

A Simple Screening Model for Identifying the Risk of Sleep Apnea in Patients on Opioids for Chronic Pain

Jananii Selvanathan, BSc^{1,2}, Rida Waseem, MA¹, Philip WH Peng, MBBS¹, Jean Wong, MD^{1,2}, Clodagh M. Ryan, MD³, and Frances Chung, MBBS^{1,2}

From the

1. Department of Anesthesia and Pain Medicine, Toronto Western Hospital, University Health Network, University of Toronto, Toronto, Ontario, Canada
2. Institute of Medical Science, Temerty Faculty of Medicine, University of Toronto, Ontario, Canada
3. Department of Medicine, Toronto General Hospital, University Health Network, University of Toronto, Ontario, Canada

SUPPLEMENTARY

S-Table 1. Diagnostic parameters of SpO₂ in predicting the risk of moderate-to-severe sleep apnea (AHI ≥ 15 events per hour from polysomnography) (n = 194).

SpO ₂ (%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	LR+	LR-	OR
≤ 93	29.0 (20.4-36.9)	90.2 (86.1-93.8)	58.1 (40.8-73.8)	73.0 (69.7-76.0)	2.9 (1.5-6.0)	0.9 (0.7-0.9)	3.7 (1.6-8.9)
≤ 94	48.4 (38.1-58.0)	81.8 (77.0-85.3)	55.6 (43.7-66.5)	77.1 (72.6-81.4)	2.7 (1.7-4.2)	0.6 (0.5-0.8)	4.2 (2.1-8.7)
≤ 95	72.6 (61.7-81.9)	51.5 (46.4-55.9)	41.3 (35.1-46.6)	80.0 (72.1-86.8)	1.5 (1.2-1.9)	0.5 (0.3-0.8)	2.8 (1.4-5.7)
≤ 96	87.1 (77.7-93.6)	28.0 (23.6-31.1)	36.2 (32.3-39.0)	82.2 (69.3-91.2)	1.2 (1.0-1.4)	0.5 (0.2-0.9)	2.6 (1.1-6.6)

Notes. 95% Confidence Intervals expressed in parentheses. Out of 204 patients with completed polysomnography, 194 patients have completed and valid data on daytime SpO₂. Abbreviations. SpO₂, oxyhemoglobin saturation; ODI, oxygen desaturation index; PP, positive predictive value; NPV, negative predictive value; LR+, positive likelihood ratio; LR-, negative likelihood ratio; OR, odds ratio.

S-Table 2. Predictive parameters of STOP-Bang ≥ 3 or SpO₂ ≤ 95% (Step 1) in predicting the risk of any sleep apnea (AHI ≥ 5 events per hour from polysomnography), moderate-to-severe sleep apnea (AHI ≥ 15 events per hour), and severe sleep apnea (AHI ≥ 30 events per hour) (n = 199).

AHI	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	LR+	LR-	OR
≥ 5	92.5 (87.8-96.0)	31.6 (24.5-37)	67.3 (63.9-69.8)	73.5 (57.0-86.0)	1.4 (1.2-1.5)	0.2 (0.1-0.5)	5.7 (2.5-13.1)
≥ 15	95.4 (87.7-98.8)	23.1 (19.4-24.8)	37.6 (34.6-38.9)	91.2 (76.5-97.7)	1.24 (1.0-1.3)	0.2 (0.05-0.6)	6.2 (1.8-21.2)
≥ 30	100 (89.4-100)	21.0 (18.6-21.0)	22.4 (20.0-22.4)	100 (88.4-100)	1.3 (1.1-1.3)	Inf	Inf

Notes. 95% Confidence Intervals expressed in parentheses. 199 participants had completed data on the STOP-Bang questionnaire or resting daytime SpO₂ levels. Abbreviations. AHI, Apnea-Hypopnea Index; SpO₂, oxyhemoglobin saturation; PPV, positive predictive value; NPV, negative predictive value; LR+, positive likelihood ratio; LR-, negative likelihood ratio; OR, odds ratio.

S-Table 3. Predictive parameters of the screening model for predicting the risk of any sleep apnea (AHI \geq 5 events per hour from polysomnography), moderate-to-severe sleep apnea (AHI \geq 15 events per hour), and severe sleep apnea (AHI \geq 30 events per hour) at different ODI thresholds (n = 159).

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	LR +	LR -	OR
Any sleep apnea							
ODI \geq 5	67.3 (61.6-72.9)	48.1 (36.4-59.6)	72.7 (66.6-78.8)	41.7 (31.5-51.7)	1.3 (1.0-1.8)	0.7 (0.6-1.0)	1.9 (1.0-3.8)
ODI \geq 10	43.9 (38.4-47.9)	82.7 (71.4-90.9)	83.9 (73.5-91.6)	41.7 (36.1-45.9)	2.5 (1.3-5.3)	0.7 (0.6-0.9)	3.7 (1.7-8.4)
ODI \geq 15	32.7 (27.5-36.2)	86.5 (75.9-93.7)	83.3 (70.2-92.2)	38.5 (33.7-41.7)	2.4 (1.1-5.8)	0.7 (0.7-1.0)	3.1 (1.3-7.6)
Moderate-to -severe sleep apnea							
ODI \geq 5	91.7 (77.9-97.8)	46.3 (42.3-48.1)	33.3 (28.3-35.6)	95.0 (86.8-98.7)	1.8 (1.4-1.9)	0.2 (0.05-0.5)	9.5 (2.8-32.6)
ODI \geq 10	75.0 (59.8-86.5)	76.4 (72.0-79.8)	48.2 (38.5-55.6)	91.3 (86.0-95.3)	3.2 (2.1-4.3)	0.3 (1.2-0.6)	9.7 (3.8-25.4)
ODI \geq 15	69.4 (54.7-81.3)	86.2 (81.9-89.6)	59.5 (46.9-50.9)	90.6 (86.1-94.2)	5.0 (3.0-7.9)	0.4 (0.2-0.6)	14.2 (5.5-37.7)

Notes. 95% Confidence Intervals expressed in parentheses. *Abbreviations.* AHI, Apnea-Hypopnea Index; SpO₂, oxyhemoglobin saturation; PPV, positive predictive value; NPV, negative predictive value; LR+, positive likelihood ratio; LR-, negative likelihood ratio; ODI, Oxygen Desaturation Index; OR, odds ratio.