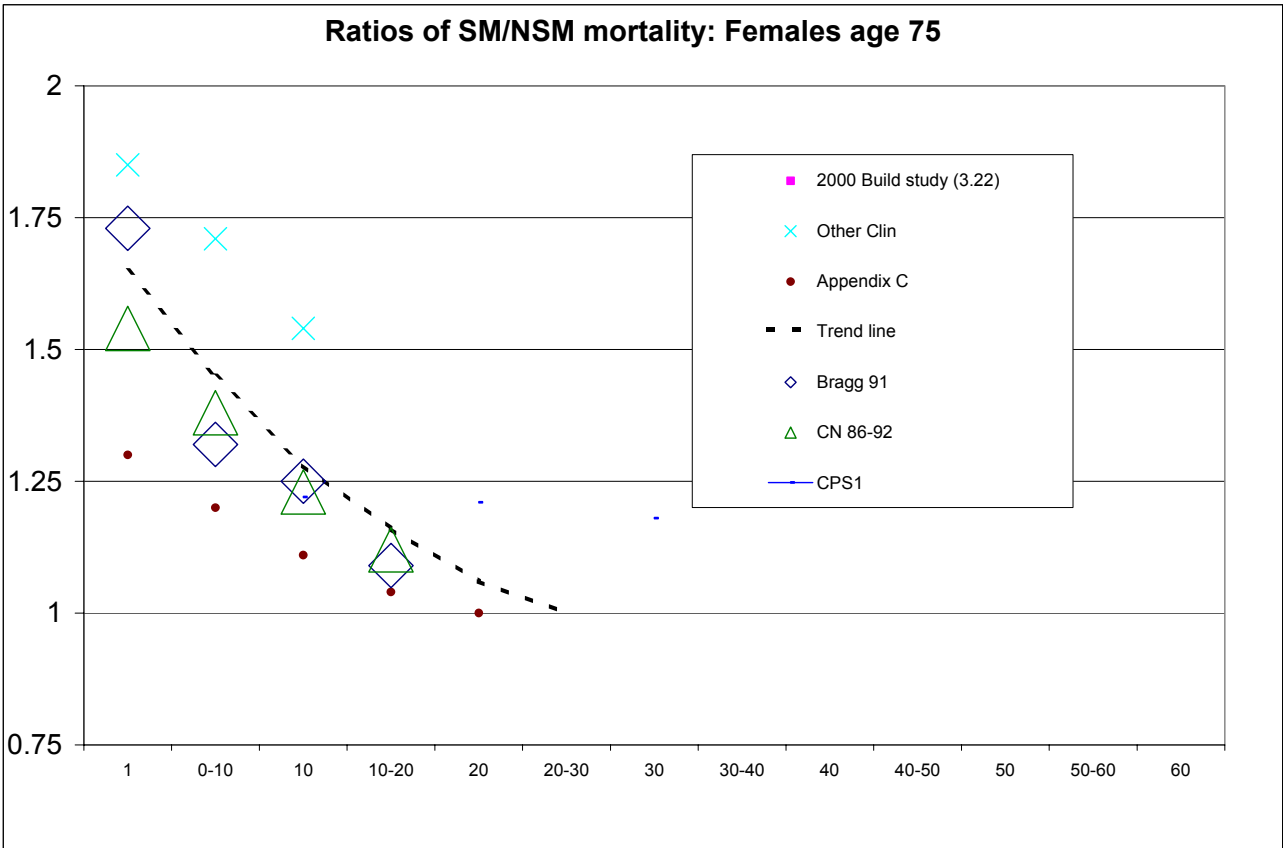
Comparisons of Ratios 65	Ref: 1 90-95 Table	7 Bragg 91	22 Other Clin	3 Appendix C	10 CN 86-92	13 CPSI	Trend Line
1	2.07	2.57	2.2	1.53	2.04		2.10
0-10	2.46	1.81		1.4	1.84		1.99
10	2	1.62	1.87	1.3	1.59	1.49	1.85
10-20		1.49		1.2	1.38		1.65
20				1.11		1.45	1.49
20-30							1.32
30						1.28	1.18
30-40							1.07
40						0.96	1.00
40-50							
50							
50-60							
60							

References

1, 3, 7, 10, 13

As noted for males

- 22 Dur 1 Several studies provided risk estimates corresponding to this age and duration. An average of these values was used.
- (22a) Upper bound: Excess mortality among cigarette smokers: Changes in a 20 yr interval (age 45+. FU of 6 years, RR 1.9)
Thun MJ, et al, Am J Pub Health 1995; 85:1223-1230
- (22b) Lower bound: Smoking and mortality among older women: the study of osteoporotic fractures (age 65-69, FU 4.9 yrs, RR 2.5)
Vogt MT, et al, Arch Intern Med. 1996; 156:630-636
- Dur 10 (0-20) Several studies provided risk estimates corresponding to this age and duration. An average of these values was used
- Upper bound: Reference 15c (RR age 55-64: 2.15)
- Lower bound: Reference 17b (RR attained age 75+: 1.58)



Comparisons of Ratios 75	7 Bragg 91	23 Other Clin	3 Appendix C	10 CN 86-92	13 CPS1	Trend Line
1	1.73	1.85	1.3	1.54		1.65
0-10	1.32	1.71	1.2	1.38		1.45
10	1.25	1.54	1.11	1.23	1.22	1.28
10-20	1.09		1.04	1.12		1.16
20			1		1.21	1.06
20-30						1.00
30					1.18	
30-40						
40						
40-50						
50						
50-60						
60						

References

1, 3, 7, 10, 13

As noted for males

23 Dur 1

Reference 22b (RR {average of 70-74 and 75+}: 1.85)

Dur 0-10

Reference 15c (RR age 65-74: 1.71)

Dur 0-20

Reference 15c (RR age 65-74: 1.54)

The final piece is to establish the prevalence rate estimates. These prevalence estimates, derived from two different sources of data, indicate a decline in smoking with age and duration. The rate of decline in the insurance data is somewhat flatter than what was projected for the general population. Prevalence estimates from the 90-95 table in the early durations are lower than what was postulated for an insured cohort from Pechmann's data. Trending of the 1990-95 data resulted in lower late duration smoking prevalence estimates in middle aged and elderly females compared to the similar aged males.

The final estimates were computed into a 25-year select and ultimate format. A summary of these estimates are displayed below.

Males – Smoking Prevalence

Age	Dur 1	Dur 5	Dur 10	Dur 15	Dur 20	Dur 25
25	14.4%	14.3%	14.1%	14.0%	13.9%	13.8%
35	13.7%	13.4%	13.2%	13.0%	12.8%	12.6%
45	12.9%	12.6%	12.3%	12.0%	11.7%	11.4%
55	12.2%	11.8%	11.4%	11.0%	10.6%	10.2%
65	11.5%	11.0%	10.5%	10.0%	9.5%	9.0%

Females – Smoking Prevalence

Age	Dur 1	Dur 5	Dur 10	Dur 15	Dur 20	Dur 25
25	11.5%	11.5%	11.5%	11.4%	11.4%	11.1%
35	13.5%	12.8%	12.2%	11.7%	10.5%	9.7%
45	15.5%	14.2%	12.9%	10.7%	9.6%	8.3%
55	17.6%	15.1%	12.5%	10.3%	8.7%	6.9%
65	15.5%	13.7%	11.8%	10.0%	7.8%	5.6%

Finally, given the underlying Valuation Basic Table, the relative risk estimates and the prevalence estimates, complete nonsmoker and smoker tables for both males and females are presented in Appendix III.