Strategic Assessment of Risk Factors Contributing to Respiratory Communicable Diseases in Saudi Arabia: A Step Toward Reducing Cases by 50% by 2030

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ARTICLE INFO	ABSTRACT
	Respiratory Communicable Diseases (RCDs) are one of the major public health concerns in Saudi Arabia. Therefore, this research proposes a strategic plan to help the country reduce RCD cases by 50% by 2030. This study establishes risk factors affecting RCD transmission and management using global best practices and the hypothetical analysis of survey data about the local context. Some related recommendations include increasing RCD public awareness and health literacy, redesigning the healthcare system for RCD management, using technology and innovation, multi-sectoral collaboration for RCD, and continuous evaluation. **Keywords:** Respiratory Communicable Diseases (RCDs), Pandemic Preparedness, Multi-Sectoral Collaboration.

I. INTRODUCTION

Respiratory communicable diseases (RCDs) pose many risks globally as well as in Saudi Arabia, affecting public health and efforts towards combating the issues. These diseases comprise influenza, MERS-CoV, asthma, tuberculosis, recent COVID-19, and pneumonia, which lead to high illness rates as well as a significant loss of life and increased costs on the health service. The Kingdom of Saudi Arabia holds RCD control as an essential healthcare priority despite its impressive healthcare development because national strategies and Vision 2030 aim to cut RCD occurrence by half by 2030. The socio-cultural and environmental situation in Saudi Arabia presents unique opportunities and challenges in the fight against RCDs. The transmission dynamics of these diseases depend on large-scale annual religious gatherings, climatic conditions, extreme weather, dust storms, accelerating urban development, and the degrees of public health awareness in the population. Identifying how different risks merge together demands research attention before developing purpose-specific preventive strategies.

This research evaluates key risk factors that cause RCDs to spread throughout Saudi Arabia. The research will achieve that through synthesizing existing literature reviews and developing an effective methodological design highlighting data-dependent findings to create essential evidence to reach the national goal of reducing RCD cases by 50% in 2030.

A. Objectives

- To systematically review the current landscape of factors that influence RCDs in Saudi Arabia

- To systematically outline key evidence-based interventions and policies to guide Saudi Arabia in reducing RCD incidence to 50% by 2030.

- To provide a guide for the constant assessment of the effectiveness of the interventions made to prevent RCD in Saudi Arabia

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II. LITERATURE REVIEW

The literature review section systematically explores existing data and knowledge about respiratory communicable diseases, their risk factors, and control approaches in Saudi Arabia through an organizational study of existing paper-based research. The review explores essential themes that create a deep understanding of existing research while pinpointing gaps that this study plans to resolve. The paper selected 30 reviewed research papers that will help enhance the themes and create an effective understanding of the gaps that exist in the industry.

A. Infectious Communicable Diseases and Intervention.

The literature review papers that explore the interventions for communicable diseases and some respiratory diseases that affect the people of Saudi Arabia. These themes are important in developing effective strategies to understand the risk factors and reduce such diseases.

Based on the research paper 1 selected, the study holds that based on the key themes evaluated, such as knowledge, attitude, and practices towards preventing diseases, young people and educated people had more knowledge and awareness than the older population [1]. The study noted a wide gap among the older population and young people in terms of understanding the issues related to the diseases. Paper 2 explored strategies for preventing and controlling infection, finding them essential for minimizing the spread of such diseases. A [2] reviewed national infection policies at the country level, noting the weaknesses and strengths of existing frameworks. The study discovered that Hospital-based Infection Prevention and Control (IPC) measures show successful outcomes, yet they need enhanced surveillance systems and routine healthcare professional training to achieve better results. They proposed performing practical evaluations to check how well IPC measures would endure across different periods. One study [3] has reviewed the changes in the healthcare system, particularly concerning the Model of Care (MOC) approach. Studies showed that using health technologies, infrastructure development, and integrated health care have helped increase availability and effectiveness. Nevertheless, some issues likely persist, including workforce training and resource management.

Epidemiological data is very important in ascertaining the characteristics of diseases and their distribution within a given population. The study [4] compared the national epidemiological data of respiratory diseases such as hepatitis B, C, and influenza. The results revealed that the reporting of infections was lower, attributed to enhanced infection control measures during the COVID-19 pandemic. The study called for sustained funding of vaccination campaigns and immunization to monitor the disease and prevent future epidemics and chronic diseases.

Non-pharmaceutical interventions (NPIs) have been observed to be very effective in the fight against outbreaks in cases of respiratory communicable diseases. The study [5] used mathematical modelling to dynamically estimate the impact of such NPIs as lockdowns, travel restrictions, and social distancing. The models demonstrated that early intervention significantly decreased infection rates. The study also shows that there is a need to ensure early intervention in the use of non-pharmacological interventions. A Study [6] reviewed several diagnostic and therapeutic options regarding respiratory diseases. The research also identified some positive signs that social media use is becoming essential for businesses and organizations. New techniques in antiviral medications, such as molecular diagnostics and CRISPR-based diagnostics, are also believed to require much more clinical validation for most of the methods. Paper [7] made an observational analysis of containment, showing that it positively impacted the patients. Findings demonstrated that rigorous environmental proper sanitation measures, staff awareness, and proper sorting of admitted patients into the hospital greatly minimized hospital-acquired infections. However, certain issues prevent them from being applied systematically in various environments, such as hospitals, thus requiring specific guidelines in various healthcare institutions. Health policies related to communicable and non-communicable diseases are vital for sustainable health improvements.

Research [8] conducted a comparative policy review of the literature on strategies for addressing NCDs in the context of globalization. Findings emphasized the importance of early identification, medical care, and intersectoral collaboration. Although the study was useful for comparing the country with others, it focused on localized issues, and it was recommended that there should be changes in policies to cater to the health issues of the various countries effectively. Lung transplant patients are at high risk of developing severe respiratory infections and are at a higher risk of them in danger of complications. A systematic review [9] examining the effect of respiratory illness on patients

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found that the disease significantly affected the patients. Infections in patients with CLA: this study has revealed a close relationship between acute respiratory viral infections and chronic lung allograft dysfunction. The study stressed the increased rate of viral diseases and inadequate diagnostic tools witnessed in the past three transplantations to minimize the risks of infection and improve the quality of life in the long run. The research paper [10] further examined the general effects of respiratory infections on vulnerable and other organ transplant patients, raising the need for good healthcare infrastructure and preventive measures in vulnerable communities.

B. Strategies and Challenges in Implementation

The study continued the exploration of the strategies for handling the RCD and the challenges that emerge when implementing these goals. The article [11] reviewed a comprehensive review of policy measures that are applied by the Ministry of Health and other government bodies and the private sector in reaction to the effect of COVID-19. A paper [12] explored the management of RCDs like COPD, Asthma, and Lung carcinoma based in Iraq. The study aims to reduce 25% of premature deaths by 2025, enhance earlier diagnosis and interventions, enhance the quality of life, and minimize the cost of care. The research found that early intervention and the use of technology are key to reducing these diseases. The study [13] assessed Alberta, Canada's Respiratory Health Strategic Clinical Network (RHSCN). The key principle initiatives identified by this study are the formation of a multi-disciplinary team, service delivery in 105 different aspects of asthma, decreasing the length of stay of COPD patients, and other preventive measures like smoking cessation. The paper [14] evaluated PanPRET, which is in the development stages and was made to enhance coordination, risk communication, and making decisions in Costa Rica and Cook Island. The study found that the approach would be effective if well implemented, but the gap in leadership was noted as a key challenge. The study [15] examined the 'One person per household testing' approach, which was used in 2020 during the pandemic. The study found that the approach is not widely used but, when used, can be useful to identify people with conditions in society and make the right decisions.

The study [16] examined the approaches to reducing respiratory diseases like COVID-19 and Flu in the Czech Republic to tell the companies about economic preventive measures and improve employee retention. Some of the analyzed works on health policy and the PICO approach are defined as the measures that would impact a health policy, including limitation of travel to the extent possible, only virtual means in meetings, strict sanitation measures, and measures that create immunity. The outcomes are rather informative about what it takes to stop an illness from escalating, and this entails that such components as air quality, protective gear, and health care provisions are tools. In [17], the protocol for the pooling strategy of SARS-CoV-2 was discussed in surveillance testing, particularly among asymptomatic patients and high-risk groups. The rationale of a conceptual aim is to enhance the time and money invested and efficiency in case identification. Thus, it was discovered that pooling is an effective way to reduce costs and maintain sensitivity at a high level (by 80%) when using the SEIR model, cross-country comparisons, and the comparison of the pooled and individual analysis. Based on the study [18], COVID-19 could be used as a scientific view of the pandemic's global preparedness through research and technology.

The measures to prevent the spread of influenza, as highlighted by [19], is a study highlighting COVID-19 in workplaces in the Czech Republic. The studies included in this paper are from 1102 scientific articles and 15 official health recommendations from March 2020 to February 2022 via the PICO method. This study proposes an economical approach to designing a system in which prevention is integrated into the production process to minimize the cost of respiratory diseases. The [20] reviews the previous preparedness of the health systems to address respiratory viral pandemics, SARS, MERS, H1N1, and COVID-19. They are divided into two broad categories: The structure intervention level, which comprises public health policies and communication, non-pharmaceutical interventions, surveillance, and mental health, and the provider level, which includes hospital and infection control. Also, the study reveals that before the vaccines, some of the most efficient ways to combat the virus include quarantine, lockdown, and good contact tracing. Taiwan effectively managed SARS regarding the triage and contact tracing, whereas China, South Korea, Italy, France, and the US fought COVID-19 using isolation.

C. Digital-Based Strategies and Methods

COVID-19 emerged as one of the greatest RCDs ever, which promoted countries and governments to design strategies to combat the disease. Especially using digital means, notably Finland in 2021, ordered the use of remote working, if possible, although, in the end, the diseases were too intense, and

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staying home became the option [21]. In 2020, South Korea effectively dealt with COVID-19 through the application of containment and mitigation measures with the help of digital technologies (DTs). This paper discusses the findings from the government reports, literature review, expert opinions, and key digital solutions such as AI chatbots, real-time public alerting, mobile tracking applications, remote healthcare, and innovative testing facilities like K-Walk-Thru stations [22]. Therefore, the study recommends that DTs be at the heart of future pandemic responses to support improved decision-making, transport, and control of respiratory diseases. The research [23] explores how, in 2020, Spain used smartphone contact tracing applications (Bluetooth, GPS, Wi-Fi, and cellular data) to manage COVID-19 through epidemic models and actual mobility data from 115 university students in Taiwan. Bluetooth tracing was identified as the most effective, but it requires 80% of the population to use the app to stop transmission. The methodology comprises stochastic and deterministic models to assess the efficiency of the smartphone contact tracing technologies.

A study conducted in South Korea in 2022 reveals a new approach of lightweight artificial intelligence algorithm for diagnosing respiratory disorders from lung sounds. The data collected 126 respiratory sound samples from patients, and the proposed model used CNN-BiGRU with noise reduction and feature extraction to enhance performance. The proposed model yielded 92.3% accuracy, 92.1% sensitivity, and 98.5% specificity and, therefore, can be used to diagnose diseases such as COPD, asthma, pneumonia, and interstitial lung disease [24]. Another study with Saudi Arabia indicates how it was able to leverage digital technology to mitigate COVID-19 using mobile Apps, AI surveillance, and telemedicine services. These measures helped to reduce the infection rate by 61% in Al Madinah Al Mounawarah and effectively avoided the second wave of the virus [25].

In 2021, the paper discusses how it was possible to identify measures taken to prevent and contain COVID-19 in India. These measures included increasing the number of hospital beds, creating awareness, immunization, and using lockdowns. The organization has the strength of having a structured approach to managing the pandemic and its control, while the weakness is that it lacks the resources to prevent the second wave of the pandemic [26]. Another paper suggests the 3rd Master Plan for the Prevention and Control of Infectious Diseases in Korea, which is on trial from 2023 to 2027 and presents new measures to address infectious diseases, including respiratory diseases, in South Korea. Based on public health data, consultations with experts, and policy research, four strategies include pandemic preparedness, AI surveillance, vaccines, and communication [27]. The study conducted in 2021 on COVID-19 interventions in Kathmandu utilizes an SEIR model. Measures have been put in place to prevent COVID-19 spread, such as physical distancing, locking down, and active case identification, including testing and isolation, contact and quarantine, and the findings indicated that social distancing for one year reduces the hospital's demand by 65%. Lockdowns only postpone the peak demand for hospital beds but do not decrease the mortality rate. Distancing with testing and isolation is most effective in decreasing deaths by 99.6% [28]. In 2020, infectious disease outbreaks such as MERS-COVID-19 were analyzed with a focus on health information and policies from various countries. This paper outlined four main approaches: enhancing surveillance, rapid response to outbreaks, and enhancing public health and vaccination initiatives [29]. Another paper under discussion focused on the TB control strategy in 2022 in Australia. Based on a review of previous TB control activities, ten lessons to be learned were also defined: detection of TB infection, diagnosis of latent TB, and management of MDR-TB. Strengths are the national strategic plan for TB control and weaknesses and challenges in TB control among migrants. This was achieved from 2015 to 2020 [30].

TABLE I.   SUMMARY LITERATURE REVIEW

Paper	Finding	Gap
[3][11][15]	These approaches in the right manner through improving outcomes through correcting and improving hospital systems, proposing low low-cost testing, and reinforcing IPC policies.	Further validation, infrastructure support, and policy evaluation are needed for broader and sustainable impact.
[4][6][12]	Strategic planning, simulation models, and surveillance systems improve early outbreak response and risk detection.	Simulation results need real-world validation; surveillance gaps and underreporting require stronger policy and

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		infrastructure support.
[7][19][30]	Highlighted the importance of early interventions, understanding viral mechanisms, and long-term disease control frameworks.	Lack of unified global strategies and need for more integrative policy testing across regions and diseases.
[8][18][25]	Findings stress the importance of proactive planning, structured hospital responses, and evidence-based strategies to prevent outbreak escalation.	More field implementation, scenario validation, and adaptability across regions are needed to ensure real-world effectiveness.
[9][16][21]	Strategies like social distancing, integrated national plans, and personal protection measures reduced the spread of both COVID-19 and seasonal respiratory infections.	Gaps remain in coordination across sectors, long-term public engagement, and real-time evaluation of containment policy impact.
[10][17][22]	Findings show that integrating digital tools, patient-specific care strategies, and flexible policies significantly enhanced pandemic responses and long-term health outcomes.	Gaps include lack of long-term evaluation for digital interventions, inconsistent treatment effectiveness in high-risk patients, and need for coordinated international response standards.
[13][26]	Findings emphasize discharge bundles to reduce hospital readmissions, improved viral surveillance, and policy-level strategies to mitigate outbreak waves.	Gaps include implementation challenges, underreporting in surveillance data, and lack of long-term outcome tracking for national strategies.
[2][27][28]	High awareness and good preventive practices were observed in specific populations, while simulation studies showed that combined distancing and case-finding drastically reduced mortality.	Gaps include uneven behavior across demographics, limited real-world validation of models, and the need for tailored education for vulnerable groups.
[1][23][29]	Findings show that awareness campaigns improved protective behaviors, strategic frameworks guided coordinated global responses, and digital tracing apps have high potential if widely adopted.	Gaps include unequal participation across regions, privacy concerns in digital tools, and the need for stronger evaluation of policy impact across countries.
[5][14][20][24]	Findings highlight the effectiveness of national transformation models, intelligent diagnostic tools, simulation-based preparedness, and integrated health policy reviews in enhancing system readiness.	Gaps include limited real-world validation, lack of inter-agency coordination, insufficient digital infrastructure, and weak global policy alignment.

III. METHODOLOGY

The research used a structured, evidence-based methodology which started with literature review to guide the design of the target group. The survey was distributed to 157 participants across various regions in Saudi Arabia to assess public awareness, behaviors, and attitudes toward respiratory

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communicable diseases (RCDs). The collected data formed the basis for both SWOT and PESTEL analyses, identifying internal and external factors impacting public health efforts. These insights were then translated into key performance indicators within a Balanced Scorecard framework. This integrated approach enables continuous monitoring and evaluation, particularly regarding the adoption of digital health solutions in the Saudi healthcare system, and ensures alignment with Vision 2030 strategic objectives see Fig. 1.
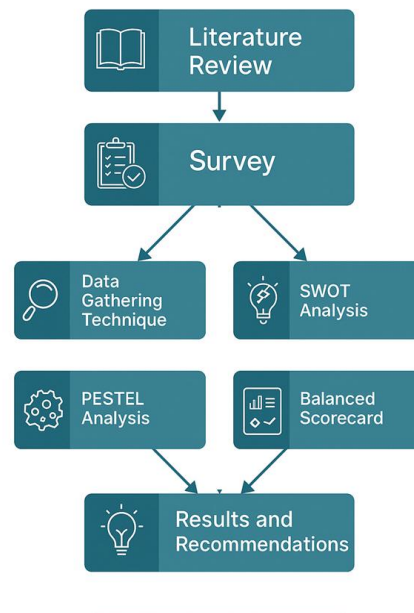

Fig. 1. Methodology Workflow

A. Data Gathering Technique

This study employed a structured survey-based approach to assess public awareness, behaviors, and challenges related to respiratory communicable diseases (RCDs) in Saudi Arabia. The survey targeted 157 participants from various regions and demographic backgrounds. It was designed based on an initial literature review and distributed digitally to ensure accessibility across urban and rural populations. The questionnaire explored five key dimensions: demographic information, knowledge and awareness, attitudes and perceptions, behavioral practices, and open-ended insights. Results revealed that 70.7% of participants had heard of respiratory diseases such as influenza and COVID-19, but only 29.3% were aware of transmission methods, indicating a notable awareness gap Behaviorally, 62.4% had received the annual flu vaccine, while 41.4% regularly used digital health tools like Tawakkalna and Sehhaty. However, precautionary practices such as mask-wearing varied in frequency, suggesting inconsistent risk perception. Open-ended responses revealed recurrent challenges including poor public commitment to preventive behavior, resistance to vaccines, low health literacy in certain groups, and environmental factors like pollution and overcrowding . Suggestions emphasized increased education, community engagement, and digital health integration. The survey included five main sections: Demographics, Knowledge and Awareness, Attitudes and Perceptions, Behavioral Practices, and Open-ended Questions. The structure ensured both quantitative and qualitative data collection to inform subsequent strategic analysis. Below is a detailed overview of each section:

a) *Demographic Information*

The demographic data showed a well-distributed sample. The majority of respondents were between the ages of 26–55 years, with age groups 26–35 and 36–45 being the most represented. Gender representation was relatively balanced with 58% female and 42% male. Regarding roles, 66.9% of participants were members of the general public, 19.1% were healthcare providers, and the remaining were patients or researchers. Participants were also drawn from a wide range of cities across Saudi Arabia, contributing to regional diversity see Fig 2.
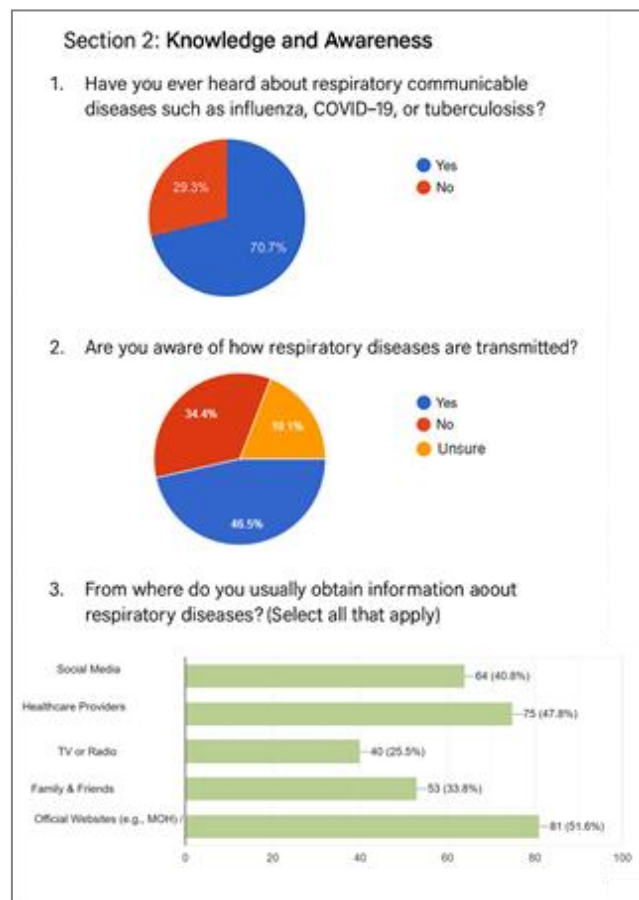
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Fig. 2. Public Awareness and Information Sources Regarding Respiratory Diseases

b) *Knowledge and Awareness*

A large proportion of respondents (70.7%) reported having heard of RCDs such as COVID-19 and influenza. However, only 19.1% indicated they clearly understood how these diseases are transmitted, highlighting a significant knowledge gap. The most common sources of information included official websites (51.6%), healthcare providers (47.8%), and social media platforms (40.8%), followed by family/friends (33.8%) and traditional media (TV or radio, 25.5%) see Fig 3.
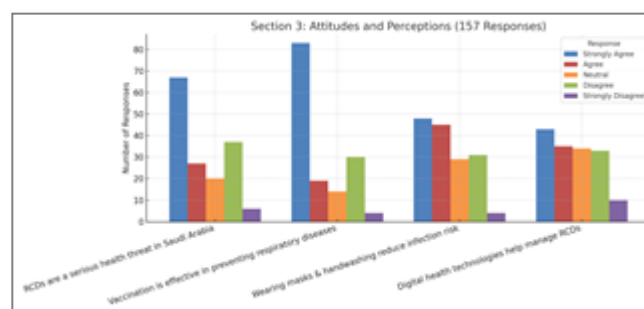

Fig. 3. Attitudes toward RCD prevention and digital tools (n = 157)

c) *Attitudes and Perceptions*

Participants were asked to express their views regarding the effectiveness of preventive measures such as vaccination, wearing masks, and hand hygiene. While the majority expressed agreement with these measures, a considerable percentage remained neutral. This suggests that some individuals are

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uncertain or hesitant, potentially due to a lack of trust or exposure to inconsistent messaging. Building confidence in public health strategies appears essential see Fig 4.
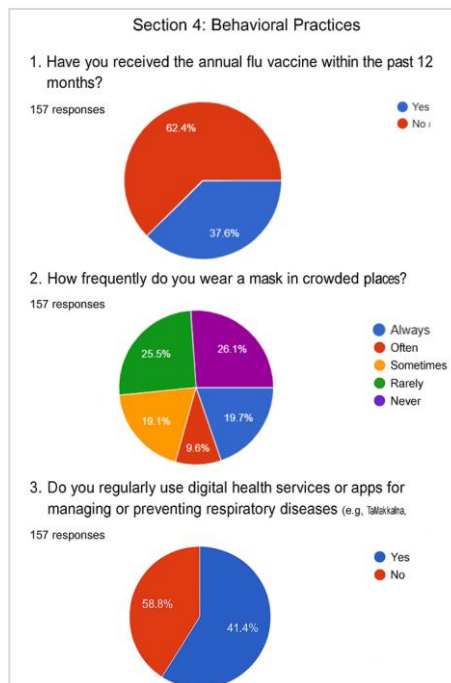

Fig. 4. Behavioral Practices toward Respiratory Disease Prevention

d) *Behavioral Practices*

Findings showed that 62.4% of respondents had received a flu vaccine within the past 12 months. However, adherence to mask-wearing in crowded areas varied: only 19.7% reported always wearing masks, while others did so often, sometimes, or rarely. Additionally, 41.4% of participants used digital health applications such as Tawakkalna or Sehhaty, indicating moderate engagement with digital tools in health behaviour (see *Figure 4*).

e) *Open-ended Questions*

Responses to open-ended questions provided deeper context. The most frequently cited challenges included:

- Weak adherence to preventive behaviors

- Resistance to vaccinations

- Low public health literacy

- Environmental factors (pollution, crowding)

- Lack of enforcement of protective policies

Participants also offered suggestions such as:

- Launching national awareness campaigns

- Enforcing hygiene protocols in public spaces

- Leveraging social media influencers for outreach

- Expanding vaccine accessibility and early screening programs

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B. SWOT Analysis

The study sought to use SWOT analysis to effectively evaluate the strengths and opportunities that exist in Saudi Arabia that can aid in achieving the goal of reducing RCDs by 50% by 2030. SWOT analysis also will aid in understanding the weaknesses and threats that exist towards achieving the same goal see Fig 5.

STRENGTHS	WEAKNESSES
• 70.7% have heard of respiratory diseases • 62.4% received flu vaccine • Balanced demographic representation • 41.4% use digital health apps	• Only 19.1% know how diseases are transmitted • Low mask compliance (only 19.7% always wear one) • 58.6% don't use health apps
OPPORTUNITIES	THREATS
• Use official websites and social media for campaigns • Involve healthcare providers and influencers • Expand digital tools for awareness and access • Align with Vision 2030 health goals	• Resistance to vaccination and masking • Environmental risks: pollution, overcrowding • Spread of misinformation • Weak enforcement of health policies

Fig. 5. SWOT Analysis

a) Strengths

The survey revealed several internal strengths. Notably, 70.7% of participants had prior awareness of respiratory diseases such as influenza and COVID-19, indicating that public familiarity with the topic is relatively high. Furthermore, a significant portion (62.4%) reported having received the annual flu vaccine, suggesting openness to preventive healthcare practices. The sample itself was demographically diverse, including balanced gender distribution and representation across different age groups and roles (e.g., general public, healthcare providers). Additionally, 41.4% of respondents actively use digital health applications such as Tawakkalna or Sehhaty, demonstrating a moderate level of digital health engagement that can be built upon.

b) Weaknesses

Despite general awareness, only 19.1% of participants understood how RCDs are transmitted, revealing a critical knowledge gap. Adherence to preventive practices was also inconsistent—only 19.7% always wore masks in crowded places, and a majority (58.6%) did not use health applications at all. Furthermore, a considerable portion of respondents maintained neutral stances toward the effectiveness of prevention strategies, such as vaccination and hygiene, suggesting either a lack of trust or insufficient exposure to reliable health information.

c) Opportunities

The analysis highlighted key opportunities for public health stakeholders. Official digital platforms (used by 51.6% of participants) and social media (used by 40.8%) emerged as primary sources of health information, offering effective channels for launching large-scale awareness campaigns. Engaging trusted figures like healthcare providers and social media influencers could also improve message penetration. The moderate use of digital health tools suggests potential for expansion in areas like vaccination reminders, educational alerts, and self-assessment tools. Additionally, aligning such initiatives with Vision 2030's healthcare transformation objectives ensure stronger institutional support and long-term sustainability.

a) Threats

There are also notable external threats that could hinder progress. Some segments of the population continue to resist public health measures, particularly mask-wearing and vaccination. Environmental factors, including air pollution and overcrowding in public or religious sites, increase the risk of transmission. Moreover, the spread of misinformation through informal channels poses a risk to

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evidence-based communication efforts. Finally, weak enforcement of health regulations in certain areas may reduce the impact of awareness and behavioral change programs.

C. PESTEL Analysis

To evaluate the feasibility of achieving a 50% reduction in respiratory communicable diseases (RCDs) by 2030, a comprehensive PESTEL analysis was conducted. This framework explores the macro-environmental factors that may influence public health strategies in Saudi Arabia, especially in relation to awareness, behavior, and adoption of preventive practices identified in the survey. These factors can either facilitate or hinder implementation and should be carefully addressed within the strategic plan.

a) Political Factors

The Saudi government actively supports health transformation initiatives through Vision 2030, which promotes digital health, vaccination programs, and public education. Survey results showed that 70.7% of participants are already familiar with respiratory diseases, reflecting strong foundational awareness that can be enhanced with further governmental support. However, open-ended responses also highlighted weak enforcement of public health measures in crowded or high-risk areas, pointing to a need for stronger policy implementation and accountability frameworks.

b) Economic Factors

Saudi Arabia's strong non-oil economic growth provides fertile ground for investment in health awareness and digital health infrastructure. Flu vaccination uptake (62.4%) suggests that individuals are willing to engage in preventive healthcare when services are accessible and affordable. Expanding funding for awareness campaigns and technology-based interventions could further reduce healthcare burdens in the long term.

c) Social Factors

The population is largely composed of young and urban individuals, which increases the potential for rapid behavior change and technology adoption. However, survey responses revealed low levels of understanding about disease transmission (only 19.1%), and inconsistent mask-wearing habits. Additionally, resistance to vaccination was noted in qualitative responses, indicating that cultural attitudes and misinformation must be addressed through tailored education and community engagement efforts.

d) Technological Factors

Saudi Arabia has made significant strides in digital health. With 41.4% of survey participants already using health applications like Tawakkalna or Sehhaty, there is room to expand their role in health education and monitoring. The government's ongoing investments in digital infrastructure, AI, and mobile technologies offer opportunities to improve accessibility, especially in remote areas.

e) Environmental Factors

Respondents cited environmental challenges such as air pollution, overcrowding, and poor hygiene in public areas as key contributors to disease spread. Seasonal factors like dust storms, combined with limited air quality controls in some areas, pose barriers to controlling RCDs. Sustainable environmental policies must therefore be integrated into health strategies to ensure holistic prevention.

f) Legal Factors

While data protection regulations such as the Personal Data Protection Law (PDPL) exist, their enforcement in public health settings remains variable. The survey revealed gaps in digital health usage and public trust, highlighting the need for clearer legal guidelines that ensure data privacy and public safety. Enhancing regulatory clarity will be crucial to enabling the safe expansion of digital health tools and large-scale awareness programs.

D. Balance Score Cared

This is a strategic map of the Balanced Scorecard that presents objectives, measures, challenging targets for 2030, and the enabler initiatives to achieve goal of reducing the RCD by 50% in Saudi Arabia. The BSC encompasses four key dimensions: Financial, Customer, Internal Processes, and

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Learning & Growth see Table II. The BSC is organized into four key perspectives: Financial, Customer, Internal Process, and Learning & Growth, each aligned with objectives derived from survey insights.

a) *Financial Perspective: Cost-Efficiency in Campaigns*

The primary goal under the financial dimension is to enhance the cost-effectiveness of national awareness and vaccination campaigns. Survey findings support the feasibility of broad public engagement through affordable strategies. Accordingly, the Balanced Scorecard sets a target to keep each campaign under SAR 50,000, with a reach of at least 100,000 individuals. Key initiatives include launching digital campaigns through government platforms and partnering with public figures and influencers to maximize visibility and impact while minimizing cost.

b) *Customer Perspective: Enhancing Public Awareness and Vaccine Uptake*

The customer perspective focuses on improving public understanding of RCD transmission and increasing vaccination acceptance. The survey revealed a significant

knowledge gap—only 19.1% of participants were aware of how these diseases spread—despite relatively high flu vaccination rates (62.4%). The BSC aims to increase awareness to 70% and annual flu vaccination rates to 75%. To achieve this, the strategy proposes seasonal campaigns and app-based health alerts using trusted platforms such as Tawakkalna and Sehhaty to deliver targeted, timely health messages.

c) *Internal Process Perspective: Strengthening Campaign Quality and Engagement*

This dimension focuses on optimizing the frequency and quality of public health education programs. Survey responses reflected varying levels of public engagement and commitment to preventive behaviors. Therefore, the Balanced Scorecard sets a target of conducting at least 5 campaigns per year, with an engagement rate of 50% or higher. Key initiatives include developing short, informative videos and infographics, and fostering partnerships with schools and workplaces to integrate public health messaging into daily environments.

TABLE II. BALANCED SCORECARD TABLE

PERSPECTIVE	OBJECTIVE	MEASUREMENT	TARGET	ACTION PLAN (INITIATIVE)
Financial	Improve cost-efficiency of awareness and vaccination campaigns	- Cost per campaign - Individuals reached	- < SAR 50,000 per campaign - Reach 100,000 people	- Launch digital campaigns on gov platforms - Partner with influencers
Customer	Raise public understanding of RCDs and increase vaccine acceptance	- % aware of transmission - % vaccinated annually	- 70% awareness - 75% flu vaccination rate	- Seasonal campaigns - App-based health alerts (Tawakkalna, Sehhaty)
Internal Process	Improve frequency and quality of public health education programs	- Campaigns per year - Engagement rate	- 5 campaigns/year - ≥ 50% engagement rate	- Create short videos & infographics - Partner with schools/workplaces
Learning & Growth	Build capacity in health communication and digital health readiness	- Trained personnel - Digital proficiency %	- 100 trained/year - 100% digitally proficient staff	- Conduct training workshops - Provide digital toolkits & modules

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d) *Learning & Growth Perspective: Building Health Communication Capacity*

The learning and growth perspective addresses the need to build internal capabilities in health communication and digital readiness. The survey highlighted limited public use of digital health apps (only 41.4%), suggesting a broader need for capacity-building.

As a result, the Balanced Scorecard includes goals to train 100 health communication personnel annually and to ensure 100% digital proficiency among staff involved in public outreach. Planned initiatives include regular workshops and the distribution of digital training kits and modules.

e) *Strategic Alignment and Budgeting*

Each perspective in the Balanced Scorecard is supported by a clear budget allocation, ensuring practical implementation of the proposed initiatives. Budgets range from SAR 45,000 per campaign for awareness efforts to SAR 80,000 annually for production and partnerships. This structured, measurable, and well-funded approach ensures that national public health strategies remain aligned with the goals of Saudi Vision 2030, while also enabling real-time monitoring, evaluation, and continuous improvement.

IV. RESULTS AND RECOMMENDATIONS

The findings of this study underscore the significant potential for reducing respiratory communicable diseases (RCDs) in Saudi Arabia by 50% by the year 2030. Insights drawn from the national survey, which involved 157 participants from varied demographic backgrounds, revealed both public receptiveness and key barriers to implementing effective health strategies. High baseline awareness (70.7%) and moderate flu vaccination uptake (62.4%) reflect a strong foundation for intervention. However, the knowledge gap surrounding disease transmission (only 19.1% aware) and low adoption of digital health tools (58.6% not using apps like Tawakkalna or Sehhaty) point to critical areas requiring targeted action.

Politically, Saudi Arabia's commitment to Vision 2030 offers a favorable landscape for implementing nationwide digital health interventions. Government-driven digitization initiatives, regulatory reform, and long-term investments in health infrastructure align well with RCD prevention goals. Technologically, the proliferation of mobile apps and the country's high internet penetration (99%) facilitate remote monitoring and digital outreach, offering opportunities for scalable, cost-efficient health campaigns.

From an economic standpoint, digital health is poised to become a major enabler of value-based care. Globally, remote health monitoring, AI-based triaging, and mobile diagnostics are estimated to contribute up to $420 billion to the global GDP by 2030. Locally, Saudi Arabia's health digitization could yield $27 billion in economic gains by that time. As healthcare providers seek to reduce operational costs while enhancing patient outcomes, digital therapeutics (DTx) and remote systems can reduce emergency room visits and readmissions, helping clinicians track patient progress and adherence more effectively.

Moreover, analysis of emergency department usage in Saudi Arabia reveals that nearly 50% of visits are non-urgent and could be avoided through effective at-home digital triage systems. The adoption of such tools would allow patients to receive guidance without overwhelming hospital resources. If implemented at scale, digital health technologies could reduce national healthcare spending by $10-15\%$, redirecting resources to high-priority areas.

Recommendations:

Based on the findings, the following recommendations are proposed:

1. Increase national investment in digital health education, focusing on disease transmission and prevention strategies.

2. Leverage existing mobile applications (e.g., Tawakkalna, Sehhaty) for targeted health alerts and vaccination reminders.

3. Implement nationwide seasonal awareness campaigns, prioritizing underserved regions and high-risk populations.

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4. Train public health staff in digital communication, ensuring message consistency and effective delivery across platforms.

5. Strengthen partnerships with schools, workplaces, and influencers to build trust and expand reach.

6. Develop legal and regulatory frameworks that support digital health adoption while safeguarding data privacy and patient safety.

These measures, when integrated with the strategic roadmap defined through the Balanced Scorecard, provide a comprehensive approach to reducing RCDs and aligning public health outcomes with Saudi Arabia's Vision 2030.

V. CHALLENGES

Despite the promising ability for the of digital and community-driven interventions to reduce respiratory communicable diseases (RCDs) in Saudi Arabia, several challenges remain. Survey findings highlighted a significant gap in knowledge, as only 19.1% of participants were aware of how RCDs are transmitted. Additionally, inconsistent preventive behaviors such as low mask usage (only 19.7% always wore masks in crowded places) and limited engagement with health applications (only 41.4% reported using apps like Tawakkalna or Sehhaty) present obstacles to behavior change. Cultural resistance to vaccination and misconceptions surrounding public health initiatives were also frequently noted in open-ended responses, alongside low health literacy in certain segments of the population. Environmental factors such as overcrowding in public and religious sites, poor air quality, and a lack of enforcement of hygiene regulations further complicate prevention efforts. On the institutional side, fragmented coordination, inadequate public communication, and a shortage of digitally skilled health educators limit the scalability of health campaigns. Lastly, concerns about data privacy, especially in the use of digital tools, underscore the need for a strong legal and regulatory framework to support trust and adoption. These challenges must be systematically addressed to ensure the success of the national strategy toward reducing RCDs by 2030.

VI. CONCLUSION

This study demonstrates that while Saudi Arabia has made notable progress in raising general awareness about respiratory communicable diseases (RCDs), substantial gaps remain in public understanding, behavior, and digital health adoption. Survey results confirmed that although awareness is relatively high (70.7%), knowledge about disease transmission is low, and engagement with preventive practices and health technologies remains inconsistent. However, the country's political will, economic capacity, and digital infrastructure offer strong foundations for change.

Strategic tools such as the SWOT and PESTEL analyses, coupled with the Balanced Scorecard, provided a comprehensive framework for identifying strengths, addressing weaknesses, and aligning public health goals with actionable plans. The proposed roadmap outlines feasible initiatives across financial, behavioral, operational, and capacity-building dimensions that are essential to achieving a 50% reduction in RCDs by 2030.

To succeed, Saudi Arabia must intensify its efforts to expand digital health literacy, strengthen intersectoral collaboration, and tailor public health campaigns to meet the specific needs of diverse population segments. With sustained commitment, data-driven planning, and alignment with Vision 2030, the Kingdom is well-positioned to transform its approach to infectious disease prevention and lead the region in innovative, people-centered healthcare.

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