

A study based on the Knowledge, Attitudes, and Practices Regarding COVID-19, Vaccines
and Non-pharmaceutical Interventions (NPIs): An International Survey

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Abstract

Background

The COVID-19 outbreak posed a significant global threat, necessitating the swift deployment of stringent measures to mitigate its spread and impact. Central to effectively managing such crises through assessments of population health must be performed and should be underpinned by the recognition that knowledge acquisition plays a pivotal role in shaping behavioral responses. In this context, the Knowledge, Attitudes, and Practices (KAP) model emerges as a robust diagnostic framework. This study aims to assess residents' understanding, attitudes, and behaviors regarding the 2019 coronavirus, vaccines, and non-pharmaceutical interventions in Cameroon and Canada. Using the KAP model, we seek to explore how knowledge, attitudes, and practices interact, providing insights for future targeted interventions and disease control measures.

Methods

An anonymous online survey was randomly administered amongst 166 participants in Cameroon and Canada via SurveyMonkey between October 25, 2022, and February 25, 2023. Descriptive and stratified analyses quantified residents' responses to KAP. The data was analyzed through both qualitative and quantitative approaches. The analytical protocol included descriptive data analyses followed by an assessment of independent factors associated with KAP. Correlations were assessed between the dependent variables. A linear regression was employed to identify predictors related to KAP scores. A scoping review was conducted to map existing evidence on COVID-19, KAP, vaccines, and NPIs using Cochrane guidelines, including 35 international studies published between December 2019 and September 2022. The review aimed to examine factors influencing COVID-19 vaccine acceptance, intention, and hesitancy, and to develop a conceptual framework for these factors and NPIs globally. Covidence was used for screening articles following inclusion and exclusion criteria.

Results

73.5% of participants identified as youths within 18-25 years of age. Data analysis revealed that there was a significant correlation between knowledge and practices ($r = 0.249$, $p < .001$). Further, residence, marital status, and educational level were identified as significant predictors of KAP. These findings also demonstrated that Canadians displayed higher knowledge levels and adherence to recommended guidelines, whereas Cameroonians exhibited better attitudes, yet less adherence to COVID-19 protocols, non-pharmaceutical interventions (NPIs), and vaccination.

Conclusion

Conclusively, our observations revealed that the level of public knowledge was significantly correlated to the level of practices. The higher the level of knowledge of the participants, the better the practices. In addition, the level of education and marital status were identified as strong predictors of KAP. These data underscore that importance of knowledge dissemination for the spread of communicable diseases related to COVID outbreaks, as it will help with adherence to disease prevention strategies.

Abstrait

Introduction

L'épidémie de la COVID-19 a constitué une menace mondiale importante, suivie de la mise en œuvre de mesures rigoureuses adoptées par l'urgence nationale pour contrôler sa propagation massive. L'évaluation de la santé d'une population est primordiale pour faciliter l'éradication des maladies, l'acquisition de connaissances est un facteur primordial dans le changement de comportement, et le modèle CAP a été identifié comme un outil de diagnostic puissant. Cette étude vise à évaluer la compréhension, les attitudes et les comportements des résidents concernant le coronavirus 2019, les vaccins et les interventions non-pharmaceutiques au Cameroun et au Canada. À l'aide du modèle CAP, nous cherchons à explorer comment les connaissances, les attitudes et les pratiques interagissent, en fournissant des informations pour des interventions ciblées et des mesures de contrôle des maladies. Une revue de la portée a été effectuée pour améliorer la robustesse de la thèse en cartographiant systématiquement les preuves existantes sur le terrain.

Méthode

Un sondage anonyme en ligne a été administré au hasard à 166 participants au Cameroun et au Canada via Survey Monkey entre le 25 octobre 2022 et le 25 février 2023. Des analyses descriptives et stratifiées ont permis de quantifier les réponses des résidents au CAP. Les données ont été analysées à l'aide d'approches qualitatives et quantitatives à l'aide de Survey Monkey et de SPSS. Le protocole d'analyse comprenait des analyses de données descriptives. Une corrélation a été évaluée entre les variables dépendantes et indépendantes. Un modèle de régression linéaire a été utilisé pour identifier les prédicteurs liés aux scores CAP. Une revue a été menée pour cartographier les données probantes existantes sur la COVID-19, les CAP, les vaccins et les INPs à l'aide des lignes directrices Cochrane. L'examen visait à examiner les facteurs influençant l'acceptation, l'intention et l'hésitation du vaccin contre la COVID-19, et à élaborer un cadre conceptuel pour ces facteurs et les INPs à l'échelle mondiale. Covidence a été utilisé pour filtrer les articles selon des critères d'inclusion et d'exclusion et 35 études internationales ont été identifier

Résultats

73.5% des participants s'identifiaient comme des jeunes-adultes. Le test statistique réalisé a révélé qu'il existait une corrélation significative entre les connaissances et les pratiques ($r=0,249$, $p<,001$). Le lieu de résidence, l'état matrimonial et le niveau de scolarité ont été identifiés comme de bons prédicteurs de la CAP à la signification à $p<. 001$. Les résultats ont montré que les Canadiens affichaient des niveaux de connaissances et de respect des lignes directrices recommandées plus élevés, tandis que les Camerounais affichaient de meilleures attitudes, mais des niveaux inférieurs de connaissances et d'adhésion aux protocoles COVID-19, aux interventions non pharmaceutiques (INPs) et à la vaccination.

Conclusion

En conclusion, le niveau de connaissance était significativement corrélé au niveau des pratiques. Plus le niveau de connaissance des participants est élevé, plus le niveau de pratiques est élevé. De plus, le niveau d'éducation et l'état matrimonial ont été identifiés comme de puissants prédicteurs de la CAP. Il est nécessaire de comprendre la propagation des maladies transmissibles d'un pays à l'autre, car cela facilitera la prise de décision et la mise en œuvre de stratégies de prévention des maladies.

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FIGURE 1: PRISMA FLOWCHART 16

Acronyms

NPIs: Non-Pharmaceutical Interventions

PHG: Public Health Guidelines

KAP: Knowledge, Attitudes, and Practice

WHO: World Health Organization

MeSH: Medical Subject Heading

Definitions of key terminologies

The following definitions were derived (from the WHO, 2024).

The **knowledge-attitude-practices (KAP) framework** is a conceptual model that favors a holistic approach of an individual's understandings, competencies, and learning towards a disease or a pandemic.

knowledge is defined as the extent to which the population understands the basic concepts, transmission routes, symptoms, and preventive measures related to a pandemic.

Attitudes: is defined as the willingness of individuals to adopt preventive behaviors, such as vaccination, mask-wearing, and social distancing.

Behavior/Practices: how that information is being conveyed is perceived via the consistency and effectiveness of their behaviors such as hand hygiene, mask usage, and avoidance of crowded spaces.

The terms **satisfactory**, **non-satisfactory**, were used throughout chapter 5, 6 and 7 to explain participant's level of understanding (i.e. accuracy of knowledge), attitudes (i.e. willingness, and actions taken (i.e. adherence to preventive measures) towards COVID-19, NPIs and vaccines.

CHAPTER 1: INTRODUCTION

The COVID-19 pandemic has led to a tragic loss of human life and significant economic challenges worldwide (Vilches T. et al., 2022). On January 30, 2020, the World Health Organization (WHO) declared a global public health emergency as viral infections spread to 18 countries outside of China. As of April 13, 2024, there have been over 704 million confirmed cases and more than 7 million deaths globally. This unprecedented crisis has placed immense strain on healthcare systems, economies, and daily life, prompting a collective response to mitigate the virus's spread and protect public health (WHO, 2020; Griffith et al., 2021). Central to this response have been non-pharmaceutical interventions, including physical distancing, mask-wearing, and lockdown measures, alongside the rapid development and distribution of vaccines (Wake Addisu, 2021). Although the WHO has declared that COVID-19 is “no longer a global health emergency, its effects continue to be felt, and the potential for new variants remains a concern.

In Africa, the fatality rate stands at 2.31%, lower than the global average of less than 3% (Ekpenyong et al., 2022). This relatively mild impact may be linked to the region's coexistence with malaria; research suggests that malaria may help mitigate the severity of COVID-19 (Osei et al., 2022). For context, as of September 2021, Africa, the most malaria-endemic region, recorded only 5.5 million COVID-19 cases (Ekpenyong et al., 2022). Additionally, statistics show that Cameroon has recorded 71 deaths per million population, compared to Canada's 1,538.43 deaths per million (Worldometer, 2025). Despite these lower rates, concerns about Africa's healthcare systems remain, as they are often under-resourced and weakened (Ekpenyong et al., 2022).

Understanding how various populations perceive, adopt, and adhere to public health measures is essential for effective global disease prevention strategies. This ongoing research is critical for shaping future public health responses and improving community resilience during pandemic via surveys (Brankston G. et al., 2022).

1.1. KAP surveys

Surveys have been used to collect information on KAP (knowledge, attitudes and practices). These surveys have traditionally been used during pandemics. Understanding a population's health status has traditionally relied on various cross-sectional surveys, with the Knowledge, Attitude, Behavior, and Practice (KABP) survey being one of the most used tools (Hausmann-Muela et al., 2003; Manderson & Aaby, 1992; Nichter, 2008). Gaining insight into human behavior is essential for driving change and improving health practices. However, recent critiques have raised questions about the effectiveness of these surveys in capturing the intended data, their suitability for their purpose, and whether the burden of such research methods is justified for populations (Launiala, 2009).

Considering these critiques, we aim to apply a KABP survey within the context of the COVID-19 pandemic to assess its utility in providing meaningful data for future global pandemic response strategies. Since the onset of COVID-19, researchers, health professionals, and scientists worldwide have conducted numerous surveys examining the KAP of the general population. While some studies have focused on the perceptions of health workers regarding COVID-19, others have concentrated on specific countries (Ekpenyong et al., 2022). Prior research on COVID-19 in different countries has primarily focused on individual countries (Pearce, N. et al, 2020). This study seeks to fill that research gap by gathering data through international comparisons between Canada and Cameroon, thereby offering a more comprehensive understanding of KAP regarding COVID-19 and informing

future health strategies. Detailed strategies adopted during the pandemic to curb disease spread are outlined below.

1.2. Non-pharmaceutical interventions I

Non-pharmaceutical interventions (NPIs) encompass a wide range of both governmental and self-initiated measures designed to interrupt infection chains by modifying key aspects of human behavior. These interventions have been crucial in mitigating the spread of infectious diseases, like the influenza virus and the COVID-19 pandemic caused (Perra, N., 2021). Among the most widely adopted NPIs are practices such as mask-wearing, hand hygiene, and physical distancing. These measures have been strongly promoted as essential strategies to reduce the transmission of COVID-19 and protect public health (Adriana M. et al., 2022).

However, the success of these interventions depends not only on their implementation but also on the acceptance and adherence by different populations. This acceptance is influenced by a range of factors, including the effectiveness of public health messaging, prevailing social norms, the spread of misinformation, and individuals' access to necessary resources (Imai N. et al., 2020).

1.3. Vaccines and vaccine hesitancy I

The development and rollout of COVID-19 vaccines have offered a promising pathway towards achieving widespread immunity and controlling the spread of the virus (Griffith J. et al., 2021). Nevertheless, vaccine hesitancy is seen as a problem in many countries, where a complex web of reasons combines to influence people's acceptance of immunization efforts, which are further complicated by public distrust of their government's health policies along with concern about the safety of vaccines (Griffith J. et al., 2021). Although vaccine hesitancy is a global issue, those rooted in Africa are particularly complex,

and due to a history of unethical medical research in the region, misinformation plays an important role in people's decisions to receive immunization (Wake Addisu, 2021).

In 2019, the World Health Organization (WHO) identified vaccine hesitancy (VH) as a top global health threat, linked to a significant rise in measles cases, especially in Europe and the Americas (WHO, 2019). The increase in measles outbreaks has led to higher rates of illness, death, and healthcare costs (Bussink-Voorend et al, 2022). Vaccine hesitancy, particularly in Europe, is the primary reason for low vaccination rates (Suijkerbuijk A, et al, 2015) . In contrast, sub-Saharan Africa faces different challenges, such as limited access to vaccines, affecting immunization coverage (Bangura, J.B., et al, 2020). For example, in some European countries, misinformation and fear about vaccine safety have led to parents refusing to vaccinate their children, contributing to outbreaks of preventable diseases like measles (Bussink-Voorend et al, 2022).

This study aims to compare the knowledge, attitudes, and practices regarding COVID-19, non-pharmaceutical interventions, and vaccines between Canadians and Cameroonians. These two countries represent diverse sociocultural contexts, healthcare systems, and public health infrastructures, offering a unique opportunity to explore the impact of cultural, socioeconomic, and structural factors on pandemic response strategies. By examining how individuals in Canada and Cameroon engage with COVID-19 prevention measures and vaccination campaigns, we aim to identify patterns, challenges, and opportunities to enhance global public health interventions.

In the following sections, we will delve into the rationale, specific objectives, and research questions. Chapter 2 consists of a review of relevant literature; chapter 3 encompasses the systematic review; chapter 4 presents the methodology of our own survey. Lastly, the final chapters report the results and discussions of our survey on KAPs towards COVID-19, NPIs and vaccines for Canadians and Cameroonians, with the overarching goal

of contributing to evidence-based strategies for pandemic control and promotion of global public health policies.

1.4. Rationale

The rationale for assessing and comparing the knowledge, attitudes, and practices (KAP) regarding COVID-19, non-pharmaceutical interventions (NPIs), and vaccines among Canadians and Cameroonians is to understand how different populations navigate pandemic response strategies. Previous research has mostly focused on individual countries, providing basic insights into public perceptions of the pandemic (Brankston G, et al., 2021; Achondou et al., 2020). However, this study aims to fill the gap by comparing how cultural, social, and healthcare contexts influence responses to health measures. By examining KAP in both countries, this research will provide insights into vaccine acceptance, hesitancy, and access barriers, informing more targeted strategies to improve vaccine uptake, enhance community resilience, and promote global health equity.

1.5. Statement of purpose and research question

The purpose of this study is to assess and evaluate the knowledge, attitudes, and practices regarding COVID-19 among individuals in Cameroon and Canada. By exploring the differences and similarities in how people from these two countries perceive and respond to the pandemic, this research aims to enhance our understanding of global responses to public health crises and inform targeted public health interventions tailored to the specific needs of each population. Through this analysis, we seek to identify potential areas for improvement in global pandemic awareness and prevention strategies, as well as highlight relevant contextual factors.

This study addresses the following research questions:

1. What factors influence the development of knowledge, attitudes, and practices (KAP) regarding COVID-19, non-pharmaceutical interventions (NPIs) and vaccines in Canada and Cameroon, and how do these factors impact residents' decisions to adopt these measures?
2. Are these factors similar or different in the two countries identified for assessment?

1.6. Research objectives

This thesis aims to understand, assess, and evaluate the knowledge, attitudes, and practices (KAP) regarding COVID-19 among Cameroonians and Canadians. To achieve this goal, the following specific objectives are addressed:

1. Identify key factors that influence the spread of COVID-19 and the adoption of vaccines and non-pharmaceutical interventions (NPIs).
2. Evaluate and compare the knowledge, attitudes, and practices related to COVID-19, NPIs, and vaccines between the Cameroonian and Canadian populations.

CHAPTER 2: LITERATURE REVIEW

2.1. Origin of COVID-19

Coronavirus is known to be a single-stranded RNA virus that belongs to the Nidovirales order (Hassan S. et al., 2020). The first detected COVID-19 case was in Wuhan, Hubei, China (Zhong et al., 2020). This novel viral strain was said to be the main cause of pneumonia and by February 11th, 2020, the pathogen was later named, severe acute respiratory syndrome Coronavirus-2 (SARS-COV-2) by the international committee on Taxonomy of Viruses (Hesaraki M. et al., 2020). COVID-19 is a contagious respiratory illness transmitted through the eyes, nose, and mouth, via droplets from coughs and sneezes, close contact with an infected person and direct contact with contaminated surfaces (Guo et al., 2020). The incubation period is approximately one week to fourteen days and possible symptoms could include fever, dry cough, dyspnea, headache, sore throat, and rhinorrhea and sometimes hemoptysis (Cascella M. et al., 2022). This disease could lead to severe respiratory problems or death, particularly among the elderly and persons with underlying chronic illnesses. Moreover, some infected people could be carriers but asymptomatic while others may experience only a mild illness and recover easily (Adhikari et al., 2020).

In addition, this disease has had a catastrophic effect on the world's population resulting in more than 6 million deaths worldwide, emerging as one of the most consequential global health crises since the influenza pandemic of 1917 (Cascella M. et al., 2023). From the first case in China, the virus rapidly spread worldwide with high mortality and morbidity. The WHO identified it to be a global burden and was followed by immediate actions to constrain its transmission; however, the overwhelming increase in morbidity and mortality rate became a major threat for public health and healthcare systems (Brankston G. et al., 2021).

2.2. Epidemiology and symptoms of COVID-19

Epidemiology is essential for understanding how diseases spread and is particularly useful to determine the potential impact of the new coronavirus variants that are currently affecting the global population (Pearce, N. et al., 2020). Like other single-stranded viruses, SARS-CoV-2, while adapting to their new human hosts, is liable to genetic evolution with the development of mutations over time, resulting in variants that may have more lethal or contagious characteristics than its ancestral strains (Zhong et al., 2020). Furthermore, the most common clinical symptoms of COVID-19 patients are fever, cough, shortness of breath, and other breathing difficulties in addition to other nonspecific symptoms including headache, dyspnea, fatigue, and muscle pain and digestive symptoms such as diarrhea and vomiting (Halaji M. et al., 2021). In addition, dominant transmission routes were identified; 1) transmission among persons (Person-to-person transmission occurs mainly via respiratory droplets spread by coughs, sneezes or talking), 2) indirect transmissions via contaminated objects 3) Direct contact of a contaminated hand with mucous membranes such as the eyes, nose, or mouth can also transmit the virus. (Van D. et al., 2020; WHO, 2024)

According to the WHO, between February 2021 and Jan 2024, more than 566 million confirmed cases of COVID-19 were identified, including 4 million deaths and increased mortality rates in old age (>60 years), males-or in those with a smoking history, diabetes, obesity or with preexisting pneumonia (Halaji M. et al., 2021). In addition, the mortality rate of the disease varies between countries, with reported mortality rates ranging from 2 to 5% (Deng, J., et al 2024). The World Health Organization (WHO) named new coronavirus variants using the letters of the Greek alphabet, starting with the Alpha variant, which emerged in 2020. Furthermore, SARS-COV-2 variants of concern were identified by the WHO, given their impact on global health:

Table 1: Coronavirus variants and reports

Coronavirus Variants	Reports
Alpha (B.1.1.7):	first reported in the United Kingdom (UK) in late December 2020
Beta (B.1.351)	first reported in South Africa in December 2020
Gamma (P.1)	first reported in Brazil in early January 2021
Delta (B.1.617.2)	first reported in India in December 2020
Omicron (B.1.1.529)	first reported in South Africa in November 2021

Throughout the pandemic a couple of measures were introduced to curb the spread of the diseases. NPIs and vaccines were the most commonly used tools to combat COVID, details are provided in the following sections.

2.3. Non-pharmaceutical interventions II

Non-pharmaceutical interventions (NPIs) are public health measures implemented to reduce the spread of infectious diseases without the use of pharmaceutical interventions such as vaccines or medications (Adriana M. et al., 2022). These interventions aim to mitigate the transmission of pathogens by modifying human behavior and reducing opportunities for contact between infected and susceptible individuals. Table 2 below presents a summary of common NPIs as defined by Perra N. (2021).

Table 2: Social distancing measures that were implemented in response to the covid-19 pandemic

Measures	Description
Physical distancing	Maintaining a certain distance between individuals to reduce the likelihood of transmission through respiratory droplets. This can include measures like staying at least 6 feet apart in public spaces and avoiding large gatherings.
Wearing face masks	Using masks or face coverings to reduce the spread of respiratory droplets from infected individuals, particularly in situations where physical distancing is challenging.

<i>Hand hygiene</i>	Encouraging frequent handwashing with soap and water or using hand sanitizers containing at least 60% alcohol to reduce the risk of transmitting pathogens through contaminated hands.
<i>Respiratory etiquette</i>	Covering coughs and sneezes with a tissue or the elbow and properly disposing of tissues to prevent the spread of respiratory droplets containing infectious agents.
<i>Quarantine and isolation</i>	Separating individuals who have been exposed to a contagious disease (quarantine) or individuals who are confirmed or suspected to be infected (isolation) to prevent further transmission
<i>Travel restrictions</i>	Limiting non-essential travel and implementing screening measures at transportation hubs to reduce the movement of individuals and potentially infected populations

NPIs are typically implemented during outbreaks of infectious diseases to slow down transmission and reduce the burden on healthcare systems, during which the development and deployment of pharmaceutical interventions such as vaccines or antiviral medications can occur (Imai N. et al., 2020). They are important at all stages of an outbreak but particularly in the early stages when vaccines or specific treatments may not be readily available.

2.4. Vaccines and vaccine hesitancy II

Vaccines reduce risks of disease infection by working with your body's natural defenses to build protection (WHO vaccines, 2022). Due to the fast global spreading of SARS-COV-2, prevention and treatment options are needed to control infection-related morbidity, mortality, and economic losses. Different countries in the world encouraged their researchers to come up with vaccines, as a result, different methodologies were adopted to develop the vaccines such as mRNA, adenovirus vector, and protein subunit vaccines (WHO, Covid vaccines, 2020). These vaccines were rapidly approved and implemented by different countries to be used in protecting their citizens. Although, normally drug, inactivated and attenuated virus vaccine development can require significant amounts of time and resources,

RNA/DNA vaccines offer a quick, simple, and cheap treatment alternative, even when produced on a large scale (Jahanafrooz Z. et al., 2020). The spike protein, which has been shown as the most antigenic SARSCoV-2 protein, has been widely selected as the target of choice for RNA /DNA vaccines. Reports on high vaccination rates and protection, but numerous unintended effects, ranging from muscle pain to death, have led to concerns about the safety of RNA/DNA vaccines (Beaudoin A. et al., 2022). According to Fouda M et al (2020) and Globalnews.ca in both Cameroon and Canada, the first cases were reported on March 6th and January 25th, 2020, respectively.

Public misinformation can pose a significant threat to public health as they can lead the people to believe that public health measures are non-essential and not necessary (Bierwiazzonek et al., 2021). In addition, people also tend not to receive the vaccine and continue to harbour the viruses in the community, as a result of misinformation (Griffith J. et al; Dinga et al, 2021). Furthermore, the acceptance rate of COVID-19 vaccines in Cameroon was very low, statistically, only about 5% in Cameroon and 83.6% in Canada of the eligible population has been vaccinated as of January 2023 creating vaccine equity gaps (WHO, 2023). Vaccine equity gaps refer to disparities in access to and uptake of COVID-19 vaccines between different populations or countries (Ali, H.A. et al., 2022). In this context, the significant difference in vaccination rates between Cameroon and Canada highlights a vaccine equity gap, such gaps can arise due to various factors, including socio-economic inequalities, healthcare infrastructure, vaccine distribution challenges, and vaccine hesitancy (Hager E. et al., 2021).

Low vaccine acceptance rates in Cameroon could have several implications for public health. Firstly, it may leave a large portion of the population vulnerable to COVID-19 infection, leading to continued transmission and potentially prolonged outbreaks (Njingu et al., 2021). Secondly, low vaccine uptake can exacerbate existing health disparities and strain

healthcare systems (Limoukou et al., 2022). Additionally, several factors could contribute to low vaccine acceptance in Cameroon, including vaccine hesitancy due to concerns about safety and efficacy, misinformation, or lack of access to accurate information about vaccines, cultural or religious beliefs, and logistical challenges in vaccine distribution and administration. In addition, social media campaigns also led to either encourage or discredit public health agencies and other government organizations concerning COVID-19 prevention strategies (Ferreira C. et al., 2022). Therefore, there is an urgent need to assess the level of COVID-19 misinformation and how this translates to changes in adherence to mandated preventative strategies.

2.5. Knowledge, attitudes, and practices (KAP)

Providing knowledge about diseases to educate the public is a strategy to influence preventive health behaviors (Buchanan et al., 2018). Knowledge of disease and health is regarded as the key to whether an individual adopts healthy behaviors.

The more health knowledge an individual has, the more healthy behaviors they will adopt (Siddiquea et al., 2021).

In addition, people's health literacy plays an important role in understanding specific health knowledge, thus, if people understand the facts of COVID-19 they will convert the acquired knowledge into practical health-promoting behaviors to improve or maintain their health conditions (Gautam et al., 2021). However, knowledge does not necessarily elicit behavioral responses; (Brankston G. et al., 2021) (Issanov et al., 2021) pointed out a huge gap between respondents' knowledge and behaviors about COVID-19, whereby respondents adopt preventive attitudes but did not take preventive health behaviors against COVID-19.

2.6. International comparisons (Canada and Cameroon)

Comparing COVID-19 fatality rates between countries can be challenging; however, it is evident that some countries experience higher mortality rates than others (Pearce et al.,

2020). For instance, the first case of HIV was identified in 1959, revealing that the risks were significantly higher in African countries, likely due to food insufficiency, poor living conditions, and poverty (Sharp P. et al., 2011). International comparisons are often disparaged because of differences in data quality and concerns about the 'ecological fallacy.' Nevertheless, when conducted meticulously, these comparisons can be instrumental in determining the ideal conditions for controlling COVID-19 (Pearce N. et al., 2020). Therefore, there is a pressing need for more thoughtful and comprehensive analyses of country-specific differences, conducted by experienced epidemiologists, as this represents one of the most crucial and valid forms of evidence for informing real-time COVID-19 policy (Pearce N. et al, 2020).

Despite global dissemination efforts, a significant disparity in COVID-19 vaccine equity, access, and affordability persists between high-income and low-income countries. According to the global dashboard for vaccine equity, established by the UN development program, WHO, and the university of Oxford), as of January 18, 2022, approximately 67.6% of individuals in high-income countries have received at least one vaccine dose, compared to only about 11.36% of individuals in low-income countries. This study aims to contribute to the development of more effective and targeted strategies and policies at various levels in both developed and developing countries under similar contexts.

The corpus of this thesis includes a scoping review (Chapter 3), which offers a qualitative summary of previous research on KAP toward COVID-19. The review aims to provide a comprehensive and unbiased synthesis of existing evidence to inform decision-making, policy development, and future research on COVID-19 and other pandemics. It also examines variations in population dynamics across different countries and the methodologies used to understand disease transmission and compliance with health measures. The study focuses on articles published between 2020 and 2023, aligning with the timeframe of the

research. As we transition to Chapter 3, the focus shifts to a detailed scoping review, specifically designed to explore international comparisons. This review examines how participants across different countries responded to the pandemic and adapted to recommended health guidelines.

CHAPTER 3: SCOPING REVIEW

A scoping review is an ideal tool used to determine the scope or coverage of a body of literature on a given topic and gives clear indication of the volume of literature and studies available as well as an overview (broad or detailed) of its focus (Munn Z. et al., 2018).

Below, are a couple of previously described indications and suggest the following purposes for conducting a scoping review (Munn Z. et al., 2018):

1) To identify the types of available evidence in a given field, 2) To clarify key concepts/ definitions in the literature, 3) To examine how research is conducted on a certain topic or field, 4) To identify key characteristics or factors related to a concept, 5) As a precursor to a systematic review, 6) To identify and analyse knowledge gaps

The use of scoping review in this thesis was to build foundational components that inform, justifies, and enhances the overall research endeavor. Also, to contribute to the scholarly discourse by synthesizing existing knowledge, identifying gaps, and providing a basis for new contributions to the field. In addition, synthesizing findings from multiple studies, a scoping review provides an evidence-based foundation for research.

The COVID-19 disease was declared a global pandemic by March eleventh, 2020, by the World Health Organization and was later declared by May 4, 2023, as no longer a “global health emergency,” emphasizing that it remains a global health threat as there could be many more emerging variants which could lead to increase morbidity and mortality rates. The KAP model is a reliable and powerful diagnostic tool used in assessing gaps in knowledge, attitudes, and practices of people towards public health-related events like the Coronavirus. This study aims to assess, evaluate, and synthesize the current reports about COVID-19, vaccines, the use of NPI and the development of their KAP based on verbal and non-verbal communication with their fellow beings.

The Cochrane guidelines were used to plan the review from searching and selecting available reports published from December 2019 to September 2022 regarding “COVID-19, KAP, vaccines, NPIs” developed by the researchers as a response to the events that surrounded the pandemic. Inclusion and exclusion criteria were used as guides to select the articles, and Covidence was used as the primary screening tool. A search criterion was identified and following the inclusion and exclusion, 35 International studies were included in this review during the study period identified for this study.

3.1. Rationale and objectives

Since the onset of the pandemic, there have been KAP reports across the globe ongoing. There is little or no studies that have synthesize/gathered scientific evidence on KAP studies related to the COVID-19 pandemic. Therefore, the purpose of this study is to provide a current synthesis of the eligible reports on COVID-19

The objectives of the review include:

1. To examine the factors that influence COVID-19 vaccine acceptance, intention, and hesitancy using findings of the various COVID-19 vaccine surveys conducted globally.
2. To develop a conceptual framework of factors that influence COVID-19 vaccine acceptance, hesitancy globally and NPIs.

3.2. Research methodology

Eligibility criteria

The review included studies that reported any form of qualitative and quantitative assessment regarding KAP based on COVID-19 in the general population across any country, region, or city worldwide. A thorough selection of the studies was assessed via the following criteria: a) The article must be a cross-sectional study because this ensures methodological consistency with the thesis, which is also cross-sectional. This design provides a snapshot of

current knowledge, enabling comparisons of trends and patterns at a single point in time. It also simplifies data synthesis and allows for direct comparisons between populations, making it ideal for understanding COVID-19-related behaviors and attitudes ; b) Must investigate all the three components of the KAP regarding COVID-19 disease; c) The articles of choice must be written in English only; d) The studies should be peer-reviewed e) Articles of interest are not limited to a specific country; f) The study will include a sample representative of the general population only and not a particular group like physicians, students etc. and have the full text available online. There were no restrictions regarding gender, age, ethnicity, country, duration, or geographical location for the study.

Exclusion criteria

Studies were excluded a) If the study is not cross-sectional; b) If the study centers on comparing COVID-19 to other diseases like influenza, HIV etc.; c) If the study consist of one or two components of the KAP; d) If the articles are written in other languages other than English; e) If the article is a review or meta-analysis; f) If the study was only on some specific group of people, healthcare workers, students, medical students, pregnant women, or people with comorbidities. Study duplicates were excluded as well. Below is a rundown of the steps the review entails:

Data extraction

In this review data was not extracted but a narrative report was presented.

Study quality assessment

Scoping reviews are different from systematic reviews as they include broader topics and include studies with more diverse study designs. Therefore, scoping reviews usually do not focus on the quality assessment of the included studies. Accordingly, the quality assessment of the included studies was not performed in the review (Grant M.J. et al., 2009)

Synthesis

Screened and eligible articles were synthesized using a narrative approach. The authors of the study attempted to classify KAP studies according to the following variables to be included in the final analysis.

Time of survey: Information gathered on the date and duration of the surveys conducted.

Study country and location: Information recorded in the country where the KAP surveys was conducted.

Study objectives: Information recorded to assess whether the study aimed to assess the knowledge, attitudes and practices regarding COVID-19.

Study design and survey platform: Information was recorded based on the types of questions, number of survey questions, types of questions and instrument of validation.

Sample size: Information on the total number of respondents enrolled in each study extracted.

Survey instruments: Information was recorded on the variables included in the vaccine survey questionnaire by the different authors.

Outcome assessed: It included reports of each study on the level of KAP regarding COVID-19.

Data analysis: Characteristics of studies were summarized in tables and described narratively.

Search strategy, information sources and study selection

Firstly, Cochrane guidelines were used to identify the steps for a systematic review. The systematic review was processed using COVIDENCE, a primary screening and data extraction tool for Cochrane authors; with the help of a librarian, updates were sent on studies that included articles related to KAP, COVID-19, NPIs and vaccines. The author searched publicly available KAP studies on COVID-19 using the following Databases: PubMed,

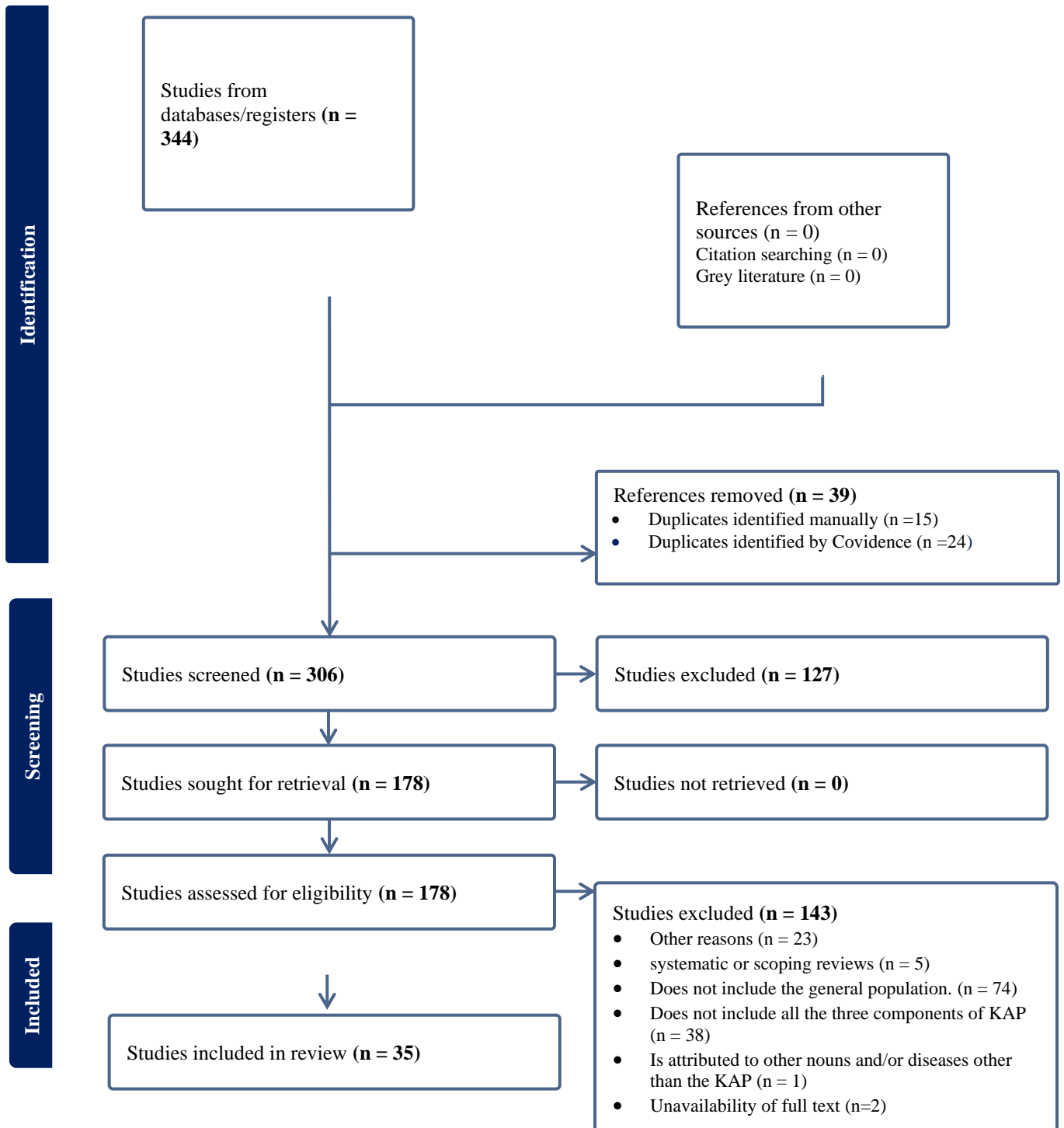
CINAHL, Web of SCIENCE, Ovid, and SCOPUS. The search strategy used a combination of MeSH terms that included: “COVID-19”, “Knowledge,” “Attitude,” “Practice,” “Behavio*,” “Vaccines,” Public Health,” “Non-Pharmaceutical Interventions” (NPI), “Cross-Sectional Study.” Only articles written in both English and French or English were considered and not in French. Endnote, Mendeley and Zotero were used as citation managers to store, organize, and manage all the citations.

Table 3: *Keywords, Boolean operators, databases and search patterns*

Keywords	Boolean Operators	Databases	Search pattern
Knowledge	AND	PubMed	Knowledge AND Attitudes AND Practices OR Behavio* AND COVID-19 AND Vaccines AND NPIs
			Knowledge AND Attitudes AND Practices OR Behavio* AND COVID-19 AND NPIs AND Vaccines AND cross-sectional study
			Knowledge AND Attitudes AND Practices AND COVID-19 NOT cross-sectional study
			Knowledge AND Attitudes AND Practices AND NPIs AND Vaccines
			NPIs AND Vaccines
			KAP AND COVID-19
Attitudes	OR	CINAHL	Knowledge AND Attitudes AND Practices OR Behavio* AND COVID-19 AND Vaccines AND NPIs
			Knowledge AND Attitudes AND Practices
Practices/Bhavio* NOT		Web of SCIENCE	Knowledge AND Attitudes AND Practices
COVID-19		Ovid	KAP AND COVID-19

does not include all the three components of KAP (n = 38), Is attributed to other nouns and/or diseases other than the KAP (n = 1), other reasons (n=23). Finally, 37 articles were included, but two articles were removed due to some extrinsic factors like unavailability of full text. In total, 35 articles were extracted.

Figure 1: PRISMA flowchart



3.3. Research objectives of eligible studies

This review aims to evaluate and synthesize the current reports about COVID-19, vaccines, and NPIs based on the KAP of the general population. The research objectives of the eligible studies were summarized below to help contextualize our findings within the broader research landscape. This enabled us to assess how well each study addresses its specific research question and whether it aligns with the objectives of the systematic review.

The research objectives of eligible studies are summarized in table 4 below.

Table 4: *Research objectives, country, and author(s) of eligible studies*

Author	Country	Research objectives
Azlan et al., 2020	Malaysia	This study aimed to determine the knowledge levels, attitudes, and practices toward COVID-19 among the Malaysian public.
Al- zalfawi et al., 2021	Saudi Arabia	This study evaluated the knowledge, attitude, and perception of the COVID-19 vaccine among the Saudi population.
Bates R et al., 2020	Colombia	The aim was to explore KAPs among Colombians to examine whether they affect adherence to recommended practices during the initial outbreak.
Bates R et al. (2020).	Ecuador	This study aimed to explore KAPs among People in Ecuador
Bates R et al., 2021	Venezuela	This study aimed to explore KAPs among people in Venezuela explore KAPs among
Brankston G et al., 2021	Canada	This study aimed to describe attitudes and behaviours towards the Canadian COVID19 public health response and identify risk-modifying behaviours based on sociodemographic characteristics.

Devkota H.R et al., 2020	Nepal	This study aims to assess knowledge, attitude, and practices (KAP) toward COVID-19 among the public and to identify associated factors.
El-Masry et al.,	Saudi Arabia	This study aimed to assess COVID-19 related knowledge, attitudes, and practices (KAPs) among the residents of the Al-Jouf region in Saudi Arabia to facilitate disease management.
Fang et al., 2020	China	This study aimed to assess KAPs towards COVID-19
Ferdous et al., 2020	Bangladesh	The aim was to assess KAP towards COVID-19 immediately after the lockdown measures were implemented and during the rapid rise period of the outbreak.
Gao et al., 2020	China	The objective of the present study was to evaluate the KAP of the Chinese public and to assess potential influencing factors related to practices.
Limoukou et al., 2022	Southeast Gabon	practices of the Gabonese public towards COVID-19.
Imtiyaz et al., 2021	Kashmiri	The study aimed to assess the knowledge, attitudes, and practices (KAP) about COVID-19 among the Kashmiri population and to determine the association of KAP scores with the sociodemographic variables.
Iqbal et al., 2021	Pakistan	The prime objective of this study is to examine the knowledge, attitudes, and practices of university students and graduates in Pakistan regarding COVID19.
Islam et al., 2021	Bangladesh	The study aimed to investigate community knowledge, attitudes, and perceptions towards COVID-19 vaccinations in Bangladesh.
Issanov et al., 2021	Kazhakstan	The study aimed to evaluate COVID-19 vaccine hesitancy and the associated factors.

Karijo et al., 2021	Kenya	This study aimed to assessed knowledge, practices, perceived risk of infection, adoption of recommended behaviour and the effects of COVID-19 among the youth in Kenya.
Lee M et al., 2021	South Korea	This paper examines the public's knowledge, attitudes, and practices (KAP) related to COVID-19 and their relationships and identifies the pandemic's vulnerable populations to provide recommendations for behavioral interventions and policies.
Luo Y-F et al., 2022	Taiwan	This study mainly explored the relationships among participants' sociodemographic status, COVID-19 knowledge, affective attitudes, and preventive behaviors.
Nakhostin et al., 2020	Iran	The current study aimed at assessing Iranians' knowledge, attitude, and practice (KAP) concerning COVID-19 after Nowruz (Persian et al. Holiday) in Iran and identify its determining demographic and socioeconomic factors.
Ngwewondo et al., 2020	Cameroon	The aim was to understand if: a) demographic variables of Cameroonian residents could influence KAP and symptomatology and b) KAP could influence the risk of having COVID-19.
Njingu et al., 2021	Cameroon	This study aimed to compare the KAP regarding COVID-19 of people living in rural and urban areas in Cameroon.
Reuben et al 2021	North-central Nigeria	This study sought to determine the levels of KAP toward COVID-19 among residents of north-central Nigeria
Šljivo1 A. et al., 2021	Bosnia and Herzegovina	This study aimed to present knowledge, attitudes, and practices at the beginning of the outbreak in Bosnia and Herzegovina when the spreading of COVID-19 was well controlled and provide helpful information to policymakers at this challenging time

Sujarwoto et al., 2022	Indonesia	The aim was to evaluate KAP regarding COVID-19 and its risk factors immediately after the Malang health authorities implemented various preventive measures.
Takoudjou et al., 2021	Chad	The aim was to explore the knowledge, attitudes, and practices (KAPs) regarding COVID-19 within the Chadian population to determine whether there are more vulnerable groups of the population that require greater attention from authorities
Van Nhu et al., 2020	Vietnam	This study aimed to describe knowledge, attitudes, and practices (KAP) in controlling COVID-19 and some related factors among the Vietnamese population in 2020.
Wilson et al., 2020	Liberia	To examine the knowledge, attitudes, and practices (KAP) of COVID-19 of rural and urban residents in Liberia to inform the development of local social and behavioral change communication strategies.
Xu H et al., 2020	China	This study aims to understand the relationships between COVID-19 infection, four personal nonpharmaceutical interventions (NPIs; handwashing, proper coughing habits, social distancing, and mask-wearing), public risk perception, knowledge, attitude, and other social demographic variables.
Yue et al., 2020	China	This study aims to understand the knowledge, attitudes, and practices of COVID-19 in the Chinese context and to provide insights for developing targeted outbreak prevention and control measures among the public.
Zhong et al., 2020	China	The aim was to investigate Chinese residents' KAP towards COVID-19 during the rapid rise period of the outbreak.

3.4. Selection strategy of eligible studies

Through COVIDENCE, the eligible articles were screened. The available information and data were extracted from each article and organized on a Word document under five primary columns with the following headings: a) Author name and year of publication; b) research country of choice; c) study objective based on the KAP(B), d) sampling period and e) risk of bias. The preliminary search was conducted by October 2022 and covered published articles between January 2020 and December 2022. All 35 eligible studies were cross-sectional types. The period of data collection varied, and all the studies provided details about the three components of the KAP during the COVID-19 pandemic. The questionnaires targeted a wider audience, people without comorbidity, and representative samples all over the globe. The sample size ranged from 354 to 10195 participants. The investigated sociodemographic variables were age, gender, marital status, education level, residence, and monthly income.

The characteristics of KAP surveys are summarized in Table 3 below. The number of questions within the surveys ranged between eight (8) and seventy-nine (79) close-ended/open-ended questions. Tools such as Facebook, WhatsApp, Instagram, email, and Amazon, as well as platforms like Wenjuanxing, Weibo, and WeChat (commonly used in Chinese studies), were employed to reach participants. In addition, data was collected by telephone interviews in two eligible studies, and one of the studies collected data via in-person interviews.

The authors applied different questionnaire validation instruments, including national and international guidelines like the WHO CDC. The KAP questionnaires, employed in six studies, were based on previous investigations like that of Zhong et al. in Hubei province, People's Republic of China. This summary is necessary because it enables readers to assess the rigor of the studies included. This includes evaluating aspects such as sample selection,

data collection techniques, and analysis methods, which can impact the validity and reliability of the findings.

Table 5: Summary of selected strategy for surveys conducted in each study

First author, citation	Survey type	Number of survey questions	Types of questions	Instrument of validation
Al-Hanawi et al., 2020	Online self-reported questionnaire	35	Close-ended (True or false, with an additional “do not know” option) questions.	Centers for Disease Control and Prevention (CDC).
Al Ahdab, (2021).	Web-based questionnaire- Facebook and WhatsApp	18	Close-ended questions	Zhong et al. Questionnaire.
Al-Marshoudi et al., 2021	Phone-based survey	23	Close-ended questions	N/A
Amalki M, (2021).	Online WhatsApp and followers on Twitter	37	Close-ended questions	WHO, the United States (CDC), and the study by Zhong et al.
Azlan et al., 2020	Online- Facebook, Twitter, and Instagram	13	Close-ended (True or false, with an additional “not sure” option) questions.	Zhong et al. Questionnaire
Al- zalfawi et al., 2021	Online survey	15	Close-ended questions	N/A
Bates R et al. (2020).	Anonymous online questionnaire	18	Close-ended (True or false, with an additional “do not	Previous study: Zhong et al., 2020

	amongst Ecuadorians		know” option) questions.	
Bates R et al., 2020	Anonymous Online questionnaire amongst Venezuelans	24	Close-ended (True or false, with an additional “do not know” option and yes, no) questions.	N/A
Bates R et al., 2021	Online questionnaire amongst Colombians	17	Close-ended questions	Zhong et al., questionnaire
Brankston et al., (2021).	Electronic survey	18	Close-ended questions	Jarvis et al. 2020
Devkota H.R et al., 2020	Telephone interviews	45	KAP questions	N/A
El-Masry et al., 2021	Online selfreported questionnaire	28	Close-ended questions	Zhong et al. Questionnaire
Fang et al., 2020	Non-interventional, anonymized, selfadministered, web-based survey	24	Close-ended questions	National Health Commission of the People’s Republic of China, Chinese CDC, WHO, and various websites of Chinese government

				agencies, official media, as well as some previous studies as of February 16, 2020
Ferdous et al., 2020	Online-Facebook, WhatsApp	19	Close-ended (yes/no/do not know, agree/ undecided/disagree) questions	WHO, Institute of Epidemiology, Disease Control and Research (IEDCR)
Gao et al., 2020	Online survey-Wenjuanxing	33	Close-ended (yes/no/do not Know, agree/disagree) questions.	Designed by the researcher
Imtiyaz et al., 2021	Online surveys	20	Close and open-ended questions	N/A
Iqbal et al., 2021	Virtual-Facebook and WhatsApp	22	Close-ended questions	Zhong et al. (42) and Azlan et al. (7), 2020 questionnaires
Islam et al., 2021	Virtual-Facebook, WhatsApp	18	Close-ended questions	N/A

Issanov et al., 2021	Electronic questionnaire- e-mail invitations, local hospitals	44	Close-ended questions	Opel et al., 2011 Questionnaire
Karijo et al., 2021	Online survey and phone interviews	40	Close-ended questions	Austian K et al, 2020
Lee M et al., 2021	anonymous Online questionnaire	6	Close-ended questions	Zhong et al. Questionnaire
Limoukou et al., 2022	In-person interviews	N/A	Close-ended (yes/no/do not know) questions	N/A
Luo Y-F et al., 2022	Anonymous Online questionnaire	15	Close-ended (true/false) questions	Taiwan Centers for Disease Control (TCDC) Website
Nakhostin et al., 2020	Anonymous Online questionnaire	25	Close-ended (yes/no) questions	Zhong et al. Questionnaire
Ngwewondo et al., 2020	Virtual- email and WhatsApp	32	Close-ended (yes/no/do not know) open-ended questions	N/A
Njingu et al., 2021	Virtual Twitter, Facebook, and WhatsApp	17	Close-ended questions	N/A
Reuben et al., 2021	Semi-structured online questionnaire	25	Close-ended questions	guidelines recommended for the

				awareness and prevention of COVID-19 by the NCDC
Šljivo1 A. et al., 2021	Anonymous online questionnaire	20	Close-ended (True or false, with an additional “do not know” option)	Zhong et al. Questionnaire
Sujarwoto et al., 2022	N/A	N/A	Close-ended and open-ended questions	WHO KAP guidelines and previous research studies
Takoudjou et al., 2021	Online survey	12	Close-ended questions	WHO Guidelines
Van Nhu et al., 2020	Online questionnaire	25	Close-ended	N/A
Wilson Brown et al., 2020	Telephone interviews and self-reported surveys	38	Close-ended and open-ended questions	WHO KAP guidelines and previous research studies
Xu H et al., 2020	Virtual-Weibo and Wechat	79	Close-ended questions	Designed by researcher
Xu Y et al., 2020	Online survey	34	Close-ended and open-ended questions	expert Chinese researchers and respiratory doctors with extensive experience in the field for

				designing and developing questions.
Yue et al., 2020	Virtual-WeChat, QQ	28	Close-ended questions	Health education manual of coronavirus disease published by the China Health Education Center
Zhong et al., 2020	Online-Wechat and Weibo	12	Close-ended (True or false, with an additional “do not know” option) questions.	Designed by researcher

3.5. Research outcomes

This review examined articles that addressed the KAP of the general population towards the COVID-19 pandemic. Data was compiled from 77,088 participants from studies conducted in 35 countries, covering all continents. The overall level of knowledge and preventive measures was considered satisfactory in 16 countries (Al,Marshoudi et al., 2021) (Azlan A. et al., 2020). Outcomes from table 6 identified, sociodemographic variables such as age, gender, income level, marital status, type of work, education level and background as predominant factors that could influence the level of KAP from low, moderate to high (Al Hanawi et al., 2020) and (Ferdous M et al, 2020).

Additionally, previous reports by Brankston G. (2021) outlined that risk perceptions, attitudes, and behaviors varied by demographic variables. Similarly, (Ferdous MZ. et al.,

2020), identified factors such as age, gender, education, and income level to influence the knowledge, attitudes, and behaviors of individuals. Al-Hanawi (2020), outlined in his study that men have less knowledge, less optimistic attitudes, and less good practice toward COVID-19 than women and found that older adults are likely to have better knowledge and practices than younger people. Statistically, knowledge of COVID-19's symptoms, mode of transmission, and attitudes toward the disease was adequate; 88.4% had heard of the vaccine, 59.3% would advise others to take it, 56.8% would take it themselves, and 47.5% would take a second dose. Males were more willing to be vaccinated (Al-Marshoudi et al., 2021).

Majority of the participants relied on government news as a major source of information. High level of education was positively linked to a higher level of KAP. There appears to be a high COVID-19 vaccine hesitancy among the participants, with several associated factors (Issanov A. et al., 2021). More than 90% of respondents reported confidence in complying with various public health measures. However, only 51% reported preparedness for illness in terms of expectation to work if sick or access to paid sick days and most participants held positive attitudes toward the successful control of COVID-19 (83.1%), the ability of Malaysia to conquer the disease (95.9%) and the way the Malaysian government was managing the crisis (89.9%) (Azlan A. et al., 2020).

Studies conducted by Van Nhu, H. (2020) outlined that 92.2% of the participants had a high level of knowledge regarding COVID-19 prevention measures, 68.6% had a positive attitude toward COVID-19 prevention measures, and 75.8% practiced all six measures for preventing the spread of the virus. Results from multiple linear regression indicated that lower knowledge scores were significantly associated with lower education level ($P < 0.05$). In contrast, poor preventive practices were common among male, young, and unemployed participants with significance levels of $P < 0.01$, $P = .000$, $P < 0.01$, respectively (Al-Ahdab Sanaa, et al., 2021). Outcomes were extracted from each of the eligible studies and were

briefly outlined per author (s) and year. This summary enabled an acute comparison and interpretation of the results by critically appraising the eligible articles on COVID-19 of the sampled populations. Table 6 presents a summary of the outcomes of each eligible study

Table 6: *Outcomes of each eligible study*

Year, Author, Citation	Outcomes
Al-Hanawi et al., 2020	The results showed that men have less knowledge, less optimistic attitudes, and less good practice toward COVID-19 than women. We also found that older adults are likely to have better knowledge and practices than younger people.
Al-Ahdab et al., 2021	Results from multiple linear regression indicated that lower knowledge scores were significantly associated with lower education level ($P < 0.05$). In contrast, poor preventive practices were common among male, young, and unemployed participants with significance levels of $P < 0.01$, $P = .000$, $P < 0.01$, respectively.
AL-Marshoudi et al., 2021	Knowledge of COVID-19's symptoms, mode of transmission, and attitudes toward the disease was adequate; 88.4% had heard of the vaccine, 59.3% would advise others to take it, 56.8% would take it themselves, and 47.5% would take a second dose. Males (CI = 2.37, OR = (2.00–2.81)) and Omani (CI = 1.956, OR = (4.595–2.397)) were more willing to be vaccinated.
Almalki M.J et al., 2021	Overall, participants demonstrated a good knowledge of COVID-19, correctly answering 77% of the knowledge questions. Most of the participants exhibited good attitudes and acceptable practices toward COVID-19.
Azlan Anis et al., 2020	The overall correct rate of the knowledge questionnaire was 80.5%. Most participants held positive attitudes toward the successful control of COVID-19 (83.1%), the ability of Malaysia to conquer the disease (95.9%) and the way the Malaysian government was managing the crisis (89.9%).
Al-Zalfawi et al., 2021	The survey results suggest that most of the Saudi population has sound knowledge and a positive attitude and perception.

Bates R. et al., 2020	Participants had low to moderate levels of knowledge about COVID-19. They expressed mixed levels of optimism about the world eventually controlling COVID-19, but they were very optimistic about Colombia's ability to control the disease. They reported significantly high levels of adoption of preventive practices.
Bates R. et al., 2020	Participants had moderate to high levels of knowledge. Participants expressed mixed attitudes about the eventual control of COVID-19 in Ecuador. Participants reported high levels of adoption of preventive practices.
Bates R. et al., 2021	Participants had a high level of knowledge about COVID-19. They expressed high levels of optimism that the world would eventually control COVID-19, but they were very pessimistic about the public authorities in Venezuela. Most participants adopted preventive practices.
Brankston G. et al., 2021	More than 90% of respondents reported confidence in complying with various public health measures. However, only 51% reported preparedness for illness in terms of expectation to work if sick or access to paid sick days. Risk perceptions, attitudes, and behaviours varied by demographic variables.
Devkota H.R et al., 2020	The study found varying degrees of correlation between Knowledge, Attitude and Practice that may increase as the pandemic evolves in Nepal. Knowledge and level of education had positive associations with attitude and adherence to precautionary measures.
El-Masry et al., 2021	Residents of the Al-Jouf region in Saudi Arabia have satisfactory levels of knowledge, optimistic attitudes, and good practices during the rapid rise period of the pandemic.
Fang et al., 2021	The respondents in China had good knowledge, positive attitudes, and active practice toward COVID19.
Ferdous et al., 2020	The level of KAP was based on factors like education level, geographical location, etc.
Gao et al., 2020	The Chinese public exhibited a good level of knowledge of COVID-19, a positive attitude, and high adherence to good practices.

Limoukou et al., 2022	Respondents generally had good knowledge of COVID-19 and a positive attitude towards using protective measures.
Imtiyaz et al., 2021	In general, scores suggested that participants possessed adequate knowledge (mean \pm standard deviation: 10.07 ± 1.134), had good attitudes (11.85 ± 1.42), and followed good practices (12.26 ± 1.42) regarding COVID-19. However, we found the correlations between KAP scores to be weak.
Iqbal et al., 2021	In addition, a low knowledge score is significantly associated with low confidence in successfully controlling COVID-19 and socially undesirable practices.
Islam et al., 2021	The findings reflect inadequate knowledge but more positive attitudes towards the COVID-19 vaccine among the general population in Bangladesh.
Issanov et al., 2021	There appears to be a high COVID-19 vaccine hesitancy among the participants, with several associated factors.
Karijo et al., 2021	There was high knowledge of COVID-19 symptoms, preventive strategies, and high adoption of preventive practices.
Lee et al., 2021	Knowledge directly affected both attitudes (e.g., perceived risk and efficacy belief) and practices (e.g., personal hygiene practices and social distancing).
Luo et al., 2022	Having adequate COVID-19 knowledge was not linked to higher involvement in precautionary behaviours.

Nakhostin-Ansari et al., 2021	Overall, Iranians showed a satisfactory KAP towards COVID-19.
Ngwewondo et al., 2020	The continuous increase in the number of cases and the overall good KAP warrants further investigation to assess the effectiveness of the measures put in place to curb the spread of the disease.
Njingu et al., 2021	Our findings suggest a significant gap in COVID-19 related knowledge, attitudes, and practices between rural and urban inhabitants in Cameroon.
Šljivo et al., 2021	Our study suggests that residents of Bosnia and Herzegovina have had good knowledge, an optimistic attitude, and appropriate practices towards COVID-19 during the first period of the outbreak.
Sujarwoto et al., 2022	The results of logistic regression analyses showed that more accurate knowledge was associated with more positive attitudes and more frequent best practices.
Wilson et al., 2020	The survey population demonstrated moderate COVID-19 knowledge, with significant differences between survey mode and educational level. Correct knowledge of COVID-19 was associated with appropriate practices in Maryland County.
Van Nhu et al., 2020	The results showed that 92.2% of the participants had a high knowledge level regarding COVID-19 prevention measures, 68.6% had a positive attitude toward COVID-19 prevention measures, and 75.8% practiced all six measures for preventing the spread of the virus
Xu H et al., 2020	We found high-risk perception, positive attitude, desirable knowledge, and a high level of adopting the four NPIs. The relevant knowledge, risk perception, and attitude were strong predictors of adapting the four NPIs

Xu Y. et al., 2021	Out of the enrolled participants who completed the survey, 85.5% responded positively toward the mandatory public health interventions implemented nationwide by the Chinese authorities.
Yue, S et al., 2021	We found that Chinese urban and rural residents held moderate COVID-19 showed a positive knowledge, practice and attitude toward the disease.
Zhong et al., 2020	Most Chinese residents of a relatively high socioeconomic status, particularly women, are knowledgeable about COVID-19, hold optimistic attitudes, and have appropriate practices toward COVID-19.

3.6. Discussion

A couple of studies conducted in Kenya, Liberia, China, Iran, Nepal, Bosnia, Saudi Arabia, Gabon reflected a moderate to high level of knowledge, optimistic attitudes, and good practice during the rapid rise period of the pandemic (Karijo et al., 2021) (El masry et al., 2021) (Fang et al., 2021) (Nakhostin et al., 2020) (limoukou et al., 2022) (Wilson et al., 2020) (Xu H et al., 2020) encouraging the development of more future interventions targeting vulnerable subgroups and closing the gap of KAP towards COVID-19. However, some studies classified the level of KAP according to a variety of features; gender, age group, place of residence, professional group, geographical location, and level of education (Brankston G et al., 2021) (Issanov et al., 2021). Stating these factors to be a major influence in KAP fluctuations based on the different characteristics. In one of the studies, the level of education was said to vary amongst the survey respondents, those who had a higher level of education turn to have a high KAP score whereas those who had a lower education level had a low KAP score (Wilson et al., 2020) (Zhong et al., 2020).

Few of the findings suggest a gap in COVID-19 related knowledge, attitudes, and practices between rural and urban inhabitants (Njingu et al., 2021). The remote or rural areas

have little or no access to healthcare facilities and are less industrialized leading to poor practices thus limiting disease eradication (Yues et al., 2021) (Ngwewondo et al., 2020) (Wilson W.J et al., 2020). However, other studies reported an issue regarding the beliefs of people in the less industrialized zone, Lee et al. (2021) therefore, there is an importance of awareness and belief in health actions for reducing disease severity and susceptibility, emphasizing the need for increased sensitization and awareness campaigns, particularly among rural dwellers. (Devkota et al., 2020).

3.7. Conclusion and suggestions for future research

Conclusively, findings suggest a call for attention of health-care policymakers to design need-based, locally adaptable, and practicable interventional strategies for target population (Imtiyaz et al., 2021). The need for vaccination and awareness campaigns are of foremost importance to curb the spread of the disease and combat any adversity regarding vaccines in terms of fear, vaccine hesitancy in order to promote herd immunity and reduce disease susceptibility. Lastly, providing wide access to healthcare facilities in rural areas could be of primordial importance in reducing socioeconomic disparities.

The corpus of this review consisted of the search strategy, PRISMA flowchart, research methodology, research objectives, selection strategy, outcomes, research gap and a conclusive paragraph. The following chapter (chapter 4) consists of the methodology which is a continuation of the thesis, and this chapter consists of the sampling procedures, sample size calculation, data management and measures, independent and dependent variables, analysis methods, data analysis and ethical considerations.

CHAPTER 4: METHODOLOGY FOR KAP

4.1. Sampling procedures

The survey was meticulously designed to suit the local context, drawing on various scientific resources on COVID-19, including studies by Achundo et al. (2020), Bates et al., Achari Kumari et al. (2021), and guidelines from the World Health Organization (WHO) on Knowledge, Attitudes, and Practices (KAP). Utilizing Survey Monkey as the platform, the questionnaire comprised 77 multiple-choice questions (MCQ) and three open-ended queries. Participants were required to consent to their participation by approving their involvement in the study, with providing personal information such as name and email being mandatory. Only individuals with internet access were eligible for participation, and the survey typically took around 15-20 minutes to complete.

Data collection spanned from December 1st, 2022, to February 28th, 2023.

Recruitment of respondents involved a referral methodology with three primary components:

1) Direct email invitations sent to individuals within the authors' personal networks, encouraging them to forward the recruitment link to potentially eligible and interested individuals; 2) A boosted Facebook post, backed by advertising, containing a link to the survey 3) Utilization of various social media platforms such as WhatsApp, LinkedIn, Facebook, and Instagram to reach potential respondents. It's important to note that while these convenience sampling methods facilitated recruitment, they may introduce selection bias and limit the generalizability of the results. To maintain data accuracy and integrity, each participant was allowed to submit only one questionnaire per IP address, thus preventing duplicate submissions.

The study population encompassed residents of both Canada and Cameroon from the general populace, with a minimum sample size requirement of 142 individuals from each country. Consent was obtained from 330 individuals, yet a total of 166 participants completed

the questionnaire in its entirety. Eligibility criteria stipulated participants to be aged 18 years and above, residing in either Canada or Cameroon, possessing the ability to read and write in English and/or French, and consenting to the study's terms. Moreover, in adherence to ethical principles outlined in the World Medical Association's declaration of Helsinki, participants were informed of their rights to withdraw from the survey at any point.

4.2. Sample size calculation

Recruitment was carried out through the principal investigator network. However, a sample size calculation was performed to ensure that the study met the minimum required sample size for statistical significance. To calculate the sample size for this survey, we hypothesized that at 80% confidence interval, 50% of the respondents would have a satisfactory KAP level of COVID-19. Using the Open-Source Epidemiologic Statistics for Public Health (OpenEpi), v.3.01 (updated 2013/04/06).

Population size (N): 1000

Anticipated % frequency (p)=50

Confidence limits (d)= 5%

Design effect (for cluster surveys-DEFF)-Random sample= 1.0

Sample size=152 (76 participants/country)

4.3. Measuring instruments

Studies within the social and health sciences involving research surveys include independent and dependent variables which are often perceived as a cause-and-effect relationship (Hoffmeyer et al., 2016). Pertaining to this, researchers might study how demographic factors like age, gender, or education level influence health-related knowledge, attitudes, and practices (KAP) in a population. For example, a more educated population is likely to exhibit a better understanding of public health recommendations and may demonstrate higher levels of compliance with them, thus contributing to more favorable

health related KAP outcomes over time. The statistical context of this study involves the dependent and independent variables which will be discussed further.

4.4. Independent and dependent variables

Independent variables

These factors were categorized based on estimates from statistics Canada (statcan.gc.ca). For sociodemographic variables, gender was coded as zero for men, and one for women. The age variable was divided into categories: 18-24 (reference category) and 25 and above statistics, Marital status was captured as binary, and a value of zero was used for marriage and one, two for others. Education was categorized into elementary, bachelor, and master's degree. Occupation was broken down into government, self-employed, private industry, and monthly income (1CAD = 423FCFA) was divided into three categories: < CAD 60,000, CAD 60,000 to 140,000, more than 140,000. We also controlled for the countries of residence: Cameroon and Canada.

Dependent variables

The second part of the questionnaire consisted of KAP items. The knowledge component had 30 questions: 5 discussing COVID-19 literacy, 25 pertaining to PHG (12 questions on NPIs and 13 questions on vaccines). It consisted of open-ended questions. The term "COVID-19" (as opposed to the more technical SARS-CoV-2) was employed, following Zhong et al (2020) because it is more easily understood by non-specialists. Respondents who were knowledgeable about the disease were considered to have met compliance. Additionally, attitudes towards COVID-19 were measured by 24 questions. All the questions focused on the participant's attitudes towards NPIs and vaccines with a "yes" or "no" option. Respondents who had positive thoughts installed by public health authorities were considered to have met compliance towards disease eradication. Finally, practices were assessed using 9 items, regarding respondent's practices to help in reducing disease spread. In

addition to asking participants to report if they had gone to crowded places and if they wore a face mask when outside their home during the pandemic, we also assessed if participants encouraged their families and friends to be vaccinated. The nature of the responses was MCQS and “yes” or “no” option.

4.5. Data management and measures

In this study, the scoring methodology used for assessing results was binary, like that of a previous study conducted by Sakr, S. et al (2021). Participants received a score of 1 for correct answers and 0 for incorrect ones. The overall scores for KAP were then categorized as satisfactory or non-satisfactory based on predetermined benchmarks: 1) Knowledge was deemed satisfactory if participants answered 15 or more out of 30 questions correctly. The maximum summation of all scores on the sub-scale equals thirty. A cut-off score <15 means not satisfactory, while a cut-off score ≥ 15 means satisfactory knowledge on the sub-scale of thirty. In addition, majority of the questions were top task questions, so participants could select the choices directly relevant to them therefore, participants who responded were given a score of one. However, other questions like ‘yes/no’ was assigned a score to rate the response of the respondents (YES = 1, NO = 0, I DON’T KNOW = 0).

Attitudes were categorized based on 'yes/no' responses, with a satisfactory score requiring 12 or more correct answers out of 24 questions. The attitude sub-section three-point rating scale included (YES = 1, NO = 0, I DON’T KNOW = 0) with scores assigned respectively (1,0,0). The maximum summation of all scores on the sub-scale equals twenty-four. A cut-off score <12 means non-satisfactory, while a cut-off score ≥ 12 means satisfactory on the sub-scale of twenty-four.

Practices were assessed by scoring 5 or more out of 9 questions correctly. The practice sub-section also has three-point rating scale (YES = 1, NO = 0, SOMETIMES = 0). The maximum summation of all scores on the sub-scale equals nine. A cut-off score <5

means poor practices, while a cut-off score ≥ 5 means good practices on the sub-scale of nine. These cut-off scores were determined according to a previous study on COVID-19 (Ferdous et al., 2022). Participants who met the criteria for all three components (knowledge, attitudes, and practices) were classified as having a satisfactory KAP. Conversely, those who fell short of the benchmarks were categorized as having a non-satisfactory KAP.

4.6. Analysis methods (SPSS and Excel)

Dependent variables: knowledge, attitudes, and practices (KAP) related to COVID-19, non-pharmaceutical interventions (NPI), and COVID-19 vaccines.

Independent variables: socio-demographic and socio-economic factors.

The data was processed by merging the French and English questionnaires in Excel, data entry, cleaning, coding, and analysis using IBM SPSS Statistics software (version 27 for Windows). Frequencies and descriptive statistics were calculated to summarize the KAP data, providing an overview of respondents' responses. The statistical difference in KAP responses between the two populations was assessed using cross-tabulations and chi-square tests. Pearson's correlation was conducted to evaluate the strength of relationships between KAP variables. Multiple linear regression was used to identify the strongest predictors of KAP, controlling for independent variables such as gender, age, education level, occupation, work status, income, and area of residency.

CHAPTER 5: KAP RESULTS

5.1. Socio-demographic and socio-economic profile of respondents

A total of 166 respondents were included in this preliminary survey. Table 7 below revealed respondents' statistics. Most respondents (73.5%, n = 122/166) were between the ages of 18–25 years. Similarly, most of the respondents (67.5%, n = 112/166) have a bachelor's and a master's degree. Respondents with a scientific/medical background accounted for 46.7% of the responses. In addition, 56% of the respondents resided in Canada (n=93/166) and 44% of the respondents resided in Cameroon. Majority of the respondents had an annual income ranged between FCFA/CAD 60000-140000 (61.4%, n=102/166). Most respondents were self-employed and worked within the private sector (79%, n=47.6; 30.7%, n=51).

Table 7: Socio-demographic and socio-economic variables of respondents

Socio-demographic variables	
Variables	Number of respondents (%)
Age (years)	
18-25	122 (73.5)
25+	44 (26.5)
Gender	
Male	67 (33.1)
Female	99 (66.9)
Level of education	
Elementary/Secondary	54 (32.5)
Bachelor's degree/master's degree or higher	112 (67.5)
Marital status	
Married	38 (22.9)
Single/divorced/widow	128 (77.1)
Ethnicity	
White	41 (27.1)
Asian	19 (11.4)

Black	79 (47.6)
Latin American	8 (4.8)
Middle East	15 (9.0)
Educational background	
Scientific	78 (46.7)
Non-scientific	89 (53.3)
Country of residence	
Canada	93 (56.0)
Cameroon	73 (44.0)
Socio-economic characteristics	
Occupation	
Private	51 (30.7)
Government/public	36 (21.7)
Self-employed, other areas of work	79 (47.6)
Annual income (CAD/FCFA)	
Less than 60,000 or 60,000	34 (20.5)
60,000-140,000.	102 (61.4)
More than \$140,000	30 (18.1)

5.2. Knowledge of respondents regarding COVID-19, NPIs and vaccines

Table 8 has been generated from detailed data provided in supplementary table 9. This table presents an overview of participants' responses, categorizing their knowledge levels as either satisfactory or non-satisfactory. Satisfactory knowledge indicates participants' ability to identify COVID symptoms and major health guidelines, aligning with recommendations from health officials. Conversely, non-satisfactory knowledge reflects a limited understanding of these critical aspects.

Most respondents were knowledgeable about the disease (n=103, 62.3%;). The majority reported their main source of information as news from national TV (52.0%, n=77/166) and as a second source, news from government agencies and discussion amongst

peers and family (45.3%, n=67; 35.8%, n=53). Majority of the respondents identified most of the symptoms of COVID-19 as fever, dry cough, fatigue, and myalgia and how it spread in the general population via droplets and contact with infected persons (47.0%, n=78; 85.5%, n= 142). The overall knowledge about public health guidelines like vaccines and non-pharmaceutical interventions (NPIs) was positive, respondents knew about the various prevention techniques like handwashing, utilization of hand sanitizers, wearing face masks, isolation, government recommended vaccines.

Table 8: Descriptive statistics of participants' knowledge regarding COVID-19, NPIs and vaccines

Knowledge			
Score		Frequency	Percent
Valid	Non-satisfactory	63	37.7
	Satisfactory	103	62.3
	Total	166	100.0
Total		166	

Table 9: Questionnaire on participants' knowledge regarding COVID-19, NPIs and vaccines

Knowledge about COVID-19	
Variables	Number of respondents (%)
2.1 What is your main source of information about COVID-19?	
News from National TV/Radio	77 (52.0)
Government agencies	67 (45.3)
Alternative health providers (e.g., naturopaths, homeopaths)	23 (15.5)
Discussion amongst friends and family	53 (35.8)
Health provider	35 (23.6)
Others (healthcare provider, social media epidemiologist, Non-profit organizations, published articles and medical journals,	13 (9.1)

medical research journals and independent research institutes like RKI, google, secret services)	
2.2. The main clinical symptoms of COVID-19 are:	
Fever	80 (48.2)
Fatigue	93 (56.0)
Dry cough	74 (44.6)
Myalgia	53 (31.9)
2.3. All people infected with COVID-19 will develop to severe cases.	
Yes	23 (13.9)
No, only the elderly are more likely	42 (25.3)
No, obese are more likely	74 (44.6)
No, young children are more likely	24 (14.5)
No, pregnant women are more likely	3 (1.7)
2.4. How does COVID-19 virus spread in the population?	
Through droplets from resp and breathing.	78 (47.0)
Through sexual transmission	142 (85.5)
Through sharing items like clothes, utensils, towels	23 (13.9)
Through contact with positive persons even if one is vaccinated	72 (43.4)
2.5. Is it necessary to follow the public health guidelines to prevent infection by the COVID-19 disease?	
Yes, very necessary	142 (74.3)
No	24 (25.7)
2.6. Which of the following have been, or are currently, public health guidelines	
Wear a face mask	82 (49.4)
Wash hands frequently with soap	103 (69.6)
Maintain at least 2m distance between people.	89 (53.6)
Sanitize your hands	82 (49.4)
Isolate yourself and avoid close contact with other people.	42 (25.3)
Take government recommended vaccines.	91 (54.8)
Avoid crowded places	72 (43.4)

Isolate yourself for two weeks if you catch COVID-19	75 (45.2)
Do not share food with others	18 (12.2)
2.7. Why are people instructed to avoid crowded places? (Choose all that apply)	
You are likely to come too close (less than 2 meters) to other people.	106 (71.6)
You may become infected if you touch another person	75 (44.9)
You share the breathing space with other people	75 (44.9)
Others	3 (2.1)
2.8. The most effective way to reduce the spread of COVID-19 is by isolating and treating people who are infected.	
Yes	124 (74.3)
No	42 (25.1)
2.9. People who have had contact with someone infected with COVID-19 virus should immediately isolate themselves in for 10-14 days.	
Yes	99 (66.9)
No	67 (33.1)
2.10. In Canada and Cameroon is the average citizen required by law to take covid vaccine?	
Yes, in Canada and in Cameroon	59 (35.5)
Not in Canada but yes in Cameroon	40 (24.1)
Yes, in Canada but not in Cameroon	44 (26.5)
Not in Canada and not in Cameroon	23 (13.9)
2.11. What are Non-Pharmaceutical Interventions (NPIs) ?	
NPIs are non-pharmaceutical agents believed to prevent COVID infection	80 (48.2)
NPIs are used to gain protection from infection	61 (36.5)
NPIs are used as therapeutic agents to help develop immunity	46 (27.7)
NPIs do not include hydroxychloroquine, chloroquine	26 (15.6)
NPIs do not include azithromycin, remdesivir	19 (11.4)
2.12. Do NPIs provide people with the benefits they are believed to provide?	
Yes	102 (69.4)
No	31 (18.7)

Not sure	14 (8.4)
2.13. Do you know if people became sick after using NPIs?	
Yes	109 (65.7)
No	57 (34.3)
2.14. Do you know if people have taken NPIs instead of COVID-19 vaccines to protect themselves?	
Yes	108 (65.1)
No	58 (34.9)
2.15. Have you taken an NPI?	
Yes	136 (81.9)
No	30 (18.1)
2.16. Which NPI did you take?	
I have not used an NPI	30 (18.1)
Lemon juice	54 (32.5)
Tequila shot	21 (12.7)
Hot green tea	61 (36.7)
2.17. Why did you take NPI?	
For their potential health benefits	46 (27.7)
To gain immunity against COVID-19	54 (32.5)
To protect myself from COVID-19	66 (39.8)
2.18. In general, are vaccines effective in protecting people from infectious diseases?	
Yes	135 (81.3)
No	31 (18.7)
2.19. Have you ever taken any vaccine in your life?	
Yes	135 (81.3)
No	31 (18.7)
2.2. If you have taken a vaccine in the past; identify which vaccines, you have taken;	
Tetanus, Diphtheria, and pertussis (Tdap)	88 (53.0)
Pertussis (whooping cough)	85 (51.2)
Polio, Hemophilus and influenza type B	71 (42.8)
Measle	36 (21.7)
Mumps	41 (24.7)

Meningococcal disease	58 (34.9)
Others (BCG, Hepatitis, HBC, HPV, typhoid)	29 (17.5)
2.20. Do you trust COVID vaccines?	
Yes	119 (71.7)
No	47 (28.3)
2.21. If the above question is answered yes, why?	
Because it will reduce my susceptibility from getting infected.	92 (68.1)
I entirely trust the pharmaceutical companies responsible for its production.	35 (10.8)
I don't want to get infected.	39 (21.1)
2.22. If the above question is answered no, why?	
They contain contaminants and can make you sick	31 (18.7)
They are made by companies that have a secret agenda	39 (17.5)
They are made to wipe off humans	7 (4.2)
They can make you sterile	35 (21.1)
They were not properly tested in clinical studies	42 (38.5)
2.23. Are physical distancing, frequent handwashing and wearing a mask sufficient to protect you from COVID-19 without having to take the vaccine?	
Yes	84 (50.6)
No	82 (49.4)
2.24. Have you taken COVID-19 vaccine?	
Yes	101 (60.8)
No	65 (39.2)
2.25. If you have not taken a COVID-19 vaccine, then please identify why? Identify all that are true.	
Because of previously existing health concerns	20 (12.0)
Because many vaccines cannot be trusted	40 (41.8)
Because many vaccines can cause health problems	16 (9.6)
Because COVID-19 vaccines cause health problems	6 (3.6)
Because wait times to receive the vaccine is too long	20 (12.0)
Because the COVID-19 vaccine is not effective	20 (12.0)

Because the COVID-19 vaccine is only effective against one variant(type) of the virus	15 (9.0)
2.26. If you took a COVID-19 vaccine, which vaccine did you take? Choose more than one if you have taken multiple types of COVID-19 vaccines.	
Pfizer	66 (39.7)
Johnson and Johnson.	24 (14.5)
Astra Zeneca.	23 (13.9)
Moderna	18 (10.8)
I did not take any COVID-19 vaccine	35 (21.1)
2.27. How many doses have you taken:	
One	92 (55.1)
Two	44 (26.3)
Three	25 (15.0)
Four	6 (3.6)
2.28. Which of the following technologies have been used to create the COVID-19 vaccine?	
None of the above	8 (4.8)
Vaccine developed using mRNA sequence	66 (39.8)
Vaccine developed using DNA sequence	25 (15.1)
Vaccine developed using RNA sequence	27 (16.3)
Vaccine developed using attenuated live virus	21 (12.6)
Vaccine developed using inactivated virus	22 (13.2)
Vaccine developed using inactivated toxic compounds	26 (15.6)
2.29. Which of the following methods used can be the most harmful to human health?	
None of the above	20 (12.0)
Vaccine developed using mRNA sequence	135 (80.8)
Vaccine developed using DNA sequence	129 (77.2)
Vaccine developed using RNA sequence	142 (85.0)
Vaccine developed using attenuated live virus	26 (15.6)
Vaccine developed using inactivated virus	12 (7.2)
Vaccine developed using inactivated toxic compounds	60 (35.9)

5.3. Attitudes of respondents regarding COVID-19, NPIs and vaccines

A report of participants attitudes towards COVID, NPIs and vaccines are stated below. Table 10 represents the general results of participants responses. This result aims to demonstrate if they had a satisfactory attitude i.e. the willingness and trust to take the vaccine, to partake and respect the recommended guidelines. Those who did not exert positive attitudes i.e. not willing to take vaccines and expressed doubts towards the vaccines their responses were not satisfactory. This table serves as a comprehensive summary, consolidating individual responses from supplementary table 11. It offers an overarching perspective on response frequencies, presented as percentages (%) and the number of respondents (n).

Participant's attitudes towards COVID-19, NPIs and vaccines was not satisfactory at a percentage of 70.1% (n=116). Most respondents had a poor attitude towards the COVID-19 pandemic as many thought the pandemic has been overstated (59.6%, n=99). Respondents' attitudes towards NPIs was not satisfactory, as many believed they were not efficient enough in protecting against COVID-19 (44.6%, n=74). According to many participants in the study, pharmaceutical companies seemed to make money from vaccines (83.7%, n=139). They had satisfactory attitudes towards vaccines, as the majority valued their importance by responding positively to COVID-19 vaccines being useful in preventing COVID-related infections, spreading, complications, hospitalizations and help in immunization. People also mentioned COVID vaccines would not render people I am totally confused here. Please help to understand this infertile (38.0%, n=63). However, some people mentioned not taking the COVID vaccine doubting about its reliability, as well as it not being thoroughly tested in animals and possibility of causing health problems (30.7%, n=51; 28.9%, n=48; 37.3%, n=62). In addition, participants believed vaccines were more efficient in protecting from infections compared to NPIs (38.0%, n=63).

Table 10: Descriptive statistics of participants' attitudes regarding COVID-19, NPIs and vaccines

Attitudes			
Score		Frequency	Percent
Valid	Non-satisfactory	116	70.1
	Satisfactory	50	29.9
	Total	166	100.0
Total		166	

Table 11: Questionnaire on participants' attitudes regarding COVID-19, NPIs and vaccines

Attitudes towards COVID-19, NPIs and Vaccines	
3.1. Do you think COVID-19 is harmful and therefore people are afraid?	
Yes	85 (51.2)
No	81 (48.8)
3.2. Why do you need to take the vaccine?	
To prevent getting COVID-19 infections.	110 (66.3)
To prevent complications and hospitalizations from being infected by a COVID-19 virus.	56 (33.7)
To immunize young people to help protect old people or those with pre-existing conditions.	75 (45.2)
I do not believe people should take the COVID-19 vaccines.	82 (49.4)
3.3. Do you believe that only vaccines can protect us from COVID-19? For example, the Pfizer vaccine.	
Yes	63 (38.0)
No	103 (62.0)
3.4. Vaccines have protected people in the past from getting infectious diseases; will they not protect people now from COVID-19?	
True; and they can protect people from COVID-19	88 (53.0)
True; but COVID-19 vaccines do not work like those vaccines.	53 (31.9)
Not true; and COVID-19 vaccines are also not effective.	25 (15.1)
3.5. Do you believe the NPIs are sufficient to stop the spread of COVID-19, compared to vaccines?	

Yes, they can.	129 (77.7)
No, they cannot	37 (22.3)
3.6. Why do you think, some people don't want to take the vaccine?	
Because the vaccine is not reliable	56 (33.8)
Because the vaccine is not tested and can make you sick	48 (28.9)
Vaccines can cause other health problems	62 (37.3)
3.7. Are (NPIs or vaccines) better for protecting people from COVID-19?	
Vaccines are better at protecting people.	63 (38.0)
NPIs are better at protecting people	33 (19.9)
Neither are good	38 (22.9)
Both are the same in protecting people	32 (19.2)
3.8. Can vaccines make people infertile?	
Yes	63 (38.0)
No	103 (62.0)
3.9. Do you think COVID-19 vaccines are more harmful because they have not been tested thoroughly in animals?	
Yes	103 (62.0)
No	63 (38.0)
3.10. Do you think you can rely on COVID-19 vaccines to stop the spread of COVID19?	
Yes	43 (25.9)
No	123 (74.1)
3.11. What can stop the spread of COVID-19?	
Non-pharmaceutical interventions	40 (24.1)
Vaccines currently in the market	5 (7.1)
Vaccines, that will be developed in the future	100 (56.2)
Herd-immunity	21 (12.6)
3.13. Do you think pharmaceutical companies make a lot of money from vaccines?	
Yes	126 (75.9)
No	40 (24.1)
3.14. Do you think authorities promote covid-19 vaccines for political and/or financial gain, rather than for public health?	
Yes	115 (69.3)

No	51 (30.7)
3.15. Do you think authorities promote vaccines to protect people?	
Yes	113 (68.1)
No	53 (31.9)
3.16. Do you agree that global COVID-19 infections will eventually be reduced to a level that most people will not have to worry about infection anymore?	
Yes	128 (77.1)
No	38 (22.9)
3.17. Do you think people have made money from COVID-19 vaccines?	
Yes	128 (77.1)
No	38 (22.9)
3.18. Are you willing to take additional COVID-19 vaccines if recommended?	
Yes	85 (51.2)
No	81 (48.8)
3.19. Have you persuaded anyone to not take the vaccine for COVID-19?	
Yes	41 (23.5)
No	127 (76.5)
3.20. Do you think the severity of the pandemic has been overstated in the media?	
Yes	96 (57.8)
No	70 (42.2)
3.21. Have your family and friends taken COVID-19 vaccines?	
Yes	108 (65.1)
No	58 (34.9)
3.22. Have you recommended to your family and friends to get a COVID-19 vaccination?	
Yes	109 (65.7)
No	57 (34.3)
3.23. Can you acquire immunity against COVID-19 without vaccination?	
Yes	99 (59.6)
No	67 (40.4)
3.24. Is herd- immunity possible without a COVID-19 vaccination?	
Yes	115 (69.3)

No	51 (30.7)
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5.4. Practices of respondents regarding COVID-19, NPIs and vaccines

A report of participants practices towards COVID, NPIs and vaccines are stated below. Table 12 represents the general results of participants responses, aiming to demonstrate if they had positive behavior (i.e. got vaccinated, encourage family to be vaccinated, practice the recommended measures). Those who did not exert positive attitudes i.e. did not take vaccines or did not practice guidelines like not going to crowded places, their responses were not satisfactory. This table gives us an overall view of the frequency in terms of percentage (%) and number of respondents (n). In addition, table 13 consists of detailed responses from participants and the variables as well.

The participants in the study demonstrated a high level of willingness to effectively practice the recommendations set forth by public health authorities, including NPIs and vaccines. Approximately 52.1% of participants indicated satisfaction with their compliance level, suggesting a strong commitment to adhering to recommended public health guidelines. This adherence was reflected in behaviors such as wearing face masks, advocating for vaccination among family and friends, and avoiding crowded places. Moreover, most respondents displayed awareness of both the positive and negative health effects associated with vaccines. They acknowledged the increasing morbidity rate as a significant pressure point on the healthcare system, emphasizing the importance of implementing measures to reduce transmission rates.

Overall, these findings highlight positive practices towards public health measures and a willingness to contribute to efforts aimed at mitigating the impact of covid-19. The high level of compliance with recommended guidelines suggests a collective effort to combat the spread of the virus and protect public health.

Table 12: Descriptive statistics of participants' practices regarding COVID-19, NPIs and vaccines

Practices			
Score		Frequency	Percent
Valid	Non-Satisfactory	79	47.9
	Satisfactory	87	52.1
	Total	166	100.0
Total		167	

Table 13: Questionnaire on participants' practices regarding COVID-19, NPIs and vaccines

Practices Towards COVID-19, vaccines and NPI	
4.1. In recent days, have you been in crowded places without a mask?	
Yes	75 (45.2)
No	91 (54.8)
4.2. In recent days have you left the house without the intention of using a mask when in close proximity to others?	
Yes	73 (44.0)
No	93 (56.0)
4.3. Do you support any one or more of the following statements. Choose all that apply.	
There is sufficient data regarding COVID-19 vaccines' safety and efficacy released by the government.	112 (67.1)
Many people are taking COVID-19 vaccine.	102 (61.4)
My healthcare professional/doctor has recommended that I take a COVID-19 vaccine.	48 (28.9)
I think taking a COVID-19 vaccine will help in eradicating COVID-19 infections in my country.	31 (18.7)
I think that taking a COVID-19 vaccine is a societal responsibility	45 (27.1)
I believe that many of my role models/political leaders/senior doctors/scientists have taken COVID-19 vaccine	37 (22.3)

4.4. I feel the benefits of taking the COVID-19 vaccine outweighs the risks involved	
Yes	93 (56.0)
No	73 (44.0)
4.5. Is the cost of receiving a COVID- 19 vaccine paid for completely by your government and other agencies?	
Yes	116 (70.0)
No	50 (30.0)
4.6. Do you think some people who got sick put pressure on the health system?	
Yes	109 (67.0)
No	57 (33.0)
4.7. Which vaccine did you take, and would you recommend as the best with least health effects?	
Pfizer	144 (86.7)
Astra Zeneca	46 (27.7)
Moderna	124 (74.7)
Johnson & Johnson	31 (18.7)
4.8. Which vaccine is believed to be the worst with the most adverse health effects?	
Pfizer	44 (26.5)
Astra Zeneca	143 (86.1)
Moderna	18 (10.8)
Johnson & Johnson	142 (85.5)
4.9. If you get COVID-19 once, can you get it again?	
Yes	127 (72.9)
No	39 (27.1)

Note: The word "eradication" was used in question 4.3 above to refer to the complete removal of the virus from the planet with no further risk of it affecting any population, as opposed to "elimination," which is limited to reducing the prevalence of a disease to zero within specific groups, regions, or countries

5.5. Cross-tabulations analysis of sociodemographic variables

Table 14 presents crosstabulation results between Canada and Cameroon for the socio-demographic and socio-economic variables. The different counts and percentages were outlined; with 80.6% (n= 75) of respondents between 18-25 of age from Canada and 34.2% (n=47), few of the respondents were above 25 years of age. In addition, 45.2% (n=42) of males and 64.8% (n=51) of females were from Canada. Most participants belonged to the black and white ethnic group (Canada, n=42 (45.2%) white; Cameroon, n=57 (78.1%)).

Moreover, 83.6% and 54.8% of respondents from Cameroon and Canada had achieved a bachelor/master's degree (n= 61, n=51) and majority of the participants were divorce/single/widow in both Cameroon (n=65, 89.0%) and Canada (n=63, 67.7%). Lastly, majority of the participants had a non-scientific background, and others had a scientific background (non-scientific, n=50; Scientific, n=43).

Respondents worked within the private sector in Canada (n=44, 47.3%) and others in Cameroon were self-employed (n=46, 63.0%). In addition, 58.1% and 65.8% of the participants had a salary range between 60,000 to 140,000 CAD/FCFA (n=54, n=48).

Table 14: Cross-tabulations of sociodemographic variables by country

Sociodemographic variables		
Variables	Canada (%)	Cameroon (%)
Age		
18-25	75 (80.6)	47(34.2)
25+	18 (19.4)	26 (35.6)

Gender		
Male	42 (45.2)	25 (34.2)
Female	51 (64.8)	48 (35.8)
You may belong to one or more racial/cultural groups.		
White	42 (45.2)	3 (4.1)
Asian	13 (14.0)	6 (8.2)
Black	22 (23.7)	57 (78.1)
Latin America	7 (7.5)	1(1.4)
Middle East	9 (9.7)	6 (8.2)
Level of education		
Elementary/Secondary	42 (45.2)	12 (16.4)
Bachelor's degree/ Master's degree	51 (54.8)	61 (83.6)
Marital status		
Married	30 (32.3)	8 (11.0)
Divorced/single/widow	63 (67.7)	65 (89.0)
Educational background		
Scientific	43 (46.2)	34 (46.6)
Non-scientific	50 (53.8)	39 (53.4)
Socio-economic variables		
Level of income (Canadian dollars/CFA)		
60,000/Less than \$60,000	24 (25.8)	10 (13.7)
60,000 to 140,000	54 (58.1)	48 (65.8)
More than 140,000	15 (16.1)	15 (20.5)
Occupation		
Private	44 (47.3)	7 (9.6)
Government/public	16 (17.2)	20 (27.4)
Self employed/other areas of work	33 (35.5)	46 (63.0)

5.6. Demographic factors influencing knowledge, attitudes and practices of respondents

Analyses were conducted between the sociodemographic variables and KAP variables, with a chi-square test performed to assess the level of significance. Women were more knowledgeable than men (n=77, 74.8%) at $p < 0.001$.

Respondents aged 18-25 years were more knowledgeable (n=77, 74.8%) than the other age group (n=26, 25.2%) at $p=0.637$. In addition, Blacks (n=42, 40.8%), Whites (n=20, 19.4%), and Asians (n=19, 18.4%) were more knowledgeable than other ethnic groups at $p < 0.001$. Widows/divorced individuals were more knowledgeable than other participants at $p < 0.001$.

Participants with bachelor's and master's degrees were more knowledgeable (n= 73, 70.9%) at $p = 0.231$. Surprisingly, participants with a non-scientific background (n= 67, 64.4%) were more knowledgeable than those with a scientific background at $p = 0.155$. Self-employed individuals and those within the public sector were more knowledgeable at $p = 0.005$.

Respondents with an income between 60,000 to 140,000 CAD or FCFA were more knowledgeable (n=79, 76.7%) than other income groups at $p < 0.001$. The knowledge level of Canadians was satisfactory (n=67, 65.0%) compared to Cameroonians at $p = 0.003$. (See Table 15).

Table 15: Knowledge by demographic variables with p-values

Variables			Knowledge		Chi-square (X ²)	Degree of freedom (df)	p-value
			Non-satisfactory (%)	Satisfactory (%)			
Gender	Male	Count	41 (65.1)	26 (25.2)	25.772	1	<0.001
	Female	Count	22 (34.9)	77 (74.8)			
Total		Count	63 (100)	103 (100)			
Age	18-25	Count	45 (71.4)	77 (74.8)	0.222	1	0.637
	25+	Count	18 (28.6)	26 (25.2)			
Total		Count	63 (100)	103 (100)			
Ethnicity	White	Count	25 (39.7)	20 (19.4)	31.566	4	<0.001
	Asian	Count	0	19 (18.4)			
	Black	Count	37 (58.7)	42 (40.8)			
	Latin America	Count	1 (1.6)	7 (6.8)			
	Middle East	Count	0	15 (14.6)			
Total		Count	63 (100)	103 (100)			

Education level	Elementary/Secondary	Count	24 (38.1)	30 (29.1)	1.433	1	0.231
	Bachelor/Master	Count	39 (61.9)	73 (70.9)			
Total		Count	63 (100)	103 (100)			
Marrital status	Married	Count	29 (46)	9 (8.7)	30.801	1	<0.001
	Divorced/single/widow	Count	34 (54)	94 (91.3)			
Total		Count	63 (100)	103 (100)			
Education background	Non-scientific	Count	22 (34.9)	67 (64.4)	13.719	1	0.155
	Scientific	Count	41 (65.1)	37 (35.6)			
Total		Count	63 (100)	104 (100)			
Occupation	Private	Count	26 (41.3)	25 (24.3)	10.658	2	0.005
	Government	Count	6 (9.5)	30 (29.1)			
	Self-employed	Count	31 (49.2)	48 (46.6)			
Total		Count	63 (100)	103 (100)			
Income level	60000 or less than 60000 CAD	Count	31 (49.2)	3 (2.9)	51.984	2	<0.001
	60000 to 140000 CAD	Count	23 (36.5)	79 (76.7)			
	More than 140000 CAD	Count	9 (4.3)	21 (20.4)			
Total		Count	63 (100)	103 (100)			
Residence	Canada	Count	26 (41.3)	67 (65.0)	8.971	1	0.003
	Cameroon	Count	37 (58.7)	36 (35.0)			
Total		Count	63 (100)	103 (100)			

The level of attitude in the female category was satisfactory (62.0%) at $p = 0.324$. The younger the respondents, the poorer the level of attitudes towards COVID-19 ($n=91$, 78%) at $p=0.165$. Whites, Asians, and blacks had more positive attitudes compared to other ethnic groups ($n=6$, 12.0%; $n=10$, 20.0%; $n=31$, 62.0%) at $p < 0.001$.

Participants with a scientific background had more positive attitudes ($n=31$, 62.0%) compared to individuals with non-scientific backgrounds at $p < 0.001$. Participants with a master's/bachelor's degree had more positive attitudes ($n=48$, 96.0%) compared to others at $p=0.273$. Participants working in the government/public sector and self-employed individuals had more positive attitudes ($n=13$, 26.0%; $n=30$, 60.0%) compared to respondents in other sectors at $p = 0.004$.

Participants with an annual income between 60,000 to 140,000 CAD/FCFA had poorer attitudes compared to other income groups at $p < 0.001$. Respondents in Cameroon ($n=30$, 60%) had better attitudes than Canadians at $p = 0.100$.

Table 16: Attitudes by demographic variables with p-values

Variables	Attitudes		Chi-square (X^2)	Degree of freedom (df)	P-value
	Non-satisfactory (%)	Satisfactory (%)			

Gender	Male	Count	48 (41.4)	19 (38.0)	0.166	1	0.324
	Female	Count	68 (58.6)	31 (62.0)			
Total		Count	116 (100)	50 (100)			
Age	18-25	Count	91 (78.4)	31 (62.0)	4.852	1	0.165
	25+	Count	25 (21.6)	19 (38.0)			
Total		Count	116 (100)	50 (100)			
Ethnicity	White	Count	39 (33.6)	6 (12.0)	16.910	4	<0.001
	Asian	Count	9 (7.8)	10 (20.0)			
	Black	Count	48 (41.4)	31 (62.0)			
	Latin America	Count	7 (6.0)	1 (2.0)			
	Middle East	Count	13 (11.2)	2 (4.0)			
Total		Count	116 (100)	50 (100)			
Level of education	Elementary/Secondary	Count	52 (44.8)	2 (4.0)	26.536	1	0.273
	Bachelor/Master	Count	64 (55.2)	48 (96.0)			
Total		Count	116 (100)	50 (100)			
Marrital status	Married	Count	31 (26.7)	7 (14.0)	3.205	1	<0.001
	Divorced/Single/Widow	Count	85 (73.3)	43 (86.0)			
Total		Count	116 (100)	50 (100)			
Education background	Non-scientific	Count	58 (50.0)	19 (38)	2.023	1	<0.001
	Scientific	Count	58 (50.0)	31 (62.0)			
Total		Count	116 (100)	50 (100)			
Occupation	Private	Count	44 (37.9)	7 (14.0)	9.442	2	0.004
	Government	Count	23 (19.8)	13 (26.0)			
	Self-employed	Count	49 (42.2)	30 (60.0)			
Total		Count	116 (100)	50 (100)			
Income level	60000 or less than 60000 CAD	Count	31 (26.7)	3 (6.0)	13.706	2	<0.001
	60000 to 140000 CAD	Count	61 (52.6)	41 (82.0)			
	More than 140000 CAD	Count	24 (20.7)	6 (12.0)			
Total		Count	116 (100)	50 (100)			
Residence	Canada	Count	73 (62.9)	20 (40.0)	7.47	1	0.100
	Cameroon	Count	43 (37.1)	30 (60.0)			
Total		Count	116 (100)	50 (100)			

Women practiced the recommended public health measures (n=55, 63.2%) such as avoiding crowded places, taking recommended vaccines, etc., with a significance level of p=0.684. Individuals aged 18-25 years had positive practices at p=0.028. Blacks and Whites recorded positive practices (n=45, 51.7%; n=16, 18.4%) compared to other ethnic groups at p=0.002.

Participants with a scientific background exhibited a positive behavioral impact (n=62, 71.3%) compared to individuals with a non-scientific background at p < 0.001. Participants with a master's or bachelor's degree showed a positive behavioral impact (n=57, 65.5%) at p= 0.155.

Self-employed individuals and government workers had positive practices (n=47, 54.0%; n=23, 26.4%) towards the disease at p=0.009. Individuals with higher financial status, earning between 60,000 and 140,000 CAD/FCFA, exhibited positive practices (n=60, 69.0%;

n=21, 24.1%) at $p < 0.001$. Canadians recorded positive practices compared to Cameroonians (n=54, 62.1%) at $p = 0.006$.

Table 17: Practices by demographic variables with p-values

Variables			Practices		Chi-square (X ²)	Degree of freedom (df)	P-value
			Non-satisfactory (%)	Satisfactory (%)			
Gender	Male	Count	35 (44.3)	32 (36.8)	0.973	1	0.684
	Female	Count	44 (55.7)	55 (63.2)			
Total		Count	79 (100)	87 (100)			
Age	18-25	Count	62 (78.5)	60 (69.0)	1.924	1	0.028
	25+	Count	17 (21.5)	27 (31.0)			
Total		Count	79 (100)	87 (100)			
Ethnicity	White	Count	29 (36.7)	16 (18.4)	21.191	4	0.002
	Asian	Count	8 (10.1)	11 (12.6)			
	Black	Count	34 (43.0)	45 (51.7)			
	Latin America	Count	7 (8.9)	1 (1.1)			
	Middle East	Count	1(1.3)	14 (16.1)			
Total		Count	79 (100)	87 (100)			
Education level	Elementary/Secondary	Count	29 (36.7)	25 (28.7)	1.199	1	<0.001
	Bachelor/Master	Count	50 (63.3)	62 (71.3)			
Total		Count	79 (100)	87 (100)			
Marrital status	Married	Count	28 (35.4)	10 (11.5)	13.453	1	0.073
	Divorced/Single/Widow	Count	51 (64.6)	77 (88.5)			
Total		Count	79 (100)	87 (100)			
Education background	Non- scientific	Count	47 (59.5)	30 (34.5)	10.414	1	0.155
	Scientific	Count	32 (40.5)	57 (65.5)			
Total		Count	79 (100)	87 (100)			
Occupation	Private	Count	34 (43.0)	17 (19.5)	10.932	2	0.009
	Government	Count	13 (16.5)	23 (26.4)			
	Self-employed	Count	32 (40.4)	47 (54.0)			
Total		Count	79 (100)	87 (100)			
Income level	60000 or less than 60000 CAD	Count	28 (35.4)	6 (6.9)	21.877	2	<0.001
	60000 to 140000 CAD	Count	42 (53.2)	60 (69.0)			
	More than 140000 CAD	Count	9 (11.4)	21 (24.1)			
Total		Count	97 (100)	87 (100)			
Residence	Canada	Count	39 (49.4)	54 (62.1)	2.711	1	0.006
	Cameroon	Count	40 (50.6)	33 (37.9)			
Total		Count	79 (100)	87 (100)			

5.7. Influence of residence on knowledge, attitudes, practices and other sociodemographic variables

A Chi-square test was performed to explore whether there's a meaningful connection between a person's knowledge and where they live. The results showed a p-value of 0.003, which is well below the typical threshold of 0.05 used to determine statistical significance. This means that the relationship between knowledge and residence is indeed significant. In simpler terms, where a person lives—whether in Canada or Cameroon—appears to influence their level of knowledge, indicating that these two factors are linked.

Table 18: Knowledge of COVID-19, NPIs and vaccines based on residence

Variables			Residence		Total	Chi-square (X ²)	Degree of freedom (df)	P- value
			Canada	Cameroon				
Knowledge	Non-satisfactory	Count	26	37	63	8.971	1	P= .003
		Expected Count	35.3	27.7	63.0			
		% within knowledge	41.3%	58.7%	100.0%			
	Satisfactory	Count	67	36	103			
		Expected Count	57.7	45.3	103.0			
		% within knowledge	65.0%	35.0%	100.0%			
Total		Count	93	73	166			
		Expected Count	93.0	73.0	166.0			
		% knowledge	56.0%	44.0%	100.0%			

A Chi-square test was conducted to examine whether there's a connection between people's attitudes and where they live. The expected counts for attitudes showed that for "non-satisfactory" attitudes, 65 individuals were expected to be from Canada and 51 from Cameroon, making a total of 116. For "satisfactory" attitudes, the expected counts were 28 from Canada and 22 from Cameroon, adding up to 50 in total. Looking at the percentages within the attitude categories, 62.9% of people with a "non-satisfactory" attitude live in Canada, while 37.1% live in Cameroon. On the other hand, 40.0% of people with a "satisfactory" attitude are from Canada, and 60.0% are from Cameroon. The Chi-square

statistic revealed a p-value of 0.006, which is statistically significant, as it's below the common threshold of 0.05. This suggests that attitudes are influenced by where people live, meaning that the likelihood of having a "satisfactory" or "non-satisfactory" attitude is different depending on whether someone lives in Canada or Cameroon.

Table 19: Attitudes towards COVID-19, NPIs and vaccines based on residence

Variables			Residence		Total	P-value	Chi-square (X ²)	Degree of freedom (df)
			Canada	Cameroon				
Attitudes	Non-satisfactory	Count	73	43	116	P=.006	7.457	1
		Expected Count	65.0	51.0	116.0			
		% within attitudes	62.9%	37.1%	100.0%			
	Satisfactory	Count	20	30	50			
		Expected Count	28.0	22.0	50.0			
		% within attitudes	40.0%	60.0%	100.0%			
Total		Count	93	73	166			
		Expected Count	93.0	73.0	166.0			
		% within attitudes	56.0%	44.0%	100.0%			

Chi-square test was conducted to explore the relationship between practices (satisfactory vs. non-satisfactory) and where people live (Canada vs. Cameroon). The expected counts for non-satisfactory practices were 44.3 for Canada and 34.7 for Cameroon, while for satisfactory practices, they were 48.7 for Canada and 38.3 for Cameroon. Looking at the percentages, 49.4% of people with non-satisfactory practices were from Canada, while 50.6% were from Cameroon. For those with satisfactory practices, 62.1% were from Canada and 37.9% from Cameroon. The Chi-square test yielded a p-value of 0.100, which is above the 0.05 threshold for statistical significance. This means there is no strong evidence to suggest a significant relationship between practices and residence. In other words, where someone lives—whether in Canada or Cameroon—does not appear to have a major impact on whether their practices are considered satisfactory or non-satisfactory. Although there are differences in the proportions of satisfactory and non-satisfactory practices between the two countries, these differences aren't large enough to be statistically significant. This suggests

that the factors influencing practices may be similar in both countries or that the differences are too small to be detected with the current data.

Table 20: Practices of COVID-19, NPIs and vaccines based on residence

Crosstab						Chi-square (X ²)	Degree of freedom	
Variables			Residence		Total			P-value
			Canada	Cameroon				
Practices	Non-satisfactory	Count	39	40	79	P= .100	2.711	
		Expected Count	44.3	34.7	79.0			
		% within practices	49.4%	50.6%	100.0%			
	Satisfactory	Count	54	33	87			
		Expected Count	48.7	38.3	87.0			
		% within practices	62.1%	37.9%	100.0%			
Total	Count	93	73	166				
	Expected Count	93.0	73.0	166.0				
	% within practices	56.0%	44.0%	100.0%				

A Chi-square test was conducted to see if there's a connection between gender (male vs. female) and where people live (Canada vs. Cameroon). The expected counts showed that for males, 37.5 were expected to be in Canada and 29.5 in Cameroon, while for females, 55.5 were expected in Canada and 43.5 in Cameroon. The actual numbers showed that 42 males (62.7% of all males) were in Canada, and 25 males (37.3%) were in Cameroon. For females, 51 were in Canada (51.5% of all females) and 48 were in Cameroon (48.5%). The Chi-square test result gave a p-value of 0.155, which is above the 0.05 threshold, meaning that there's no statistically significant relationship between gender and residence. The observed numbers for both males and females in each country were very close to the expected values, with only minor differences that aren't large enough to be considered significant. This suggests that the distribution of males and females across Canada and Cameroon is very similar, and any differences that exist are likely due to chance rather than any meaningful connection to where someone lives.

Table 21: Gender distribution by residence with chi-square test

Crosstab								
Variables			Residence		Total	P-value	Chi-square (X ²)	Degree of freedom (df)
			Canada	Cameroon				
Gender	Male	Count	42	25	67	P= 0.155	2.024	1
		Expected count	37.5	29.5	67.0			
		% within gender	62.7%	37.3%	100.0%			
	Female	Count	51	48	99			
		Expected count	55.5	43.5	99.0			
		% within gender	51.5%	48.5%	100.0%			
Total		Count	93	73	166			
		Expected count	93.0	73.0	166.0			
		% within gender	56.0%	44.0%	100.0%			

The Chi-square test showed a statistically significant relationship between age (18-25 v0s. 25+) and where people live (Canada vs. Cameroon), with a p-value of 0.018. This suggests that age distribution is different between the two countries. For the 18-25 age group, a larger proportion, 61.5%, live in Canada, while only 38.5% are in Cameroon. On the other hand, the 25+ age group is more heavily represented in Cameroon, with 59.1% living there compared to 40.9% in Canada. These differences imply that younger people are more likely to move to Canada, possibly for educational or economic opportunities, while older individuals may prefer to stay in or return to Cameroon, perhaps due to factors like family connections or career stability.

Table 22: Age distribution by residence with chi-square test

Crosstab								
Variables			Residence		Total	P-value	Chi-square (X ²)	Degree of freedom (df)
			Canada	Cameroon				
Age	18-24	Count	75	47	122	P= .018	5.552	1
		Expected Count	68.3	53.7	122.0			
		% within age	61.5%	38.5%	100.0%			
	25+	Count	18	26	44			
		Expected Count	24.7	19.3	44.0			
		% within age	40.9%	59.1%	100.0%			

Total	Count	93	73	166			
	Expected Count	93.0	73.0	166.0			
	% within age	56.0%	44.0%	100.0%			

The Chi-square test ($p < 0.001$) indicates a significant relationship between ethnicity and where people live, showing that ethnic groups are distributed differently between Canada and Cameroon. White individuals are overwhelmingly based in Canada, making up 93.3% of the group there. In contrast, Black individuals are more likely to live in Cameroon, with 72.2% of them residing there. South Asians are more evenly spread, with 68.4% living in Canada. Latin American and Southeast Asian individuals are also more likely to live in Canada. These patterns suggest that migration trends, historical ties, and economic factors play a significant role in shaping the ethnic distribution across the two countries, with some groups more inclined to migrate to Canada, while others remain in Cameroon.

Table 23: Ethnic distribution by residence with chi-square test

Crosstab								
Variables			Residence		Total	P-value	Chi-square (X ²)	Degree of freedom (df)
			Canada	Cameroon				
Ethnicity	White	Count	42	3	45	P < .001	55.380	4
		Expected Count	25.2	19.8	45.0			
		% within Ethnicity	93.3%	6.7%	100.0%			
	Asian	Count	13	6	19			
		Expected Count	10.6	8.4	19.0			
		% within Ethnicity	68.4%	31.6%	100.0%			
	Black	Count	22	57	79			
		Expected Count	44.3	34.7	79.0			
		% within Ethnicity	27.8%	72.2%	100.0%			
	Latin America	Count	7	1	8			
		Expected Count	4.5	3.5	8.0			
		% within Ethnicity	87.5%	12.5%	100.0%			
	Middle East	Count	9	6	15			

		Expected Count	8.4	6.6	15.0			
		% within Ethnicity	60.0%	40.0%	100.0%			
Total		Count	93	73	166			
		Expected Count	93.0	73.0	166.0			
		% within Ethnicity	56.0%	44.0%	100.0%			

The Chi-square test ($p < 0.001$) reveals a significant relationship between education level and where people live, showing that education levels are distributed differently between Canada and Cameroon. A larger-than-expected proportion of individuals with elementary or secondary education live in Canada, making up 77.8% of the group, while only 22.2% of them reside in Cameroon. On the other hand, for individuals with bachelor's or master's degrees, the distribution is more balanced, though Cameroon has a slight overrepresentation, with 54.5% of this group living there, compared to 45.5% in Canada. These findings suggest that migration trends likely play a role, with those holding higher levels of education tending to move to Canada, while individuals with lower education levels may be more likely to stay in or return to Cameroon.

Table 24: Educational level distribution by residence with chi-square test

Crosstab								
Variables			Residence		Total	P-value	Chi-square (X ²)	Degree of freedom
			Canada	Cameroon				
Education level	Elementary/Secondary	Count	42	12	54	P<.001	15.373	1
		Expected Count	30.3	23.7	54.0			
		% within Education level	77.8%	22.2%	100.0%			
	Bachelor/Master	Count	51	61	112			
		Expected Count	62.7	49.3	112.0			
		% within Education level	45.5%	54.5%	100.0%			
Total		Count	93	73	166			

	Expected Count	93.0	73.0	166.0			
	% within Education level	56.0%	44.0%	100.0%			

The Chi-square test ($p < 0.001$) shows a significant relationship between marital status and where people live, indicating that marital status is distributed differently between Canada and Cameroon. A larger proportion of married individuals live in Canada, making up 78.9% of the married group, while only 21.1% of married people reside in Cameroon. On the other hand, the divorced, single, or widowed group is more evenly split, with 49.2% living in Canada and 50.8% in Cameroon. These findings suggest that married individuals may be more likely to migrate to Canada, while the divorced, single, or widowed group is more evenly distributed between the two countries. This could be influenced by migration patterns, personal circumstances, or social factors.

Table 25: Marital status distribution by residence with chi-square test

Crosstab								
Variables			Residence		Total	P-value	Chi-square (X ²)	Degree of freedom (df)
			Canada	Cameroon				
Marrital status	Married	Count	30	8	38	P<.001	10.511	1
		Expected Count	21.3	16.7	38.0			
		% within Marrital status	78.9%	21.1%	100.0%			
	Divorced/Single/Widow	Count	63	65	128			
		Expected Count	71.7	56.3	128.0			
		% within Marrital status	49.2%	50.8%	100.0%			
Total	Count	93	73	166				
	Expected Count	93.0	73.0	166.0				
	% within Marrital status	56.0%	44.0%	100.0%				

The chi-square test for occupation and residence shows a highly significant relationship ($p < 0.001$), indicating that occupation types are distributed differently between Canada and Cameroon. Majority (86.3%) of individuals in the private sector work in Canada,

suggesting better economic opportunities in this sector there. In contrast, the government/public sector is more evenly distributed, with a slightly higher proportion (55.6%) in Cameroon. The self-employed group is also more evenly split, with a slight majority (58.2%) in Cameroon. These differences likely reflect economic conditions and migration patterns, with Canada attracting more private sector workers and Cameroon having a stronger representation in government/public and self-employment sectors.

Table 26: Occupation distribution by residence with chi-square test

Crosstab								
Variables			Residence		Total	P-value	Chi-square (X ²)	Degree of freedom (df)
			Canada	Cameroon				
Occupation	Private	Count	44	7	51	P<.001	27.415	2
		Expected Count	28.6	22.4	51.0			
		% within Occupation	86.3%	13.7%	100.0%			
	Government/Public	Count	16	20	36			
		Expected Count	20.2	15.8	36.0			
		% within Occupation	44.4%	55.6%	100.0%			
	Self-employed	Count	33	46	79			
		Expected Count	44.3	34.7	79.0			
		% within Occupation	41.8%	58.2%	100.0%			
Total	Count		93	73	166			
	Expected Count		93.0	73.0	166.0			
	% within Occupation		56.0%	44.0%	100.0%			

The chi-square test for income level and residence shows no significant relationship ($p = 0.152$), indicating that income level is not strongly associated with whether an individual lives in Canada or Cameroon. The distribution of income levels is fairly similar across the two countries. A higher proportion of individuals with incomes of 60,000 or less live in Canada, but this difference is not statistically significant. The income brackets of 60,000 to 140,000 CAD and more than 140,000 CAD show a more even distribution between the two countries. This suggests that income level does not significantly influence whether someone

resides in Canada or Cameroon, possibly due to similar income distributions or insufficient sample size to detect smaller differences.

Table 27: Income level distribution by residence with chi-square test

Crosstab								
Variables			Residence		Total	P-value	Chi-square (X ²)	Degree of freedom (df)
			Canada	Cameroon				
Income level	60000 or less than 60000 CAD	Count	24	10	34	P=.152	3.763	2
		Expected Count	19.0	15.0	34.0			
		% within Income level	70.6%	29.4%	100.0%			
	60000 to 140000 CAD	Count	54	48	102			
		Expected Count	57.1	44.9	102.0			
		% within Income level	52.9%	47.1%	100.0%			
	More than 140000 CAD	Count	15	15	30			
		Expected Count	16.8	13.2	30.0			
		% within Income level	50.0%	50.0%	100.0%			
Total		Count	93	73	166			
		Expected Count	93.0	73.0	166.0			
		% within Income level	56.0%	44.0%	100.0%			

5.8. Correlation analysis

Pearson correlation analysis was conducted to examine the relationships between the dependent variable (Knowledge, Attitudes, and Practices - KAP) and various independent sociodemographic and socio-economic factors. The analysis identified several significant correlations: gender ($r = 0.394$, $p < .001$), ethnicity ($r = 0.229$, $p < .003$), marital status ($r = 0.431$, $p < .001$), education background ($r = 0.287$, $p < .001$), and income level ($r = 0.410$, $p < .001$) were significantly correlated with knowledge. Additionally, a significant correlation was found between knowledge and practices ($r = 0.249$, $p < .001$), indicating that individuals with better knowledge tend to have better practices.

For attitudes, significant correlations were found with age ($r = 0.171$, $p < .028$), education level ($r = 0.400$, $p < .001$), residence ($r = 0.212$, $p < .006$), and type of industry ($r =$

0.201, $p < .009$). Practices were significantly correlated with ethnicity ($r = 0.234$, $p < .002$), marital status ($r = 0.285$, $p < .001$), educational background ($r = 0.250$, $p < .001$), and income level ($r = 0.332$, $p < .001$). However, no statistically significant correlations were found between knowledge and attitudes ($r = 0.108$, $p = 0.168$), or between attitudes and practices ($r = 0.152$, $p = 0.05$), as both did not meet the threshold for significance ($p < 0.05$).

These results suggest that while many sociodemographic factors are significantly associated with different aspects of KAP, certain relationships, particularly between attitudes and practices, were not statistically significant.

Table 28: Correlation analysis between the KAP components and sociodemographic variables.

Variables		Knowledge	Attitudes	Practices
Gender	Pearson Correlation	.394**	.032	.077
	Sig. (2-tailed)	<.001	.686	.327
	N	166	166	166
Age	Pearson Correlation	-.037	.171*	.108
	Sig. (2-tailed)	.640	.028	.167
	N	166	166	166
Ethnicity	Pearson Correlation	.229**	.048	.234**
	Sig. (2-tailed)	.003	.537	.002
	N	166	166	166
Education level	Pearson Correlation	.093	.400**	.085
	Sig. (2-tailed)	.234	<.001	.276
	N	166	166	166
Marital status	Pearson Correlation	.431**	.139	.285**
	Sig. (2-tailed)	<.001	.074	<.001

	N	166	166	166
Education background	Pearson Correlation	.287**	.110	.250**
	Sig. (2-tailed)	<.001	.157	.001
	N	167	166	166
Occupation	Pearson Correlation	.080	.220**	.213**
	Sig. (2-tailed)	.303	.004	.006
	N	166	166	166
Income level	Pearson Correlation	.410**	.089	.332**
	Sig. (2-tailed)	<.001	.254	<.001
	N	166	166	166
Residence	Pearson Correlation	-.232**	.212**	-.128
	Sig. (2-tailed)	.003	.006	.101
	N	166	166	166
Knowledge	Pearson Correlation	1	.108	.249**
	Sig. (2-tailed)		.168	.001
	N	167	166	166
Attitudes	Pearson Correlation	.108	1	.152
	Sig. (2-tailed)	.168		.050
	N	166	166	166
Practices	Pearson Correlation	.249**	.152	1
	Sig. (2-tailed)	.001	.050	
	N	166	166	166

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

5.9. Regression analysis

Tables 29, 30, and 31 present the results of linear regression analysis, which was conducted to identify key predictors of knowledge, attitudes, and practices (KAP). The regression models controlled for several sociodemographic factors, including age, gender, ethnicity, marital status, education level, educational background, place of residence, industry, and income. By using linear regression, we aimed to determine which of these variables significantly predicted KAP, providing insights into how these sociodemographic factors influence individuals' knowledge, attitudes, and practices related to disease spread.

Marital Status and Income as Predictors of Knowledge:

Marital status and income level were found to be strong predictors of knowledge at a significant level of $p < .001$. This suggests that individuals who are married and have higher income levels tend to have higher levels of knowledge compared to those who are single or have lower income levels. These findings imply that marital status and income play important roles in shaping individuals' knowledge levels, possibly due to factors such as access to resources, social support, or life experiences associated with marriage and higher income.

Residence (Geographical Location) and its Relationship with Knowledge:

Although residence was identified as significant at $p < .001$, it had a negative correlation with knowledge. Despite its significance, residence was not considered a strong predictor of knowledge. This suggests that while geographical location may influence knowledge levels, other factors such as marital status and income have a stronger impact.

Table 29: Model 1- Linear regression analysis of predictors for knowledge

Model 1: Knowledge	Standardized Coefficients		95.0% Confidence Interval for B	
	B	Sig.	Lower Bound	Upper Bound
(Constant)	.094	.239	-.063	.251
Gender	.159	.026	.019	.300

Age	.062	.437	-.096	.220
Ethnicity	.020	.508	-.039	.078
Education level	-.080	.337	-.245	.084
Marrital status	.438	<.001	.256	.619
Education background	.079	.220	-.048	.207
Occupation	-.021	.636	-.109	.067
Income level	.213	<.001	.097	.330
Residence	-.371	<.001	-.502	-.240
Industry	.026	.517	-.053	.106

Level of Education as a Predictor of Attitudes

In the subsequent model, holding all other independent variables constant, the level of education emerged as a robust predictor of individuals' attitudes, demonstrating statistical significance at a level of $p < .001$. This finding suggests that education level plays a substantial role in shaping attitudes, highlighting its importance as a determinant factor in the context being studied.

Table 30: Model 2- Linear regression analysis of predictors for attitudes

Model : attitudes	Unstandardized Coefficients		95.0% Confidence Interval for B	
	B	Sig.	Lower Bound	Upper Bound
(Constant)	.079	.391	-.102	.259
Gender	-.053	.514	-.214	.108
Age	.008	.928	-.173	.190
Ethnicity	-.047	.166	-.114	.020
Education level	.364	<.001	.175	.553
Marrital status	.063	.553	-.146	.271
Education background	.051	.492	-.095	.197
Occupation	-.019	.711	-.119	.082

Income level	-.013	.842	-.147	.120
Residence	.115	.133	-.035	.265
Industry	.052	.260	-.039	.144

Residence and Marital Status as a Predictor of Practices:

In the third model, marital status and residence was identified as a strong predictor of practices at a significant level of $p < .001$. This suggests that marital status influences individuals' behaviors or practices. Married individuals may exhibit different practices compared to unmarried individuals due to factors such as family responsibilities, social norms, or shared decision-making processes within the household.

Table 31: Model 3 –Linear regression analysis of predictors for practices

Model : Practices		Unstandardized Coefficients		95.0% Confidence Interval for B	
		B	Sig.	Lower Bound	Upper Bound
1	(Constant)	.067	.473	-.117	.252
	Gender	-.141	.093	-.306	.024
	Age	.165	.081	-.021	.350
	Ethnicity	.041	.235	-.027	.110
	Education level	-.211	.033	-.405	-.017
	Marrital status	.396	<.001	.183	.610
	Education background	.105	.168	-.045	.254
	Occupation	.092	.080	-.011	.195
	Income level	.155	.027	.018	.291
	Residence	-.306	<.001	-.460	-.153
	Industry	.067	.159	-.026	.161

Conclusively, the regression analysis indicates that sociodemographic factors such as residence (geographical location), education level, marital status, and level of income are significant predictors of knowledge, attitudes, and practices. These findings highlight the

importance of considering sociodemographic factors in understanding and addressing disparities in knowledge, attitudes, and practices related to the study domain.

CHAPTER 6: DISCUSSION

To the best of our knowledge, this research is one of the first studies examining the KAP towards COVID-19, NPIs and vaccines between Cameroon and Canada. Through this chapter we aim at discussing the global challenges faced by residents in both countries as well as their common grounds and comparing our results to previous research which gives more credibility to our study. Firstly, the first part of this discussion addresses the general results of the participants based on the three KAP components, stating the assumptions and relating it to other previous studies with similar findings.

Most respondents (62.3%) demonstrated a high level of knowledge about the disease, which can be attributed to the well-educated and active population in both countries, comprising mainly bachelor's and master's degree holders aged between 18 to 25 years. This finding aligns with previous studies by Ngwewondo et al. (2020), Achundou et al. (2020), and Brankston et al. (2021), which also reported a high level of knowledge among respondents regarding COVID-19 and public health guidelines (PHG).

However, it is noteworthy that while knowledge levels were high, most respondents (29.9%) did exhibit a non-satisfactory attitude towards the disease and PHG. This discrepancy may be attributed to the non-scientific background of the majority of participants. This finding is consistent with the study conducted by Achundou et al. (2020), which reported a prevalence of only 28% positive attitudes towards COVID-19. It is important to highlight that while knowledge levels may be adequate, attitudes towards COVID-19 prevention were found to be significantly associated with inadequate attitudes, as demonstrated in the study by Zhong et al. (2020). This underscores the importance of addressing not only knowledge gaps but also fostering positive attitudes towards COVID-19 prevention and public health measures.

Additionally, compliance towards practices related to COVID-19 prevention was found to be satisfactory, with 52.1% of participants demonstrating adherence to recommended practices. This level of compliance may be attributed to the composition of the participant population, which primarily consists of an active demographic aged between 18-25 years. This finding aligns with the results reported by Achundou et al. (2020), where a prevalence of 51.6% positive practices towards COVID-19 was observed. Together, these findings suggest a relatively high level of adherence to recommended practices among young adults, highlighting the potential impact of age and demographic factors on compliance behavior.

The second part of this discussion consists of describing these factors that influence KAP and associating other studies with similar results.

Age emerges as a key factor in understanding patterns of disease spread within populations, as highlighted by Clouston et al. (2017). According to the World Health Organization (WHO), an active population comprised of youths may be more effective in combatting disease spread compared to other age groups due to their access to pandemic-related information, resources, and higher levels of immunization (WHO, 2020). In our study, age was identified as a strong predictor of Knowledge, Attitudes, and Practices (KAP), with most participants falling within the 18-25 age group. However, findings from a similar study conducted in Canada, as reported by Brankston G. et al. (2021), suggest that younger adults may exhibit attitudes of invulnerability and demonstrate little or no compliance with public health measures, potentially contributing to disease transmission. Conversely, older adults may adopt more cautious behaviors, perceiving themselves to be at higher risk for severe illness from COVID-19, as noted by Halaji et al. (2021). Previous research, such as that conducted by Achundou et al. (2021), indicates that individuals above 50 years of age may be more susceptible to contamination but are also more likely to adhere strictly to preventive

measures to reduce the risk of developing severe illness. These findings emphasize on the complex relationship between age, risk perception, and adherence to preventive measures in the context of disease spread. Understanding these dynamics is crucial for developing targeted interventions and public health strategies tailored to different age groups to mitigate the impact of COVID-19 and other infectious diseases.

According to the World Health Organization (WHO), **gender** encompasses socially constructed characteristics, norms, roles, and relations that may vary across societies (WHO, 2023). In our study, women demonstrated higher levels of Knowledge, Attitudes, and Practices (KAP) compared to men, with 77 (74.8%) women exhibiting better knowledge, 31 (62.0%) having more positive attitudes, and 55 (63.2%) demonstrating better practices. These findings are consistent with previous research, including a study by Clouston et al. (2017), which reported that women tend to have higher health literacy than men, though the underlying reasons for these differences remain unclear. Additionally, our study aligns with the findings of Achondou et al. (2020), further supporting the notion that women may exhibit superior KAP levels regarding COVID-19. The WHO also highlights that men's increased risk of acquiring SARS-CoV-2 may be linked to their non-compliance with public health guidelines, such as wearing face masks and getting vaccinated, compared to women. This emphasizes the importance of understanding and addressing gender disparities in health behavior to effectively mitigate the spread of COVID-19 and promote equitable health outcomes across genders.

Income level often serves as a primary determinant of individuals' ability to access healthcare services (Hager E. et al., 2020). The level of income is often described as the amount of earnings an individual or household receives. Pertaining to this research individuals who had an income level between CAD/FCFA 60, 000-140, 000 or more in both countries exhibited a satisfactory KAP (knowledge = 76.7%, 20.4%; Attitudes = 82.0%,

12.0% and Practices = 69.0%, 24.1%) whereas those with lower earnings may face financial barriers such as high out-of-pocket costs for medical care, insurance premiums, deductibles, and co-payments, which can limit their ability to seek timely and appropriate healthcare services. Statistically 70% of individuals in this study outlined that, the vaccine was free of cost in their countries of residence. Also, findings state that individuals with low socioeconomic status have little or no accessibility to healthcare, therefore, disparities in socioeconomic status might lead to fluctuations in healthcare accessibility while high financial status leads to increase chances of accessibility to healthcare, perhaps, higher chances of combatting disease spread. This study is in line with one conducted by Achundou et al, (2020) as well as Brankston G. et al (2021) stating that high income earners tend to have better practices thereby respecting health guidelines.

In general, **educational level** is said to have a direct effect on knowledge and consequently on practices as less educated individuals are less likely to adopt preventive measures (Issanov, A et al, 2021), therefore the more someone is educated, the better his/her understanding on the preventive strategies related to COVID-19 (Achundou et al, 2020). Similarly, this study identified education level as a strong predictor of KAP and there was a strong correlation between knowledge and practices. A couple of studies outlined the level of education as an essential factor in combatting disease eradication. High education level leads to a better KAP towards COVID-19 and understanding public health guidelines and vice-versa (Ferdous MZ et al, 2020).

Surprisingly, the marital status was identified as a predominant factor of the KAP variables in the regression model. To date, few studies have explored the relationship between marital satisfaction and well-being (Katja Margelisch et al, 2017). A previous study states that married individuals are healthier and tend to live longer than those who are single, divorced, or widowed. But not all marriages are equal: unhappy marriages provide fewer

benefits than happy ones (Lawrence et al, 2019). As per the result of this study divorced, single and widows had a satisfactory KAP towards COVID-19, NPIs and vaccines (n=94, 91.3%; n=43, 86.0%; n=77, 88.5%) compared to married couples. In addition, the regression results states marital status as a strong predictor of KAP in disease eradication. Conclusively, the presumption could be that the divorced/single/widow are happy being alone compared to others who are single and consequently turn to focus on their wellbeing, health and other factors that could directly influence their health positively. Future research and interventions aimed at promoting desirable outcomes in knowledge, attitudes, and practices may benefit from targeting these sociodemographic factors to effectively tailor interventions and support strategies.

6.1. Knowledge

Acquiring knowledge is fundamental as it shapes individuals' thoughts and daily practices, particularly in the context of understanding and responding to public health challenges such as COVID-19. In this study, compliance to knowledge regarding COVID-19, Non-Pharmaceutical Interventions (NPIs), and vaccines was observed at 62.3%, underscoring the significance of knowledge in influencing behavioral practices.

The source of information plays a crucial role in knowledge acquisition, with many respondents in this study identifying national TV (52%) and government agencies (45.3%) as the main sources of information. These findings are similar to those reported by Hager et al. (2020), where national TV (44%) and social media platforms (84%) were primary sources of information for young adults surveyed in Egypt and Nigeria. These sources proved instrumental in facilitating the adoption of better behavioral practices among respondents. Furthermore, participants demonstrated an understanding of key aspects of COVID-19, such as identifying common symptoms like fever (48.2%), fatigue (56.0%), and dry cough (44.6%), as well as recognizing modes of disease transmission, including contact with

individuals who tested positive (43.4%). However, it is important to note that knowledge gaps have been identified in previous studies, such as the one conducted in Cameroon by Achondou et al. (2020), particularly related to disease transmission. Overall, these findings reveal the critical role of knowledge acquisition and information sources in shaping individuals' understanding and responses to COVID19. Addressing knowledge gaps and ensuring access to reliable information sources are essential steps in promoting informed decision-making and fostering positive behavioral practices to mitigate the spread of the disease.

6.2. Attitudes

The prevalence of positive attitudes in this study was 29.9%. This percentage was low and in line with a study conducted in Cameroon whose prevalence was 28% (Achundou et al., 2020). Similarly, to other studies, some of the respondents agreed on the importance of public health guidelines such as handwashing, vaccines, and other preventive measures in reducing the chances of being infected. A similar positive attitude towards most preventive measures were earlier reported in a study between Egypt and Nigeria (Hager E. et al., 2020). In addition, majority of the participants reported vaccines not to be effective in acquiring herd immunity (n=115, 69.3%), however, a good number of them still took the vaccine and would encourage their families and friends to be vaccinated. A similar study conducted in Canada by Griffith G. et al, 2021, outlined vaccine safety, political skepticism, authority figures, and deficits in medical and epidemiologic literacy concerning the benefits of vaccination as factors responsible for vaccine hesitancy and distrust. In a previous study, similar results were obtained adequate knowledge of participants towards COVID-19 prevention was found to be significantly associated with inadequate attitude towards the COVID-19 epidemic in this study (Zhong et al, 2020).

6.3. Practices

The overall level of practice of the participants was satisfactory at 52.1%. Similarly, a study conducted in Cameroon by Achondou et al, 2020, revealed that, the level of practice towards COVID-19 preventive measures was reasonable among 51.6% of respondents. Most respondents used face masks when going to crowded places to reduce the chances of being infected (n=91, 54.8%). Many expressed doubts towards vaccines but would still recommend and encourage their families and friends to be vaccinated. Others identified Pfizer and Moderna to be the best vaccine with the least health effect (n=144, 86.7%; n=124, 74.7%). However, others identified Astra Zeneca and Johnson & Johnson as vaccines with the most adverse health effect (n=143, 86.1%; n=142, 85.5%).

In this study, the correlation analysis indicates a strong association between knowledge and practice. Participants residing in Canada demonstrated superior knowledge (65.0%) and adherence to recommended practices (62.1%) compared to those in Cameroon, who displayed positive attitudes (60.0%) but weaker practices. These findings suggest that individuals in Canada may have greater access to accurate information, possibly due to robust government measures such as vaccination campaigns and widespread dissemination of news via various media platforms. Conversely, residents in Cameroon exhibited positive attitudes, likely reflecting a willingness to adhere to guidelines. However, the absence of reinforced government measures may have hindered the development of stronger practices and access to reliable information on COVID-19, NPIs, and vaccines.

6.4. Participant's comments

The questionnaire consisted of MCQs and open-ended questions, each participant was given the chance to comment on the different questions if the options weren't within their expectations. Apart from fever, fatigue, dry cough, and headache as symptoms of COVID-19, participants identified others such as changes in taste and smell, fear of loss of

smell, sore throat, breathing difficulties, cough, and headache. They also identified ways through which COVID spread via aerosols, magnetic waves, and touching body parts like nose, and eyes. Other public health guidelines were identified like taking hot drinks and avoiding the use of masks as it does not protect but render susceptible/vulnerable to diseases and become a host for micro-organisms thus facilitating disease transmission and the sanitization of grocery cards as it may be a host for micro-organisms.

The study encountered several limitations that may impact on the interpretation and generalizability of the findings. Firstly, inaccessibility to internet in Cameroon, particularly in rural areas, limited the participation of a significant proportion of the population in the online survey. This may have introduced selection bias, as individuals without internet access may have different perspectives and experiences related to COVID-19. Secondly, the heterogeneity of the study population, with Canadians being four times more populous than Cameroonians, raises concerns about the generalizability of the results. Differences in healthcare systems, policies, and pandemic experiences between the two countries further compound this issue, making it challenging to extrapolate findings to other populations or contexts.

Additionally, the study did not account for participants' nationality during data collection, overlooking the potential influence of cultural, socioeconomic, and healthcare access differences between Cameroonians residing in Canada and Canadians residing in Cameroon. This oversight may have implications for understanding the nuances of COVID-19 experiences and responses among diverse racial and ethnic groups. Furthermore, variations in financial and healthcare accessibility between blacks residing in Canada and whites residing in Cameroon were not considered, potentially limiting the depth of analysis regarding disparities in pandemic experiences and outcomes.

6.5. The interdisciplinarity

Interdisciplinarity involves combining insights from multiple disciplines. My study on COVID-19 spans across various fields including economics, sociology, public health, politics, and healthcare systems. Traditional approaches that focus solely on one discipline may not adequately capture the complex impacts of COVID19 on health. To address this, we need interdisciplinary perspectives to understand the multifaceted challenges posed by COVID-19 and its vaccines. By integrating knowledge from different disciplines, we can develop comprehensive strategies to combat the disease.

Our study aims to delve into various factors influencing disease transmission and the effectiveness of public health measures. Through interdisciplinary collaboration, we seek to unravel why some individuals adhere to regulations while others do not and explore the reasons behind vaccine hesitancy. By embracing interdisciplinarity, we hope to gain deeper insights into the knowledge, attitudes, and practices related to COVID-19, ultimately contributing to more effective response efforts.

6.6. General limitations pertaining to this thesis

This study represents a pioneering cross-sectional analysis focusing on international comparisons, a practice often encouraged in research. However, several limitations were encountered during the thesis composition.

It was noted that accessing reliable and comparable data between developed and developing countries posed challenges, potentially impacting the study's comprehensiveness. Notably, there was limited information available concerning the similarities and differences between the selected countries. For instance, in Cameroon, there was a lack of consistent statistical updates regarding population incidence, morbidity, and mortality, unlike in Canada. Additionally, the absence of comparative international studies, particularly between the chosen countries, resulted in a scarcity of relevant literature to support this study. However,

existing country-specific studies were utilized to augment the research content. Furthermore, the variations in historical contexts, and socio-economic factors may introduce complexities when comparing outcomes between countries. For example, Cameroon is often perceived as a country with a poor economy compared to Canada. Furthermore, variations in measurement methodologies, definitions, and reporting standards between the two countries can impede direct comparisons. For example, the criteria used to define and report health indicators such as disease prevalence or mortality rates may differ between Cameroon and Canada. This discrepancy can make it challenging to draw meaningful comparisons between the two countries' health outcomes. Moreover, relying solely on aggregate data from entire countries can obscure within-country variations and lead to misleading interpretations. For instance, while Cameroon may be perceived as having a generally lower economic status compared to Canada, there may be significant regional disparities within each country that are not captured in national-level data.

The choice of countries for comparison may not be representative of the broader population, potentially biasing the findings. Differences in sampling techniques and sample sizes between countries may affect the generalizability of results. Controlling all relevant variables across countries may be challenging, leading to omitted variable bias and potential confounding effects.

Findings from a specific developed-developing country pair may not be applicable to other countries or regions, limiting the generalizability of results. Economic, political, and social conditions within countries may change over time, affecting the relevance and applicability of conclusions drawn from the study. While international comparisons can highlight disparities and inform policy debates, the applicability of policy recommendations across different contexts should be carefully considered.

CHAPTER 7: CONCLUSIONS

Women, individuals with higher income, and those residing in Canada demonstrated higher levels of knowledge. Positive attitudes towards COVID-19 were more common among individuals with scientific backgrounds, and those in the government/public sector and self-employed individuals. Younger individuals (18-25) and those with higher income were more likely to practice recommended health behaviors. Canadians exhibited better practices than Cameroonians. While residence played a significant role in knowledge and attitudes, it did not have a strong influence on practices.

In conclusion, our study recommends the development of need-based, locally adaptable, and practicable interventional strategies by healthcare policymakers to promote adherence to health practices among the target population. Key interventions such as vaccination, awareness campaigns, and adequate monitoring of social media platforms are essential to combat misinformation, fear, and vaccine hesitancy, thereby promoting herd immunity and reducing disease susceptibility. Furthermore, the lessons learned from COVID-19 emphasizes the importance of considering social determinants of health in pandemic research priorities, public health goals, and policy implementation efforts.

CHAPTER 8: DIRECTIONS FOR FUTURE STUDIES

8.1. Bi-national and multinational surveys

This study is conducted as a bi-national endeavor, focusing on two countries with distinct backgrounds, cultures, and racial compositions. The primary objective is to gain insight into the diverse perspectives individuals bring to the table regarding disease spread, with a specific focus on addressing major infections such as COVID19. By exploring these perspectives through a holistic approach, the study aims to shed light on the unique challenges and opportunities present in different countries.

Conducting surveys across these two nations allows for the evaluation of differences in knowledge, attitudes, and practices related to disease spread, providing valuable insights into the factors that shape public health responses in diverse contexts. By understanding these variations, decision-makers can tailor interventions and policies to address specific needs and preferences, ultimately contributing to efforts to flatten the curve of disease spread on a global scale.

Furthermore, the findings of this study have the potential to inform evidence based decision-making processes, guiding the development of strategies and interventions that are culturally sensitive, contextually relevant, and effective in mitigating the impact of infectious diseases. By leveraging the knowledge generated through bi-national research collaborations, people can work towards building more resilient and inclusive healthcare systems capable of addressing the complex challenges posed by emerging infectious diseases.

8.2. Qualitative studies: In-depth interviews

In-depth interviews serve as a valuable qualitative research method aimed at understanding participants' perspectives, experiences, and behaviors in greater depth. The primary objective of these interviews is to delve into the richness of participants' responses,

exploring nuances and insights that may not be captured through other data collection methods such as surveys or observations.

In the context of exploring Knowledge, Attitudes, and Practices (KAP) related to disease spread and vaccine acceptance, in-depth interviews offer a platform for participants to express their thoughts, beliefs, and behaviors in their own words. Researchers can probe deeper into participants' responses, seeking clarification, exploring contradictions, and uncovering underlying motivations or influences. For example, researchers may inquire about participants' experiences with encouraging their families to take vaccines, probing beyond simple yes or no responses. Through in-depth questioning, researchers can explore the specific actions participants took to facilitate vaccine uptake among their families, such as assisting with appointment scheduling or providing informational support. Additionally, researchers can explore the barriers or challenges participants encountered in promoting vaccine acceptance within their families, as well as any facilitators or strategies they employed to overcome these challenges.

Overall, in-depth interviews offer a flexible and dynamic approach to qualitative inquiry, allowing researchers to adapt the interview process as needed to explore emergent themes, uncover new insights, and gain a deeper understanding of participants' perspectives and behaviors related to disease spread and vaccine acceptance. Through these interviews, researchers can contribute valuable insights to inform public health efforts and interventions aimed at addressing vaccine hesitancy and promoting disease prevention behaviors.

8.3. Longitudinal studies

Extending data collection beyond the initial timeframe could provide a more comprehensive understanding of how disease patterns, particularly related to COVID-19 spread, evolve over time in relation to changes in individuals' knowledge, attitudes, and behaviors. While the data collected in this study offers a snapshot of the

population's KAP within a specific timeframe, longitudinal data collection would allow for the assessment of behavioral changes over an extended period. Cross-sectional studies, including the one conducted in this study, provide valuable insights into the status of KAP related to disease spread.

However, they may not capture temporal trends or changes in behavior that occur over time. By extending data collection efforts, researchers can track shifts in public perceptions, behaviors, and disease patterns, enabling a deeper understanding of the dynamic nature of infectious disease transmission and response. Longitudinal studies offer the opportunity to assess the impact of interventions, policy changes, and external factors on individuals' KAP and disease outcomes over time. They also allow for the identification of trends, patterns, and predictors of behavior change, facilitating the development of targeted interventions and public health strategies. In conclusion, extending data collection efforts beyond the initial timeframe would enhance our ability to monitor and respond to changes in disease patterns and public behaviors, ultimately contributing to more effective disease prevention and control efforts.

8.4. Underrepresentation

The recruitment of participants posed a significant limitation in this study, potentially impacting on the representation and generalizability of the findings. As such, replication of the study with a larger sample size could address this limitation and enhance the significance of the research. By recruiting a larger and more diverse sample, researchers can ensure that a broader range of perspectives and experiences are captured, leading to more robust and reliable conclusions. A highly represented population would also allow for subgroup analyses and comparisons, facilitating a deeper understanding of the factors influencing knowledge, attitudes, and behaviors related to disease spread. Additionally, a larger sample size increases the statistical power of the study, enhancing the ability to detect

meaningful associations and effects. This, in turn, strengthens the validity and reliability of the findings, making them more applicable to the broader population.

8.5. Persons with disabilities or comorbidities

The study was conducted online, which inherently presents limitations in reaching certain populations, including individuals with disabilities and comorbidities. These populations may face barriers to accessing and participating in online surveys due to various factors such as limited internet access, digital literacy challenges, and physical or cognitive impairments that affect their ability to engage with online platforms. Furthermore, the survey did not include specific questions aimed at understanding the present condition of the respondents and how they were affected by the pandemic, such as inquiries about pre-existing health conditions, disabilities, or comorbidities. As a result, individuals with disabilities and comorbidities were likely underrepresented in the study sample, and their perspectives and experiences related to COVID-19 may not have been adequately captured.

This underrepresentation is concerning because individuals with disabilities and comorbidities may face unique challenges and vulnerabilities during the pandemic, including barriers to accessing healthcare, increased risk of infection and severe illness, and disruptions to support services and resources. By excluding these populations from the study, important insights into their experiences, needs, and responses to COVID-19 may have been overlooked. Moving forward, future research efforts should strive to be more inclusive and representative by actively engaging and accommodating individuals with disabilities and comorbidities. This may involve implementing accessible survey designs, providing alternative data collection methods (e.g., phone interviews, mail-in surveys), and incorporating questions that specifically address the experiences and needs of these populations during the pandemic. By doing so, researchers can ensure that the voices and

perspectives of individuals with disabilities and comorbidities are heard and integrated into efforts to address the ongoing challenges posed by COVID-19.

CHAPTER 9: REFERENCES

Adriana Milazzo, Lynne Giles, Natalie Parent, Sophie McCarthy, Caroline Laurence, (2022) The impact of non-pharmaceutical interventions on COVID-19 cases in South Australia and Victoria, *Australian and New Zealand Journal of Public Health*, Volume 46(4), 482-487 <https://doi.org/10.1111/1753-6405.13249>.

Agley, J., Xiao, Y. Misinformation about COVID-19: evidence for differential latent profiles and a strong association with trust in science. *BMC Public Health* **21**, 89 (2021).
<https://doi.org/10.1186/s12889-020-10103-x>

Ahuja P, Kaur J, Puri D, Meshram P, Matreja PS, Kumar J. A cross-sectional study of knowledge, attitude and practices of medical students regarding COVID-19 in Northern India. *J CLIN MED KAZ*. 2023;20(2):2632.
<https://doi.org/10.23950/jcmk/13139>

Ali, H.A., Hartner, AM., Echeverria-Londono, S. *et al.* Vaccine equity in low- and middle-income countries: a systematic review and meta-analysis. *Int J Equity Health* **21**, 82 (2022).
<https://doi.org/10.1186/s12939-022-01678-5>

Akhostin-Ansari A, Aghajani F, Khonji MS, Aghajani R, Pirayandeh P, Allahbeigi R, Hosami Rudsari H. Did Iranians respect health measures during Nowruz holidays? A study on Iranians' knowledge, attitude and practice toward COVID-19. *J Prev Med Hyg* 2020;61: E501-E507. <https://doi.org/10.15167/24214248/jpmh2020.61.4.1576>

Akomoneh, Elvis Achondou, and Lundi-Anne Omam Ngo Bibaa. "Public Knowledge, Attitude and Practices towards COVID-19: A Cross-Sectional Study in the Conflict Affected Area of the Northwest Region of Cameroon," December 24, 2020.

<https://doi.org/10.5281/ZENODO.4392301>

Al ahdab, S. A cross-sectional survey of knowledge, attitude, and practice (KAP) towards COVID-19 pandemic among the Syrian residents. *BMC Public Health* 21, 296 (2021).

<https://doi.org/10.1186/s12889-021-10353-3>

Al-Hanawi MK, Angawi K, Alshareef N, Qattan AMN, Helmy HZ, Abudawood Y, Alqurash M, Kattan WM, Kadasah NA, Chirwa GC and Alsharqi O (2020) Knowledge, Attitude and Practice Toward COVID-19 Among the Public in the Kingdom of Saudi Arabia: A Cross-Sectional Study. *Front. Public Health* 8:217.

<https://doi.org/10.3389/fpubh.2020.00217>

Almalki M. J. (2021). Knowledge, Attitudes, and Practices Toward COVID-19 Among the General Public in the Border Region of Jazan, Saudi Arabia: A Cross-Sectional Study. *Frontiers in public health*, 9, 733125.

<https://doi.org/10.3389/fpubh.2021.733125>

Al-Marshoudi S, Al-Balushi H, Al-Wahaibi A, Al-Khalili S, Al-Maani A, Al-Farsi N, Al-Jahwari A, Al-Habsi Z, Al-Shaibi M, Al-Msharfi M, Al-Ismaili A, Al-Buloshi H, AlRawahi B, Al-Barwani K, Al-Abri S. Knowledge, Attitudes, and Practices (KAP) toward the COVID-19 Vaccine in Oman: A Pre-Campaign Cross-Sectional Study. *Vaccines*. 2021; 9(6):602.

<https://doi.org/10.3390/vaccines9060602>

Archana Kumari, Piyush Ranjan, Sakshi Chopra, Divjyot Kaur, Ashish Datt Upadhyay, Tanveer Kaur, Arunangshu Bhattacharyya, Mehak Arora, Hardik Gupta, Arnav Thrinath, Bindu Prakash, Naval K. Vikram, Development, and validation of a questionnaire to assess knowledge, attitude, practices, and concerns regarding COVID-19 vaccination among the general population, *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, Volume 15, Issue 3, 2021, Pages 919925, ISSN 1871-4021.
<https://doi.org/10.1016/j.dsx.2021.04.004>.

Al-Zalfawi, S. M., Rabbani, S. I., Asdaq, S. M. B., Alamri, A. S., Alsanie, W. F., Alhomrani, M., Mohzari, Y., Alrashed, A. A., AlRifdah, A. H., & Almagrabe, T. (2021). Public Knowledge, Attitude, and Perception towards COVID-19 Vaccination in Saudi Arabia. *International Journal of Environmental Research and Public Health*, 18(19), 10081.
<https://doi.org/10.3390/ijerph181910081>

Azlan AA, Hamzah MR, Sern TJ, Ayub SH, Mohamad E (2020) Public knowledge, attitudes, and practices towards COVID-19: A cross-sectional study in Malaysia. *PLOS ONE* 15(5): e0233668. <https://doi.org/10.1371/journal.pone.0233668>

Bangura, J.B., Xiao, S., Qiu, D. *et al.* Barriers to childhood immunization in sub-Saharan Africa: A systematic review. *BMC Public Health* 20, 1108 (2020).
<https://doi.org/10.1186/s12889-020-09169-4>

Bates B.R., Adriana Villegas Botero & Mario J.Grijalva (2020) Knowledge, attitudes, and practices towards COVID-19 among Colombians during the outbreak: an online cross-

sectional survey, *Journal of Communication in Healthcare*, 13:4, 262-270,

<https://doi.org/10.1080/17538068.2020.1842843>

Bates, B.R., Moncayo, A.L., Costales, J.A. et al. Knowledge, Attitudes, and Practices Towards COVID-19 Among Ecuadorians During the Outbreak: An Online CrossSectional Survey. *J Community Health* 45, 1158–1167 (2020).

<https://doi.org/10.1007/s10900-020-00916-7>

Bates BR, Tami A, Carvajal A, Grijalva MJ (2021) Knowledge, attitudes, and practices towards COVID-19 among Venezuelans during the 2020 epidemic: An online cross-sectional survey. *PLOS ONE* 16(4): e0249022. <https://doi.org/10.1371/journal.pone.0249022>

Brankston, G., Merkley, E., Fisman, D.N. et al. Socio-demographic disparities in knowledge, practices, and ability to comply with COVID-19 public health measures in Canada. *Can J Public Health* 112, 363–375 (2021). <https://doi.org/10.17269/s41997021-00501-y>

Brown Wilson, J., Deckert, A., Shah, R., Kyei, N., Copeland Dahn, L., Doe-Rogers, R., Hinneh, A. B., Johnson, L. W., Natt, G. D., Verdier, J. A., Vosper, A., Louis, V. R., Dambach, P., & Thomas-Connor, I. (2021). COVID-19-related knowledge, attitudes, and practices: a mixed-mode cross-sectional survey in Liberia. *BMJ open*, 11(7), e049494. <https://doi.org/10.1136/bmjopen-2021-049494>

Buchanan Lunsford, N., Berktold, J., Holman, D. M., Stein, K., Prempeh, A., & Yerkes, A. (2018). Skin cancer knowledge, awareness, beliefs, and preventive behaviors among black

and hispanic men and women. *Preventive Medicine Reports*, 12, 203–209.

<https://doi.org/10.1016/j.pmedr.2018.09.017>

Bussink-Voorend, D., Hautvast, J.L.A., Vandeberg, L. *et al.* A systematic literature review to clarify the concept of vaccine hesitancy. *Nat Hum Behav* 6, 1634–1648 (2022).

<https://doi.org/10.1038/s41562-022-01431-6>

Caldwell, P. H., & Bennett, T. (2020). Easy guide to conducting a systematic review. *Journal of paediatrics and child health*, 56(6), 853–856. <https://doi.org/10.1111/jpc.14853>

Cameroon: WHO Coronavirus Disease (COVID-19) Dashboard [Internet]. [cited 2021 Jan 2].

Available from: <https://covid19.who.int>

“Canada COVID: 1,703,917 Cases and 28,838 Deaths - Worldometer.” Accessed

October 26, 2021. <https://www.worldometers.info/coronavirus/country/canada>

Casella, M., Rajnik, M., Aleem, A., Dulebohn, S. C., & Di Napoli, R. (2023).

Features, Evaluation, and Treatment of Coronavirus (COVID-19). In StatPearls. StatPearls Publishing.

Chen, Y., Liu, Q., & Guo, D. (2020). Emerging coronaviruses: Genome structure, replication, and pathogenesis. *Journal of medical virology*, 92(4), 418–423.

<https://doi.org/10.1002/jmv.25681>

Clouston, S. A. P., Manganello, J. A., & Richards, M. (2017). A life course approach to health literacy: the role of gender, educational attainment, and lifetime cognitive capability. *Age and ageing*, 46(3), 493–499. <https://doi.org/10.1093/ageing/afw229>

Conlon, Anna, Carmel Ashur, Laraine Washer, Kim A. Eagle, and Marion A. Hofmann Bowman. “Impact of the Influenza Vaccine on COVID-19 Infection Rates and Severity.” *American Journal of Infection Control* 49, no. 6 (June 2021): 694– 700. <https://doi.org/10.1016/j.ajic.2021.02.012>.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approach*. Sage publications.

Deng, J., Fang, Y., Wang, Q., Tian, Y., Wang, S., Yang, Y., Yang, D., & Li, S. (2024). Meta-analysis of KAP toward COVID-19 in Chinese residents. *Frontiers in public health*, 12, 1279293. <https://doi.org/10.3389/fpubh.2024.1279293>

Devkota, H. R., Sijali, T. R., Bogati, R., Clarke, A., Adhikary, P., & Karkee, R. (2021). How Does Public Knowledge, Attitudes, and Behaviors Correlate in Relation to COVID-19? A Community-Based Cross-Sectional Study in Nepal. *Frontiers in public health*, 8, 589372. <https://doi.org/10.3389/fpubh.2020.589372>

Dinga, J. N., Sinda, L. K., & Titanji, V. P. K. (2021). Assessment of Vaccine Hesitancy to a COVID-19 Vaccine in Cameroonian Adults and Its Global Implication. *Vaccines*, 9(2), 175. <https://doi.org/10.3390/vaccines9020175>

Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. (2013).

Vaccine hesitancy: an overview. *Human vaccines & immunotherapeutics*, 9(8), 1763–1773.

<https://doi.org/10.4161/hv.24657>

El-Masry, E. A., Mohamed, R. A., Ali, R. I., Al Mulhim, M. F., & Taha, A. E. (2021). Novel coronavirus disease-related knowledge, attitudes, and practices among the residents of Al-

Jouf region in Saudi Arabia. *The Journal of Infection in Developing Countries*, 15(01), 32–

39. <https://doi.org/10.3855/jidc.14243>

Ekpenyong, B. N., Abu, E. K., Langsi, R., Osuagwu, U. L., Oloruntoba, R., Ovenseri-Ogbomo, G., Timothy, C. G., Charwe, D. D., Nwaeze, O., Goson, C. P., Miner, C. A., Ishaya, T., Mashige, K. P., & Agho, K. E. (2022). Public awareness and perception towards COVID-

19 in Sub-Saharan African countries during the lockdown. *Health promotion*

perspectives, 12(2), 200–211. <https://doi.org/10.34172/hpp.2022.25>

Fang, Y., Liu, P., & Gao, Q. (2021). Assessment of Knowledge, Attitude, and Practice

Toward COVID-19 in China: An Online Cross-Sectional Survey, *The American*

Journal of Tropical Medicine and Hygiene, 104(4), 1461-1471. Retrieved Jan 22, 2023, from

<https://www.ajtmh.org/view/journals/tpmd/104/4/article-p1461.xml>

Ferdous MZ, Islam MS, Sikder MT, Mosaddek ASM, Zegarra-Valdivia JA, et al.

(2020) Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladesh: An online-based cross-sectional study. *PLOS ONE* 15(10): e0239254.

<https://doi.org/10.1371/journal.pone.0239254>

Ferreira Caceres, M. M., Sosa, J. P., Lawrence, J. A., Sestacovschi, C., TiddJohnson, A., Rasool, M. H. U., Gadamidi, V. K., Ozair, S., Pandav, K., Cuevas-Lou, C., Parrish, M., Rodriguez, I., & Fernandez, J. P. (2022). The impact of misinformation on the COVID-19 pandemic. *AIMS public health*, 9(2), 262–277.

<https://doi.org/10.3934/publichealth.2022018>

Gao, H., Hu, R., Yin, L. et al. Knowledge, attitudes and practices of the Chinese public with respect to coronavirus disease (COVID-19): an online cross-sectional survey. *BMC Public Health* 20, 1816 (2020).

<https://doi.org/10.1186/s12889-02009961-2>

Gautam V, S D, Rustagi N, et al. Health literacy, preventive COVID 19 behaviour and adherence to chronic disease treatment during lockdown among patients registered at primary health facility in urban Jodhpur, Rajasthan. *Diabetes & Metabolic Syndrome*. 2021 Jan-Feb;15(1):205-211. DOI: 10.1016/j.dsx.2020.12.023. PMID: 33387854; PMCID: PMC7833282.

Griffith, J., Marani, H., & Monkman, H. (2021). COVID-19 Vaccine Hesitancy in Canada: Content Analysis of Tweets Using the Theoretical Domains Framework. *Journal of medical Internet research*, 23(4), e26874 <https://doi.org/10.2196/26874>

Grant, M. J., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health information and libraries journal*, 26(2), 91–108.

<https://doi.org/10.1111/j.1471-1842.2009.00848.x>

Guo, Y. R., Cao, Q. D., Hong, Z. S., Tan, Y. Y., Chen, S. D., Jin, H. J., Tan, K. S., Wang, D. Y., & Yan, Y. (2020). The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status. *Military Medical Research*, 7(1), 11. <https://doi.org/10.1186/s40779-020-00240-0>

Hager, E., Odetokun, I. A., Bolarinwa, O., Zainab, A., Okechukwu, O., & AlMustapha, A. I. (2020). Knowledge, attitude, and perceptions towards the 2019 Coronavirus Pandemic: A bi-national survey in Africa. *PloS one*, 15(7), e0236918. <https://doi.org/10.1371/journal.pone.0236918>

Halaji, M., Heiat, M., Faraji, N., & Ranjbar, R. (2021). Epidemiology of COVID-19: An updated review. *Journal of research in medical sciences : the official journal of Isfahan University of Medical Sciences*, 26, 82. https://doi.org/10.4103/jrms.JRMS_506_20

Hale, T., Angrist, N., Goldszmidt, R., Kira, B., Petherick, A., Phillips, T., Webster, S., Cameron-Blake, E., Hallas, L., Majumdar, S., & Tatlow, H. (2021). A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). *Nature human behaviour*, 5(4), 529–538. <https://doi.org/10.1038/s41562021-01079-8>

Hassan, S. A., Sheikh, F. N., Jamal, S., Ezeh, J. K., & Akhtar, A. (2020). Coronavirus (COVID-19): A Review of Clinical Features, Diagnosis, and Treatment. *Cureus*, 12(3), e7355. <https://doi.org/10.7759/cureus.7355>

Hausmann-Muela, S., Ribera, J., & Nyamongo, I.K. (2003). No . 14 Health-seeking behaviour and the health system response.

Hesaraki, M., Akbarizadeh, M., Ahmadidarrehsima, S., Moghadam, M. P., & Izadpanah, F. (2020). Knowledge, attitude, practice and clinical recommendations of health care workers towards COVID-19: a systematic review. *Reviews on environmental health*, 36(3), 345–357.
<https://doi.org/10.1515/reveh-2020-0099>

Hoffmeyer-Zlotnik, J. H. P. (2016). Standardisation and Harmonisation of SocioDemographic Variables. *GESIS Survey Guidelines*. Mannheim, Germany: GESIS – Leibniz Institute for the Social Sciences. DOI: 10.15465/gesis-sg_en_012

Imai, N., Gaythorpe, K. A. M., Abbott, S., Bhatia, S., van Elsland, S., Prem, K., Liu, Y., & Ferguson, N. M. (2020). Adoption and impact of non-pharmaceutical interventions for COVID-19. *Wellcome open research*, 5, 59.
<https://doi.org/10.12688/wellcomeopenres.15808.1>

Imboumy-Limoukou RK, Ngoubangoye B, Dibakou SE, Oyegue-Liabagui SL, Mounioko F, Kouna LC, Matangoye WR, Ontoua SS, Mbani Mpega NC, LekanaDouki J-B. Knowledge, Attitude and Practice during the COVID-19 Pandemic in South-East Gabon. *Behavioral Sciences*. 2022; 12(7):226.
<https://doi.org/10.3390/bs12070226>

Intiyaz, B. S., Jamwal, C., Hussain, A., Roub, F., Tariq, R., Qayoom, I., Syed, J., & Renzu, M. (2021). Knowledge, attitudes, and practices about COVID-19 among

Kashmiri population: A cross-sectional study. *Indian journal of psychiatry*, 63(4), 383– 390.

https://doi.org/10.4103/psychiatry.IndianJPsychiatry_408_20

Iqbal, M. A., & Younas, M. Z. (2021). Public knowledge, attitudes, and practices towards COVID-19 in Pakistan: A cross-sectional study. *Children and youth services review*, 120, 105784. <https://doi.org/10.1016/j.chilyouth.2020.105784>

Islam, M.S., Siddique, A.B., Akter, R. et al. Knowledge, attitudes and perceptions towards COVID-19 vaccinations: a cross-sectional community survey in Bangladesh. *BMC Public Health* 21, 1851 (2021). <https://doi.org/10.1186/s12889021-11880-9>

Issanov, A., Akhmetzhanova, Z., Riethmacher, D., & Aljofan, M. (2021). Knowledge, attitude, and practice toward COVID-19 vaccination in Kazakhstan: a cross-sectional study. *Human vaccines & immunotherapeutics*, 17(10), 3394–3400. <https://doi.org/10.1080/21645515.2021.1925054>

Jahanafrooz Z, Baradaran B, Mosafer J, Hashemzaei M, Rezaei T, Mokhtarzadeh A, Hamblin MR. Comparison of DNA and mRNA vaccines against cancer. *Drug Discov Today*. 2020 Mar;25(3):552-560. doi: 10.1016/j.drudis.2019.12.003. Epub 2019 Dec 13. PMID: 31843577; PMCID: PMC7080609.

Karijo, E., Wamugi, S., Lemanyishoe, S. et al. Knowledge, attitudes, practices, and the effects of COVID-19 among the youth in Kenya. *BMC Public Health* 21, 1020 (2021). <https://doi.org/10.1186/s12889-021-11067-2>

Katja Margelisch, Klaus A. Schneewind, Jeanine Violette & Pasqualina Perrig-Chiello (2017)

Marital stability, satisfaction and well-being in old age: variability and continuity in long-

term continuously married older persons, *Aging & Mental Health*, 21:4, 389-398, DOI:

10.1080/13607863.2015.1102197

Launiala, A. (2009). How much can a KAP survey tell us about people's knowledge,

attitudes, and practices? Some observations from medical anthropology research on malaria

in pregnancy in Malawi. *Anthropology Matters*, 11(1).

Lawrence, E.M., Rogers, R.G., Zajacova, A. *et al.* Marital Happiness, Marital Status, Health, and Longevity. *J Happiness Stud* 20, 1539–1561 (2019).

<https://doi.org/10.1007/s10902-018-0009-9>

Lee, M., Kang, B.A. & You, M. Knowledge, attitudes, and practices (KAP) toward

COVID-19: a cross-sectional study in South Korea. *BMC Public Health* 21, 295(2021).

<https://doi.org/10.1186/s12889-021-10285-y>

Li, J., Huang, D. Q., Zou, B., Yang, H., Hui, W. Z., Rui, F., Yee, N. T. S., Liu, C.,

Nerurkar, S. N., Kai, J. C. Y., Teng, M. L. P., Li, X., Zeng, H., Borghi, J. A., Henry, L.,

Cheung, R., & Nguyen, M. H. (2021). Epidemiology of COVID-19: A systematic

review and meta-analysis of clinical characteristics, risk factors, and outcomes. *Journal of*

medical virology, 93(3), 1449–1458. <https://doi.org/10.1002/jmv.26424>

Luo, Y.-F., Chen, L.-C., Yang, S.-C., & Hong, S. (2022). Knowledge, Attitude, and

Practice (KAP) toward COVID-19 Pandemic among the Public in Taiwan: A CrossSectional Study. *International Journal of Environmental Research and Public Health*, 19(5), 2784.

<https://doi.org/10.3390/ijerph19052787ukm>

Mader, S., & Rüttenauer, T. (2022). The Effects of Non-pharmaceutical Interventions on COVID-19 Mortality: A Generalized Synthetic Control Approach Across 169 Countries.

Frontiers in public health, 10, 820642.

<https://doi.org/10.3389/fpubh.2022.820642>

Munn, Z., Peters, M.D.J., Stern, C. *et al.* Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol* **18**, 143 (2018).

<https://doi.org/10.1186/s12874-018-0611-x>

Nakhostin-Ansari, A., Aghajani, F., Khonji, M. S., Aghajani, R., Pirayandeh, P., Allahbeigi, R., & Hosami Rudsari, H. (2021). Did Iranians respect health measures during Nowruz

holidays? A study on Iranians' knowledge, attitude, and practice toward COVID-19. *Journal of preventive medicine and hygiene*, 61(4), E501–E507.

<https://doi.org/10.15167/2421-4248/jpmh2020.61.4.1576>

Ngwewondo, A., Nkengazong, L., Ambe, L. A., Ebogo, J. T., Mba, F. M., Goni, H. O., Nyunäi, N., Ngonde, M. C., & Oyono, J. E. (2020). Knowledge, attitudes, practices

of/towards COVID 19 preventive measures and symptoms: A cross-sectional study during the exponential rise of the outbreak in Cameroon. *PLoS neglected tropical diseases*, 14(9),

e0008700. <https://doi.org/10.1371/journal.pntd.0008700>

Njingu, A. E., Jabbossung, F. E., Ndip-Agbor, T. E., & Dedino, A. G. (2021).

Comparing knowledge, attitudes and practices regarding COVID-19 amongst Cameroonians living in urban versus rural areas. *The Pan African medical journal*, 38, 234

<https://doi.org/10.11604/pamj.2021.38.234.25964>

Osei, S. A., Biney, R. P., Anning, A. S., Nortey, L. N., & Ghartey-Kwansah, G. (2022). Low incidence of COVID-19 case severity and mortality in Africa; Could malaria co-infection provide the missing link?. *BMC infectious diseases*, 22(1), 78.

<https://doi.org/10.1186/s12879-022-07064-4>

OurWorldData. Cumulative COVID-19 tests, confirmed cases and deaths per million people 2021 <https://ourworldindata.org/grapher/covid-tests-cases-deaths-per-million>. Accessed 28 Oct 2024.

Pearce, N., Lawlor, D. A., & Brickley, E. B. (2020). Comparisons between countries are essential for the control of COVID-19. *International journal of epidemiology*, 49(4), 1059–1062. <https://doi.org/10.1093/ije/dyaa108>

Perra N. (2021). Non-pharmaceutical interventions during the COVID-19 pandemic: A review. *Physics reports*, 913, 1–52. <https://doi.org/10.1016/j.physrep.2021.02.001>

Sakr, S., Ghaddar, A., Sheet, I., Eid, A. H., & Hamam, B. (2021). Knowledge, attitude and practices related to COVID-19 among young Lebanese population. *BMC public health*, 21(1), 653. <https://doi.org/10.1186/s12889-021-10575-5>

Sarria-Guzmán, Y., Fusaro, C., Bernal, J. E., Mosso-González, C., GonzálezJiménez, F. E., & Serrano-Silva, N. (2021). Knowledge, Attitude and Practices (KAP) towards COVID-19 pandemic in America: A preliminary systematic review. *Journal of infection in developing countries*, 15(1), 9–21. <https://doi.org/10.3855/jidc.14388>

Sharp, P. M., & Hahn, B. H. (2011). Origins of HIV and the AIDS pandemic. *Cold Spring Harbor perspectives in medicine*, 1(1), a006841. <https://doi.org/10.1101/cshperspect.a006841>

Siddiquea, B. N., Shetty, A., Bhattacharya, O., Afroz, A., & Billah, B. (2021). Global epidemiology of COVID-19 knowledge, attitude and practice: a systematic review and meta-analysis. *BMJ open*, 11(9), e051447. <https://doi.org/10.1136/bmjopen-2021051447>

Šljivo, A., Kačamaković, M., Siručić, I., Mujičić, E., & Džubur Kulenović, A. (2021). Knowledge, attitudes, and practices towards COVID-19 among residents of Bosnia and Herzegovina during the first stage of COVID-19 outbreak. *Annali di igiene : medicina preventiva e di comunita*, 33(4), 371–380. <https://doi.org/10.7416/ai.2021.2447>

Suijkerbuijk A, Woudenberg T, Hahné S, et al. Economic Costs of Measles Outbreak in the Netherlands, 2013–2014. *Emerging Infectious Diseases*. 2015;21(11):2067-2069. doi:10.3201/eid2111.150410.

Sujarwoto, S., Holipah, H., & Maharani, A. (2022). A Cross-Sectional Study of Knowledge, Attitudes, and Practices concerning COVID-19 Outbreaks in the General Population in Malang District, Indonesia. *International Journal of Environmental*

Research and Public Health, 19(7), 4287. <https://doi.org/10.3390/ijerph19074287>

Van Doremalen, N., Bushmaker, T., Morris, D. H., Holbrook, M. G., Gamble, A., Williamson, B. N., Tamin, A., Harcourt, J. L., Thornburg, N. J., Gerber, S. I., Lloyd-Smith, J. O., de Wit, E., & Munster, V. J. (2020). Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *The New England journal of medicine*, 382(16), 1564–1567. <https://doi.org/10.1056/NEJMc2004973>

Van Nhu, H., Tuyet-Hanh, T.T., Van, N.T.A. et al. Knowledge, Attitudes, and Practices of the Vietnamese as Key Factors in Controlling COVID-19. *J Community Health* 45, 1263–1269 (2020). <https://doi.org/10.1007/s10900-020-00919-4>

Vilches, T.N., Abdollahi, E., Cipriano, L.E. et al. Impact of non-pharmaceutical interventions and vaccination on COVID-19 outbreaks in Nunavut, Canada: a Canadian Immunization Research Network (CIRN) study. *BMC Public Health* 22, 1042 (2022) <https://doi.org/10.1186/s12889-022-13432-1>

WMA. World Medical Association Declaration of Helsinki ethical principles for medical research involving human subjects. *JAMA*. 2013; 310: 2191–2194. <https://doi.org/10.1001/jama.2013.281053> PMID: 24141714

Wake, Addisu Dabi. “The Acceptance Rate Toward COVID-19 Vaccine in Africa: A Systematic Review and Meta-Analysis.” *Global Pediatric Health* 8 (January 2021): 2333794X2110487. <https://doi.org/10.1177/2333794X211048738>

Wang, X., & Cheng, Z. (2020). Cross-Sectional Studies: Strengths, Weaknesses, and Recommendations. *Chest*, 158(1S), S65–S71. <https://doi.org/10.1016/j.chest.2020.03.012>

WHO. Knowledge, Attitudes, and Practices (KAP) Surveys during Cholera Vaccination Campaigns: Guidance for Oral Cholera Vaccine Stockpile Campaigns. Available online: [https://www.who.int/publications/m/item/knowledge-attitudes-andpractices-\(kap\)-surveys-during-cholera-vaccination-campaigns-guidance-for-oralcholera-vaccine-stockpile-campaigns](https://www.who.int/publications/m/item/knowledge-attitudes-andpractices-(kap)-surveys-during-cholera-vaccination-campaigns-guidance-for-oralcholera-vaccine-stockpile-campaigns)

World Health Organization. WHO Director-General’s opening remarks at the media briefing on COVID-19 - 11 March 2020. Available at:

<https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-atthe-media-briefing-on-covid-19-11-march-2020> (accessed on 12/05/2020).

World Health Organization 2023 data.who.int, WHO Coronavirus (COVID-19) dashboard > Deaths [Dashboard]. <https://data.who.int/dashboards/covid19/deaths>.

Wu, Y., Ho, W., Huang, Y., Jin, D. Y., Li, S., Liu, S. L., Liu, X., Qiu, J., Sang, Y., Wang, Q., Yuen, K. Y., & Zheng, Z. M. (2020). SARS-CoV-2 is an appropriate name for the new coronavirus. *Lancet* (London, England), 395(10228), 949–950. [https://doi.org/10.1016/S0140-6736\(20\)30557-2](https://doi.org/10.1016/S0140-6736(20)30557-2)

Xu H, Gan Y, Zheng D, Wu B, Zhu X, Xu C, Liu C, Tao Z, Hu Y, Chen M, Li M, Lu Z, Chen J Relationship Between COVID-19 Infection and Risk Perception, Knowledge, Attitude, and Four Nonpharmaceutical Interventions During the Late Period of the

COVID-19 Epidemic in China: Online Cross-Sectional Survey of 8158 Adults J. Med Internet Res 2020;22(11):e21372 <https://www.jmir.org/2020/11/e21372>

Xu, Y., Lin, G., Spada, C., Zhao, H., Wang, S., Chen, X., Chen, Y., Zhang, Y., Marraro, G. A., Zeng, X., Ye, X., Zhang, L., & Zeng, Y. (2021). Public Knowledge, Attitudes, and Practices Behaviors Towards Coronavirus Disease 2019 (COVID-19) During a National Epidemic-China. *Frontiers in public health*, 9, 638430. <https://doi.org/10.3389/fpubh.2021.638430>

Yue, S., Zhang, J., Cao, M. et al. Knowledge, Attitudes and Practices of COVID-19 Among Urban and Rural Residents in China: A Cross-sectional Study. *J Community Health* 46, 286–291 (2021). <https://doi.org/10.1007/s10900-020-00877-x>

Zhong, B.L., Luo, W., Li, H.M., Zhang, Q.Q., Liu, X.G., Li, W.T., Li, Y. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *International Journal of Biological Sciences*, 16(10), 1745-1752. <https://doi.org/10.7150/ijbs.45221>