

Online repository facility – Thorax website

Chronic breathlessness associated with poorer physical and mental health-related quality of life (SF-12) across all adult age groups.

There is a consistent relationship between increasing levels of breathlessness due to a range of specific conditions, and impaired health-related quality of life (HrQoL). Conditions include: COPD, [1-6] chronic heart failure, [7-8] interstitial lung disease, [9-11] cystic fibrosis; [12] lung cancer; [13] and at the end of life. [14] These data are also reflected in specific age groups [15-16]. Data on the impact of increasingly severe chronic breathlessness in the general population are lacking on HrQoL, independent of health service utilisation, specific diagnoses or in age categories. [17]

Detailed Methods

Setting

The study was conducted in South Australia, the state with the second lowest population nationally with just 7% of the Australian population. On average, residents are slightly older than the rest of the country with a slightly lower proportion of people who were born overseas. [18]

Sample

Data were collected using the 2015 South Australian Health Omnibus Surveys (HOS). [19, 20] HOS is a multi-stage, systematic, clustered area sample of households. It is conducted face-to-face annually in Spring based on the Australian Bureau of Statistics (ABS) census collector districts (CCDs). Each annual HOS sample includes randomly selected households from CCDs across metropolitan Adelaide and regional towns with a population of $\geq 1,000$

inhabitants. Within each CCD, a random starting point is selected and from this starting point, ten households were approached in a given direction with a fixed skip pattern. Up to six call-back visits were made to the chosen households if the selected person was uncontactable. Non-residential premises formed a proportion of the properties approached. Hospitals, boarding houses and residential care facilities were also not included.

A letter introducing HOS was sent to each identified household. In each household, one person aged ≥ 15 years who was the person who most recently had a birthday was selected for face-to-face interview by a trained interviewer. There was no replacement by another person within the household when the selected member of the household declined participation.

Data were weighted by five year age group, sex, residence in metropolitan or non-metropolitan areas, and household size to the Australian Bureau of Statistics' (ABS) 2011 Estimated Residential Population for South Australia to generate whole-of-population estimates.

Measures used in the study

Health-related quality of life (HrQoL)

The SF-12, a 12 item questionnaire, is widely used to measure population HrQoL.[21, 22] It includes six questions each in two domains: physical well-being (physical component score [PCS]); and mental well-being (mental component score [MCS]). Each domain is measured on a scale of 0-70 with higher scores reflecting better HrQoL. (Table 1) Although a statistically significant decrement in SF-12 sub-scales may be as low as 1-2 points, previous work suggests that a clinically meaningful difference is about 5 points for each sub-scale at a population level [16, 23-25] but may be even as low as 3 (PCS) and 3.5 (MCS) in people with cardio-respiratory diseases where breathlessness is a cardinal symptom.[26]

Breathlessness

The mMRC breathlessness scale was originally conceived for studying people with occupationally related breathlessness[27] modified,[28] and later validated in a number of clinical settings where breathlessness was experienced. (Table 1) A higher score reflects worse breathlessness. Given the numbers of people with more severe breathlessness, data were grouped into mMRC 0, 1 or ≥ 2 . [29]

Socio-demographics

Demographic variables included age (nine year age groups), sex, educational attainment, and employment and current smoking statuses.

Statistical analyses

Data analysis was conducted using Statistical Package for Social Sciences (SPSS) Version 23.0 (IBM Corp; Armonk, NY, USA 2014) and Stata Version 13 (StataCorp; College Station, Texas; USA 2013). Analyses used population weighted data. Univariable analyses compared the proportion of respondents in three sub-groups of breathlessness severity (mMRC = 0; mMRC = 1; and mMRC ≥ 2) for key socio-demographic factors using χ^2 tests.

Three multivariable linear regression models were used to analyse the association between the two SF-12 component scores and people with increasing severity of chronic breathlessness: unadjusted; adjusted for sex, age, educational attainment, dwelling status, employment status, and smoking status. In a sensitivity analysis, smoking was excluded from the adjusted regression model as smoking is a population-level factor highly correlated with

chronic breathlessness. Data were also examined for the relationship between the two subscales of the SF-12 and increasing severity in five sub-groups by age (15-44; 45-54, 55-64, 65-74, ≥ 75).

Ethics, consent and reporting

Ethical approval for the project was granted by the Ethics Committee of the South Australian Department of Health. Participants gave informed verbal consent and continued participation in each face-to-face interview in the respondent's own home was accepted as continuing consent. This paper is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[30]

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Table 1: Modified Medical Research Council (mMRC) question adapted for chronicity of breathlessness. (n=3005)

Question: Thinking back over the last 6 months, have you had an episode of breathlessness that has lasted more than 3 months? (*An episode of breathlessness means breathlessness experienced on most days over that period.*)

Category in analysis	modified Medical Research Council (mMRC) breathlessness scale [26]	Responses
0 (n=2655)	0 (n=2655)	No
1 (n=260)	1 (n=260)	Yes, I got short of breath when hurrying on the level or up a slight hill
≥ 2 (n=88)	2 (n=54)	Yes, I have to stop for breath when walking at my own pace on the level
	3 (n=29)	Yes, I stop for breath after walking 100 metres or after a few minutes on the level
	4 (n=5)	Yes, I am too breathless to leave the house
	Missing (n=2)	Declined to answer / not stated

Table 2: Univariable analyses of severity of chronic breathlessness and covariates (socio-demographic and smoking status) of people aged 15 years and over

	Overall		Level of chronic breathlessness (mMRC)						p value
	n	% (95% CI)	n	0 % (95% CI)	n	1 % (95% CI)	n	2 to 4 % (95% CI)	
SEX									
Female	1516	50.8 (48.3-53.4)	1321	87.1 (83.9-89.8)	144	9.5 (7.5-12.1)	51	3.3 (2.4-4.6)	0.129
Male	1466	49.2 (46.6-51.7)	1316	89.8 (87.4-91.7)	113	7.7 (5.8-10.3)	37	2.5 (1.8-3.4)	
AGEGP									
75+ years old	264	8.9 (7.4-10.5)	192	72.5 (66.3-77.9)	43	16.2 (12.5-20.9)	30	11.3 (7.9-15.8)	<0.011
65-74 years old	354	11.9 (10.6-13.2)	298	84.2 (80.1-87.5)	41	11.5 (8.8-14.9)	15	4.4 (3.0-6.4)	
55-64 years old	450	15.1 (13.4-16.9)	380	84.4 (79.2-88.5)	53	11.8 (8.4-16.2)	17	3.8 (2.4-6.1)	
45-54 years old	490	16.4 (15.1-17.9)	441	89.9 (84.8-93.4)	36	7.4 (4.7-11.5)	13	2.7 (1.4-5.2)	
15-44 years old	1423	47.7 (44.4-51.1)	1327	93.2 (90.4-95.3)	85	6.0 (4.1-8.6)	12	0.8 (0.4-1.7)	
EDUCATIONAL ATTAINMENT									
Up to secondary	1104	37.0 (33.0-41.2)	941	85.2 (82.1-87.9)	109	9.9 (7.7-12.7)	54	4.9 (3.8-6.3)	0.001
Trade, Apprenticeship, Certificate, Diploma	1163	39.0 (35.8-42.4)	1034	88.8 (85.7-91.4)	103	8.8 (6.5-11.9)	27	2.3 (1.7-3.2)	
Degree or higher	711	23.8 (19.9-28.2)	659	92.7 (89.6-94.9)	45	6.4 (4.0-9.9)	7	1.0 (0.4-2.1)	
EMPLOYMENT STATUS									
Work full or part time	1647	55.2 (52.4-58.1)	1533	93.1 (90.5-95.0)	100	6.1 (4.2-8.7)	14	0.8 (0.5-1.5)	<0.011
Home duties	172	5.8 (4.9-6.8)	149	86.7 (80.8-91.0)	21	12.2 (8.0-18.0)	2	1.1 (0.3-4.0)	
Unemployed	112	3.8 (2.8-5.1)	99	88.5 (80.7-93.4)	9	8.2 (4.2-15.5)	4	3.3 (1.0-10.2)	
Retired	628	21.1 (18.8-23.5)	496	78.9 (75.1-82.3)	85	13.5 (10.8-16.8)	47	7.6 (5.5-10.2)	
Student	285	9.6 (7.6-12.0)	263	92.1 (86.2-95.6)	19	6.8 (3.4-13.1)	3	1.1 (0.3-4.8)	
Not working because work related injury or disability, other	136	4.6 (3.5-6.0)	95	70.0 (60.0-78.5)	23	17.0 (10.8-25.8)	18	12.9 (7.4-21.5)	
DWELLING STATUS									
Owned or being purchased	2092	70.2 (65.4-74.6)	1859	88.8 (86.4-90.9)	179	8.6 (6.5-11.2)	54	2.6 (2.1-3.2)	<0.011
Rented from Housing SA	155	5.2 (3.8-7.1)	116	74.9 (65.4-82.6)	20	13.0 (8.7-19.1)	19	12.0 (8.0-17.8)	
Rented privately	650	21.8 (18.3-25.8)	595	91.5 (87.4-94.4)	45	7.0 (4.4-10.8)	10	1.5 (0.8-2.9)	
Other	65	2.2 (1.5-3.1)	53	82.1 (74.0-88.1)	9	13.8 (8.8-21.1)	3	4.1 (1.7-9.2)	
CURRENT SMOKER									
No	2518	84.6 (82.2-86.6)	2244	89.1 (87.0-90.9)	205	8.1 (6.5-10.2)	69	2.8 (2.2-3.4)	0.092
Yes	460	15.4 (13.4-17.8)	390	84.8 (79.2-89.1)	52	11.2 (7.3-17.0)	18	3.9 (2.4-6.3)	
Overall	2982	100.0	2637	88.4 (86.2-90.4)	257	8.6 (6.8-10.9)	87	2.9 (2.4-3.6)	

Table 3: Mean SF-12 Physical Component Summary (PCS) score, crude and adjusted multivariable analyses of the association between PCS and level of chronic breathlessness (mMRC)

	PCS	Unadjusted		Adjusted	
	mean (95% CI)	beta (95% CI)	p value	beta (95% CI)	p value
Level of chronic breathlessness(mMRC)					
0	50.9 (50.4,51.5)	<i>ref</i>		<i>ref</i>	
1	41.7 (39.7,43.6)	-9.3 (-11.1 - -7.5)	<0.001	-6.9 (-8.3 - -5.5)	<0.001
2 to 4	32.6 (29.6,35.5)	-18.4 (-21.3 - -15.4)	<0.001	-12.7 (-15.7 - -9.7)	<0.001
SEX					
Female	48.9 (48.1,49.7)	<i>ref</i>		<i>ref</i>	
Male	50.3 (49.7,51.0)	1.4 (0.6 - 2.2)	0.001	0.9 (0.3 - 1.5)	0.002
AGE group					
15-44 years old	52.4 (51.8,53.1)	<i>ref</i>		<i>ref</i>	
45-54 years old	48.8 (47.2,50.4)	4.0 (2.3 - 5.6)	<0.001	2.7 (1.2 - 4.2)	0.001
55-64 years old	46.9 (45.4,48.4)	3.5 (1.6 - 5.5)	0.001	1.4 (-0.5 - 3.4)	0.149
65-74 years old	47.4 (46.2,48.5)	5.4 (3.5 - 7.3)	<0.001	2.2 (-0.2 - 4.7)	0.073
75+ years old	43.4 (42.2,44.6)	9.1 (7.5 - 10.6)	<0.001	4.9 (2.7 - 7.1)	<0.001
EDUCATIONAL ATTAINMENT					
Up to secondary	48.1 (47.2,49.1)	<i>ref</i>		<i>ref</i>	
Trade, Apprenticeship, Certificate, Diploma	49.5 (48.9,50.2)	1.4 (0.3 - 2.5)	0.012	-0.5 (-1.3 - 0.3)	0.185
Degree or higher	52.1 (51.4,52.8)	3.9 (2.9 - 5.0)	<0.001	0.2 (-0.7 - 1.2)	0.613
EMPLOYMENT STATUS					
Work full or part time	52.4 (51.9,53.0)	<i>ref</i>		<i>ref</i>	
Home duties	48.2 (46.4,50.1)	-4.2 (-6.0 - -2.3)	<0.001	-3.3 (-4.8 - -1.8)	<0.001
Unemployed	46.1 (43.4,48.8)	-6.3 (-8.8 - -3.8)	<0.001	-4.9 (-7.2 - -2.6)	<0.001
Retired	45.2 (44.2,46.1)	-7.2 (-8.5 - -6.0)	<0.001	-3.7 (-6.0 - -1.4)	0.002
Student	52.4 (51.1,53.8)	0.0 (-1.3 - 1.3)	0.984	-1.2 (-2.7 - 0.3)	0.114
Not working because work related injury or disability, other	35.0 (31.5,38.5)	-17.4 (-20.7 - -14.1)	<0.001	-13.0 (-15.9 - -10.0)	<0.001
DWELLING STATUS					
Owned or being purchased	50.1 (49.6,50.6)	<i>ref</i>		<i>ref</i>	
Rented from Housing SA	41.5 (38.5,44.6)	-8.5 (-11.4 - -5.6)	<0.001	-3.6 (-5.6 - -1.5)	0.001
Rented privately	50.5 (49.3,51.8)	0.4 (-0.8 - 1.7)	0.476	-0.8 (-1.6 - -0.0)	0.047
Other	45.5 (42.5,48.5)	-4.6 (-7.7 - -1.5)	0.005	-1.3 (-3.6 - 1.0)	0.255
CURRENT SMOKER					
No	50.2 (49.6,50.7)	<i>ref</i>		<i>ref</i>	
Yes	46.5 (44.8,48.2)	-3.7 (-5.3 - -2.1)	<0.001	-2.6 (-3.8 - -1.3)	<0.001
Constant		50.9 (50.4 - 51.5)		49.7 (47.4 - 52.1)	
Overall	49.6 (49.0,50.2)				
Model		F(2,56)=138.7		F(20,56)=63.79	
R ²		0.140		0.290	

Note: Multivariable linear regression adjusted for age, sex, educational attainment, employment status, dwelling status, and smoking status. mMRC modified Medical Research Council breathlessness scale

Table 4: Mean SF-12 Mental Component Summary (MCS) score, crude and adjusted multivariable analyses of the association between MCS and severity of chronic breathlessness (mMRC)

	MCS mean (95% CI)	Unadjusted		Adjusted	
		beta (95% CI)	p value	beta (95% CI)	p value
Level of chronic breathlessness (mMRC)					
0	51.6 (51.1,52.0)	<i>ref</i>		<i>ref</i>	
1	44.0 (42.5,45.6)	-7.5 (-8.9 - -6.1)	<0.001	-5.8 (-7.0 - -4.5)	<0.001
2 to 4	36.9 (34.1,39.8)	-14.6 (-17.4 - -11.9)	<0.001	-10.3 (-13.3 - -7.3)	<0.001
SEX					
Female	51.4 (50.8,52.0)	<i>ref</i>		<i>ref</i>	
Male	49.6 (48.8,50.3)	1.9 (1.0 - 2.7)	<0.001	1.6 (1.0 - 2.2)	<0.001
AGEGP					
15-44 years old	52.0 (51.4,52.6)	<i>ref</i>		<i>ref</i>	
45-54 years old	49.6 (48.1,51.0)	3.7 (2.0 - 5.4)	<0.001	2.9 (1.3 - 4.4)	0.001
55-64 years old	49.1 (47.7,50.6)	2.7 (0.6 - 4.7)	0.013	1.6 (-0.3 - 3.5)	0.106
65-74 years old	50.2 (49.1,51.2)	3.1 (1.4 - 4.8)	0.001	1.2 (-0.8 - 3.1)	0.235
75+ years old	46.5 (45.3,47.7)	5.6 (4.1 - 7.0)	<0.001	2.9 (1.1 - 4.7)	0.002
EDUCATIONAL ATTAINMENT					
Up to secondary	49.4 (48.4,50.4)	<i>ref</i>		<i>ref</i>	
Trade, Apprenticeship, Certificate, Diploma	50.4 (49.8,51.1)	1.0 (-0.1 - 2.1)	0.069	-0.9 (-1.7 - -0.0)	0.041
Degree or higher	52.3 (51.6,53.0)	2.8 (1.8 - 3.9)	<0.001	-0.3 (-1.3 - 0.7)	0.519
EMPLOYMENT STATUS					
Work full or part time	52.8 (52.3,53.3)	<i>ref</i>		<i>ref</i>	
Home duties	48.6 (46.6,50.6)	-4.2 (-6.2 - -2.1)	<0.001	-3.0 (-4.8 - -1.1)	0.002
Unemployed	45.6 (42.6,48.6)	-7.2 (-10.1 - -4.3)	<0.001	-6.0 (-8.7 - -3.4)	<0.001
Retired	48.2 (47.4,49.1)	-4.6 (-5.6 - -3.5)	<0.001	-2.7 (-4.6 - -0.9)	0.004
Student	51.7 (50.3,53.0)	-1.1 (-2.5 - 0.3)	0.115	-2.0 (-3.5 - -0.4)	0.016
Not working because work related injury or disability, other	37.2 (34.1,40.4)	-15.5 (-18.6 - -12.5)	<0.001	-12.3 (-15.3 - -9.4)	<0.001
DWELLING STATUS					
Owned or being purchased	51.1 (50.6,51.6)	<i>ref</i>		<i>ref</i>	
Rented from Housing SA	43.5 (40.6,46.5)	-7.6 (-10.4 - -4.8)	<0.001	-3.3 (-5.5 - -1.1)	0.004
Rented privately	50.5 (49.5,51.5)	-0.6 (-1.5 - 0.3)	0.165	-0.9 (-1.7 - -0.1)	0.022
Other	47.7 (44.7,50.6)	-3.5 (-6.5 - -0.4)	0.026	-0.9 (-3.0 - 1.1)	0.368
CURRENT SMOKER					
No	51.0 (50.6,51.5)	<i>ref</i>		<i>ref</i>	
Yes	47.4 (45.8,49.0)	-3.7 (-5.2 - -2.1)	<0.001	-2.4 (-3.9 - -1.0)	0.001
Constant		51.6 (51.1 - 52.0)		51.3 (49.2 - 53.4)	
Overall	50.5 (49.9,51.0)				
Model		F(2,56)=116.8		F(20,56)=37.52	
R ²		0.102		0.225	

Note: Multivariable linear regression adjusted for age, sex, educational attainment, employment status, dwelling status, and smoking status. mMRC modified Medical Research Council breathlessness scale

Table 5: Mean SF-12 Physical and Mental Component Summary scores by episode of breathlessness and age groups

	mMRC 0 Mean (95% CI)	mMRC 1 Mean (95% CI)	mMRC 2-4 Mean (95% CI)
PCS			
15-44	53.0 (52.4-53.6)	45.1 (42.3-48.0)	43.6 (39.8-47.4)
45-54	50.1 (48.9-51.3)	41.0 (32.8-49.1)	27.7 (22.6-32.9)
55-64	49.2 (48.0-50.4)	37.3 (33.6-41.0)	26.2 (22.2-30.1)
65-74	48.6 (47.5-49.7)	42.4 (40.0-44.9)	35.3 (31.1-39.6)
75+	45.8 (44.6-47.0)	40.1 (37.2-43.0)	32.7 (28.5-36.9)
MCS			
15-44	52.6 (52.0-53.1)	45.2 (42.5-47.9)	42.7 (37.4-48.0)
45-54	50.5 (49.4-51.7)	43.9 (36.9-50.9)	32.4 (28.4-36.5)
55-64	51.0 (49.8-52.2)	41.6 (38.4-44.8)	32.4 (26.6-38.2)
65-74	51.3 (50.3-52.3)	45.2 (42.5-47.9)	41.1 (37.3-45.0)
75+	48.5 (47.4-49.7)	43.8 (41.1-46.6)	37.2 (32.4-42.0)