

## SUPPLEMENTARY MATERIAL

### FOUR DECADES OF PULMONARY TUBERCULOSIS IN DECEASED SOUTH AFRICAN MINERS: TRENDS AND DETERMINANTS

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**Table S1** Crude group-specific proportions of PTB in miners at autopsy, by calendar period and population group (1975-2014)

Characteristic	Black miners						Characteristic	White miners					
	1975-1989 N=24,570		1990-2004 N=19,529		2005-2014 N=9,149			1975-1989 N=14,927		1990-2004 N=11,117		2005-2014 N=4,680	
	n	PTB (n, %)	n	PTB (n, %)	n	PTB (n, %)		n	PTB (n, %)	n	PTB (n, %)	n	PTB (n, %)
Year of autopsy							Year of autopsy						
1975-1979	8,096	440 (5.43)					1975-1979	4,682	128 (2.73)				
1980-1984	7,979	601 (7.53)					1980-1984	5,218	119 (2.28)				
1985-1989	8,495	580 (6.83)					1985-1989	5,027	132 (2.63)				
1990-1994			7,041	673 (9.56)			1990-1994			4,434	123 (2.77)		
1995-1999			5,948	1,010 (16.98)			1995-1999			3,689	91 (2.47)		
2000-2004			6,540	2,163 (33.07)			2000-2004			2,994	132 (4.41)		
2005-2009					5,578	2,303 (41.29)	2005-2009					2,507	157 (6.26)
2010-2014					3,571	1,207 (33.80)	2010-2014					2,173	121 (5.57)
Age (years)							Age (years)						
<30	8,945	367 (4.10)	1,941	196 (10.10)	330	117 (35.45)	<50	3,258	55 (1.69)	1,889	59 (3.12)	526	45 (8.56)
30-39	7,238	425 (5.87)	6,533	1,193 (18.26)	1,787	761 (42.59)	50-59	3,196	66 (2.07)	2,170	85 (3.92)	877	67 (7.64)
40-49	4,922	441 (8.96)	7,134	1,689 (23.68)	3,643	1,557 (42.74)	60-69	4,742	135 (2.85)	3,135	93 (2.97)	1,297	82 (6.32)
50-59	2,667	293 (10.99)	3,368	685 (20.34)	2,654	927 (34.93)	≥70	3,731	123 (3.30)	3,923	109 (2.78)	1,980	84 (4.24)
≥60	798	95 (11.90)	553	83 (15.01)	735	148 (20.14)							
Commodity							Commodity						
Gold	19,387	1,317 (6.79)	16,128	3,150 (19.53)	5,793	2,491 (43.00)	Gold	12,123	336 (2.77)	8,579	282 (3.29)	3,468	232 (6.69)
Platinum	2,465	174 (7.06)	664	89 (13.40)	285	63 (22.11)	Platinum	859	9 (1.05)	741	11 (1.48)	345	7 (2.03)
Asbestos	346	32 (9.25)	243	42 (17.28)	589	140 (23.77)	Asbestos	321	13 (4.05)	316	15 (4.75)	104	6 (5.77)
Coal	1,928	71 (3.68)	2,207	528 (23.92)	2,234	768 (34.38)	Coal	327	3 (0.92)	450	13 (2.89)	310	15 (4.84)
Other	444	27 (6.08)	287	37 (12.89)	248	48 (19.35)	Other	1,297	18 (1.39)	1,031	25 (2.42)	453	18 (3.97)
Gold employment duration (years)							Gold employment duration (years)						
0	4,216	250 (5.93)	2,819	567 (20.11)	2,747	826 (30.07)	0	1,985	27 (1.36)	1,820	42 (2.31)	840	35 (4.17)
<10	16,055	936 (5.83)	6,733	1,113 (16.53)	1,917	718 (37.45)	<10	2,203	35 (1.59)	1,810	61 (3.37)	646	26 (5.26)
10-19	3,481	340 (9.77)	7,772	1,634 (21.02)	2,141	970 (45.31)	10-19	2,262	59 (2.61)	2,086	74 (3.55)	933	70 (7.50)
≥20	818	95 (11.61)	2,205	532 (24.13)	2,344	996 (42.49)	20-29	3,128	105 (3.36)	2,434	88 (3.62)	1,162	82 (7.06)
							≥30	5,349	153 (2.86)	2,967	81 (2.73)	1,099	57 (5.19)
Silicosis absent	23,024	1,311 (5.69)	14,966	2,871 (19.18)	5,858	2,108 (35.98)	Silicosis absent	11,249	210 (1.87)	8,311	191 (2.30)	3,171	121 (3.82)
Silicosis present	1,546	310 (20.05)	3,201	886 (27.68)	2,378	1,037 (43.61)	Silicosis present	3,678	169 (4.59)	2,051	134 (6.53)	1,088	136 (12.5)
HIV absent	24,566	1,621 (6.60)	13,750	2,379 (17.24)	5,419	1,972 (36.39)	HIV absent	14,927	379 (2.54)	10,128	313 (3.09)	4,110	239 (5.83)
HIV present	4	-	4,294	1,369 (31.88)	3,004	1,252 (41.68)	HIV present	0	-	44	3 (6.82)	43	6 (13.95)
PTB present	24,570	1,621 (6.60)	19,529	3,846 (19.69)	9,149	3,510 (38.36)	PTB present	14,927	379 (2.54)	11,117	346 (3.11)	4,680	278 (5.94)

Trends for PTB by age group and gold employment duration were significant ( $p < 0.001$ ) for black miners in the three calendar periods and for white miners except for age group in 1990-2004 ( $p = 0.122$ ) and gold employment duration in 1990-2004 ( $p = 0.588$ ) and 2005-2014 ( $p = 0.181$ ).

**Table S2** Adjusted odds ratios (AORs) for PTB in models with and without silicosis in black miners, by calendar period

Variable	1975-1989					1990-2004					2005-2014				
	Model 1 Model with silicosis			Model 2 Model without silicosis		Model 1 Model with silicosis			Model 2 Model without silicosis		Model 1 Model with silicosis			Model 2 Model without silicosis	
	n	AOR (95%CI)	p-value	AOR (95%CI)	p-value	n	AOR (95%CI)	p-value	AOR (95%CI)	p-value	n	OR (95%CI)	p-value	AOR (95%CI)	p-value
Year of autopsy															
1975-1979	440	Reference		Reference		440	Reference	128	Reference		440	Reference	128	Reference	
1980-1984	601	1.31 (1.15, 1.49)	<0.001	1.38 (1.22, 1.57)	<0.001										
1985-1989	580	1.09 (0.96, 1.25)	0.182	1.18 (1.04, 1.35)	0.010										
1990-1994						673	1.62 (1.42, 1.84)	<0.001	1.65 (1.45, 1.87)	<0.001					
1995-1999						1,010	2.71 (2.39, 3.08)	<0.001	2.77 (2.44, 3.14)	<0.001					
2000-2004						2,163	5.95 (5.25, 6.73)	<0.001	6.14 (5.42, 6.95)	<0.001					
2005-2009											2,303	9.79 (8.58, 11.16)	<0.001	10.07 (8.83, 11.48)	<0.001
2010-2014											1,207	7.78 (6.78, 8.93)	<0.001	8.00 (6.97, 9.18)	<0.001
Age (years)															
<30	367	Reference		Reference		196	Reference		Reference		117	Reference		Reference	
30-39	425	1.33 (1.15, 1.54)	<0.001	1.39 (1.20, 1.61)	<0.001	1,193	1.40 (1.22, 1.61)	<0.001	1.40 (1.22, 1.60)	<0.001	761	1.33 (1.13, 1.58)	0.001	1.32 (1.12, 1.57)	0.001
40-49	441	1.81 (1.55, 2.11)	<0.001	2.12 (1.87, 2.47)	<0.001	1,689	1.58 (1.38, 1.82)	<0.001	1.66 (1.45, 1.91)	<0.001	1,557	1.30 (1.09, 1.54)	0.003	1.32 (1.12, 1.57)	0.001
50-59	293	2.24 (1.88, 2.66)	<0.001	1.63 (2.21, 2.11)	<0.001	685	1.44 (1.23, 1.68)	<0.001	1.55 (1.33, 1.81)	<0.001	927	1.00 (0.83, 1.20)	0.990	1.04 (0.87, 1.24)	0.681
≥60	95	2.47 (1.92, 3.18)	<0.001	2.83 (2.21, 3.64)	<0.001	83	1.39 (1.09, 1.78)	<0.001	1.48 (1.16, 1.89)	0.002	148	0.65 (0.51, 0.82)	0.000	0.67 (0.53, 0.85)	0.001
Gold employment duration (years)															
0	250	Reference		Reference		567	Reference		Reference		826	Reference		Reference	
<10	936	1.05 (0.88, 1.18)	0.832	1.09 (0.95, 1.27)	0.215	1,113	0.97 (0.87, 1.09)	0.637	1.02 (0.92, 1.14)	0.696	718	1.13 (1.01, 1.27)	0.030	1.16 (1.04, 1.30)	0.010
10-19	340	1.10 (0.92, 1.32)	0.300	1.38 (1.16, 1.65)	<0.001	1,634	1.00 (0.89, 1.11)	0.934	1.09 (0.98, 1.22)	0.098	970	1.46 (1.29, 1.64)	<0.001	1.57 (1.40, 1.76)	<0.001
≥20	95	1.05 (0.80, 1.36)	0.733	1.35 (1.04, 1.70)	0.022	532	0.99 (0.86, 1.14)	0.921	1.14 (0.99, 1.30)	0.062	996	1.43 (1.26, 1.63)	<0.001	1.63 (1.45, 1.84)	<0.001
HIV															
Absent	1,621					2,477	Reference		Reference		2,258	Reference		Reference	
Present	-					1,369	1.37 (1.25, 1.49)	<0.001	1.38 (1.26, 1.50)	<0.001	1,252	1.17 (1.07, 1.28)	<0.001	1.16 (1.06, 1.27)	0.001

**Table S3** Adjusted odds ratios (AORs) for PTB in models with and without silicosis in white miners, by calendar period

Variable	1975-1989					1990-2004					2005-2014				
	Model 1 Model with silicosis			Model 2 Model without silicosis		Model 1 Model with silicosis			Model 2 Model without silicosis		Model 1 Model with silicosis			Model 2 Model without silicosis	
	n	AOR (95%CI)	p-value	AOR (95%CI)	p-value	n	AOR (95%CI)	p-value	AOR (95%CI)	p-value	n	OR (95%CI)	p-value	AOR (95%CI)	p-value
Year of autopsy															
1975-1979	128	Reference		Reference		128	Reference		Reference		128	Reference		Reference	
1980-1984	119	0.84 (0.65, 1.08)	0.173	0.84 (0.65, 1.08)	0.172										
1985-1989	132	1.02 (0.80, 1.31)	0.856	0.96 (.075, 1.24)	0.773										
1990-1994						123	1.12 (0.87, 1.45)	0.370	1.02 (0.79, 1.32)	0.864					
1995-1999						91	1.03 (0.78, 1.36)	0.855	0.91 (0.69, 1.20)	0.489					
2000-2004						132	1.87 (1.45, 2.42)	<0.001	1.66 (1.29, 2.14)	<0.001					
2005-2009											157	2.74 (2.14, 3.52)	<0.001	2.53 (1.98, 3.24)	<0.001
2010-2014											121	2.46 (1.87, 3.22)	<0.001	2.33 (1.78, 3.04)	<0.001
Age (years)															
<50	55	Reference		Reference		59	Reference		Reference		45	Reference		Reference	
50-59	66	1.02 (0.70, 1.49)	0.921	1.11 (0.76, 1.61)	0.591	85	1.26 (0.93, 1.71)	0.136	1.38 (1.02, 1.86)	0.038	67	0.98 (0.70, 1.38)	0.917	1.10 (0.79, 1.54)	0.580
60-69	135	1.30 (0.92, 1.84)	0.138	1.51 (1.07, 2.12)	0.019	93	0.69 (0.50, 1.27)	0.677	1.10 (0.82, 1.49)	0.510	82	0.76 (0.54, 1.05)	0.104	0.93 (0.67, 1.29)	0.653
≥70	123	1.40 (0.97, 2.00)	0.071	1.72 (1.21, 2.46)	0.003	109	0.85 (0.62, 1.16)	0.304	1.08 (0.79, 1.47)	0.628	84	0.53 (0.37, 0.76)	<0.001	0.71 (0.50, 1.00)	0.051
Gold employment duration (years)															
0	27	Reference		Reference		42	Reference		Reference		35	Reference		Reference	
<10	35	1.22 (0.73, 2.03)	0.447	1.27 (0.76, 2.12)	0.354	61	1.30 (0.90, 1.87)	0.156	1.41 (0.98, 2.01)	0.066	34	1.03 (0.68, 1.57)	0.892	1.13 (0.74, 1.72)	0.575
10-19	59	1.67 (1.05, 2.65)	0.030	1.90 (1.20, 3.01)	0.006	74	1.10 (0.77, 1.56)	0.601	1.34 (0.95, 1.90)	0.940	70	1.18 (0.81, 1.71)	0.380	1.50 (1.04, 2.17)	0.030
20-29	105	1.88 (1.22, 2.91)	0.004	2.36 (1.54, 3.63)	<0.001	88	1.18 (0.84, 1.65)	0.338	1.67 (1.21, 2.31)	0.002	82	1.22 (0.85, 1.75)	0.278	1.80 (1.28, 2.55)	0.001
≥30	153	1.39 (0.90, 2.14)	0.137	1.79 (1.17, 2.73)	0.007	81	0.89 (0.63, 1.25)	0.489	1.28 (0.92, 1.78)	0.149	57	0.96 (0.66, 1.40)	0.843	1.49 (1.04, 2.15)	0.031
HIV															
Absent	397					343	Reference		Reference		272	Reference		Reference	
Present	-					3	1.83 (0.55, 6.03)	0.323	1.93 (0.90, 6.32)	0.277	6	2.53 (1.03,6.22)	0.043	2.50 (1.04, 6.02)	0.040

**Table S4** Adjusted odds ratios (AORs) for complete case analysis and multiple imputation in black miners at autopsy, by calendar period

Variable	1975-1989				1990-2004				2005-2014			
	Complete case analysis		Iterative chained equations		Complete case analysis		Iterative chained equations		Complete case analysis		Iterative chained equations	
	AOR	SE*	AOR	SE*	AOR	SE*	AOR	SE*	AOR	SE*	AOR	SE*
Year of autopsy												
1975-79	Reference		Reference		Reference		Reference		Reference		Reference	
1980-84	1.31 (1.15, 1.49)	0.086	1.32 (1.17, 1.50)	0.064								
1985-89	1.09 (0.96, 1.25)	0.073	1.10 (0.97, 1.25)	0.065								
1990-94					1.62 (1.42, 1.84)	0.106	1.62 (1.43, 1.83)	0.064				
1995-99					2.71 (2.39, 3.08)	0.176	2.72 (2.40, 3.07)	0.063				
2000-04					5.95 (5.25, 6.73)	0.378	5.92 (5.24, 6.69)	0.062				
2005-09									9.79 (8.58, 11.16)	0.657	9.95 (2.17, 2.42)	0.065
2005-14									7.78 (6.78, 8.93)	0.548	7.68 (1.89, 2.19)	0.075
Age (years)												
<30	Reference		Reference		Reference		Reference		Reference		Reference	
30-39	1.33 (1.15, 1.54)	0.099	1.30 (1.12, 1.50)	0.074	1.40 (1.22, 1.61)	0.098	1.36 (1.19, 1.56)	0.069	1.33 (1.13, 1.58)	0.114	1.30 (0.09, 0.43)	0.085
40-49	1.81 (1.55, 2.11)	0.142	1.73 (1.48, 2.01)	0.078	1.58 (1.38, 1.82)	0.113	1.52 (1.32, 1.74)	0.070	1.30 (1.09, 1.54)	0.113	1.26 (1.06, 1.49)	0.087
50-59	2.24 (1.88, 2.66)	0.199	2.11 (1.75, 2.89)	0.088	1.44 (1.23, 1.68)	0.113	1.38 (1.19, 1.61)	0.078	1.00 (0.83, 1.20)	0.092	0.96 (0.80, 1.15)	0.092
≥60	2.47 (1.92, 3.18)	0.319	2.25 (1.75, 2.89)	0.128	1.39 (1.09, 1.78)	0.173	1.27 (1.01, 1.61)	0.120	0.65 (0.51, 0.82)	0.077	0.64 (0.51, 0.81)	0.119
Gold employment duration (years)												
0	Reference		Reference		Reference		Reference		Reference		Reference	
<10	1.05 (0.88, 1.18)	0.076	1.01 (0.87, 1.17)	0.074	0.97 (0.87, 1.09)	0.054	0.97 (0.87, 1.08)	0.055	1.13 (1.01, 1.27)	0.066	1.17 (1.04, 1.31)	0.059
10-19	1.10 (0.92, 1.32)	0.101	1.11 (0.93, 1.32)	0.090	1.00 (0.89, 1.11)	0.055	1.00 (0.87, 1.11)	0.055	1.46 (1.29, 1.64)	0.088	1.49 (1.32, 1.68)	0.061
≥20	1.05 (0.80, 1.36)	0.141	1.08 (0.83, 1.40)	0.131	0.99 (0.86, 1.14)	0.070	1.00 (0.87, 1.15)	0.070	1.43 (1.26, 1.63)	0.093	1.46 (1.28, 1.66)	0.066
Silicosis												
Absent	Reference		Reference		Reference		Reference		Reference		Reference	
Present	3.08 (2.65, 3.57)	0.233	3.08 (2.66, 3.56)	0.075	1.54 (1.4, 1.69)	0.073	1.57 (1.44, 1.73)	0.047	1.34 (1.20, 1.49)	0.072	1.33 (1.20, 1.48)	0.055
HIV												
Absent					Reference		Reference		Reference		Reference	
Present					1.37 (1.25, 1.49)	0.061	1.39 (1.28, 1.52)	0.044	1.17 (1.07, 1.28)	0.055	1.16 (1.06, 1.28)	0.048

\*SE, standard error