

1 **SUPPLEMENTARY**

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3 **Title**

4 Characterization of lung function trajectories and associated early life predictors in
5 in an Australian birth cohort study

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1 **Appendix S1. Additional methods and results**

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4 **Statistical analysis**

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6 *Early life predictors*

7 Associations between early life predictors and lung function trajectories were first evaluated by
8 unadjusted multinomial linear and logistic regression. Childhood, parental and environmental
9 predictors associated with lung function trajectories with $p < 0.1$ were retained for entry into full
10 models. The final models were carried out separately for FEV₁, FVC and FEV₁/FVC z-scores,
11 and were adjusted for sex, socio-economic status, preterm birth, childhood asthma, childhood
12 respiratory infections, childhood atopy, maternal smoking, parental asthma, parental hay fever,
13 parental eczema, and early life exposure to NO₂ and PM_{2.5}Absorbance.

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15 **Results of air pollution exposure in participants**

16 Descriptive summary statistics for early-life exposure to PM_{2.5}Absorbance and NO₂ in the
17 participants are shown in Supplementary Table 1.

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20 **Results of Lung function trajectories**

21 We also assessed the overlap of participants in both FEV₁ and FVC lung function trajectories
22 where participants in the lowest trajectories of FEV₁ were not necessary in the lowest trajectories
23 of FVC (Supplementary Table 5).

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1 **References**

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6 of the B-spline group-based trajectory model with the polynomial group-based trajectory
7 model for identifying trajectories of depressive symptoms around old-age retirement. *Aging &*
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Supplementary Table 1 A, B. Descriptive summary of
PM_{2.5}Absorbance and NO₂ during early-life in the Raine
participants

	Mean	Std Dev	Min	Max
PM_{2.5} Absorbance (10^{-5} m^{-1})	0.94	± 0.37	0.02	2.99
NO₂ ($\mu\text{g}/\text{m}^3$)	5.15	± 2.08	0.06	12.19

Supplementary Table 2. Childhood and parenthood characteristics in included and excluded Raine Study participants

Participant demographics			
Variable	Included (n=1512)	Excluded (n=1356)	P- value
Female sex, %	744 (49.21)	670 (49.41)	0.913
Missing values	0 (0.0)	0 (0.0)	
Ethnic origin, %			0.797
Caucasian	1321 (87.37)	533 (39.31)	
Other	116 (7.67)	49 (3.61)	
Missing values	75 (4.96)	774 (57.08)	
Socio-economic status, %**			<0.001
≤16.000	137 (9.06)	95 (7.01)	
16000-40000	609 (40.28)	359 (26.47)	
≥40000	653 (43.19)	252 (18.58)	
Missing values	113 (7.47)	650 (47.94)	
Maternal education, %			<0.001
Low	304 (20.11)	211 (15.56)	
Medium	417 (27.58)	277 (20.43)	
High	683 (45.17)	765 (56.42)	
Missing values	108 (7.14)	103 (7.60)	

Respiratory infections, %			<0.001
URTI only	503 (33.27)	346 (25.52)	
LRTI or both	333 (33.27)	227 (16.74)	
Missing values	0 (0.0)	(0.0)	
Preterm (<37 gestational age), %	101 (6.68)	117 (8.63)	0.046
Missing values	68 (4.50)	66 (4.87)	
Birthweight			0.218
Low	122 (8.25)	127 (9.37)	
Missing values	34 (22.49)	46 (33.92)	
Current asthma at age 6, %	235 (15.54)	114 (8.41)	<0.001
Missing values	0 (0.0)	(0.0)	
Current asthma at age 14, %	147 (9.72)	49 (3.61)	<0.001
Missing values	0 (0.0)	(0.0)	
Current asthma at age 22, %	103 (6.81)	18 (1.33)	<0.001
Missing values	0 (0.0)	0 (0.0)	
Current wheeze at age 6, %	314 (20.77)	168 (12.39)	0.610
Missing values	68 (4.50)	616 (45.43)	
Current wheeze at age 14, %	192 (12.70)	61 (4.50)	0.296
Missing values	104 (6.88)	968 (71.39)	
Current wheeze at age 22, %	202 (13.36)	28 (2.06)	0.582
Missing values	519 (34.33)	1204 (88.79)	
Current eczema at age 6, %	340 (22.49)	155 (11.43)	0.131
Missing values	90 (5.95)	619 (45.65)	
Current eczema at age 14, %	274 (18.12)	64 (4.72)	0.192

Missing values	101 (6.68)	968 (71.39)	
Current eczema at age 22, %	127 (8.40)	24 (1.77)	0.314
Missing values	541 (35.78)	1207 (89.01)	
Current hay fever at age 6, %	104 (6.88)	50 (3.69)	<0.001
Missing values	0 (0.0)	0 (0.0)	
Current hay fever at age 14, %	291 (19.25)	66 (4.87)	0.113
Missing values	102 (6.75)	968 (71.39)	
Current hay fever at age 22, %	177 (11.71)	26 (1.92)	0.814
Missing values	102 (34.99)	968 (88.86)	
Atopy at age 6, %			<0.001
Food Allergy only	32 (2.12)	9 (0.66)	
Aeroallergens only or both	332 (21.96)	78 (5.75)	
Missing values	0 (0.0)	0 (0.0)	
Current FEV₁ at age 6, (z-scores), %	-0.85 (0.98)	-0.89 (0.99)	0.261
Missing values	139 (9.01)	986 (72.71)	
Current FEV₁ at age 14, (z-scores), %	-0.46 (1.04)	-0.63 (1.07)	0.024
Missing values	120 (7.94)	1202 (88.64)	
Current FEV₁ at age 22, (z-scores), %	-0.11 (0.99)	-0.29 (1.07)	0.071
Missing values	522 (34.52)	1286 (94.84)	
Current FVC at age 6, (z-scores), %	-1.08 (1.05)	-1.04 (1.31)	0.753
Missing values	139 (9.19)	987 (72.79)	
Current FVC at age 14, (z-scores), %	-0.79 (1.06)	-0.87 (1.01)	0.181
Missing values	120 (7.93)	1202 (88.64)	
Current FVC at age 22, (z-scores), %	0.08 (0.93)	-0.02 (0.82)	0.189

Missing values	523 (34.59)	1288 (94.99)	
Current FEV₁/FVC at age 6, (z-scores), %	0.71 (1.18)	0.66 (1.26)	0.263
Missing values	141 (9.33)	987 (72.79)	
Current FEV₁/FVC at age 14, (z-scores), %	0.71 (1.19)	0.52 (1.32)	0.030
Missing values	120 (7.94)	1202 (88.64)	
Current FEV₁/FVC at age 22, (z-scores), %	-0.34 (0.92)	-0.50 (1.03)	0.078
Missing values	523 (34.59)	1288 (94.99)	
Current FEV₁ at age 6, (liters), %	1.09 (0.47-1.47)	1.08 (0.57-1.98)	
Current FEV₁ at age 14, (liters), %	3.07 (1.07- 5.05)	2.95 (1.75- 5.01)	
Current FEV₁ at age 22, (liters), %	4.01 (1.97- 6.41)	3.93 (2.18- 6.49)	
Current FVC at age 6, (liters), %	1.16 (0.51- 2.07)	1.17 (0.65- 2.76)	
Current FVC at age 14, (liters), %	3.38 (1.15- 5.8)	3.29 (2.04- 5.62)	
Current FVC at age 22, (liters), %	4.82 (2.62- 8.42)	4.79 (2.73- 7.95)	
Current FEV₁/FVC at age 6, (liters), %	0.94 (0.34- 1.00)	0.94 (0.33- 1.00)	
Current FEV₁/FVC at age 14, (liters), %	0.91 (0.6- 1.00)	0.90 (0.63- 1.00)	
Current FEV₁/FVC at age 22, (liters), %	0.84 (0.45- 1.00)	0.82 (0.59- 0.99)	
Maternal smoking, %			0.003
Only in pregnancy	66 (4.37)	45 (3.32)	
Only at age 6	106 (7.01)	62 (4.57)	
Both in pregnancy and at age 6	277 (18.32)	183 (13.50)	
Missing values	137 (9.06)	646 (47.64)	
Paternal smoking, %	509 (33.66)	629 (46.39)	<0.001
Missing values	55 (3.64)	58 (4.28)	
Parental asthma, %			0.291

Mother only	215 (14.22)	88 (6.49)	
Father only	124 (8.20)	55 (4.06)	
Both	36 (2.38)	23 (1.70)	
Missing values	221 (14.62)	726 (53.54)	
Parental eczema, %			0.701
Mother only	223 (14.75)	118 (8.70)	
Father only	97 (6.42)	44 (3.24)	
Both	40 (2.65)	15 (1.11)	
Missing values	219 (14.48)	717 (52.88)	
Parental hay fever, %			<0.001
Mother only	441 (29.17)	207 (15.27)	
Father only	239 (15.81)	122 (9.00)	
Both	21 (13.96)	77 (5.68)	
Missing values	0 (0.0)	0 (0.0)	
Parental wheeze, %	626 (43.90)	307 (41.60)	0.306
Missing values	86 (5.69)	618 (45.58)	

**Values are means (SD) or percentages (absolute numbers). Differences were tested by using the Student t test for continuous variables, and the X^2 test for categorical variables. **SES=socio economic status was defined by the family incomes, expressed in Australian dollars (\$AUD), LRTI= low respiratory tract infections in the first year of life, URTI= upper respiratory tract infections in the first year of life.*

Supplementary Table 3. Average posterior probabilities for each group within FEV₁, FVC, and FEV₁/FVC trajectories.

	FEV ₁				FVC				FEV ₁ /FVC			
	Trajectories				Trajectories				Trajectories			
	Very Low	Low	Average	Above Average	Very Low	Low	Average	Above Average	Very Low	Low-Average	Average	Average-Low
Average posterior probabilities	0.81	0.84	0.79	0.83	0.72	0.77	0.72	0.79	0.84	0.82	0.79	0.85

Supplementary Table 4. Distribution of forced expiratory flow in one second (FEV₁), forced vital capacity (FVC) and their ratio (FEV₁/FVC) in the lung function trajectories in the Raine Study participants with two or more spirometry measurements.

Trajectory	FEV ₁ n (%)				FVC n (%)				FEV ₁ /FVC n (%)			
	Very Low	Low	Average	Above Average	Very Low	Low	Average	Above Average	Very Low	Low-Average	Average	Average-Low
	51 (3.37)	746 (49.34)	611 (40.41)	104 (6.88)	61 (4.03)	855 (56.55)	457 (30.22)	139 (9.19)	131 (8.66)	198 (13.10)	654 (43.25)	529 (34.99)
Total	1512				1512				1512			

Note. *All values are given as frequencies with percentages in parentheses.

Supplementary Table 5. Individual distribution of FEV₁ and FVC lung function trajectories in the Raine Study participants with two or more spirometry measurements.

	FVC				
FEV ₁	Very low n (%)	Low n (%)	Average n (%)	Above Average n (%)	Total
Very low	26 (42.62)	23 (2.69)	1 (0.22)	1 (0.72)	51 (3.37)
Low	35 (57.38)	626 (73.22)	82 (17.94)	3 (2.16)	746 (49.34)
Average	0 (0.00)	206 (24.09)	343 (75.05)	62 (44.60)	611 (40.41)
Above average	0 (0.00)	0 (0.00)	31 (6.78)	73 (52.52)	104 (6.88)
Total	61	457	139	855	1,512

Note. *All values are given as frequencies with percentages in parentheses.

Aeroallergens only or both	11 (21.57)	161 (21.58)	131 (21.44)	29 (27.88)		15 (24.59)	178 (20.82)	100 (21.88)	39 (28.06)		30 (22.90)	42 (21.21)	107 (20.23)	153 (23.39)	
Maternal smoking															
Never	25 (62.5)	454 (67.2)	379 (66.8)	68 (73.9)	0.018	31 (58.5)	533 (68.7)	273 (65.3)	89 (69.5)	0.022	67 (54.9)	126 (69.6)	307 (64.9)	426 (71.1)	0.005
Smoking in pregnancy only	2 (5.0)	24 (3.6)	31 (5.5)	9 (9.8)		3 (5.7)	30 (3.9)	22 (5.3)	11 (8.6)		7 (5.7)	8 (4.4)	29 (6.1)	22 (3.7)	
Smoke at 6 only	0 (0.0)	56 (8.3)	47 (8.3)	3 (3.3)		5 (9.4)	72 (9.3)	25 (6.0)	4 (3.1)		8 (6.6)	12 (6.6)	34 (7.2)	52 (8.7)	
Both	13 (32.5)	142 (21.0)	110 (19.4)	12 (13.0)		14 (26.4)	141 (18.2)	98 (23.4)	24 (18.8)		40 (32.8)	35 (19.3)	103 (21.8)	99 (16.5)	
Paternal smoking					0.983					0.739					0.631
No	32 (62.75)	476 (63.81)	378 (61.87)	62 (59.62)		35 (57.38)	546 (63.86)	283 (61.93)	84 (60.43)		72 (54.96)	127 (64.14)	332 (62.76)	417 (63.76)	
Yes	17 (33.33)	243 (32.57)	211 (34.53)	38 (36.54)		25 (40.98)	278 (32.51)	155 (33.92)	51 (36.69)		52 (39.69)	65 (32.83)	178 (33.65)	214 (32.72)	
Respiratory infections															
Never	26 (51.0)	345 (46.3)	263 (43.0)	42 (40.4)	0.080	32 (52.5)	380 (44.4)	206 (45.1)	58 (41.7)	0.532	62 (47.4)	84 (42.4)	240 (45.4)	290 (44.3)	0.928
URTI only	9 (17.7)	233 (31.2)	221 (36.2)	40 (38.5)		14 (23.0)	283 (33.1)	152 (33.3)	54 (38.9)		39 (29.8)	69 (34.9)	170 (32.1)	225 (34.4)	
LRTI or both	16 (31.4)	168 (22.5)	127 (20.8)	22 (21.2)		15 (24.6)	192 (22.5)	99 (21.7)	27 (19.4)		30 (22.9)	45 (22.7)	119 (22.5)	139 (21.3)	
Preterm birth	3 (6.4)	56 (7.9)	36 (6.1)	6 (6.0)	0.649	6 (10.0)	57 (7.0)	30 (6.9)	8 (5.9)	0.776	6 (4.7)	18 (9.6)	46 (9.1)	31 (5.0)	0.015
Birthweight					0.132					0.369					0.058
Low	10 (13.89)	62 (7.49)	170 (9.18)	7 (5.98)		8 (13.11)	68 (7.95)	38 (8.32)	8 (5.76)		123 (93.86)	177 (89.39)	477 (90.17)	613 (93.73)	
Normal	62 (86.11)	766 (92.51)	1681 (90.82)	110 (94.02)		53 (86.89)	787 (92.05)	419 (91.68)	131 (94.24)		8 (6.11)	21 (10.61)	52 (9.83)	41 (6.27)	
Parental Asthma															
No	25 (64.1)	446 (69.9)	376 (71.4)	69 (79.3)	0.485	29 (58.0)	523 (71.6)	272 (70.1)	92 (74.8)	0.677	72 (65.5)	135 (76.3)	288 (65.2)	421 (74.9)	0.064
Mother only	10 (25.6)	104 (16.3)	90 (17.1)	11 (12.6)		13 (26.0)	115 (15.8)	67 (17.3)	20 (16.3)		21 (19.1)	25 (14.1)	88 (19.9)	81 (14.4)	
Father only	4 (10.3)	66 (10.3)	49 (9.3)	5 (5.8)		6 (12.0)	72 (9.9)	37 (9.5)	9 (7.3)		14 (12.7)	13 (7.3)	50 (11.3)	47 (8.4)	
Both	0 (0.00)	22 (3.5)	12 (2.3)	2 (2.3)		2 (7.3)	20 (2.7)	12 (3.1)	2 (1.6)		3 (2.7)	4 (2.3)	16 (3.6)	13 (2.3)	
Parental Eczema															
No	32 (80.0)	453 (71.3)	379 (71.6)	69 (77.5)	0.399	36 (69.2)	541 (73.9)	265 (68.3)	91 (75.2)	0.399	69 (63.9)	136 (76.4)	317 (72.1)	411 (72.5)	0.265
Mother only	3	113	96	11		9	115	79	20		23	24	74	102	

	(7.5)	(17.8)	(18.2)	(12.4)		(17.3)	(15.7)	(20.4)	(16.5)		(21.3)	(13.5)	(16.8)	(18.0)	
Father only	4 (10.0)	54 (8.5)	33 (6.2)	6 (6.7)		6 (11.5)	57 (7.8)	27 (7.0)	7 (5.8)		14 (13.0)	11 (6.2)	36 (8.2)	36 (6.4)	
Both	1 (2.5)	15 (2.4)	21 (4.0)	3 (3.4)		1 (1.9)	19 (2.6)	17 (4.4)	3 (2.5)		2 (1.9)	7 (3.9)	13 (3.0)	18 (3.2)	
Parental Hay Fever															
No	26 (51.0)	325 (43.6)	229 (37.5)	41 (39.4)	0.444	24 (39.3)	384 (44.9)	167 (36.5)	46 (33.1)	0.052	56 (42.8)	75 (37.9)	217 (41.0)	273 (41.7)	0.771
Mother only	14 (27.5)	214 (28.7)	185 (30.3)	28 (26.9)		19 (31.2)	242 (28.3)	138 (30.2)	42 (30.2)		32 (24.4)	60 (30.3)	150 (28.4)	199 (30.4)	
Father only	6 (11.8)	111 (14.9)	104 (17.0)	18 (17.3)		11 (18.0)	117 (13.7)	86 (18.8)	25 (18.0)		26 (19.9)	34 (17.2)	88 (16.6)	91 (13.9)	
Both	5 (9.8)	96 (12.9)	93 (15.2)	17 (16.35)		7 (11.5)	112 (13.1)	66 (14.4)	26 (18.7)		17 (13.0)	29 (14.7)	74 (14.0)	91 (13.9)	
Parental Wheeze	27 (57.4)	306 (43.6)	252 (43.5)	41 (42.3)	0.298	28 (48.3)	345 (42.8)	190 (44.6)	63 (46.7)	0.708	74 (59.2)	78 (40.4)	226 (46.2)	248 (40.1)	0.001

*Note. *All values are given as frequencies with percentages in parentheses. **Significance of differences was evaluated by chi-square test and are given in bold. ***SES= socio economic status, LRTI= low respiratory tract infections in the first year of life, URTI= upper respiratory tract infections in the first year of life ****The average trajectory of FEV₁, FEV₁/FVC and FVC respectively were used as reference category.*