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## Closing the Gaps: Optimizing Emergency Department Protocols for Vaping-Related Respiratory Illnesses

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# Walden University

College of Management and Human Potential

This is to certify that the doctoral study by

Dominique Roy

has been found to be complete and satisfactory in all respects,  
and that any and all revisions required by  
the review committee have been made.

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Closing the Gaps: Optimizing Emergency Department Protocols for Vaping-Related  
Respiratory Illnesses

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## Abstract

The rising prevalence of vaping-related illnesses poses significant challenges for healthcare systems worldwide. Hospitals increasingly encounter patients with symptoms related to vaping, such as respiratory issues and lung injuries, which strain emergency departments (EDs). Addressing these challenges requires the development and implementation of effective standard operating procedures (SOPs) to enhance the diagnosis and treatment of vaping-related illnesses. This integrative review examined how SOPs can enhance clinical practices within hospitals by identifying gaps in current approaches and providing recommendations to improve patient care. The review, analyzing literature from 2016 to 2023, highlighted several important themes, including the necessity of standardized protocols for diagnosis and treatment, the need for comprehensive healthcare provider training, and the challenges associated with managing vaping-related illnesses. Recommendations from the review emphasize the creation of SOPs that focus on immediate triage, detailed patient histories, symptom screenings, and the use of validated diagnostic criteria. The findings align with theoretical frameworks such as the health belief model (HBM) and the social ecological model (SEM), which advocate for a multifaceted approach. The development and implementation of SOPs for vaping-related illnesses have significant implications for positive social change. By improving diagnostic accuracy and treatment effectiveness, these protocols help reduce health disparities and ensure equitable access to high-quality care. Ultimately, these efforts support positive social change within a healthcare system that is more responsive, equitable, and capable of addressing the evolving challenges posed by vaping-related health issues, fostering a healthier future for all.

## Part 1: Practice-Based Problem

### **Problem of Interest**

The prevalence of vaping-related hospitalizations has surged in recent years, creating significant challenges for healthcare systems worldwide (Center for Disease Control and Prevention [CDC], 2020). Hospitals are encountering an increasing number of patients with severe respiratory illnesses, lung injuries, and other adverse health effects linked to vaping, straining healthcare resources and exposing gaps in the management of vaping-related cases in acute care settings (CDC, 2020). The rising prevalence of vaping-related hospital admissions, particularly among young adults, emphasizes the urgent need for targeted interventions and enhanced healthcare administration strategies to address this growing issue (Evans et al., 2020).

One of the critical issues compounding these challenges is the lack of standardized operating protocols (SOPs) for diagnosing and treating vaping-related illnesses, resulting in delays in diagnosis, inappropriate treatments, and suboptimal patient outcomes (Chatham-Stephens et al., 2019). Healthcare systems face the dual challenge of identifying and managing vaping-related cases while implementing prevention strategies to curb the use of vaping products among vulnerable populations (Evans et al., 2020). A systematic approach to developing and implementing SOPs is essential to improve the quality and consistency of care for patients with vaping-related illnesses and enhance the overall resilience and preparedness of healthcare systems in responding to vaping-related public health crises (Creamer et al., 2019; Wang et al., 2022).

In this integrative review, I explored how SOPs within hospitals can enhance the diagnosis and treatment of vaping-related illnesses, with a particular focus on E-cigarette or vaping product use-associated lung injury (EVALI) in emergency departments. By identifying gaps in current practices and providing recommendations for improving patient care and outcomes, this review seeks to contribute to the quality improvement domain of healthcare administration. The findings will guide the development and implementation of evidence-based SOPs tailored to the unique challenges posed by vaping-related illnesses, ultimately enhancing patient care and healthcare system efficiency.

## **Healthcare Administration Problem**

### **Background**

The rise of electronic cigarettes (e-cigarettes) and other vaping devices has introduced a new set of health challenges, particularly within hospital settings. Initially marketed as a safer alternative to traditional tobacco products, e-cigarettes have gained substantial popularity, especially among young adults and adolescents. However, as their use proliferated, so did the incidence of health issues associated with vaping, culminating in a significant public health concern (CDC, 2020).

The first reports of severe lung injury associated with e-cigarette use, later termed E-cigarette or Vaping product use-Associated Lung Injury (EVALI), emerged in the United States in 2019 (CDC, 2019). Patients presented with symptoms such as shortness of breath, chest pain, cough, and, in severe cases, respiratory failure requiring mechanical ventilation. By the end of 2019, the CDC had reported over 2,800 hospitalized cases of

EVALI, with 68 confirmed deaths (CDC, 2020). These alarming statistics underscored the urgency of addressing vaping-related illnesses within the healthcare system.

Emergency departments (EDs) were at the forefront of responding to the EVALI outbreak (Chatham-Stephens et al., 2019). Healthcare providers faced the challenge of quickly identifying and managing a condition that was previously unknown. This placed a significant strain on ED resources, as patients often required extensive diagnostic workups, including imaging studies and laboratory tests, to rule out other causes of their symptoms. The lack of standardized protocols for diagnosing and treating EVALI exacerbated these challenges, leading to variability in care and sometimes suboptimal patient outcomes (Chatham-Stephens et al., 2019).

The surge in vaping-related illnesses highlighted several deficiencies within healthcare systems, particularly regarding preparedness and response to emerging health threats. Key challenges included:

1. **Lack of Standardized Protocols:** The absence of established guidelines for the diagnosis and management of EVALI led to inconsistent care practices across different hospitals and regions (Creamer et al., 2019).
2. **Healthcare Provider Awareness:** Many healthcare providers were initially unaware of the potential severity of vaping-related illnesses, resulting in delays in diagnosis and treatment (Amato et al., 2020).
3. **Resource Strain:** The high number of EVALI cases placed significant demands on ED resources, including personnel, equipment, and intensive care unit (ICU) beds, straining an already overburdened system (CDC, 2020).

4. **Multidisciplinary Care Needs:** Effective management of EVALI often required the involvement of multiple specialties, including pulmonology, critical care, infectious disease, and toxicology, highlighting the need for coordinated multidisciplinary care (Chatham-Stephens et al., 2019).

In response to the EVALI outbreak, healthcare systems began to recognize the need for comprehensive standard operating procedures (SOPs) to enhance the diagnosis and treatment of vaping-related illnesses (Krishnasamy et al., 2020). This included developing evidence-based protocols, improving healthcare provider education and training, and fostering multidisciplinary collaboration to ensure comprehensive and coordinated care.

Quality improvement initiatives focused on:

1. **Developing and Implementing SOPs:** Creating standardized guidelines for the diagnosis, management, and follow-up of patients with EVALI to ensure consistency in care and improve patient outcomes (Case et al., 2016).
2. **Enhancing Provider Education:** Implementing training programs to increase awareness of vaping-related illnesses among healthcare providers and ensure timely and accurate diagnosis and treatment (Wang et al., 2022).
3. **Improving Resource Allocation:** Ensuring that EDs and ICUs have the necessary resources, including personnel and equipment, to effectively manage the influx of EVALI cases (CDC, 2020).
4. **Promoting Multidisciplinary Care:** Encouraging collaboration among various specialties to provide comprehensive care for patients with complex health needs related to vaping (Chatham-Stephens et al., 2019).



5. **Public Health Interventions:** Supporting public health initiatives aimed at reducing the prevalence of e-cigarette use among young adults and addressing the root causes of the EVALI outbreak (Krishnasamy et al., 2020).

The EVALI outbreak underscored the critical need for healthcare systems, particularly EDs, to be prepared for emerging health threats. Developing and implementing evidence-based SOPs is essential to enhance the quality and consistency of care for patients with vaping-related illnesses (Creamer et al., 2019). By addressing these challenges through targeted quality improvement initiatives, healthcare systems can better manage current and future public health crises, ultimately improving patient outcomes and reducing the burden on healthcare resources (Kelsh, 2023).

### **Operational Problem**

The CDC (2020) reported a nationwide outbreak of vaping-related injuries, which highlighted the need for hospitals to enhance their diagnostic and treatment protocols. The surge in hospitalizations due to vaping-related lung injuries illustrated the critical requirement for standardized procedures to ensure timely and accurate diagnosis, appropriate treatment, and consistent follow-up care. The CDC's report reflects a pressing public health concern that has strained healthcare resources and emphasized the need for improved hospital protocols.

Secondly, Chatham-Stephens et al. (2019) analyzed national data and demonstrated a significant increase in hospitalizations linked to vaping-related lung injuries. The study indicated that Emergency Departments (EDs) faced substantial challenges due to limited awareness among healthcare providers and the variability in the presentation of symptoms. This evidence reinforces the necessity for standardized

diagnostic and treatment protocols to manage the growing prevalence of vaping-related cases effectively.

Reports from the CDC, empirical studies, and feedback from healthcare professionals, underscore the urgency and significance of improving standard operating protocols within hospitals to enhance the diagnosis and treatment of vaping-related illnesses. Public health surveys and reports reported by CDC and the World Health Organization (WHO) have highlighted the growing prevalence of vaping among young adults, contributing to an increase in vaping-related hospitalizations. Implementing standardized protocols tailored to the diagnosis and treatment of vaping-related illnesses in hospitals is essential to address improving patient care and mitigating the impact of vaping-related illnesses on healthcare systems and resources.

Currently, hospital EDs lack standardized protocols for managing vaping-related illnesses, leading to variability in patient care. Upon arrival, patients are triaged based on the severity of their symptoms. Those with severe respiratory distress or other life-threatening conditions are prioritized. However, there is often a lack of specific guidelines for recognizing and categorizing vaping-related symptoms. Diagnostic testing involves chest X-rays or CT scans to assess lung damage, but there are no standardized protocols for when and how to use these imaging techniques specifically for vaping-related cases (Chatham-Stephens et al., 2019). Blood tests, including complete blood counts and inflammatory markers, may be conducted, but toxicology screens to detect substances related to vaping are infrequently utilized and not standardized.

Lastly, Amato et al. (2020) highlighted the difficulties in managing vaping-related illnesses due to the absence of standardized operating protocols (SOPs). Their research

showed that without clear guidelines, healthcare providers struggled with inconsistent diagnoses and treatments, leading to suboptimal patient outcomes. This lack of SOPs contributes to variability in care and increased strain on healthcare resources, underscoring the need for structured, evidence-based protocols to enhance patient management and outcomes.

Depending on the case, pulmonologists, toxicologists, and other specialists may be consulted. Coordination among these specialists is often hectic and lacks a structured framework. Patients are advised to follow up with their primary care physicians or specialists, but there is no standardized process for ensuring consistent follow-up and monitoring (CDC, 2020).

### **Ideal State of Operations**

The ideal state of operations for managing vaping-related illnesses in hospital emergency departments (EDs) involves the implementation of comprehensive, evidence-based SOPs (Hartnett et al., 2019). These SOPs would include standardized assessment and triage procedures, such as a vaping-specific screening tool for ED staff to promptly identify potential vaping-related cases and clear guidelines for categorizing symptoms and prioritizing patients based on the severity of their vaping-related conditions (Case et al., 2016). Comprehensive diagnostic testing protocols would establish criteria for the use of chest X-rays, CT scans, and other imaging techniques tailored to vaping-related illnesses, ensuring timely and appropriate imaging. Additionally, standardized protocols for conducting relevant laboratory tests, including toxicology screens, would be implemented to identify substances related to vaping (Chatham-Stephens et al., 2019).

Evidence-based treatment protocols would include guidelines for respiratory support, such as oxygen therapy, bronchodilators, and mechanical ventilation, as well as standardized medication protocols for the use of steroids, antibiotics, and other medications specific to vaping-related illnesses (Wang et al., 2022). A multidisciplinary team approach would be established, involving structured frameworks for the involvement of specialists such as pulmonologists, toxicologists, and respiratory therapists in the care of vaping-related cases, including regular case reviews and coordinated care plans (Creamer et al., 2019). A standardized follow-up process would be implemented, ensuring consistent follow-up care and monitoring for patients with vaping-related illnesses, including scheduled follow-up appointments and clear communication with primary care providers (Krishnasamy et al., 2020).

### **Professional Practice Gap Statement**

Despite the surge in vaping-related hospital admissions among young adults, many hospitals still face challenges due to a lack of comprehensive and standardized protocols for diagnosing and treating vaping-related illnesses (Amato et al., 2020). While some hospitals have implemented basic protocols, these are often inconsistent and vary significantly between facilities (Pound, 2022). Existing protocols may include general guidelines for respiratory assessment and treatment, but they frequently lack specificity for vaping-related conditions (Metcalf, 2022).

Protocols typically cover standard diagnostic approaches such as chest X-rays or CT scans and general treatment measures like oxygen therapy and steroids. However, there is often a lack of detailed, evidence-based procedures tailored to the unique

manifestations of vaping-related illnesses, which can lead to variability in patient care and outcomes (Doukas, 2020).

To address these gaps, hospitals need to develop and implement more robust, standardized SOPs that specifically target vaping-related illnesses. This includes creating detailed guidelines for symptom assessment, diagnostic testing, treatment interventions, and follow-up care to ensure consistent and effective management across all healthcare settings. By refining and standardizing these protocols, healthcare systems can improve diagnostic accuracy, streamline treatment approaches, and enhance overall patient outcomes (Kelsh, 2023).

### **Summary of Evidence**

The rise in vaping-related hospitalizations, particularly among young adults, underscores an urgent need for standardized protocols in healthcare settings. The CDC (2020) reported a notable increase in these hospital admissions, highlighting the critical need for optimized diagnostic and treatment approaches. Empirical research and feedback from healthcare professionals reveal significant challenges, including limited awareness and variability in symptom presentation, which complicate timely diagnosis (Creamer et al., 2019; Doukas, 2020). The absence of standardized protocols further exacerbates these challenges, leading to inconsistent patient care and suboptimal outcomes.

Addressing these issues requires the development and implementation of evidence-based SOPs in EDs. Research indicates that without clear, evidence-based guidelines, hospitals face difficulties in managing vaping-related cases, impacting patient care and increasing the strain on healthcare resources (Amato et al., 2020). Standardized protocols are essential for improving diagnostic accuracy, treatment consistency, and

overall patient outcomes. By integrating comprehensive SOPs tailored to vaping-related illnesses, healthcare systems can enhance care quality, streamline workflows, and mitigate the broader public health impact of vaping (Kelsh, 2023). This approach aligns with the need for targeted interventions and standardized practices to address the emerging public health challenge effectively.

### **Purpose of the Integrative Review**

The purpose of the integrative review was to synthesize existing literature on SOPs within EDs and their role in enhancing the diagnosis and treatment of vaping-related illnesses. By systematically analyzing the available evidence, this review aims to identify gaps, challenges, and best practices in SOP implementation, providing insights into strategies for optimizing patient care and outcomes in the context of vaping-related illnesses. Moreover, I explored the impact of SOPs on healthcare resource utilization, healthcare provider satisfaction, and overall healthcare system preparedness in managing vaping-related cases.

By synthesizing evidence from various sources, including empirical studies, reports, and expert opinions, I identified gaps, challenges, and best practices in current hospital protocols for managing vaping-related cases. Ultimately, my goal was to provide insights that inform the development and implementation of evidence-based SOPs tailored to address the unique challenges posed by vaping-related illnesses in hospital settings. This comprehensive analysis will not only contribute to the enhancement of patient care but also to the optimization of resource allocation and healthcare system preparedness in responding to the growing prevalence of vaping-related illnesses.

### **Integrative Review Question(s)**

How can hospitals, particularly in the ED effectively develop and implement evidence-based SOPs to optimize the diagnosis and treatment of vaping-related respiratory illnesses?

Key Elements of the Healthcare Administrative Problem:

1.      Lack of standardized protocols: Many hospitals lack standardized protocols specifically tailored to diagnosing and treating vaping-related illnesses, leading to inconsistencies in patient care and outcomes.
2.      Limited awareness and education: Healthcare providers may have limited awareness and education about vaping-related illnesses, resulting in challenges in timely diagnosis and appropriate treatment.
3.      Variable symptom presentation: Vaping-related illnesses can present with a wide range of symptoms, making it challenging for healthcare providers to accurately diagnose and treat these conditions.
4.      Resource strain: The increasing prevalence of vaping-related hospitalizations strains healthcare resources, highlighting the need for efficient and effective protocols to manage these cases.

Connection to a Possible Solution: I used the questions in this review to explore the existing SOPs within hospitals regarding the diagnosis and treatment of vaping-related illnesses. By investigating the current protocols in place, I identified areas of strength and areas needing improvement. I identified potential gaps or deficiencies in the SOPs and proposed recommendations for enhancements. Healthcare administrators and

policymakers can use the findings from this review to develop effective strategies for optimizing SOPs to better address the challenges posed by vaping-related illnesses.

### **Theoretical and/or Conceptual Framework**

The theoretical and conceptual framework for this review revolves around the healthcare administration problem of enhancing the diagnosis and treatment of vaping-related illnesses within Eds. The theoretical frameworks that I used to guide this study were the health belief model (HBM) and the social ecological model (SEM). The HBM, developed by Rosenstock in the 1950s, posits that individual health behaviors are influenced by their perceptions of susceptibility to illness, the severity of consequences, benefits of action, and barriers to action. Originating from ecological systems theory, the SEM, developed by Bronfenbrenner, emphasizes the interplay between individual, interpersonal, organizational, community, and societal factors in shaping health behaviors.

In the context of vaping-related illnesses, the HBM provides insights into individuals' perceptions of the risks associated with vaping and their motivation to adopt preventive measures or seek medical care. For instance, understanding young adults' perceptions of susceptibility to vaping-related health issues and the perceived severity of these consequences can inform interventions aimed at promoting healthier behaviors. Additionally, the SEM offers a broader perspective by considering how social and environmental factors influence vaping behaviors. By examining factors at multiple levels, such as peer influences, organizational policies, and societal norms, the SEM helps identify potential leverage points for interventions targeting vaping prevention and treatment.



The alignment of these theoretical frameworks with the practice-based problem of developing and implementing SOPs for vaping-related illnesses is evident. The HBM elucidated individuals' attitudes and beliefs regarding vaping and its health implications, guiding the development of tailored interventions. Meanwhile, the SEM underscores the importance of considering broader contextual factors, such as healthcare policies, community norms, and societal attitudes toward vaping, in shaping healthcare practices and outcomes.

By integrating these frameworks, I provided a comprehensive understanding of the multifaceted factors influencing vaping-related behaviors and healthcare practices, ultimately informing the development of effective SOPs within hospital settings.

## Part 2: Literature Review, Quality Appraisal, and Analysis

### **Literature Search Strategy**

The literature search strategy for this integrative review was designed to identify studies that address the healthcare administration challenge of improving the diagnosis and treatment of vaping-related illnesses within hospital settings, particularly in Emergency Departments (EDs) and implement evidence-based standard operating procedures. A comprehensive search was conducted across multiple electronic databases, including PubMed, MEDLINE, PsycINFO, CDC, and Google Scholar, to ensure a thorough and diverse review of relevant literature.

Keywords and search terms are carefully selected to capture the key concepts of *vaping, hospital administration, standard operating procedures, diagnosis, and treatment*. Boolean operators (AND, OR) are used to combine these terms effectively.

Inclusion and exclusion criteria are outlined in Table 1. The inclusion criteria for studies will focus on peer-reviewed articles published in English language journals within the past decade. Studies must examine SOPs, protocols, or guidelines related to the diagnosis and treatment of vaping-related illnesses within Emergency Departments. Both quantitative and qualitative studies are considered for inclusion.

**Table 1***Inclusion and Exclusion Search Criteria*

Inclusion search criteria	Exclusion search criteria
<ul style="list-style-type: none"> <li>• Vaping-related terms (e.g., E-cigarettes, Juul, EVALI)</li> <li>• Hospital protocols, guidelines, and procedures</li> <li>• Peer-reviewed articles</li> <li>• English language publications</li> <li>• Published between 2019-2024</li> <li>• Hospital administration and ED settings</li> </ul>	<ul style="list-style-type: none"> <li>• Studies conducted outside of clinical or hospital settings.</li> <li>• Studies on unrelated topics</li> <li>• Studies with insufficient sample size</li> <li>• Focus on individual factors without addressing broader hospital protocols</li> <li>• Duplicate studies</li> <li>• Non-peer-reviewed literature such as conference abstracts, editorials, commentaries, and letters to the editor.</li> <li>• Literature published in languages other than English</li> </ul>

**Quality Appraisal**

A total of 668 articles were relevant for review. The term *vaping* is used in many articles and the search needed to be refined. 383 articles are screened via titles and abstracts using the inclusion and exclusion criteria. 226 articles are excluded, leaving 157 articles for further analysis. Full text reviews then resulted in a further 115 articles being excluded due to: small sample sizes; lack of focus on hospital administration; and being editorial or non-peer reviewed nature. See appendix B: Review Question(s) Search Log for more search results information. Institutional Review Board approval was not required for an integrative review.

A total of 15 articles were included for analysis. The 15 articles were appraised for quality using the Johns Hopkins Nursing Evidence-Based Practice Model (JHNEBP) and Research Evidence Appraisal form. This tool rated two articles as having a strength of evidence at Level 5, two articles a strength of evidence at Level 4, three articles a strength of evidence at level 3, and eight articles a strength of evidence at Level 2. Of the 15 articles chosen for review, nine were appraised as high quality, and six were appraised as good quality. For more details on the quality appraisal results see Appendix C: Critical Appraisal Results Log.

### **Thematic Analysis of Literature**

The literature that I reviewed primarily consisted of cross-sectional, relational, comparative, and descriptive non-experimental studies. These study designs facilitated the collection of critical data needed to build a comprehensive evidence base for SOPs. The integration of these research findings into the SOP development process ensures that hospitals can effectively respond to the unique challenges posed by vaping-related respiratory illnesses, improving both the quality and timeliness of care in the ED. They also highlighted the need for more robust experimental designs to establish causality and enhance the generalizability of findings. Measures to alleviate bias and ensure reliability and validity were critical in strengthening the credibility of these studies.

### Part 3: Presentation of Results and Interpretation of Findings

#### **Presentation of Results**

The thematic analysis that I conducted on the 15 included articles yielded five major themes and 14 sub-themes that directly relate to how hospitals, particularly in the ED, can effectively develop and implement evidence-based standard operating procedures SOPs to optimize the diagnosis and treatment of vaping-related respiratory illnesses. The findings were categorized by level of accountability and aligned with the HBM and the SEM. For detailed results of the thematic analysis, see Appendix D: DHA Thematic Analysis Results.

#### **Initial Codes**

The initial codes were: Vaping-related respiratory conditions, EVALI (e-cigarette or vaping product use), health risks of vaping, surveillance systems for vaping illnesses, user perceptions and behaviors, behavioral influence on health outcomes, public health warning and guidelines, health promotion strategies, policy advocacy for vaping regulations, knowledge gaps among healthcare providers and methodological challenges in research.

Once all the codes were pulled from the 15 articles, seven major themes were constructed, along with sub-themes listed below the main themes below. The seven themes are health effects and clinical implications, regulatory framework and policy implications, healthcare challenges and provider training needs, surveillance and epidemiology, user perceptions and behaviors, public health interventions and education, research gaps and future directions.

**Health Effects and Clinical Implications**

1. Vaping-Related Respiratory Conditions: Understanding the specific respiratory illnesses linked to vaping that require targeted SOPs.
2. EVALI (E-cigarette or Vaping Product Use-Associated Lung Injury): Identifying clinical guidelines for diagnosing and managing EVALI within SOPs.
3. Health Risks of Vaping: Evaluating the health risks associated with vaping to inform evidence-based practice in SOPs.

**Regulatory Framework and Policy Implications**

1. Policy Advocacy for Vaping Regulations: The role of policy advocacy in supporting the implementation of evidence-based SOPs in Emergency Departments.
2. Current Regulatory Landscape: Overview of existing regulations related to vaping products and their implications for SOPs.
3. Recommendations for Policy Changes: Proposing changes to enhance regulatory frameworks supporting vaping-related health initiatives.

**Healthcare Challenges and Provider Training Needs**

1. Knowledge Gaps Among Healthcare Providers: Addressing knowledge gaps in vaping-related health issues to ensure comprehensive training for ED staff.
2. Training Requirements for ED Staff: Developing training programs that equip providers with the knowledge and skills needed to manage vaping-related illnesses effectively.

3. Resource Constraints in EDs: Identifying and addressing the resource limitations that hinder the implementation of effective SOPs.

### **Surveillance and Epidemiology**

1. Surveillance Systems for Vaping Illnesses: The importance of establishing effective surveillance systems to track and respond to vaping-related health issues.
2. Data Collection and Reporting: Developing methodologies for accurate data collection and reporting on vaping-related illnesses.
3. Epidemiological Trends: Analyzing trends in vaping-related respiratory conditions to inform SOP development.

### **User Perceptions and Behaviors**

1. User Perceptions and Behaviors: Understanding patient and user perceptions of vaping to tailor educational components of SOPs.
2. Behavioral Influence on Health Outcomes: Examining how behavioral factors impact the diagnosis and treatment of vaping-related conditions.
3. Risk Perception Among Users: Investigating how perceived risks influence vaping behaviors and decision-making.

### **Public Health Interventions and Education**

1. Public Health Warnings and Guidelines: Integrating public health recommendations into ED SOPs for vaping-related respiratory illnesses.

2. **Health Promotion Strategies:** Identifying effective health promotion strategies to be included in SOPs that address vaping risks.
3. **Patient Education Initiatives:** Developing educational resources for patients presenting with vaping-related conditions.

### **Research Gaps and Future Directions**

1. **Identifying Research Gaps:** Highlighting areas requiring further investigation to enhance the understanding of vaping-related health impacts.
2. **Future Research Priorities:** Recommendations for studies aimed at addressing existing gaps and improving clinical practices in EDs.
3. **Methodological Challenges in Research:** Recognizing methodological challenges that may affect the development and implementation of SOPs.

To view the Thematic Map, see Appendix E: DHA Thematic Map.

## **Interpretation of the Findings**

### **Health Effects and Clinical Implications**

The health effects of vaping have garnered significant attention in recent years, particularly concerning the respiratory illnesses associated with e-cigarette use. This theme emphasizes the necessity of understanding these health risks to develop targeted SOPs in Eds. The specific sub-themes of this discussion include Vaping-Related Respiratory Conditions, EVALI (E-cigarette or Vaping Product Use-Associated Lung Injury), and Health Risks of Vaping.

#### ***Vaping-Related Respiratory Conditions***



A comprehensive understanding of the specific respiratory illnesses linked to vaping is essential for crafting effective SOPs. Research indicates that e-cigarette use can lead to a range of respiratory conditions, such as acute bronchitis, chronic obstructive pulmonary disease (COPD), and exacerbated asthma (Ghinai et al., 2019). For instance, a study conducted by Ghinai et al. (2020) noted that individuals who vape frequently exhibit higher rates of respiratory symptoms, including persistent cough, shortness of breath, and chest discomfort. These symptoms can complicate the diagnosis and management of respiratory illnesses, making it crucial for healthcare providers to be well-informed about the potential impacts of vaping (Layden et al. 2019). By incorporating this knowledge into SOPs, ED staff can better identify and treat these conditions effectively, ultimately improving patient outcomes and ensuring safety. This approach aligns with the HBM, which emphasizes the importance of perceived severity and susceptibility in motivating healthcare providers to take preventive actions, as well as the SEM, which calls for multilevel interventions that engage individuals, communities, and policy frameworks.

### ***EVALI (E-cigarette or Vaping Product Use-Associated Lung Injury)***

EVALI has emerged as a critical public health concern, necessitating the identification of clinical guidelines for its diagnosis and management within SOPs. According to the CDC (2020), EVALI is characterized by acute respiratory distress and has been linked to the use of e-cigarette products containing THC and vitamin E acetate. Layden et al. (2019) highlighted the urgent need for standardized approaches to diagnosing EVALI, as its symptoms often mimic those of pneumonia and other respiratory conditions. Effective management of EVALI requires a multifaceted approach

that encompasses patient education, symptom management, and continuous monitoring. By establishing clear clinical guidelines for EVALI within SOPs, healthcare providers can ensure timely and appropriate care, thereby reducing morbidity associated with this condition (Evans et al. 2020). The integration of evidence-based practices into SOPs can significantly enhance the clinical response to EVALI cases in the ED, ultimately leading to better health outcomes for affected individuals. This aligns with the HBM by reinforcing the need for perceived severity among patients, while the SEM encourages collaboration among healthcare providers, community organizations, and policymakers to create supportive environments for effective treatment (Siegel et al. 2019).

### ***Health Risks of Vaping***

Evaluating the health risks associated with vaping is fundamental for informing evidence-based practices in SOPs. Research has consistently shown that vaping exposes users to harmful substances that can lead to both acute and chronic respiratory issues (CDC 2020). The long-term effects of vaping remain inadequately understood, complicating risk assessments and clinical decision-making. A systematic review by the U.S. Department of Health and Human Services (2020) indicated that adolescents and young adults are particularly vulnerable to the harmful effects of e-cigarettes, which may include not only respiratory issues but also cardiovascular problems and addiction. By integrating findings from current research into SOPs, healthcare providers can raise awareness about these risks and encourage proactive engagement from patients. The HBM underscores the importance of perceived severity and susceptibility in motivating behavior change; therefore, effectively communicating the risks of vaping can be critical in reducing prevalence and improving health outcomes among at-risk populations. The

SEM complements this by promoting community-wide health education initiatives, thereby fostering a more informed public regarding the dangers associated with vaping (Alexander 2023).

### **Regulatory Framework and Policy Implications**

This theme encompassed the comprehensive analysis of the regulatory measures, policies, and frameworks surrounding the use of e-cigarettes. Understanding the current regulatory landscape is vital for hospitals, particularly in EDs as it directly influences the development and implementation of effective SOPs for managing vaping-related health issues. The evaluation of existing regulations provides insights into their effectiveness in curbing e-cigarette usage and protecting public health. For instance, while some states have implemented age restrictions and advertising limitations, gaps remain that may undermine these efforts (U.S. Department of Health and Human Services, 2020).

### ***Policy Advocacy for Vaping Regulations***

Policy advocacy plays a crucial role in supporting the implementation of evidence-based SOPs in EDs concerning vaping-related health issues. As vaping-related illnesses continue to rise, the need for comprehensive regulations becomes increasingly urgent. Advocacy efforts can influence lawmakers to create or amend policies that regulate e-cigarette products, ensuring they are safe for public consumption (Berg et al. 2020). By aligning advocacy efforts with the HBM, which highlights perceived severity and susceptibility, advocates can better communicate the risks associated with vaping and encourage policy changes that support public health. The SEM also emphasizes the need for multilevel interventions, including policy measures that can lead to improved health outcomes at both the individual and community levels.

### ***Current Regulatory Landscape***

An overview of the current regulatory landscape reveals a patchwork of state and federal regulations governing vaping products. While the FDA has made strides in regulating e-cigarettes, challenges remain due to the rapid evolution of vaping products and marketing strategies that target youth (U.S. Department of Health and Human Services, 2020). Existing regulations, such as age restrictions and advertising limitations, aim to reduce access and appeal to younger demographics. However, gaps remain in enforcement and consistency across states, complicating the development of effective SOPs in EDs. The HBM indicates that perceived barriers to accessing regulated products may deter users from seeking help for vaping-related health issues. By integrating insights from the SEM, stakeholders can advocate for comprehensive regulatory frameworks that not only limit access to harmful products but also promote public awareness about the risks of vaping.

### ***Recommendations for Policy Changes***

Proposing changes to enhance the regulatory framework supporting vaping-related health initiatives involves a multi-faceted approach. First, increasing funding for research on the health impacts of vaping is essential to develop evidence-based policies that inform SOPs in EDs. Secondly, implementing stricter regulations on marketing practices targeted at minors can help reduce the prevalence of vaping among youth (Cornelius 2022). Thirdly, establishing robust public health campaigns that educate communities about the risks associated with vaping can foster a more informed public, ultimately leading to behavior change. These recommendations align with the HBM by enhancing perceived severity and susceptibility, motivating individuals to make healthier

choices. Furthermore, the SEM supports a collaborative approach, advocating for partnerships among healthcare providers, policymakers, and community organizations to create a unified front in addressing vaping-related health issues.

### **Healthcare Challenges and Provider Training Needs**

This theme addresses the critical healthcare challenges and training needs that arise in managing vaping-related respiratory illnesses in EDs. Understanding these challenges is essential for developing effective SOPs that can optimize the diagnosis and treatment of patients affected by vaping-related conditions. The identification of knowledge gaps among healthcare providers is particularly crucial, as these gaps can lead to inadequate patient care and missed opportunities for intervention (Shields, 2017).

#### ***Knowledge Gaps Among Healthcare Providers***

Research indicates that many healthcare providers lack comprehensive knowledge regarding the health risks and clinical implications associated with vaping (Metcalf et al. 2021). A systematic review revealed that many providers are uncertain about the diagnosis and management of vaping-related illnesses, including EVALI (U.S. Department of Health and Human Services, 2020). Addressing these knowledge gaps is vital to ensure that ED staff can provide effective care and accurately convey the risks associated with vaping to patients. The HBM can guide the development of educational initiatives by emphasizing the importance of perceived severity and susceptibility, which can motivate healthcare providers to enhance their understanding and approach to vaping-related conditions.

#### ***Training Requirements for ED Staff***

To effectively manage vaping-related illnesses, it is essential to develop targeted training programs for ED staff. These programs should equip providers with the knowledge and skills needed to diagnose, treat, and educate patients about the risks associated with vaping. Training should encompass clinical guidelines for managing conditions such as EVALI and chronic obstructive pulmonary disease (COPD), as well as effective communication strategies to engage patients in their care (Evans et al., 2020). By incorporating the social ecological model (SEM) into these training programs, providers can be better prepared to address individual, community, and policy-level factors influencing vaping behaviors. This multi-level approach enhances the efficacy of care and promotes a holistic understanding of vaping-related health issues.

### ***Resource Constraints in EDs***

Finally, resource constraints within EDs pose significant challenges to the implementation of effective SOPs for managing vaping-related illnesses. Limited staffing, inadequate training materials, and insufficient funding for educational initiatives can hinder the ability of healthcare providers to deliver comprehensive care (Layden et al., 2019). Identifying these resource limitations is critical for developing strategies to address them, such as advocating for additional funding, leveraging community partnerships, and implementing efficient training modules that require fewer resources. By acknowledging and addressing these constraints, hospitals can create a more supportive environment for ED staff, ultimately improving patient care outcomes.

For instance, Layden et al. (2019) emphasized that the lack of communication between healthcare providers and public health officials can lead to delays in identifying and responding to outbreaks of vaping-related illnesses. This confirmation underscores

the necessity of developing streamlined communication protocols and integrated healthcare systems to address these challenges effectively.

### **Surveillance and Epidemiology**

This theme focuses on the vital role of surveillance systems and epidemiological analysis in tracking and managing vaping-related respiratory illnesses in EDs. The establishment of robust surveillance mechanisms and effective data collection methodologies is essential for informing SOPs that address the health risks associated with vaping. By analyzing epidemiological trends, healthcare providers can gain valuable insights into the prevalence and patterns of vaping-related conditions, ultimately leading to more effective clinical practices and public health interventions (Xu, 2021).

#### ***Surveillance Systems for Vaping Illnesses***

Studies by the CDC (2020) and Krishnasamy (2020) confirmed the effectiveness of existing surveillance systems and highlight areas for improvement, such as enhancing reporting mechanisms and ensuring consistent data collection. The research underscored the importance of epidemiological analysis in understanding the patterns and trends of vaping-related illnesses, which was essential for developing targeted public health interventions. Surveillance data served as a cue to action within the HBM, prompting public health alerts and individual behavior changes. The SEM framework emphasized the need for robust surveillance mechanisms at the community level and policy support for data sharing between healthcare entities, ensuring timely and effective public health responses.

#### ***Data Collection and Reporting***

Developing accurate methodologies for data collection and reporting on vaping-related illnesses is essential for understanding the extent and impact of these health issues. Research indicates that inconsistent data reporting practices can lead to gaps in knowledge regarding the true prevalence of vaping-related respiratory conditions (U.S. Department of Health and Human Services, 2020). Implementing standardized data collection protocols across healthcare settings can enhance the reliability of information regarding vaping-related illnesses. By utilizing the social ecological model (SEM), healthcare organizations can design data collection strategies that consider individual behaviors, community influences, and policy implications, ensuring a comprehensive understanding of the factors contributing to vaping-related health issues. Accurate data reporting not only supports clinical decision-making but also informs public health policies aimed at reducing the health risks associated with vaping.

To optimize SOPs, hospitals can use ETP data to develop geographically targeted interventions and allocate resources effectively. SOPs should include protocols for ongoing data collection, trend analysis, and collaboration with public health agencies. By integrating ETP findings, hospitals enhance their ability to identify high-risk populations, implement preventive measures, and tailor treatment strategies that address local epidemiological trends.

### ***Epidemiological Trends***

Population health impact and surveillance systems (PHISS) provided a comprehensive framework for hospitals to assess the broader public health implications of vaping-related illnesses. This thematic category integrated findings from CDC reports,



academic research, and collaborative studies, emphasizing the interconnectedness between individual health outcomes and population-level impacts.

Analyzing epidemiological trends in vaping-related respiratory conditions is crucial for informing SOP development and public health strategies. Recent studies have revealed alarming trends in the rising incidence of EVALI and other vaping-related illnesses, particularly among young adults and adolescents (Ghinai et al., 2020). Understanding these trends allows healthcare providers to tailor their SOPs to address the specific needs of the population most affected by vaping. Additionally, examining demographic factors, such as age, gender, and socioeconomic status, can provide insights into health disparities related to vaping. By integrating epidemiological findings into SOPs, ED staff can enhance their preparedness to manage vaping-related respiratory conditions effectively, ultimately leading to improved patient outcomes and alignment with public health initiatives.

### **User Perceptions and Behaviors**

User perceptions, behaviors, and risk perception regarding vaping are multifaceted and influenced by various social, cultural, and informational factors. Addressing these complexities in SOP development required a nuanced approach that integrates insights from behavioral science, health communication, and public health strategies. By understanding and effectively addressing user perceptions and behaviors, hospitals can optimize their SOPs to mitigate vaping-related health risks and improve outcomes among young adult populations.

### ***User Perception and Behaviors***

Understanding patient and user perceptions of vaping is critical for developing tailored educational components of SOPs in EDs. Research has shown that many individuals, particularly adolescents and young adults, perceive vaping as a safer alternative to traditional cigarette smoking (Kelsh et al., 2023). This misperception can lead to a higher likelihood of experimentation and continued use, increasing the risk of developing vaping-related respiratory illnesses. Integrating insights into user perceptions into SOPs enables healthcare providers to address misconceptions directly, fostering a more informed patient population. The HBM highlights the importance of perceived severity and susceptibility; by educating patients on the serious health consequences associated with vaping, healthcare providers can enhance understanding and encourage behavior change. For example, implementing educational programs that clarify the risks associated with e-cigarettes can empower patients to make more informed decisions about their vaping habits, ultimately supporting better health outcomes (Pepper and Brewer (2013).

### ***Behavioral Influence on Health Outcomes***

Examining how behavioral factors impact the diagnosis and treatment of vaping-related conditions is essential for effective clinical management. Various behavioral influences, such as social norms, peer pressure, and psychological factors, significantly shape an individual's decision to initiate or continue vaping. In the ED setting, understanding these behavioral factors is crucial for accurately diagnosing and managing vaping-related illnesses. For instance, patients may hesitate to disclose their vaping habits due to fear of judgment or stigma, which can hinder effective treatment (Berg et al., 2021). By fostering a non-judgmental environment and employing motivational

interviewing techniques, healthcare providers can facilitate open discussions about vaping behaviors. This approach aligns with the SEM, which emphasizes interventions at multiple levels—individual, community, and policy—to address the complex behavioral factors influencing health outcomes. By understanding and addressing these influences, providers can create more effective treatment plans and improve patient compliance.

### ***Risk Perception Among Users***

Investigating how perceived risks influence vaping behaviors and decision-making is vital for the development of effective SOPs. Numerous studies indicate that individuals who underestimate the risks associated with vaping are more likely to engage in high-risk behaviors, such as using unregulated products or vaping substances not intended for inhalation (CDC, 2020). This misperception can lead to an increased incidence of vaping-related respiratory illnesses, necessitating urgent and effective risk communication strategies within SOPs. Educating patients on the potential health risks of vaping through clear, engaging messaging can help shift perceptions and encourage healthier decision-making. The HBM can enhance the effectiveness of these educational initiatives by addressing perceived susceptibility and severity, thereby motivating users to reconsider their vaping behaviors. For instance, incorporating personal stories or case studies of individuals affected by vaping-related illnesses into educational materials can make the risks more tangible and relatable, promoting informed decision-making among users.

### **Public Health Interventions and Education**

In the domain of public health, addressing the complexities of vaping and e-cigarette use necessitates a comprehensive approach encompassing Public Health

Interventions and Education (CDC, 2020; Pepper & Brewer, 2013). This overarching theme integrated several critical sub-themes aimed at mitigating the adverse health effects associated with these products.

### ***Health Promotion Strategies***

Strategies advocated by Pipe et al. (2022) and Farsalinos and LeHouezec (2015) emphasize integrating vaping cessation services and promoting safer alternatives to reduce health risks. These strategies should be incorporated into hospital SOPs to enhance their effectiveness. The HBM framework highlights the perceived benefits of cessation and harm reduction strategies, while the SEM framework emphasizes organizational and policy support for these interventions, ensuring comprehensive care and reducing vaping prevalence among young adults.

### ***Patient Education Initiatives***

Developing educational resources for patients presenting with vaping-related conditions is a vital component of an effective response to the vaping epidemic. Tailored educational initiatives should address the specific health risks associated with vaping, practical cessation strategies, and available support resources. For instance, the incorporation of visually engaging materials, such as infographics and videos, can enhance patient understanding and retention of information (Sindelar, 2020). Additionally, incorporating motivational interviewing techniques can help healthcare providers engage patients in discussions about their vaping habits, encouraging them to reflect on their behaviors and consider cessation options. The HBM emphasizes the importance of perceived benefits and barriers in influencing behavior change; therefore, providing clear and actionable information on the benefits of quitting vaping can

empower patients to take positive steps toward improving their health. By equipping patients with the knowledge and resources they need, healthcare providers can play a critical role in supporting individuals affected by vaping-related illnesses.

### **Research Gaps and Future Directions**

The theme is crucial in understanding the broader landscape of vaping-related health research. It highlights areas of insufficient current knowledge, such as the long-term health effects of e-cigarette use and the differential impacts of various e-cigarette components. Additionally, it addresses the methodological challenges researchers face, including the rapid evolution of vaping products and the lack of standardized protocols. This theme also underscores the importance of future research and policy developments to effectively mitigate vaping-related health risks and inform clinical and public health practices.

#### ***Identifying Research Gaps***

Identifying research gaps in the field of vaping-related health impacts is essential for advancing our understanding and response to this emerging public health issue. Despite the increasing prevalence of vaping, significant gaps remain in the literature regarding the long-term health effects of e-cigarette use, particularly among different demographic groups such as adolescents, young adults, and individuals with pre-existing respiratory conditions. Additionally, there is a need for more nuanced studies examining the specific components of vaping products that contribute to health issues, as current research often aggregates data without differentiating between various substances (Ghinai et al., 2019). Furthermore, there is limited understanding of the social determinants of health that influence vaping behaviors and subsequent health outcomes. By addressing

these gaps, researchers can provide critical insights that inform the development of evidence-based SOPs in EDs. The SEM suggests that understanding the multifaceted influences on health behaviors can lead to more comprehensive public health strategies (Boakye et al., 2023; Esteban-Lopez et al., 2022).

Additionally, there is a need for more detailed studies that investigate the differential impacts of various e-cigarette components. Research should delve into how different levels of nicotine, flavoring agents, and other additives affect respiratory and cardiovascular health (Farsalinos and LeHouezec, 2015). Understanding these nuances is crucial for developing targeted public health strategies and regulatory policies. Such studies will provide a clearer picture of the specific health risks associated with different e-cigarette formulations and inform safer product standards.

### ***Future Research Priorities***

To enhance clinical practices in EDs and address existing gaps, future research should prioritize longitudinal studies that track the health outcomes of individuals who vape over extended periods. This approach will provide valuable data on the chronic health impacts of vaping and inform preventive measures. Additionally, studies should focus on developing and testing intervention strategies that target specific populations at risk for vaping-related health issues. For example, interventions aimed at reducing vaping among adolescents in school settings could be explored, given their increased susceptibility to the marketing of e-cigarette products (Krishnasamy, 2020). Moreover, research should investigate the effectiveness of various educational interventions for healthcare providers to improve their knowledge and skills related to vaping-related conditions. Implementing findings from the HBM can enhance these educational

initiatives by emphasizing the importance of perceived risk and benefits in motivating behavior change among both healthcare providers and patients.

### ***Methodological Challenges in Research***

Recognizing the methodological challenges in vaping-related research is crucial for ensuring the validity and reliability of findings. One major challenge is the inconsistency in the definitions and classifications of vaping-related illnesses across studies, which can hinder comparisons and synthesis of data. Furthermore, the rapid evolution of vaping products complicates the ability to establish standardized assessment tools and metrics for evaluating health impacts (Evans et al., 2020).

Additionally, many studies rely on self-reported data, which can introduce bias and affect the accuracy of findings. Addressing these methodological challenges will require collaboration among researchers, policymakers, and healthcare providers to establish consensus on definitions, develop standardized protocols, and utilize innovative research methodologies. By overcoming these obstacles, future research can more effectively inform the development and implementation of SOPs in EDs, ultimately improving patient care and health outcomes (Sindelar, 2020).

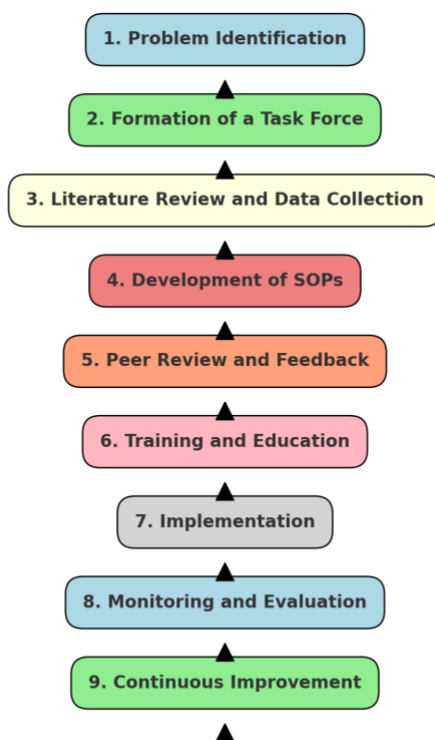
## Part 4: Recommendation for Professional Practice and Implications for Social Change

### Recommendations for Professional Practice

The following figure depicts the flow-chart for developing professional practice procedures.

**Figure 1**

Flow Chart



Vaping has emerged as a significant public health concern, particularly among young adults, due to its association with respiratory illnesses such as bronchiolitis and EVALI (Cooper., 2022). Addressing this issue requires hospitals and healthcare providers to develop and implement evidence-based SOPs that prioritize early diagnosis, effective treatment, and preventive measures. This approach not only ensures optimal patient care



but also aligns with theoretical frameworks guiding health behavior and policy interventions.

The process begins with identifying the increased incidence of vaping-related respiratory illnesses as a critical issue requiring immediate attention (CDC, 2020). Symptoms such as cough, shortness of breath, and chest pain among young adults have been linked to vaping, prompting healthcare institutions to prioritize the development of tailored SOPs to manage these conditions effectively.

This prompts the formation of a multidisciplinary task force including pulmonologists, nurses, researchers, and administrators. This team is essential for overseeing the development and implementation of SOPs, ensuring diverse expertise and perspectives are integrated into guideline development (Ghinai et al., 2020). Collaboration among stakeholders is crucial for synthesizing evidence and establishing consensus on protocols (St. Claire., 2020).

Comprehensive literature reviews and systematic data collection from clinical studies, research papers, and case reports provide the foundational evidence for SOP development (Layden et al., 2019). These efforts synthesize current knowledge on vaping-related health impacts, diagnostic methodologies, treatment outcomes, and preventive strategies. Identifying gaps in knowledge informs evidence-based decision-making in SOP development, ensuring protocols are robust and responsive to clinical needs (Sindelar, 2020)

Based on the findings from literature reviews and data collection, SOPs are meticulously crafted to encompass clinical pathways, treatment protocols, and preventive measures (CDC, 2020). Clinical pathways establish clear diagnostic criteria and

standardized testing protocols to ensure uniformity and accuracy in patient assessment across healthcare settings. Treatment protocols define evidence-based guidelines for medication use, therapeutic interventions, and patient monitoring to optimize health outcomes and minimize complications. Preventive measures include implementing educational initiatives and cessation programs aimed at preventing future cases of vaping-related respiratory illnesses among young adults (Mughal, 2020).

The developed SOPs undergo rigorous peer review by internal and external experts to validate their effectiveness and relevance (CDC, 2020). This process ensures SOPs align with best practices, reflect current clinical evidence, and are adaptable to emerging insights and healthcare needs. Peer feedback is integral in refining protocols, enhancing their applicability and adherence in clinical practice (Amato, 2021).

Comprehensive training programs are essential to equip healthcare staff with the knowledge and skills required to implement SOPs effectively (Ghinai et al., 2020). Training initiatives utilize diverse educational methods such as manuals, videos, and workshops, focusing on practical application, patient interaction strategies, and adherence to standardized procedures specific to vaping-related respiratory illnesses (Cornelius, 2022). Once trained, SOPs are integrated into daily operations and workflows across healthcare settings to ensure consistent and standardized care delivery. Healthcare providers adhere to established protocols, promoting uniformity in clinical practices and enhancing patient safety and quality of care (Jose, 2020).

Systems for monitoring patient outcomes and adherence to SOPs are established to evaluate the effectiveness of implemented protocols (CDC, 2020). Regular evaluation meetings facilitate ongoing review of clinical practices, identification of areas for

improvement, and integration of new evidence and feedback into SOP updates.

Continuous monitoring ensures SOPs remain current, responsive to evolving clinical insights, and aligned with best practices in managing vaping-related respiratory illnesses.

Mechanisms for continuous improvement include regular updates to SOPs based on new evidence, emerging clinical guidelines, and feedback from peer reviews and evaluation meetings. Ongoing re-training initiatives are provided to healthcare staff to maintain proficiency, adapt to changes in clinical practices, and promote a culture of continuous learning and improvement (Pipe, 2022).

Theoretical frameworks such as the HBM and the SEM guide interventions at individual, interpersonal, and policy levels (Evans, 2019). The HBM emphasizes increasing awareness and perceived severity of vaping-related illnesses among healthcare providers and the public through targeted education and awareness campaigns. The SEM advocates for policy changes and community interventions to support healthier behaviors, complementing clinical efforts to manage vaping-related respiratory illnesses effectively.

### **Implications for Social Change**

The integration of findings related to vaping-related respiratory illnesses into hospital SOPs, guided by HBM and SEM, holds profound implications for social change, particularly concerning the social determinants of health. These determinants, which include socioeconomic status, education, social support networks, and access to healthcare, play a critical role in shaping health behaviors and outcomes.

One of the most significant implications is the potential to reduce health disparities associated with vaping. Young adults from lower socioeconomic backgrounds and minority communities are disproportionately affected by vaping-related illnesses due

to higher rates of e-cigarette use and limited access to healthcare resources. By implementing evidence-based SOPs in hospitals, healthcare providers can ensure that all patients, regardless of their background, receive accurate diagnoses and effective treatments. This equitable approach can help mitigate the disproportionate burden of vaping-related illnesses on vulnerable populations, addressing a key social determinant of health (Evans et al., 2020).

Effective SOPs that include educational components about the risks of vaping can lead to broader public health education and awareness campaigns. These campaigns, informed by the HBM, can enhance individuals' perceptions of the severity and susceptibility of vaping-related health risks, thereby influencing healthier behaviors. The SEM framework supports the dissemination of this information through community-based initiatives and policy changes, ensuring that education reaches diverse populations. Increased awareness can empower individuals to make informed decisions about their health, contributing to a reduction in vaping prevalence and associated health risks (Sindelar, 2020).

Developing and implementing SOPs based on the latest research findings can improve the overall quality of healthcare provided to individuals suffering from vaping-related illnesses. By standardizing care procedures and ensuring that healthcare providers are well-informed and trained, hospitals can deliver more consistent and effective treatments. This improvement in healthcare quality is particularly crucial for underserved communities, where access to high-quality care is often limited. Enhanced healthcare access and quality are fundamental to addressing the social determinants of health and achieving health equity (Metcalf et al., 2021).

The identification of knowledge gaps and the call for more longitudinal studies on the long-term health effects of vaping highlight the need for sustained research efforts. Long-term studies are essential for understanding the chronic implications of vaping and for informing future public health strategies and clinical guidelines. Policymakers can use these findings to develop comprehensive policies that address the evolving landscape of e-cigarette products and their health impacts. Continued research and policy development will ensure that public health interventions remain relevant and effective, ultimately contributing to a healthier society (Farsalinos & LeHouezec, 2015).

### **Limitations**

Despite the valuable insights provided, this study on developing and implementing evidence-based SOPs for optimizing the diagnosis and treatment of vaping-related respiratory illnesses among young adults in EDs acknowledges several limitations. Firstly, resource constraints pose significant challenges. Many EDs face financial limitations, staffing shortages, and a lack of specialized equipment, which can impede the development and implementation of comprehensive SOPs. These constraints affect the ability to train healthcare staff effectively, monitor patient outcomes, and keep protocols up-to-date with emerging research (Krishnasamy, 2020).

Another critical limitation is the gap in knowledge among healthcare providers regarding vaping-related illnesses. ED clinicians may not be fully aware of the unique symptoms and treatment protocols required for conditions like EVALI (Mughal, 2020). Addressing this gap through targeted education and training is crucial to ensure consistent and high-quality care in the ED setting (Evans et al., 2020).

Integrating new SOPs into existing ED protocols also presents challenges. EDs often have established procedures for managing respiratory conditions such as asthma or COPD, which may not adequately address the specific needs of vaping-related illnesses. Adapting SOPs to fit within these existing frameworks while effectively addressing the unique aspects of vaping-related conditions requires careful planning and coordination (Metcalf et al., 2021). Additionally, the dynamic nature of vaping-related health research necessitates continuous updates to SOPs. EDs need robust mechanisms for regularly reviewing and revising protocols to ensure they remain current and effective (Boakye et al., 2023).

Effective data collection and evaluation are essential for refining SOPs, but limited access to comprehensive data on vaping-related illnesses can hinder EDs' ability to assess and optimize their procedures. Furthermore, EDs must navigate evolving regulations and advocate for policies that support evidence-based care. Uncertainties about the legal status and safety of vaping products may impact SOP development and implementation, requiring EDs to remain adaptable to regulatory changes (Esteban-Lopez et al., 2022).

### **Conclusion**

The development and implementation of evidence-based SOPs for diagnosing and treating vaping-related respiratory illnesses are critical for optimizing healthcare outcomes, particularly among young adults. By integrating the HBM and SEM, hospitals can address the complex dimensions of vaping-related health risks more effectively. The HBM emphasizes understanding and altering individual perceptions and behaviors

related to vaping, while the SEM highlights the importance of multi-level interventions that include policy, community, and institutional support.

In the context of Eds, SOPs must address several key elements to improve the diagnosis and treatment of EVALI. These include standardized triage procedures, diagnostic testing protocols, treatment guidelines, and follow-up care. The current ED process involves a range of specialties, including emergency physicians, pulmonologists, and toxicologists, who collaborate to manage vaping-related cases. Implementing SOPs that streamline and integrate these specialties can enhance coordination and ensure a comprehensive approach to patient care.

The HBM and SEM frameworks support a holistic approach that not only enhances clinical practice but also promotes public health education, equitable access to care, and informed policy development. By addressing health disparities, empowering individuals with the knowledge to make healthier choices, and ensuring that healthcare systems adapt to the evolving landscape of e-cigarette use, these SOPs can foster a healthier and more equitable future. The recommended improvements to current SOPs should involve clearly defined roles for each specialty, standardized diagnostic and treatment protocols, and robust mechanisms for follow-up and cessation support. This approach will ultimately enhance patient care, optimize resource use, and improve overall healthcare outcomes in response to the vaping epidemic.

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- Krishnasamy, V. P., Hallowell, B. D., Ko, J. Y., Board, A., Hartnett, K. P., Salvatore, P. P., Danielson, M., Kite-Powell, A., Twentyman, E., Kim, L., Cyrus, A., Wallace, M., Melstrom, P., Haag, B., King, B. A., Briss, P., Jones, C. M., Pollack, L. A., Ellington, S., ... Werner, A. (2020). Update: Characteristics of a nationwide outbreak of e-cigarette, or vaping, product use-associated lung injury — United States, August 2019–January 2020. *MMWR. Morbidity and Mortality Weekly Report*, 69(3), 90–94. <https://doi.org/10.15585/mmwr.mm6903e2>
- Layden, J. E., Ghinai, I., Pray, I., Kimball, A., Layer, M., Tenforde, M. W., Navon, L., Hoots, B., Salvatore, P. P., Elderbrook, M., Haupt, T., Kanne, J., Patel, M. T., Saathoff-Huber, L., King, B. A., Schier, J. G., Mikosz, C. A., & Meiman, J. (2020). Pulmonary illness related to e-cigarette use in Illinois and Wisconsin — final report. *New England Journal of Medicine*, 382(10), 903–916. <https://doi.org/10.1056/nejmoa1911614>
- Metcalf, M., Rossie, K., Stokes, K., & Tanner, B. (2022). Health Care Professionals' clinical skills to address vaping and e-cigarette use by patients: Needs and Interest Questionnaire Study. *JMIR Formative Research*, 6(4). <https://doi.org/10.2196/32242>
- Mughal, M. S., Dalmacion, D. L., Mirza, H. M., Kaur, I. P., Dela Cruz, M. A., & Kramer, V. E. (2020). E-cigarette or vaping product use associated lung injury, (EVALI) -

a diagnosis of exclusion. *Respiratory Medicine Case Reports*, 31, 101174.

<https://doi.org/10.1016/j.rmcr.2020.101174>

Pepper, J. K., & Brewer, N. T. (2013). Electronic Nicotine Delivery System (electronic cigarette) awareness, use, reactions and beliefs: A systematic review. *Tobacco Control*, 23(5), 375–384. <https://doi.org/10.1136/tobaccocontrol-2013-051122>

Pipe, A. L., Evans, W., & Papadakis, S. (2022). Smoking cessation: Health system challenges and opportunities. *Tobacco Control*, 31(2), 340–347.

<https://doi.org/10.1136/tobaccocontrol-2021-056575>

Pound, C. M., & Coyle, D. (2022). A cost-utility analysis of the impact of electronic nicotine delivery systems on health care costs and outcomes in Canada. *Health Promotion and Chronic Disease Prevention in Canada*, 42(1), 29–36.

<https://doi.org/10.24095/hpcdp.42.1.05>

Shields, P. G., Berman, M., Brasky, T. M., Freudenheim, J. L., Mathe, E., McElroy, J. P., Song, M.-A., & Wewers, M. D. (2017). A review of pulmonary toxicity of electronic cigarettes in the context of smoking: A focus on inflammation. *Cancer Epidemiology, Biomarkers & Prevention*, 26(8), 1175–1191.

<https://doi.org/10.1158/1055-9965.epi-17-0358>

Siegel, D. A., Jatlaoui, T. C., Koumans, E. H., Kiernan, E. A., Layer, M., Cates, J. E., Kimball, A., Weissman, D. N., Petersen, E. E., Reagan-Steiner, S., Godfred-Cato, S., Moulia, D., Moritz, E., Lehnert, J. D., Mitchko, J., London, J., Zaki, S. R., King, B. A., Jones, C. M., ... Smalley, R. (2019). Update: Interim guidance for health care providers evaluating and caring for patients with suspected e-cigarette, or vaping, product use associated lung injury — United States, October

2019. *MMWR. Morbidity and Mortality Weekly Report*, 68(41), 919–927.

<https://doi.org/10.15585/mmwr.mm6841e3>

Sindelar, J. L. (2020). Regulating vaping — policies, possibilities, and perils. *New*

*England Journal of Medicine*, 382(20). <https://doi.org/10.1056/nejmp1917065>

St Claire, S., Gouda, H., Schotte, K., Fayokun, R., Fu, D., Varghese, C., & Prasad, V. M.

(2020). Lung Health, tobacco, and related products: Gaps, challenges, new threats, and suggested research. *American Journal of Physiology-Lung Cellular and Molecular Physiology*, 318(5). <https://doi.org/10.1152/ajplung.00101.2020>

Wang, Y., Sung, H.-Y., Lightwood, J., Yao, T., & Max, W. B. (2022). Healthcare

Utilization and expenditures attributable to current e-cigarette use among US adults. *Tobacco Control*, 32(6), 723–728. <https://doi.org/10.1136/tobaccocontrol-2021-057058>

Xu, X., Shrestha, S. S., Trivers, K. F., Neff, L., Armour, B. S., & King, B. A. (2021).

U.S. healthcare spending attributable to cigarette smoking in 2014. *Preventive Medicine*, 150, 106529. <https://doi.org/10.1016/j.ypmed.2021.106529>

Appendix A: DHA Practice-Based Problem Literature Review Matrix

Author/ date	Theoretical/ conceptual framework	Research question(s)/ hypotheses	Methodology	Analysis & results	Conclusions	Implications for future research	Implications for practice	Empirical research? (Yes or No)
Paul T Harrell, et al. (2019)	N/A	Are young adults implementing the use of e- cigarettes because of convenience?	12 focus groups and 2 individual interviews from a large metropolitan city in the southeastern United States.	E-cigarette use allows convenient use of nicotine in locations where cigarette smoking is prohibited.	Differences in group sizes may have biased the results	N/A	N/A	Yes
Toluey, M., et al. (2019)	N/A	This study investigated the link between smoking and myocardial infarctions and short- term hospital outcomes.	300 patients and 717 patients were smokers and non- smokers. Non- Smokers were younger, while smokers had a higher rate of heart attack.	Patients were divided into groups of where the myocardial infarction occurred. Between groups, in- hospital deaths were compared.	The study lacked information on the brand of cigarettes that patients use. The study only used patients presented to our hospital and there were no out-of-hospital.	N/A	N/A	Yes
Smith J. & Johnson, A. (2021)	health belief model	Does the implementatio n of hospital- wide vaping protocols reduce healthcare utilization and financial	Mixed-methods approach, combining surveys to quantify vaping prevalence and qualitative interviews to explore individual	Quantitative data analyzed using statistical methods, revealing a decrease in healthcare utilization post- protocol implementation.	Hospital-wide protocols effectively address vaping issues, reducing both healthcare utilization and financial burden.	Investigate long-term effects of protocols, explore variations in implementati on across different	Hospitals should adopt and customize protocols addressing vaping among young adults to minimize healthcare utilization and	yes

		burden among young adults?	experiences and perceptions.	Qualitative analysis identified key themes such as improved awareness and behavior change.		hospital settings.	financial strain.	
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## Appendix B: DHA Review Question(s) Search Log

Database or location name	Search terms	Results	Notes
Academic Search Complete Limit to: peer reviewed journals (2019-)	Vaping or vape or electronic cigarettes	668	Term “vaping” used in many articles.
Medline with Full Text Limit to: peer reviewed journals (2019-)	Vaping or e-cigarettes	383	Narrow down- maybe use specific e-cigarettes brands
APA PsycINFO Limit to: peer reviewed journals (2019-)	Vaping or vape or electronic cigarettes and protocols or guidelines or procedures and hospital	15	e-cigarettes with youth behavior.
ScienceDirect (2020-2023) Limit to: peer reviewed journals	Vaping or vape or electronic cigarettes and protocols or guidelines or procedures and hospital	10	Narrowed down to cardiac issues arose from electronic cigarettes
Complementary Index Limit to: peer reviewed journals (2019-)	Vaping or vape or electronic cigarettes and protocols or guidelines or procedures and hospital	15	Find another term for “protocol”- studies had nothing to do with e-cigarettes.
Academic Search Complete	Vaping or vape or electronic cigarettes	226	

Database or location name	Search terms	Results	Notes
Limit to: peer reviewed journals (2019-)	and protocols or guidelines or procedures and hospital public health or community health or population health or epidemiology		
CINAHL Plus Limit to Peer reviewed journals (2019)	Vaping or vape or electronic cigarettes and protocols or guidelines or procedures and hospital public health or community health or population health	2	Lung injury associated with e-cigarettes or vaping
Morbidity and Mortality Weekly Report, 2019).	Vaping or vape or electronic cigarettes and protocols or guidelines or procedures and hospital	20	

### Appendix C: DHA Appraisal Results Log

Author, date, and title	Evidence level and quality rating	Focus: HSO type, Research Domain, and Specific Problem being addressed	Findings that help answer the review question(s)	Metrics and Measures if used	Source Limitations
Alexander, S. (2023). <i>Stopping the Vapor of Death: Implementing a Vaping Cessation Protocol in an Emergency Department</i>	Level I High- A	HSO type: Emergency Department, Research Domain: Clinical Implementation, Problem: Vaping cessation	Implementing cessation protocols improved patient outcomes; highlights the need for standardized protocols.	Patient outcomes, protocol adherence rates	Limited to a single ED; small sample size.
Amato, M. S. et al. (2020). <i>“It’s really addictive and I’m trapped:” A qualitative analysis of the reasons for quitting vaping among treatment-seeking young people</i>	Level II, High Quality	HSO type: Addiction Services, Research Domain: Behavioral Health, Problem: Youth vaping cessation	Identifies motivations for quitting vaping, emphasizing addiction perceptions among youth.	Qualitative themes from interviews	Small, self-selected sample may limit generalizability.

Author, date, and title	Evidence level and quality rating	Focus: HSO type, Research Domain, and Specific Problem being addressed	Findings that help answer the review question(s)	Metrics and Measures if used	Source Limitations
Berg, C. J. et al. (2020). <i>Vape Shop Owners/Managers' Opinions About FDA Regulation of E-Cigarettes</i>	Level III B. Moderate Quality	HSO type: Retail, Research Domain: Regulatory Perspectives, Problem: Industry regulation	Vape shop owners support FDA regulation due to health concerns; potential for regulatory impact.	Survey responses from shop owners	Potential industry bias; may not represent all views.
Case, K. et al. (2016). <i>Formative research to identify perceptions of e-cigarettes in college students: Implications for future health communication campaigns</i>	Level III, Moderate Quality B	HSO type: Academic Institutions, Research Domain: Health Communication, Problem: Perceptions of e-cigarettes	Highlights misconceptions about e-cigarettes; informs targeted health campaigns for college students.	Survey measures of perception	Self-reported data may be biased; limited demographics.
Chatham-Stephens, K. et al. (2019). <i>Characteristics of Hospitalized and Nonhospitalized Patients in a Nationwide</i>	Level II, High Quality A	HSO type: Hospitals, Research Domain: Clinical Characteristics, Problem: EVALI	Characterizes patients affected by EVALI, showing differences between hospitalized and nonhospitalized cases.	Clinical characteristics, demographics	Limited to outbreak data; may not represent long-term trends.

Author, date, and title	Evidence level and quality rating	Focus: HSO type, Research Domain, and Specific Problem being addressed	Findings that help answer the review question(s)	Metrics and Measures if used	Source Limitations
<i>Outbreak of E-cigarette, or Vaping, Product Use—Associated Lung Injury</i> Hospital Administration.					
Creamer, M. R. et al. (2019). Tobacco Product Use and Cessation Indicators Among Adults — United States, 2018	Level I, High Quality A	HSO type: Public Health, Research Domain: Tobacco Use, Problem: Cessation Indicators	Provides comprehensive data on adult tobacco use and cessation indicators, relevant for understanding vaping trends.	Cessation rates, usage patterns	Cross-sectional design limits causal inferences.
Evans, M. E. et al. (2020). <i>Update: Interim Guidance for Health Care Professionals Evaluating and Caring for Patients with Suspected E-cigarette, or Vaping, Product</i>	Level I High Quality A	HSO type: Healthcare Providers, Research Domain: Clinical Guidelines, Problem: Vaping-related lung injury	Offers updated guidance for healthcare providers on managing vaping-related injuries, improving care quality.	Clinical management recommendations	May not cover all potential scenarios; focuses on interim guidance.

Author, date, and title	Evidence level and quality rating	Focus: HSO type, Research Domain, and Specific Problem being addressed	Findings that help answer the review question(s)	Metrics and Measures if used	Source Limitations
<i>Use-Associated Lung Injury</i>					
Ghinai, I., Navon, L., Gunn, J. K., Duca, L. M., Brister, S., Love, S., ... & Layden, J. E (2019) Characteristics of persons who report using only nicotine-containing products among interviewed patients with e-cigarette, or vaping, product use-associated lung injury—Illinois, August–December 2019	Level II A	HSO Type: Hospital Setting Research Domain: Public Health/Epidemiology Specific Problem: Understanding the characteristics and potential risk factors associated with vaping-related lung injury, particularly in the context of the EVALI outbreak in the United States.	It highlights differences in age, gender, symptoms, and clinical presentations between these two groups, providing insights into potential risk factors for EVALI.	The study utilized structured questionnaires, medical records abstraction, follow-up interviews, and laboratory testing (e.g., urine cannabinoid screens) to collect demographic, product use, and clinical data from EVALI patients.	The study's limitations include small sample size, potential reporting biases in self-reported product use, lack of routine urine toxicology screens, and potential misclassification of EVALI cases. Not all EVALI patients were reached for initial or follow-up interviews, which could limit the generalizability of findings.

Author, date, and title	Evidence level and quality rating	Focus: HSO type, Research Domain, and Specific Problem being addressed	Findings that help answer the review question(s)	Metrics and Measures if used	Source Limitations
				Metrics include demographic characteristics, product use patterns, clinical symptoms, laboratory results, and clinical outcomes.	
Wang, Y. et al. (2022). <i>Healthcare utilization and expenditures attributable to current e-cigarette use among US adults</i>	Level III B	HSO type: Economic Analysis, Research Domain: Healthcare Utilization, Problem: Expenditures	Assesses healthcare utilization and costs associated with e-cigarette use among adults.	Economic analysis metrics	Based on estimates, potential variability in data accuracy.
Krishnasamy, V. P., Hallowell, B. D., Ko, J. Y., Board, A., Hartnett,	Level II A.	The focus of this study is on investigating the characteristics of a nationwide outbreak	demographic characteristics of affected individuals, common symptoms,	The study may utilize various metrics and measures, including	limitations inherent to retrospective observational studies, such as potential biases in case

Author, date, and title	Evidence level and quality rating	Focus: HSO type, Research Domain, and Specific Problem being addressed	Findings that help answer the review question(s)	Metrics and Measures if used	Source Limitations
K. P., Salvatore, P. P., ... & Ellington, S. (2020) Update: Characteristics of a Nationwide Outbreak of E-cigarette, or Vaping, Product Use-Associated Lung Injury—United States		of lung injuries associated with e-cigarette, or vaping, product use in the United States. It falls under the domain of public health and epidemiology, particularly addressing the urgent problem of vaping-related lung injury outbreaks	patterns of product use, and potential risk factors associated with the outbreak. It may also discuss clinical outcomes, treatment approaches, and implications for public health policy and practice	epidemiological data on reported cases, clinical assessments of lung injury severity, laboratory analyses of vaping products, and possibly economic assessments of healthcare costs associated with the outbreak	ascertainment and data collection
Jose, T. et al. (2020). <i>Improved Documentation of Electronic Cigarette Use in an Electronic Health Record</i>	Level III, High Quality	HSO type: Health Information Systems, Research Domain: Clinical Documentation, Problem: EHR Practices	Discusses improvements in EHR documentation of e-cigarette use, enhancing patient care quality.	Documentation metrics	Focused on a single institution; may not represent broader trends.
Layden, J. E. et al. (2019). <i>Pulmonary Illness Related to E-Cigarette Use in Illinois</i>	Level II, High Quality A	HSO type: Public Health, Research Domain: Clinical Characteristics,	Reports clinical features and outcomes of patients with pulmonary illness related to vaping.	Clinical outcomes, demographic data	Preliminary report; may lack comprehensive follow-up data.



Author, date, and title	Evidence level and quality rating	Focus: HSO type, Research Domain, and Specific Problem being addressed	Findings that help answer the review question(s)	Metrics and Measures if used	Source Limitations
<i>and Wisconsin — Preliminary Report</i>		Problem: Pulmonary Illness			
Friedman, A. S., Xu, S., & Guydish, J. (2020) Vaping prevalence and correlates of use among U.S. adolescents: Findings from the 2018 National Youth Tobacco Survey	Level II B.	Focus: This study focuses on assessing the prevalence of vaping among adolescents in the United States and identifying factors associated with its use. HSO type: Public health research Domain: Adolescent health and substance use	data on the prevalence of vaping among U.S. adolescents in 2018 and examines correlates associated with vaping, such as demographics, tobacco use, and social influences	prevalence rates, odds ratios, and survey responses to assess vaping behavior	recall bias in self-reported survey data, the cross-sectional nature of the study design limiting causal inference, and the possibility of underrepresentation or selection bias in the survey sample
Centers for Disease Control and Prevention (CDC) (2020) Outbreak of lung injury associated with e-cigarette use, or vaping	Level V A	Focus: Public health surveillance and response to the outbreak of lung injury associated with e-cigarette use, or vaping. HSO type:	updates on the number of cases, demographics of affected individuals, clinical characteristics, potential causative agents, and recommendations for	epidemiological measures such as incidence rates, case counts, and demographic data to characterize the	limitations such as reporting delays, incomplete data, and challenges in identifying causative agents in complex public health outbreaks

Author, date, and title	Evidence level and quality rating	Focus: HSO type, Research Domain, and Specific Problem being addressed	Findings that help answer the review question(s)	Metrics and Measures if used	Source Limitations
		Public health agency report Research Domain: Respiratory health, substance use, epidemiology	healthcare providers and the public	outbreak and assess its impact	
Siegel, D. A. et al. (2019). <i>Update: Interim Guidance for Health Care Providers Evaluating and Caring for Patients with Suspected E-cigarette, or Vaping, Product Use Associated Lung Injury</i>	Level I, High Quality	HSO type: Healthcare Providers, Research Domain: Clinical Guidelines, Problem: Lung Injury Management	Provides interim guidance for healthcare providers managing vaping-related lung injuries, improving clinical practices.	Clinical management recommendations	May not cover all scenarios; interim nature limits application.

#### Appendix D: DHA Thematic Analysis Results

Author(s) and date	Data extracted	Initial codes	Preliminary themes
Alexander, S. (2023). Stopping the Vapor of Death: Implementing a Vaping Cessation Protocol in an Emergency Department. <i>Ir.ua.edu</i> . <a href="https://ir.ua.edu/items/88642877-05a0-4dcc-87fb-df715873da19">https://ir.ua.edu/items/88642877-05a0-4dcc-87fb-df715873da19</a>	Implementing a vaping cessation protocol in emergency departments (EDI).	Health risks of vaping Emergency department interventions	Health Effect and Clinical Implications
Amato, M. S., Bottcher, M. M., Cha, S., Jacobs, M. A., Pearson, J. L., & Graham, A. L. (2020). “It’s really addictive and I’m trapped:” A qualitative analysis of the reasons for quitting vaping among treatment-seeking young people. <i>Addictive Behaviors</i> , 112(106599), 106599. <a href="https://doi.org/10.1016/j.addbeh.2020.106599">https://doi.org/10.1016/j.addbeh.2020.106599</a>	Qualitative reasons for quitting vaping among young people	User perceptions and behaviors Behavioral influence on health outcomes	User Perceptions and Behaviors
Berg, C. J., Barker, D. C., Sussman, S., Getachew, B., Pulvers, K., Wagener, T. L., Hayes, R. B., & Henriksen, L. (2020). Vape Shop Owners/Managers’ Opinions About FDA Regulation of E-Cigarettes. <i>Nicotine &amp; Tobacco Research</i> , 23(3), 535–542. <a href="https://doi.org/10.1093/ntr/ntaa138">https://doi.org/10.1093/ntr/ntaa138</a>	Opinions of vape shop owners/managers on FDA regulation	Regulatory framework, Policy advocacy for vaping regulations	Regulatory Framework and Policy Implications
Case, K., Crook, B., Lazard, A., & Mackert, M. (2016). Formative research to identify perceptions of e-cigarettes in college students: Implications for	Formative research on perceptions of e-cigarettes in college students.	User perceptions and behaviors,	

Author(s) and date	Data extracted	Initial codes	Preliminary themes
future health communication campaigns. <i>Journal of American College Health</i> , 64(5), 380–389. <a href="https://doi.org/10.1080/07448481.2016.1158180">https://doi.org/10.1080/07448481.2016.1158180</a>		Health promotion strategies	Public Health Interventions and Education
Chatham-Stephens, K., Roguski, K., Jang, Y., Cho, P., Jatlaoui, T. C., Kabbani, S., Glidden, E., Ussery, E. N., Trivers, K. F., Evans, M. E., King, B. A., Rose, D. A., Jones, C. M., Baldwin, G., Delaney, L. J., Briss, P., Ritchey, M. D., Anderson, K., Annor, F. B., & Brown, S. E. (2019). Characteristics of Hospitalized and Nonhospitalized Patients in a Nationwide Outbreak of E-cigarette, or Vaping, Product Use–Associated Lung Injury — United States, November 2019. <i>MMWR. Morbidity and Mortality Weekly Report</i> , 68(46), 1076–1080. <a href="https://doi.org/10.15585/mmwr.mm6846e1">https://doi.org/10.15585/mmwr.mm6846e1</a>	Characteristics of hospitalized and nonhospitalized patients in a nationwide outbreak of vaping-associated lung injury.	Vaping-related respiratory conditions, Surveillance systems for vaping illnesses	Surveillance and Epidemiology
Creamer, M. R., Wang, T. W., Babb, S., Cullen, K. A., Day, H., Willis, G., Jamal, A., & Neff, L. (2019). Tobacco Product Use and Cessation Indicators Among Adults — United States, 2018. <i>MMWR. Morbidity and Mortality Weekly Report</i> , 68(45), 1013–1019. <a href="https://doi.org/10.15585/mmwr.mm6845a2">https://doi.org/10.15585/mmwr.mm6845a2</a>	Surveillance data on electronic cigarette use among adults.	Health risks of vaping, public health warnings	Public Health Interventions and Education

Author(s) and date	Data extracted	Initial codes	Preliminary themes
Evans, M. E., Twentyman, E., Click, E. S., Goodman, A. B., Weissman, D. N., Kiernan, E., Hocevar, S. A., Mikosz, C. A., Danielson, M., Anderson, K. N., Ellington, S., Lozier, M. J., Pollack, L. A., Rose, D. A., Krishnasamy, V., Jones, C. M., Briss, P., King, B. A., Wiltz, J. L., & Glover, M. J. (2020). Update: Interim Guidance for Health Care Professionals Evaluating and Caring for Patients with Suspected E-cigarette, or Vaping, Product Use–Associated Lung Injury and for Reducing the Risk for Rehospitalization and Death Following Hospital Discharge — United States, December 2019. <i>MMWR. Morbidity and Mortality Weekly Report</i> , 68(5152), 1189–1194. <a href="https://doi.org/10.15585/mmwr.mm685152e2">https://doi.org/10.15585/mmwr.mm685152e2</a>	Provide updated guidelines for healthcare professionals to improve the evaluation, care, and follow-up of patients with EVALI.	Healthcare challenges, Provider training needs	Healthcare Challenges and Provider Training Needs
Fernandez, E. (2022, May 23). <i>E-Cigarette Use Costs U.S. \$15B Per Year, Reports UCSF in First Study of Its Kind</i> / UC San Francisco. <a href="https://www.ucsf.edu/news/2022/05/422891/e-cigarette-use-costs-us-15b-year-reports-ucsf-first-study-its-kind">Www.ucsf.edu. https://www.ucsf.edu/news/2022/05/422891/e-cigarette-use-costs-us-15b-year-reports-ucsf-first-study-its-kind</a>	Economic impact of e-cigarette uses in the U.S.	Healthcare challenges, Provider training needs	Health Effect and Clinical Implications
Hartnett, K. P., Kite-Powell, A., Patel, M. T., Haag, B. L., Sheppard, M. J., Dias, T. P., King, B. A., Melstrom, P. C., Ritchey, M. D., Stein, Z., Idaikkadar, N., Vivolo-Kantor, A. M., Rose, D.	Syndromic surveillance for vaping-associated lung injury.	Surveillance systems for vaping illnesses,	

Author(s) and date	Data extracted	Initial codes	Preliminary themes
A., Briss, P. A., Layden, J. E., Rodgers, L., & Adjemian, J. (2019). Syndromic Surveillance for E-Cigarette, or Vaping, Product Use–Associated Lung Injury. <i>New England Journal of Medicine</i> . <a href="https://doi.org/10.1056/nejmsr1915313">https://doi.org/10.1056/nejmsr1915313</a>		Epidemiological monitoring	Surveillance and Epidemiology
Ghinai, I., Navon, L., Gunn, J. K., Duca, L. M., Brister, S., Love, S., ... & Layden, J. E (2019) Characteristics of persons who report using only nicotine-containing products among interviewed	Surveillance systems and epidemiological monitoring of vaping-related illnesses	Surveillance systems for vaping illnesses	Surveillance and Epidemiology

Author(s) and date	Data extracted	Initial codes	Preliminary themes
patients with e-cigarette, or vaping, product use-associated lung injury—Illinois, August–December 2019		Public health monitoring	
Glantz, S. A., Nguyen, N., & Luiz, A. (2024). Population-Based Disease Odds for E-Cigarettes and Dual Use versus Cigarettes. <i>NEJM Evidence</i> , 3(3). <a href="https://doi.org/10.1056/evidoa2300229">https://doi.org/10.1056/evidoa2300229</a>	Policy advocacy for stricter vaping regulations and its impact on public health	Policy advocacy for vaping regulations Legislative responses	Regulatory Framework and Policy Implications
Jose, T., Hays, J. T., & Warner, D. O. (2020). Improved Documentation of Electronic Cigarette Use in an Electronic Health Record. <i>International Journal of Environmental Research and Public Health</i> , 17(16), 5908. <a href="https://doi.org/10.3390/ijerph17165908">https://doi.org/10.3390/ijerph17165908</a>	strategies for enhancing documentation accuracy, integration of e-cigarette use documentation into clinical workflows, and the importance of comprehensive documentation for better patient care	Methodological challenges in research, Healthcare documentation	Healthcare Challenges and Provider Training Needs
Layden, J. E., Ghinai, I., Pray, I., Kimball, A., Layer, M., Tenforde, M., Navon, L., Hoots, B., Salvatore, P. P., Elderbrook, M., Haupt, T., Kanne, J., Patel, M. T., Saathoff-Huber, L., King, B. A., Schier, J. G., Mikosz, C. A., & Meiman, J. (2019). Pulmonary Illness Related to E-Cigarette Use in Illinois and Wisconsin — Preliminary Report. <i>New England Journal of</i>	Characteristics of hospitalized patients with vaping-associated lung injury.	Vaping-related respiratory conditions, Health risks of vaping	

Author(s) and date	Data extracted	Initial codes	Preliminary themes
<i>Medicine</i> , 382(10). <a href="https://doi.org/10.1056/nejmoa1911614">https://doi.org/10.1056/nejmoa1911614</a>			Health Effects and Clinical Implications
McAlinden et al. (2021)	User behavior patterns and health risk perceptions regarding vaping	User perceptions and behaviors Health risk awareness	
Metcalf, M., Rossie, K., Stokes, K., & Tanner, B. (2021). Healthcare Professionals' Clinical Skills to Address Vaping/e-Cigarette Use by Patients: Needs and Interest Questionnaire Study (Preprint). <i>JMIR Formative Research</i> , 6(4). <a href="https://doi.org/10.2196/32242">https://doi.org/10.2196/32242</a>	Clinical skills needed by healthcare professionals to address vaping use	Provider training needs, Knowledge gaps among healthcare providers	User Perceptions and Behaviors
Pipe, A. L., Evans, W., & Papadakis, S. (2022). Smoking cessation: health system challenges and opportunities. <i>Tobacco Control</i> , 31(2), 340–347. <a href="https://doi.org/10.1136/tobaccocontrol-2021-056575">https://doi.org/10.1136/tobaccocontrol-2021-056575</a>	Health system challenges and opportunities in smoking cessation	Healthcare utilization, Economic implications	Healthcare Challenges and Provider Training Needs
Pound, C. M., & Coyle, D. (2022). A cost-utility analysis of the impact of electronic nicotine delivery systems on health care costs and outcomes in Canada. <i>Health Promotion and Chronic Disease Prevention in Canada</i> , 42(1), 29–36. <a href="https://doi.org/10.24095/hpcdp.42.1.05">https://doi.org/10.24095/hpcdp.42.1.05</a>	Cost-utility analysis of electronic nicotine delivery systems.	Healthcare utilization, Economic implications	Healthcare Challenges and Provider Training Needs



Author(s) and date	Data extracted	Initial codes	Preliminary themes
Siegel, D. A., Jatlaoui, T. C., Koumans, E. H., Kiernan, E. A., Layer, M., Cates, J. E., Kimball, A., Weissman, D. N., Petersen, E. E., Reagan-Steiner, S., Godfred-Cato, S., Moulia, D., Moritz, E., Lehnert, J. D., Mitchko, J., London, J., Zaki, S. R., King, B. A., Jones, C. M., & Patel, A. (2019). Update: Interim Guidance for Health Care Providers Evaluating and Caring for Patients with Suspected E-cigarette, or Vaping, Product Use Associated Lung Injury — United States, October 2019. <i>MMWR. Morbidity and Mortality Weekly Report</i> , 68(41), 919–927. <a href="https://doi.org/10.15585/mmwr.mm6841e3">https://doi.org/10.15585/mmwr.mm6841e3</a>	Interim guidance for healthcare providers on vaping-related lung injury	Healthcare challenges, Provider training needs	Health Effects and Clinical Implications  Healthcare Challenges and Provider Training Needs
Sindelar, J. L. (2020). Regulating Vaping — Policies, Possibilities, and Perils. <i>New England Journal of Medicine</i> , 382(20), e54. <a href="https://doi.org/10.1056/nejmp1917065">https://doi.org/10.1056/nejmp1917065</a>	Discussion on the regulation of vaping and its implications.	Policy advocacy for vaping regulations, Health system responses	
Wang, Y., Sung, H.-Y., Lightwood, J., Yao, T., & Max, W. B. (2022). Healthcare utilization and expenditures attributable to current e-cigarette use among US adults. <i>Tobacco Control</i> , tobaccocontrol-2021-057058. <a href="https://doi.org/10.1136/tobaccocontrol-2021-057058">https://doi.org/10.1136/tobaccocontrol-2021-057058</a>	Healthcare utilization and expenditures due to current e-cigarette use	Healthcare costs, Economic impact	Regulatory Framework and Policy Implications

Author(s) and date	Data extracted	Initial codes	Preliminary themes
Xu, X., Shrestha, S. S., Trivers, K. F., Neff, L., Armour, B. S., & King, B. A. (2021). U.S. healthcare spending attributable to cigarette smoking in 2014. <i>Preventive medicine</i> , 150, 106529.	Healthcare spending attributable to cigarette smoking.	Healthcare costs, Economic implications	Health Effects and Clinical Implications  Health Effects and Clinical Implications

## Appendix E: Final Concept/Thematic Map

