# Pneumonia

**rule**

(std(skwns) < 16.88) ∧ (std(mel10=1687Hz) < 0.54) ∧ (min(mel8=1194Hz) < -4.20) ∧ (std(mel8=1194Hz) < 0.19)

(std(skwns) < 16.88) ∧ (std(mel10=1687Hz) < 0.54) ∧ (min(mel8=1194Hz) < -4.20) ∧ (std(mel8=1194Hz) ≥ 0.19) ∧ (max(mel6=845Hz) ≥ -3.58) ∧ (st

(std(skwns) < 16.88) ∧ (std(mel10=1687Hz) ≥ 0.54) ∧ (bsd(mel14=3366Hz) ≥ 3.5) ∧ (3ac(mel8=1194Hz) ≥ 0.01)

(std(skwns) ≥ 20.37) ∧ (std(mel9=1419Hz) ≥ 0.14) ∧ (med(mel9=1419Hz) < -3.28)

(min(mfcc2) < 1.50) ∧ (max(mfcc4) ≥ 0.56) ∧ (mean(mfcc5) < 0.48) ∧ (med(mel11=2005Hz) < 9.76e-5)

(min(mfcc2) ≥ 1.50) ∧ (min(mfcc3) ≥ -0.53) ∧ (min(mel14=3366Hz) ≥ 2.98e-8) ∧ (med(cntrd) < 19.89) ∧ (3ac(mfcc4) ≥ 0.00)

∧ G□((max(cntrd) ≥ 1084.33) □ (std□(skwns) ≤ 0.08))

⟨G⟩(max(mel8=1194Hz) ≤ -4.91) ∧ [G](max(cntrd) < 1084.33) ∧ [G](std⁺(mel10=1687Hz) < 0.42) ∧ [G]((max(mel8=1194Hz) ≤ -4.91) → [DBE](std⁺(mel1

⟨G⟩((max(mfcc2) ≤ 1.60) ∧ ⟨D̄B̄Ē⟩(min(mfcc5) ≥ -0.01)) ∧ [G]((max(mfcc2) ≤ 1.60) → [G](max(mfcc5) < 0.91))

⟨G⟩((max(mfcc3) ≤ -0.52) ∧ ⟨L⟩(max(crest) ≤ 20.89)) ∧ [G](max(mfcc2) > 1.60) ∧ [G]((max(mfcc3) ≤ -0.52) → [D̄B̄Ē](max(mfcc4) > -0.53)) ∧ [G]((max(mf

[G](max(mfcc2) > 1.60) ∧ [G](max(mfcc3) > -0.52) ∧ [G](max(mel12=2383Hz) > 1.23e-8) ∧ [G](std⁺(mfcc6) < 0.32)

# Bronchiecstasis

**rule**

std(decrs) < 2.77

std(decrs) ≥ 2.77

mean(decrs) < -1.49

mean(decrs) ≥ -1.49

⟨G⟩((max(mel7=1005Hz) ≥ -4.14) ∧ ⟨AO⟩((max(kurts) ≤ 6.44) ∧ ⟨D̄B̄Ē⟩((mean(mel7=1005Hz) ≤ -4.18) ∧ ⟨D̄B̄Ē⟩((median(decrs) ≥ -0.36) ∧ (std⁺(mel1=35

⟨G⟩((max(mel7=1005Hz) ≥ -4.14) ∧ ⟨AO⟩(max(kurts) ≤ 6.44)) ∧ [G]((max(mel7=1005Hz) ≥ -4.14) → [AO]((max(kurts) ≤ 6.44) → [D̄B̄Ē](mean(mel7=1005

⟨G⟩(max(mel7=1005Hz) ≥ -4.14) ∧ [G]((max(mel7=1005Hz) ≥ -4.14) → [AO](max(kurts) > 6.44))

[G](max(mel7=1005Hz) < -4.14) ∧ [G](std□(mel13=2832Hz) > 0.00)

⟨G⟩((max(kurts) ≤ 5.06) ∧ ⟨D̄B̄Ē⟩(median(mel8=1194Hz) ≤ 9.17e-5)) ∧ [G]((max(kurts) ≤ 5.06) → [D̄B̄Ē]((median(mel8=1194Hz) ≤ 9.17e-5) → (quantile_

⟨G⟩(max(kurts) ≤ 5.06) ∧ [G]((max(kurts) ≤ 5.06) → [D̄B̄Ē](median(mel8=1194Hz) > 9.17e-5))

⟨G⟩(std⁺(mel2=424Hz) ≥ 0.01) ∧ [G](max(kurts) > 5.06) ∧ [G](max(mel7=1005Hz) > 8.51e-7)

# COPD

**rule**

(med(entrp) < 0.21) ∧ (min(mel12=2383Hz) ≥ -8.02) ∧ (std(mel10=1687Hz) ≥ 0.15) ∧ (mean(slope) ≥ -0.03)

(med(entrp) ≥ 0.23) ∧ (min(mel14=3366Hz) ≥ -5.87)

(mean(crest) < 120.66) ∧ (qnt(mel6=845Hz) ≥ 1.73)

(mean(crest) ≥ 120.66) ∧ (min(mfcc2) < 1.55) ∧ (med(mel13=2832Hz) < 8.06e-5) ∧ (mean(slope) ≥ -0.05)

(mean(crest) ≥ 120.66) ∧ (min(mfcc2) ≥ 1.55) ∧ (med(slope) < -0.02) ∧ (max(mfcc5) < 0.83) ∧ (max(mfcc6) ≥ 0.02)

⟨G⟩((max(mel1=357Hz) ≤ -3.83) ∧ ⟨L̄⟩((max(mel13=2832Hz) ≥ -8.07) ∧ (max(skwns) ≤ 1.57) ∧ ⟨G⟩(std⁺(entrp) ≥ 0.11)))

⟨G⟩((max(mel1=357Hz) ≤ -3.83) ∧ ⟨L̄⟩((max(mel13=2832Hz) ≥ -8.07) ∧ (max(skwns) ≤ 1.57) ∧ ⟨D̄B̄Ē⟩(std⁻(cntrd) ≤ 13.24))) ∧ [G]((max(mel1=357Hz) ≤

⟨G⟩(max(mel1=357Hz) ≤ -3.83) ∧ [G]((max(mel1=357Hz) ≤ -3.83) → [L̄](max(mel13=2832Hz) < -8.07))

⟨G⟩(max(mel12=2383Hz) ≥ -4.46) ∧ [G](max(mel1=357Hz) > -3.83)

[G](max(mel1=357Hz) > -3.83) ∧ [G](max(mel12=2383Hz) < -4.46) ∧ [G](max(cntrd) < 986.78) ∧ [G](max(mel7=1005Hz) < -2.36)

⟨G⟩((max(mel5=711Hz) ≤ 5.15e-5) ∧ ⟨AO⟩((min(cntrd) ≥ 984.58) ∧ ⟨AO⟩(min(mfcc4) ≥ 0.44))) ∧ [G]((max(mel5=711Hz) ≤ 5.15e-5) → [AO]((min(cntrd) ≥

⟨G⟩((max(mfcc6) ≥ 0.05) ∧ (max(mfcc5) ≤ 0.24)) ∧ [G](max(mel5=711Hz) > 5.15e-5)

# URTI

**rule**

(mean(skwns) < 17.49) ∧ (mean(mel4=599Hz) ≥ -5.19) ∧ (std(mel1=357Hz) ≥ 0.48) ∧ (3ac(mel3=504Hz) < 0.15) ∧ (qnt(mel14=3366Hz) ≥ 2.10)

(mean(skwns) ≥ 17.49) ∧ (min(mel1=357Hz) < -3.17) ∧ (mean(slope) < -0.02) ∧ (qnt(cntrd) < 2.05)

(mean(skwns) ≥ 17.49) ∧ (min(mel1=357Hz) < -3.17) ∧ (mean(slope) < -0.02) ∧ (qnt(cntrd) ≥ 2.05) ∧ (max(mel10=1687Hz) ≥ -4.21) ∧ (std(decrs) < 8

(mean(mfcc2) < 3.53) ∧ (med(mfcc2) ≥ 1.49) ∧ (max(mfcc3) ≥ 0.26) ∧ (qnt(kurts) < 2.14) ∧ (bsm(mfcc1) ≥ 10.5) ∧ (bsd(mfcc6) < 4.5)

(mean(mfcc2) ≥ 3.53) ∧ (mean(mel3=504Hz) ≥ 9.25e-5) ∧ (max(mel13=2832Hz) < 1.44e-6)

⟨G⟩(max(flatn) ≥ 0.14) ∧ [G]((max(flatn) ≥ 0.14) → [L](max(flatn) < 0.28)) ∧ [G]((max(flatn) ≥ 0.14) → [L̄](sumdiagcov⁻(flatn) > 0.01)) ∧ [G]((max(flatn) ≥ 0

⟨G⟩((max(mel7=1005Hz) ≤ -4.79) ∧ ⟨AO⟩(sumdiagcov⁻(entrp) ≤ 0.04)) ∧ [G](max(flatn) < 0.14) ∧ [G]((max(mel7=1005Hz) ≤ -4.79) → [D̄B̄Ē](max(mel8=4

⟨G⟩((max(mfcc2) ≥ 5.02) ∧ ⟨Ā̄Ō⟩(std⁻(sprd) ≤ 1.03))

⟨G⟩((max(mfcc2) ≥ 5.02) ∧ (mean(flatn) ≥ 0.02) ∧ ⟨G⟩(std⁺(entrp) ≥ 0.10)) ∧ [G]((max(mfcc2) ≥ 5.02) → [Ā̄Ō](std⁻(sprd) > 1.03)) ∧ [G]((max(mfcc2) ≥ 5.0

⟨G⟩(max(skwns) ≤ 1.13) ∧ [G](max(mfcc2) < 5.02) ∧ [G](max(mfcc4) > -0.03) ∧ [G](std⁺(skwns) < 3.45) ∧ [G](std⁺(mfcc4) < 0.61) ∧ [G]((max(skwns) ≤ 1

## Bronchiolitis

### rule

(mean(kurts) < 5761.28) ∧ (med(mel6=845Hz) < -3.25) ∧ (mean(entrp) < 0.21) ∧ (max(mel1=357Hz) ≥ -2.47) ∧ (mean(skwns) < 15.58) ∧ (std(mel3=

(mean(kurts) < 5761.28) ∧ (med(mel6=845Hz) < -3.25) ∧ (mean(entrp) ≥ 0.21) ∧ (min(skwns) < 3.35)

mean(kurts) ≥ 5761.28

(max(mfcc2) < 6.36) ∧ (med(mfcc5) < 0.11)

(max(mfcc2) < 6.36) ∧ (med(mfcc5) ≥ 0.11) ∧ (mean(crest) < 134.78) ∧ (qnt(mel6=845Hz) ≥ 1.85) ∧ (mean(mel4=599Hz) ≥ 1.47e-5)

(max(mfcc2) < 6.36) ∧ (med(mfcc5) ≥ 0.11) ∧ (mean(crest) ≥ 134.78) ∧ (med(mfcc2) < 2.03)

(max(mfcc2) ≥ 6.36) ∧ (med(skwns) < 15.43)

⟨G⟩((max(crest) ≥ 39.35) ∧ ⟨AO⟩((median(flux) ≥ 0.21) ∧ ⟨AO⟩((min(mel4=599Hz) ≤ -5.09) ∧ (max(mel8=1194Hz) ≥ -5.55)))) ∧ [G]((max(crest) ≥ 39.35)

[G](max(crest) < 39.35) ∧ [G](sumdiagcov□(entrp) > 0.00)

⟨G⟩((max(crest) ≥ 39.35) ∧ ⟨AO⟩((mean(mel1=357Hz) ≥ 0.00) ∧ (mean(mfcc1) ≤ -19.99))) ∧ [G]((max(crest) ≥ 39.35) → [AO]((mean(mel1=357Hz) ≥ 0.0

[G](max(crest) < 39.35) ∧ [G](std□(mel11=2005Hz) > 1.23e-9)

| consequent | coverage | confidence | lift | natoms | type | condition |
|---|---|---|---|---|---|---|
| Pneumonia | 0.17 | 1 | 2.2 | 4 | propositional | Pneumonia |
| Pneumonia | 0.15 | 0.73 | 1.61 | 7 | propositional | Pneumonia |
| Healthy | 0.12 | 0.92 | 1.68 | 4 | propositional | Pneumonia |
| Healthy | 0.22 | 0.95 | 1.75 | 3 | propositional | Pneumonia |
| Healthy | 0.37 | 0.86 | 1.75 | 4 | propositional | Pneumonia |
| Pneumonia | 0.27 | 0.96 | 1.91 | 5 | propositional | Pneumonia |
| Healthy | 0.17 | 1 | 2.02 | 2 | modal | Pneumonia |
| Pneumonia | 0.28 | 0.93 | 1.84 | 5 | modal | Pneumonia |
| Healthy | 0.4 | 0.92 | 1.67 | 4 | modal | Pneumonia |
| Healthy | 0.12 | 0.58 | 1.05 | 12 | modal | Pneumonia |
| Pneumonia | 0.25 | 0.96 | 2.15 | 4 | modal | Pneumonia |

| consequent | coverage | confidence | lift | natoms | type | condition |
|---|---|---|---|---|---|---|
| Bronchiectasis | 0.5 | 1 | 2 | 1 | propositional | Bronchiectasis |
| Healthy | 0.5 | 1 | 2 | 1 | propositional | Bronchiectasis |
| Healthy | 0.61 | 1 | 1.64 | 1 | propositional | Bronchiectasis |
| Bronchiectasis | 0.39 | 1 | 2.57 | 1 | propositional | Bronchiectasis |
| Healthy | 0.17 | 1 | 2 | 5 | modal | Bronchiectasis |
| Bronchiectasis | 0.17 | 1 | 2 | 8 | modal | Bronchiectasis |
| Bronchiectasis | 0.28 | 0.8 | 1.6 | 3 | modal | Bronchiectasis |
| Healthy | 0.17 | 0.67 | 1.33 | 2 | modal | Bronchiectasis |
| Healthy | 0.44 | 0.94 | 1.69 | 5 | modal | Bronchiectasis |
| Bronchiectasis | 0.14 | 1 | 2.25 | 3 | modal | Bronchiectasis |
| Bronchiectasis | 0.17 | 0.83 | 1.88 | 3 | modal | Bronchiectasis |

| consequent | coverage | confidence | lift | natoms | type | condition |
|---|---|---|---|---|---|---|
| Healthy | 0.24 | 0.96 | 1.86 | 4 | propositional | COPD |
| COPD | 0.27 | 0.97 | 2.01 | 2 | propositional | COPD |
| COPD | 0.29 | 0.94 | 1.64 | 2 | propositional | COPD |
| Healthy | 0.32 | 0.97 | 2.27 | 4 | propositional | COPD |
| COPD | 0.16 | 0.89 | 1.55 | 5 | propositional | COPD |
| Healthy | 0.32 | 0.94 | 1.92 | 4 | modal | COPD |
| Healthy | 0.1 | 0.91 | 1.85 | 13 | modal | COPD |
| COPD | 0.12 | 1 | 1.96 | 3 | modal | COPD |
| COPD | 0.15 | 1 | 1.96 | 2 | modal | COPD |
| COPD | 0.13 | 0.93 | 1.82 | 4 | modal | COPD |
| Healthy | 0.31 | 0.97 | 1.84 | 7 | modal | COPD |
| COPD | 0.25 | 0.96 | 2.04 | 3 | modal | COPD |

| consequent | coverage | confidence | lift | natoms | type | condition |
|---|---|---|---|---|---|---|
| URTI | 0.12 | 0.9 | 1.94 | 5 | propositional | URTI |
| Healthy | 0.12 | 0.6 | 1.12 | 4 | propositional | URTI |
| Healthy | 0.12 | 0.7 | 1.31 | 8 | propositional | URTI |
| Healthy | 0.1 | 0.78 | 1.49 | 6 | propositional | URTI |
| URTI | 0.16 | 0.86 | 1.8 | 3 | propositional | URTI |
| Healthy | 0.14 | 0.5 | 1.08 | 7 | modal | URTI |
| URTI | 0.24 | 0.9 | 1.69 | 7 | modal | URTI |
| URTI | 0.1 | 0.78 | 1.37 | 2 | modal | URTI |
| URTI | 0.14 | 0.83 | 1.46 | 10 | modal | URTI |

| Healthy | 0.12 | 0.5 | 1.16 | 9 modal | URTI |
|---------|------|-----|------|---------|------|

| consequent | coverage | confidence | lift | natoms | type | condition |
|------------|----------|------------|------|--------|------|-----------|
| Bronchiolitis | 0.11 | 1 | 2.07 | 7 | propositional | Bronchiolitis |
| Bronchiolitis | 0.25 | 0.93 | 1.93 | 4 | propositional | Bronchiolitis |
| Healthy | 0.27 | 0.87 | 1.67 | 1 | propositional | Bronchiolitis |
| Healthy | 0.18 | 0.9 | 1.63 | 2 | propositional | Bronchiolitis |
| Bronchiolitis | 0.23 | 0.77 | 1.72 | 5 | propositional | Bronchiolitis |
| Healthy | 0.12 | 1 | 1.81 | 4 | propositional | Bronchiolitis |
| Bronchiolitis | 0.16 | 0.78 | 1.74 | 2 | propositional | Bronchiolitis |
| Bronchiolitis | 0.3 | 0.88 | 1.83 | 8 | modal | Bronchiolitis |
| Healthy | 0.16 | 1 | 1.93 | 2 | modal | Bronchiolitis |
| Bronchiolitis | 0.25 | 0.93 | 1.63 | 7 | modal | Bronchiolitis |
| Healthy | 0.21 | 0.83 | 1.94 | 2 | modal | Bronchiolitis |

| scale | featset |
|---|---|
| semitones | () |
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| scale | featset |
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