The Role of Artificial Intelligence in Respiratory Care

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This Presentation is Approved for 1 CRCE Credit Hour

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Disclaimer

- Artificial intelligence (AI) tools are decision-support technologies, not autonomous clinical decision makers.
- AI systems do not replace the clinical judgment
- All patient care decisions must be based on direct patient assessment, institutional policy, and provider orders.
- AI outputs may be influenced by data quality, system limitations, and potential bias and must be interpreted in clinical context.
- Mention of AI technologies does not imply endorsement of any specific product, platform, or manufacturer.

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Learning Objective

- Describe current applications of artificial intelligence (AI) in respiratory care, including diagnostics, monitoring, and treatment optimization.
- Recognize limitations and ethical considerations of AI in respiratory care.
- Apply AI-supported insights to RT-driven protocols and ventilator management scenarios.

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Why AI Matters to RTs

- RTs manage continuous physiologic data
- ICUs generate more data than humans can process alone
- AI excels at trend recognition and early warning

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Why AI Matters to RTs

- Clinical documentation & note generation
- Coding and billing optimization
- Prior authorization
- Scheduling and staffing predictions
- Inbox and chart review summarization

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What AI Is – and What It Is Not

- AI = decision support, not autonomous care
- AI analyzes trends; clinicians make decisions
- Responsibility always remains with the RT

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Data Interpretation What AI "Sees"

- Continuously analyzes:
  - Respiratory rate and work of breathing
  - Breath sounds (documented or acoustic sensors, emerging)
  - SpO_2 and oxygen requirements
  - Peak flow or FEV_1 (when available)
  - Ventilator waveforms (if intubated)
  - Frequency of PRN bronchodilator use
  - Response to prior treatments

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Patient Monitoring

- Continuously analyzes:
  - Respiratory rate trends
  - SpO_2 and FiO_2 requirements
  - $EtCO_2$ patterns
  - Heart rate and blood pressure
  - Ventilator pressures, volumes, and waveforms

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Early Warning & Detection

- Predicts respiratory deterioration before overt failure
- Identifies patients at risk for:
- Escalation of oxygen therapy
- Need for NIV or intubation
- ICU transfer
- Uses trend-based analysis, not single data points

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Case Example #1

- 67-year-old male with COPD exacerbation
- 2 L/min nasal cannula
- SpO_2 stable at 93–94%
- Respiratory rate trending down over 12 hours
- No wheezing documented on last two RT assessments
- No objective improvement after three bronchodilator treatments

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Case Example #1

- Analyzes RR trend, oxygen needs, and prior treatment response
- Matches data to institutional bronchodilator protocol
- AI recommendation

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Case Example #1

- Respiratory therapist:
  - Performs direct patient assessment
  - Confirms minimal wheeze and stable work of breathing
  - Discontinues bronchodilator therapy per protocol
  - Documents clinical rationale and response

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Case Example #1

- Improves protocol compliance
- Reduces overtreatment
- Standardizes care across shifts
- Supports RT-driven protocols during short staffing
- Provides defensible documentation logic

- Hospitals
- Quality committees
- Compliance reviewers

Case Takeaway:

AI supports protocol logic; RT makes the decision

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Case Example #2
Silent Respiratory Deterioration

- 54-year-old female admitted with community-acquired pneumonia
- High-flow nasal cannula at 40 L/min, FiO_2 0.50
- SpO_2 stable at 92%
- Respiratory rate increased from 22 → 30 over 6 hours
- Increasing oxygen requirement despite stable saturation
- Patient reports increased dyspnea but no acute distress

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Case Example #2
AI Monitoring & Analysis

- Continuously analyzes respiratory rate trends
- Tracks increasing FiO_2 requirements
- Evaluates oxygenation stability relative to work of breathing
- Identifies pattern consistent with impending respiratory failure
- Sends alert

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Case Example #2
RT Bedside Action

- Performs focused bedside assessment
- Confirms increased work of breathing and fatigue
- Obtains ABG per protocol
- Initiates NIV and notifies provider
- Documents early intervention and response

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Case Example #2
Clinical & Operational Impact

- Earlier escalation of care
- Reduced risk of emergent intubation
- Improved patient safety
- Supports RT-driven escalation protocols
- Reinforces proactive rather than reactive care

Case Takeaway

AI identifies risk early; RT intervenes early

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Early Warning Gaps

- May not add true early warning value
- AI may be reflecting clinician actions, not physiology
- We must understand what the AI is actually recognizing

University of Michigan study on AI sepsis alerts (2024)

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AI Diagnostic Imaging

- Chest X-ray and CT interpretation tools
- AI helping identify pneumonia, fibrosis, nodules, etc.
- Reducing diagnostic errors

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AI Predictive Analytics

- Predicting hospital readmissions for COPD/asthma
- Early warning systems for respiratory failure
- Risk stratification using EHR data

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AI Assisted Documentation

- AI generated progress notes
- AI summarization tools

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AI Assisted Documentation

- For RTs
  - Reduces redundant typing
  - Require clinical verification and editing
  - May assist with standardizing note quality and completeness
  - Clinical judgment and responsibility remain with the clinician

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AI Hallucinations

- Not rare
- Documents examinations that never occurred
- Creates non-existent diagnoses or treatments not present in the chart
- Misinterprets context (e.g., past vs. present symptoms)
- Omits critical, relevant clinical information that was actually in the record

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Case Example #3
AI Hallucination

- 72-year-old female admitted with COPD exacerbation
- Receiving bronchodilator therapy and supplemental oxygen
- RT documents diminished breath sounds, mild wheeze, stable work of breathing
- No medication changes made during the encounter

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Case Example #3
AI Hallucination

- 72-year-old female admitted with COPD exacerbation
- Receiving bronchodilator therapy and supplemental oxygen
- RT documents diminished breath sounds, mild wheeze, stable work of breathing
- No medication changes made during the encounter

- AI-generated draft note documents:
  - Diffuse wheezing and increased WOB
  - Escalate bronchodilator therapy

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Case Example #3
AI Hallucination

- RT identifies fabricated findings
- Corrects breath sound documentation
- Removes inaccurate treatment escalation
- Finalizes note with accurate clinical assessment

Case Takeaway

AI can hallucinate; clinician verification is essential

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AI & Mechanical Ventilation Core Areas

- Mechanical ventilation monitoring
- Ventilator waveform & asynchrony detection
- Oxygen therapy & hypoxemia prediction
- Early respiratory deterioration alerts
- Weaning & extubation readiness (emerging)

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AI & Weaning Readiness (Emerging Use)

- Trend analysis of RR, VT, RSBI, and oxygen requirements
  - Identifies patterns associated with readiness or failure
  - Cannot assess cough strength, secretions, or mental status
  - RT remains the final decision-maker

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Reflection: Clinical Judgment Still Matters

- If AI had not flagged this patient, what would you rely on?
  - Staffing levels and cognitive load
  - Bedside assessment and waveform interpretation
  - Experience and clinical intuition

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AI & Mechanical Ventilation Current & Near Term

- Continuous waveform analysis (pressure, flow, volume)
- Detection of:
  - Double triggering
  - Auto-PEEP
  - Flow starvation
  - Missed patient effort
- Alarm fatigue reduction through trend analysis

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Case Example #4
Ventilator Asynchrony

- 68-year-old male, COPD
- AC-VC, RR 20, VT 450 mL
- Persistent tachypnea, high peak pressures
- RN reports "patient looks uncomfortable"

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Case Example #4
Ventilator Asynchrony

- Confirm waveform findings
- Increase inspiratory flow
- Adjust I:E ratio
- Reassess comfort and synchrony

Case Takeaway:

AI detected the problem early — the RT fixed it.

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Closed-Loop Vent Modes

- Automatically adjust specific ventilator parameters
- Use predefined rules
- Respond to immediate physiologic feedback

- Key Characteristics
  - Rule-based
  - Deterministic ("if X happens, do Y")
  - Limited to parameters defined by the manufacturer
  - Directly changes ventilator settings

Closed-loop modes automate the ventilator.

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AI Vent Support

- Analyze large amounts of data over time
- Look for patterns and trends
- Generate alerts, predictions, or recommendations
- Does not directly control the ventilator

AI supports clinician decision-making.

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AI Reducing RT Burnout Workflow Improvements

- Automated documentation support
- Smart alarm filtering
- Predictive staffing needs
- Prioritized patient lists

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AI Limitations

- Cannot assess anxiety or distress
- Cannot account for patient preferences
- Cannot override ethics or clinical judgment
- Can reflect bias in training data

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AI in Remote Monitoring

- Wearable sensors for SpO_2, HR, RR
- Smart inhalers for adherence and technique
- Telehealth integration with AI triage

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Ethical Considerations

- Over-reliance risk
- Bias in predictive models
- Transparency concerns
- Patient trust & consent

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When AI + Clinicians Perform Worse Than AI Alone

- AI alone outperformed clinicians in a controlled diagnostic study
  - Clinicians using AI support did not outperform AI alone
  - Human–AI interaction introduced cognitive bias and misinterpretation
  - AI effectiveness depends on clinician understanding

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How to Avoid This Failure

- Treat AI as decision support, not authority
  - Use AI outputs as prompts for reassessment
  - Avoid overriding AI to confirm initial impressions
  - Document clinical reasoning, not AI output alone
  - Maintain strong core clinical skills

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Emerging Technologies

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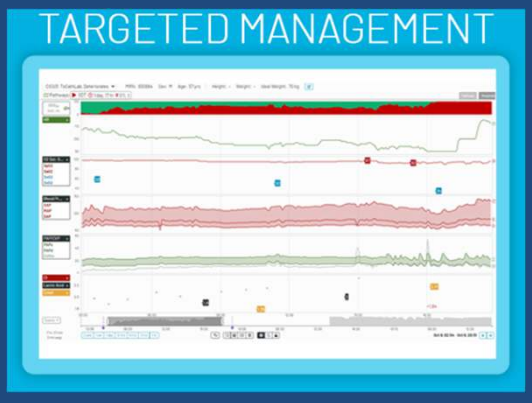
Etiometry

- AI-driven integration of ventilator and physiologic data
- Trend analysis for respiratory support and weaning decisions



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Hamilton Medical (INTELLiVENT-ASV)

- Closed-loop ventilation with algorithm-driven adjustments
- Often mistaken for AI, but rule-based and manufacturer-defined

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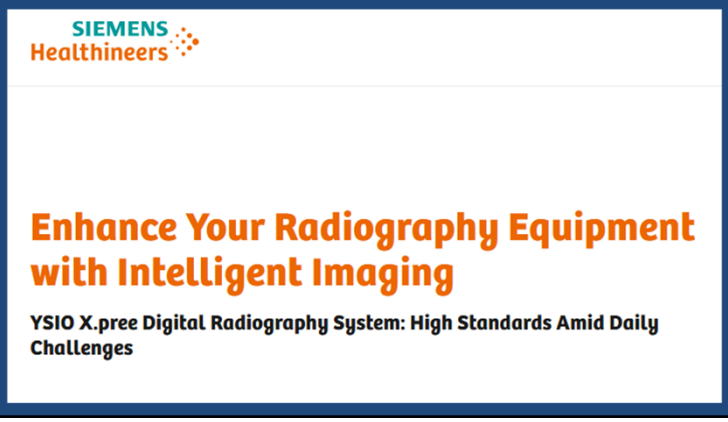
GE HealthCare / Siemens Healthineers

- AI-assisted chest X-ray and CT interpretation
- Helps identify pneumonia, nodules, fibrosis, and other findings



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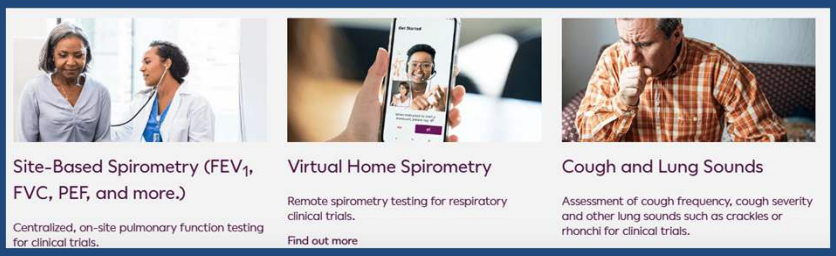
Clario
AI Spirometry & PFT Tools

- AI-assisted spirometry quality control and interpretation
- Flags poor effort and inconsistent testing



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Propeller Health
Smart Inhaler Platforms

- Tracks inhaler use, adherence, and technique
- AI identifies patterns linked to poor control or risk

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Masimo
Advanced Monitoring Analytics

- Continuous SpO_2, RR, and physiologic trend analysis
- Early detection of deterioration

Halo ION®

Patient Score

Allows clinicians to aggregate trend data from multiple physiologic parameters

Iris® Analytics

Individual Patient Reports and Alarm Analytics

A Supplemental Tool to Generate Alarm Analytics and Individual Patient Reports Across the Continuum of Care

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Epic Systems
AI Documentation Tools

- AI-generated note drafts and chart summarization
- Clinician review required before finalizing

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Microsoft DAX Copilot in Epic

- Ambient AI scribe technology
- Drafts clinical documentation from conversations

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Summary & Review

- AI Is Decision Support, Not Decision Making
- AI Is Only as Good as the Data
- AI Amplifies RT Expertise
- RTs Remain Legally & Clinically Responsible
- AI Literacy Is a Career Advantage

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Final Thought

AI may watch the data continuously — but respiratory therapists understand the patient. The future of respiratory care isn't AI replacing RTs. It's RTs who know how to use AI wisely.

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The End

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