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Contents

Sociodemographic Characteristics Associated with Higher Numbers of COVID-19 Cases: A Neighbourhood Level Study in Ottawa, Ontario

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Abstract

Introduction: The complex interplay of the social conditions that one lives in and functions greatly influences the exposure to a certain health condition and the ability to recover from it. Reports on COVID-19 diagnosis, hospitalization and fatality reveal a clear sociodemographic divide with the marginalized communities bearing a disproportionately higher burden of the outcomes. The objectives of this study was to explore the neighbourhoods characteristics associated with higher COVID-19 rates in Ottawa by employing a social determinants of health framework that identifies critical intersections that impact of multi-level determinants of health.

Methodology: This study is based on data on 98 neighbourhoods in Ottawa that were collected from the Ottawa Neighbourhood study (ONS). The outcome variable was COVID-19 rate between March 09, 2020 - January 31, 2021. The independent variables were potentially vulnerable groups, Socioeconomic, neighbourhood, and demographic factors. We used descriptive and logistic regression methods to analyse the data.

Results: The neighbourhoods that had relatively high number of rates COVID-19 cases were Hunt Club Park (909), Manor Park (831), Greenboro East (739), Overbrook McArthur (641), and Hunt Club Upper-Blossom Park (619); and the ones with lowest rates were Laurentian (44), Old Ottawa South (31), Richmond (22), Riverside South Leitrim (19), Wateridge Village (5), and Westboro (3). Multivariate regression analysis showed that neighborhood characteristics such as percentage of community health center within a 50m walk, higher population density, higher percentage of people taking public transportation to work, higher percentage of people with no high school diploma, perceived walkability score, low income prevalence, higher percentage of unsuitable housing, households with multiple family,   refugee population, new comer during 2011-16, single parent family, and higher percentage of living alone were associated higher odds of above average COVID-19 rates.

Conclusion: These findings reflect a greater likelihood of COVID-19 infection in the neighbourhoods with poorer socioeconomic and living conditions such as low income, unhealthy housing, and higher population density. Addressing the challenges among the disadvantaged communities may help reduce the higher vulnerability and promote health conditions.

Keywords: COVID-19 cases, socioeconomic risk factors, neighbourhood study, Ottawa.

1. Introduction

The novel coronavirus (SARS-CoV-2) outbreak, since its declaration as a global pandemic, has emerged as a significant concern not only for global public health, but also for broader social and economic issues in developed and developing countries alike (Cucinotta & Vanelli, 2020; Zhou, Yang et al., 2020). The medical literature on the pandemic is a fast-growing one, and a significant proportion of the studies and reports stress on the non-clinical

determinants and outcomes of the virus e.g. demographic, spatial, and social factors that have proven to be favorable to the survival and transmission of the virus (Abrams & Szefler, 2020; Upshaw et al., 2021; Zhou, Ghose et al., 2020). Although the virus has been found to be exceptionally virulent and have caused more than a million fatalities globally including many high-profile public figures, a clear social divide has been in play in both the health (hospitalization, co-morbidities, mental illness) and non-health (food and income insecurity, stigmatization and marginalization) repercussions of the pandemic. Not surprisingly, it is the most disadvantaged of the social strata that are worst affected by these outcomes. There is a host of socioeconomic factors that can influence one's susceptibility to a certain health condition, the ability to recover from it, and establish a healthier lifestyle to avoid the recurrence of the condition. (Etowa et al., 2021; Wan & Tang, 2020; Burströ & Tao, 2020). For instance, families in remote and low-income neighborhoods are less likely to be able to afford and access emergency care (Patel et al., 2020; Tran et al., 2020; Ahmad et al., 2020). Living in straightened conditions also translates to congested and unhealthy housing conditions, poorer dietary behavior, lesser capacity to receive and apply health promoting behavior, all of which can singly or in combination with others result in poorer health conditions that can greatly enhance one's vulnerability to acquiring COVID-19 (Ahmad et al., 2020; Finch & Hernández Finch, 2020; Van Lancke & Parolin, 2020). Low-wage earners with sub-clinical infection may also find it difficult to abstain from attending work and maintain isolation from other household members and thus further increase the risk of human-to-human infection (Jay et al., 2020; Deng & Naslund, 2020). From this viewpoint, social determinants of health and illness occupies an important position in infectious disease epidemiology. Therefore, healthcare systems must reorient their strategies and resources to address the underlying factors that function at the interface of society and health. In the present study, we aimed to highlight the role of various socioeconomic and living condition related factors on COVID-19 rates in Ottawa. The findings are discussed in light of the existing gaps in data and literature to facilitate a better understanding of the current situation and providing a basis for adoption of contextualized and directed policies.

2. Methods and Data Source

This research is based on data from (Ottawa Neighbourhood Study) (2021) that collected data on a range of demographic, health and socioeconomic issues for each neighbourhood in Ottawa. The objectives of the Ottawa Neighbourhood Study are: *to better understand the physical and social pathways by which neighbourhoods in Ottawa affect our health and well-being, and to provide citizens in Ottawa with facts that support evidence-based decision-making* (Ottawa Neighbourhood Study, 2021). Based at the Centre for Research and Education in Community Services at the University of Ottawa, this multidisciplinary study was funded by the Canadian Institutes of Health Research (CIHR), United Way East Ontario/Centraide de l'Est de l'Ontario, the Community Foundation of Ottawa, the Population Health Improvement Network (PHIRN) Opens in a new window, and Champlain LHIN. The variables used in the present analysis were described in Table 1.

Table 1. Data source and description of the variables

Variables	Description
Cov-19 rate	The total neighbourhood "rate" (/100,000 residents) of COVID-19. That is, the total number of residents with laboratory confirmed COVID-19 per 100,000 residents in the neighbourhood (reported between March 09 2020 - January 31 2021), excluding cases associated with outbreaks in long term care homes (LTCH) or retirement homes.
Low-income prevalence	The Low-income measure, after tax, refers to a fixed percentage (50%) of median adjusted after-tax income of private households. The household after-tax income is adjusted by an equivalence scale to take economies of scale into account. This adjustment for different household sizes reflects the fact that a household's needs increase, but at a decreasing rate, as the number of members increases.
% Unsuitable housing	Housing suitability refers to whether a private household is living in suitable accommodations according to the National Occupancy Standard (NOS); that is, whether the dwelling has enough bedrooms for the size and composition of the household. Reported for private households.
% Black	Data from Statistics Canada's "visible minority" target group profile dataset.
% 50 m walk to CHS	Percentage of households living within 50m walking distance to
No high school diploma	This category includes persons who have not obtained any certificates, diplomas or degrees or their equivalents. Reported for population aged 25 to 64 years in private households.

% Of public transportation users	The main mode of transportation a person uses to travel between his or her home and his or her place of work.
Population density	Main mode of commuting refers to the main mode of transportation a person uses to travel between his or her home and his or her place of work. Reported for population aged 15 years and over, in private households, who worked at some time since January 1, 2015.
% Single parent families	Never married refers to persons who have never legally married and are not living with a person as a couple.
% Households with multiple families	Multiple-family household refers to a household in which two or more census families (with or without additional persons) occupy the same private dwelling.
Senior recent immigrants	% of seniors who are recent immigrants Refers to the percent of seniors (65+) who immigrated to Canada between 2011-2016
% Newcomers (2011-2016)	Year of immigration refers to the year in which the immigrant first obtained landed immigrant or permanent resident status.
% Refugees	Refugees includes immigrants who were granted permanent resident status on the basis of a well-founded fear of returning to their home country.
% residents within 15 min walking distance of CHC	Community Health and Resource Centre refers to a multi-service, community-based health and resource centre, which recognizes the importance of responding to the diversity of needs within local communities and pay particular attention to those members of the community who are most vulnerable and at risk.
Perceived walkability	Neighbourhood perceived walkability is derived from comparisons of Google Street View images and answers to "where would you rather walk?". A machine-learning model was trained to do this task. Neighbourhoods were classified in deciles, with 10 being the most walkable and 1 being the least walkable.
% People living alone	Household size refers to the number of persons in a private household.
% Single parent family	Lone-parent family includes families containing only one parent with his or her child(ren).

2.1 Data Analysis

Data were extracted from the Ottawa Neighbourhood Study website by two researchers upon reaching an agreement on the selection of variables that were deemed to be relevant to the outcome variable. All data were analysed with Stata 16 (College Station, Texas). We used bar charts to present the top 20 neighbourhoods for highest and lowest COVID-19 rates. The rate of COVID-19 was dichotomised as above and below mean, the factors associated with this were measured using binary logistic regression methods. The explanatory variables included neighborhoods with percentage of Senior recent immigrants; 50m walk to CHC; Population density; Black population; Public transportation to work; No high school diploma; Perceived walkability score; Low income prevalence; Unsuitable housing; HH with multiple family; Refugee population; New comer during 2011-16; Single parent family; and lives alone. The results were presented as odds ratios with 95% confidence intervals. All associations were considered statistically significant at a p value of <0.05.

Results
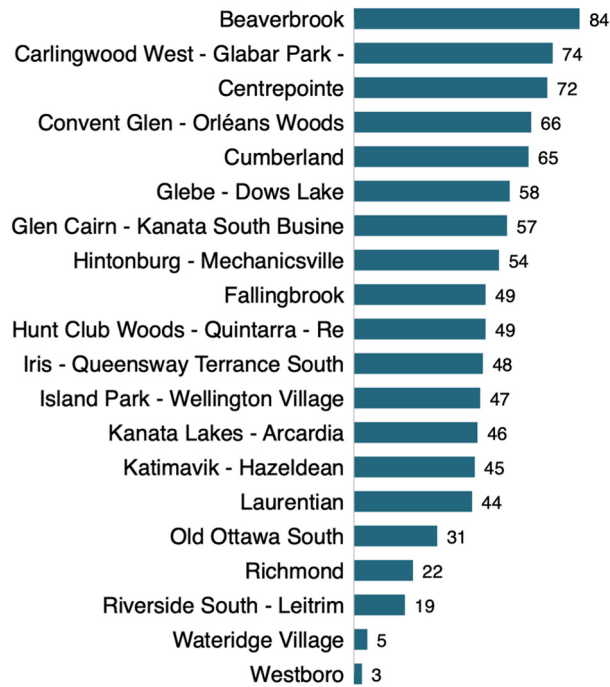
Figure 1. Neighbourhoods with lowest COVID-19 rates as of January 31, 2021 (per 100,000 residents)

Figure 1 shows the lowest ranking of the neighbourhoods in terms of COVID-19 rates: Laurentian (44), Old Ottawa South (31), Richmond (22), Riverside South Leitrim (19), Wateridge Village (5), and Westboro (3).
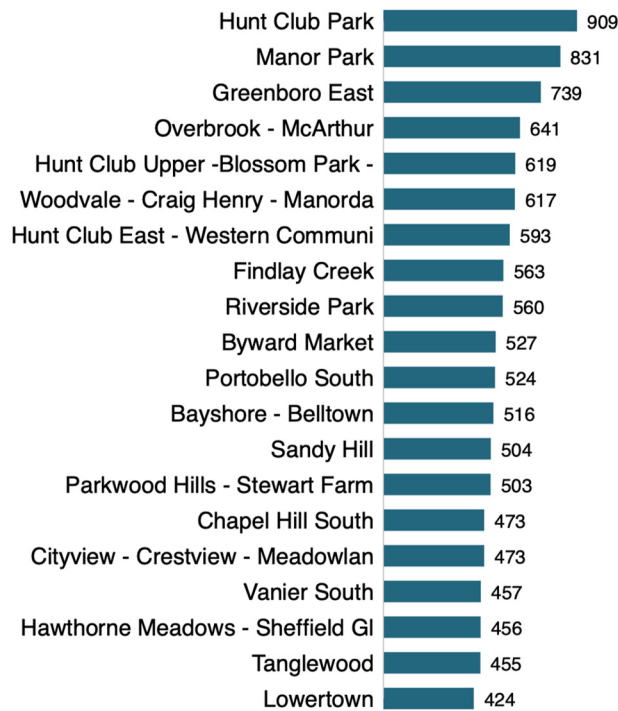
Figure 2. Neighbourhoods with highest COVID-19 rates as of January 31, 2021 (per 100,000 residents)

As shown by Figure 2, Hunt Club Park (909), Manor Park (831), Greenboro East (739), Overbrook McArthur (641), and Hunt Club Upper-Blossom Park (619), were the five neighbourhoods with top five highest rates of COVID-19.
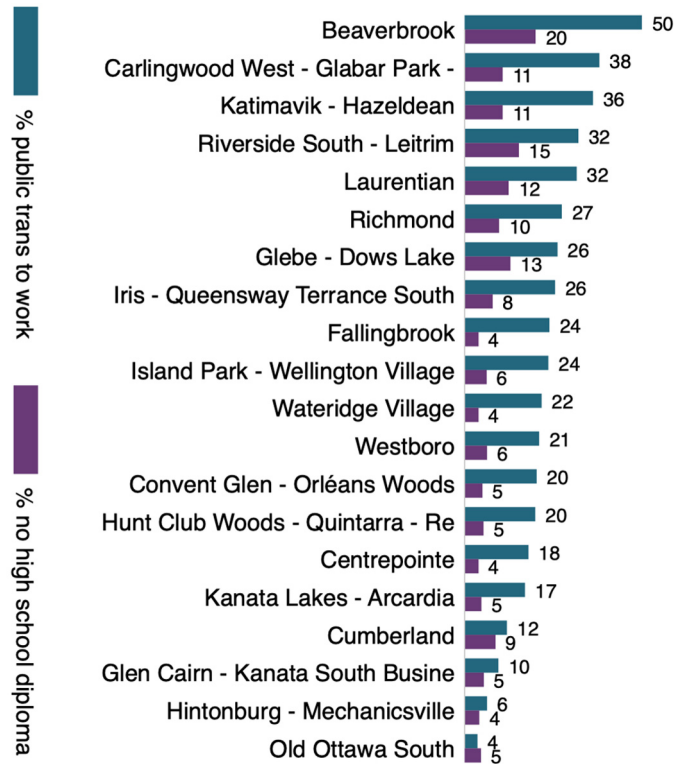
Figure 3. Neighbourhoods with higher percentage public transportation to work and no high school diploma

Figure 3, shows the neighbourhoods with percentages of population taking public transportation to work and not having a high school diploma, two important risk factors for COVD-19 infection. Beaverbrook had the highest percentage of those taking public transportation to work (50%) and not having a high school diploma (20%), while Old Ottawa South had the lowest percentage of those two.
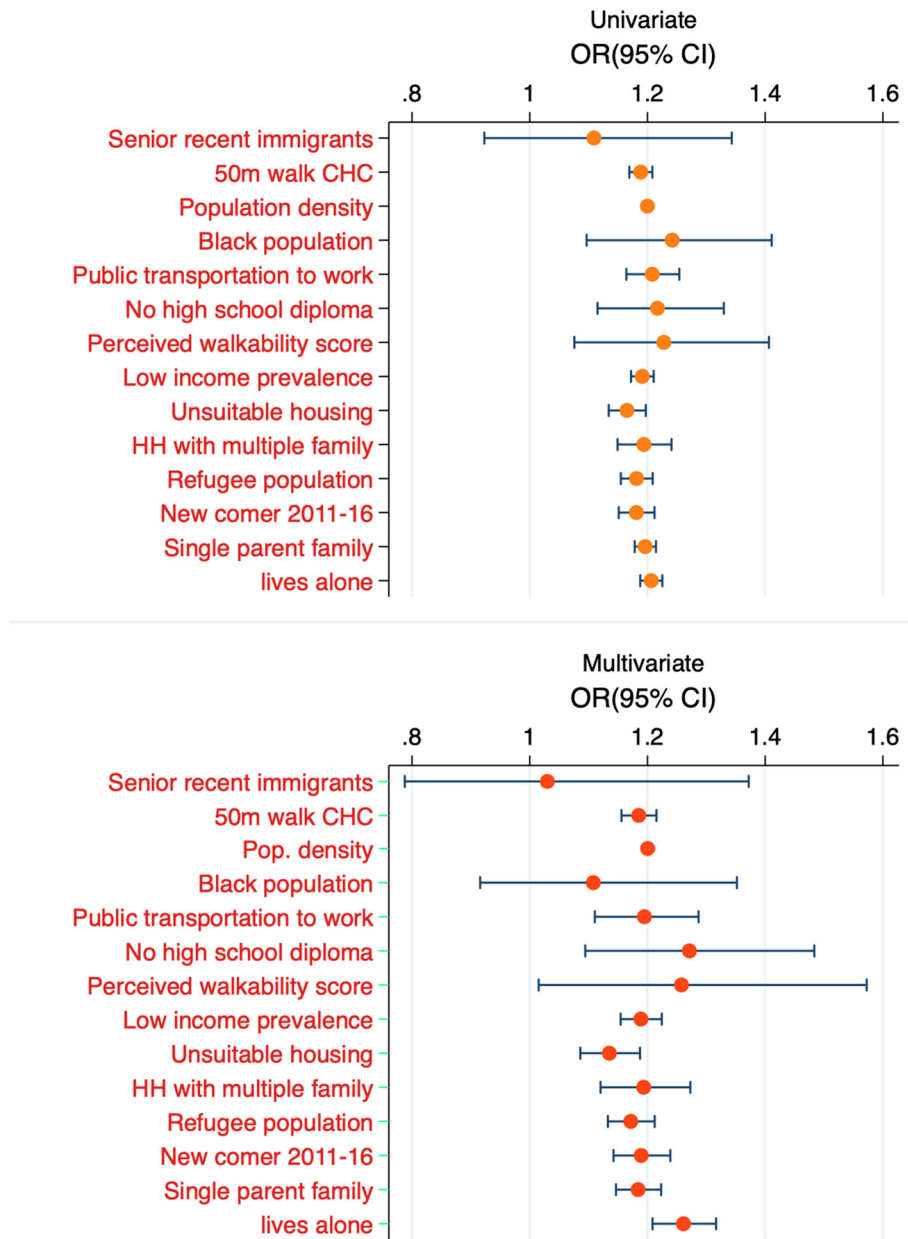
Figure 4. Results of logistic regression showing the association between neighbourhood characteristics and COVID-19 rates in Ottawa

As shown in Figure 4, neighborhood characteristics such as percentage of having a CHC within a 50m walk, higher population density, higher percentage of people taking public transportation to work, higher percentage of people with no high school diploma, perceived walkability score, low income prevalence, higher percentage of unsuitable housing, households with multiple family, refugee population, new comer during 2011-16, single parent family, and higher percentage of living alone were associated higher odds of above average COVID-19 rates.
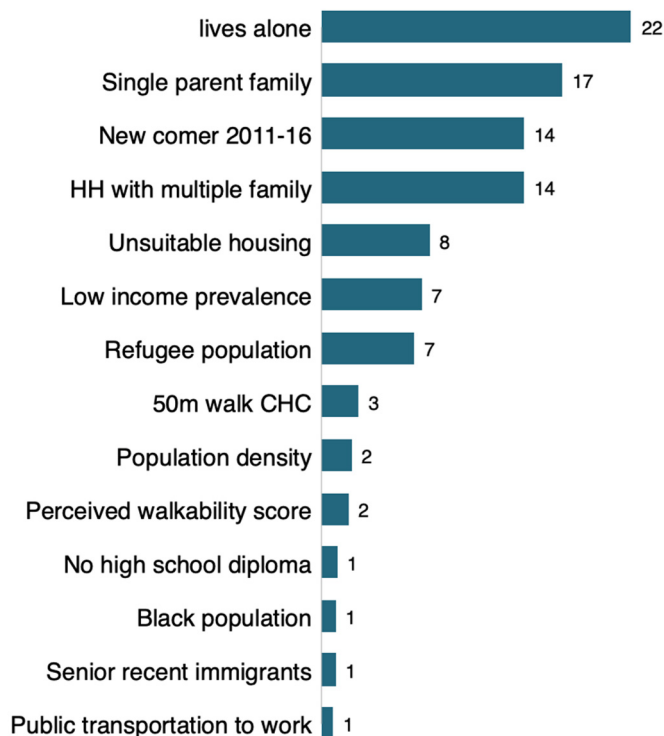
Figure 5. Variable importance plot

As shown in Figure 5, neighbourhood characteristics such as higher percentages of household where people lives alone, single parent family, new comer (during 2011-16), and households with multiple family and unsuitable housing were associated higher than average rates of COVID-19 infection rates.

4. Discussion

This study analysed data from Ottawa Neighbourhood Study to identify the differences among the Ottawa neighbourhoods in terms of COVID-19 rates. Descriptive analysis showed striking disparities among the highest and worst affected neighbourhoods. With 909 cases per hundred thousand population, Hunt Club Park had the highest rates of COVID-19 whereas Wateridge Village and Westboro had less than ten cases. It is hard to measure to what extent these differences are attributable to the unmeasured neighbourhood characteristics, such as deprivation of social and healthcare services and barriers to access to preventive and curative care. Nonetheless, the difference among the most and least affected neighbourhoods is in this study is extremely concerning and requires further investigation. The descriptive analysis also highlighted the importance of living arrangement such as single parent family and households with multiple family as well we living environment unsuitable housing. These findings underscore the role of living environmental on health outcomes for the marginalised communities. Place of living is a strong determinant of health and illness, and have attracted strong research and policy attention in the areas of non-communicable diseases. This study adds to the previous findings regarding the role of quality living environment in maintaining a healthy life (Aret, Doblhamme, & Janssen, 2019). The health, quality of life, and well-being of community dwellers are closely intertwined with the social and environmental factors that shape their health behaviour and vulnerability to illness. Certain communities are more endowed with more health promoting resources than others such as sustainable access to clean water for maintaining adequate hygiene and a clean living space for optimum functioning in daily life. The role of the environmental factors are themselves linked with other socioeconomic and political, and structural factors that need to be taken into account when interpreting these findings. In short, our findings highlight the fact that neighborhoods with unhealthy living conditions can aggravate the spread of COVID-1 infection. (Ahmad et al., 2020; Radwan et al., 2021) Policy makers and urban planner need to prioritize neighborhoods inhabited by low-income and families and reduce income inequality in an effort to tackle the burden of COVID-19.

Another important aspect of the findings was the strong association between high percentage of new comer (during

2011-16) and higher COVID-19 rates. The possible causes behind this association could be lack of familiarity with the health care system, lack of awareness of the risk factors and poor navigability through the social support entities (Radwan et al., 2021; Smith et al., 2021). New comers constitute a socioeconomically vulnerable group in Canada who health and social needs should be met special policy interventions such as creation of community support groups, peer leaders, and making the healthcare system more adaptive to the challenges specific to them (Barker, 2021; Edmonds & Flahault, 2021).

Despite these thought-provoking findings, it is important to keep in mind that these data were collected at neighbourhood level and are not reflective of the situation at individual level. While neighbourhood level data provide important insights regarding the inter-regional characteristics in the distribution of a health condition, it does not allow exploring the individual-level parameters such as age or racial profile of the population. Both individual and neighbourhood level data must therefore be collected in order to get a fuller understanding the situation.

Followed by descriptive analysis, we also conducted multivariate regression analysis to explore the relationship between COVID-19 rates and the explanatory factors that were categorized under several themes regarding the vulnerable groups- demographic (% of newcomers), environmental (e.g. housing conditions) and community factors (e.g. distance to health facilities). This classification was guided by the social determinants of health approach that focuses on the non-biological factors of health outcomes. The Ottawa Neighbourhood Study provides information on a wide range of indicators including the percentage of refugee and Black population, recent immigrants, educational qualification, level of income and housing quality. In line with the previous findings, recent studies on COVID-19 established a strong connection between various socioeconomic conditions and rate of transmission and mortality (Chedid et al., 2020; Dalton et al., 2021; Raisi-Estabragh et al., 2021). Identifying the patterns in social vulnerability helps to understand why certain neigbourhoods are better or worse off than others in terms of health outcomes such as rate of transmission, hospitalization, recovery and mortality. Similar to all multicultural communities, Ottawa also bears traces of deep inequalities across the social strata (Etowa & Hyman, 2021; Shahidi, Parnia, & Siddiqi, 2020; Government of Canada SC, 2021) that are being manifested most recently through higher rates of transmission among vulnerable population such as newcomers and refugee population. Newcomers are less likely to be able to afford proper housing and living conditions, and therefore tend to cluster together in the low-income neighbourhoods which further increases the risk of disease and vulnerability (Edmonds, J., & Flahault, 2021; Esses et al., 2021; Browne et al., 2017). As expected, our findings indicated a moderately strong positive association between the number of refugee population and COVID-19 rates such that neighbourhoods with higher percentage of refugee population and newcomers were more likely to have higher rates of COVID-19 cases. In addition, neighbourhoods with higher prevalence of low-income families and densely populated households were found to have higher COVID-19 rates. Lastly, we also found a positive association between higher median age with COVID-19 rates reflecting the increasing vulnerability of COVID-19 transmission among older population.

As far as we are concerned, this is the first neighbourhood level study on COVID-19 in a Canadian setting from the perspective of social determinants of health. Based on secondary data covering a broad range of health related indicators, we aimed to explore the environmental, socioeconomic, neighbourhood and demographic factors that are likely to be contributing to higher COVID-19 rates in certain neighbourhoods Ottawa. Having focused on neighbourhood level factors, this study also emphasises on the importance of population-level data and identifies an important gap in the availability of such data in Canada. Given the growing concern over socioeconomic risk factors of COVID-19 such as racism, discrimination, and social exclusion, more surveys should be conducted to identify the address the impact of these factors in order to better manage the pandemic. Although not reflective of the population level scenario, this study highlighted the adverse effect of being refugee and newcomers in relation to elevate risks of COVID-19 transmission. The relation between health vulnerability and social position is a bidirectional one and therefore special attention must be given to the vulnerable population to ensure the most effective controlling of the ongoing pandemic.

5. Conclusion

Our findings indicated that the five least affected neighbourhoods included Laurentian, Old Ottawa South, Richmond, Riverside South, Wateridge Village, Westboro, and worst affected ones were Hunt Club Park, Manor Park, Greenboro, East Overbrook, McArthur Hunt Club, and Upper-Blossom Park. As expected, the study revealed that neighbourhood's socioeconomic and housing characteristics were significant factor for higher COVID-19 rates. Although no systematic study data are available to generate a robust picture of the racial divide in terms of COVID-19 outcomes in Ottawa, these preliminary findings make a compelling case for a critical

reappraisal of the social determinants in Ottawa and other cities of striking social contrasts with signs of extraordinary opulence in parallel with extreme impoverishment. While neighbourhood data allows to assess the risk factors at community level, its capacity is limited in understanding the impacts or influence of the individual level factors such as awareness about and attitude towards the protective measures, COVID-19 literacy, self-efficacy, knowledge of how to provide care for the infected individuals.

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Informed Consent

Obtained.

Provenance and Peer Review

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Data Availability Statement

The data that support the findings of this study are available on request.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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Appendix:

List of neighbourhoods included in the study.

ONS Neighbourhood	ONS Neighbourhood
Woodvale - Craig Henry - Manordale - Estates of Arlington Woods	Hintonburg - Mechanicsville
Whitehaven - Queensway Terrace North	Hawthorne Meadows - Sheffield Glen
Westboro	Greenboro East
West Centretown	Greenbelt
Wateridge Village	Greely
Vars	Glen Cairn - Kanata South Business Park
Vanier South	Glebe - Dows Lake
Vanier North	Fitzroy
Trend-Arlington	Findlay Creek
Tanglewood	Fallingbrook
Stonebridge - Half Moon Bay - Heart's Desire	Emerald Woods - Sawmill Creek
Stittsville	Elmvale - Canterbury
South Keys - Greenboro West	Edwards - Carlsbad Springs
Skyline - Fisher Heights	East Industrial
Sandy Hill	Dunrobin
Rothwell Heights - Beacon Hill North	Cumberland
Rockcliffe Park	Crystal Bay - Lakeview Park
Riverview	Corkery
Riverside South - Leitrim	Convent Glen - Orléans Woods
Riverside Park	Constance Bay
Rideau Crest - Davidson Heights	Civic Hospital-Central Park
Richmond	Cityview - Crestview - Meadowlands
Queenswood Heights	Chatelaine Village
Qualicum - Redwood Park	Chapman Mills
Portobello South	Chapel Hill South
Playfair Park - Lynda Park - Guildwood Estates	Chapel Hill North
Pineview	Centretown
Parkwood Hills - Stewart Farm	Centrepointe
Overbrook - McArthur	Carson Grove - Carson Meadows
Osgoode - Vernon	Carp
Orléans Village - Chateauneuf	Carlingwood West - Glabar Park - McKellar Heights
Orléans Industrial	Carlington
Old Ottawa South	Carleton Heights - Rideauview
Old Ottawa East	Cardinal Creek
Old Barrhaven West	Byward Market
Old Barrhaven East	Brookside - Briarbrook - Morgan's Grant
North Gower - Kars	Britannia Village
Navan - Sarsfield	Bridlewood - Emerald Meadows
Munster - Ashton	Briar Green - Leslie Park

Metcalfe	Braemar Park - Bel Air Heights - Copeland Park
Merivale Gardens - Grenfell Glen - Pineglen - Country Place	Borden Farm - Fisher Glen
Marlborough	Blackburn Hamlet
Manotick	Billings Bridge - Alta Vista
Manor Park	Bells Corners West
Lowertown	Bells Corners East
Lindenlea - New Edinburgh	Beaverbrook
Ledbury - Heron Gate - Ridgemont	Beacon Hill South - Cardinal Heights
Lebreton Development	Bayshore - Belltown
Laurentian	
Kinburn	
Katimavik - Hazeldean	
Kanata Lakes - Arcardia	
Island Park - Wellington Village	
Iris - Queensway Terrance South	
Hunt Club Woods - Quintarra - Revelstoke	
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Perceptions of Diagnosis of Diabetes among Newly Diagnosed Diabetes Patients – A Qualitative Study

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Abstract

This research aims to explore the contextual barriers and beliefs surrounding the recent diagnosis of diabetes mellitus type II from the viewpoint of patients. Thirty-two individuals diagnosed with diabetes mellitus II were interviewed to understand the circumstances leading to their diagnosis and to identify any obstacles hindering early detection. Grounded theory qualitative methods were employed for the analysis of the interviews. The diabetes diagnosis in the interviewed patients commonly resulted from chance discovery, symptom recognition, or patient-driven initiatives. Despite having a familial predisposition to diabetes, many patients had limited awareness of diabetes symptoms before diagnosis. Frequently, symptoms were incorrectly attributed to other factors. Notably, concerns related to fear and trust were not prominent among these patients. There appears to be a lack of awareness among individuals with undiagnosed diabetes regarding the significance of reported symptoms. Clinicians need to remain alert to identify individuals at increased risk of diabetes, and the implementation of screening programs should be considered.

Keywords: newly diagnosed diabetes, diabetic symptoms, diabetes education, qualitative, patient attitude.

1. Introduction

The prevalence of diabetes is acknowledged as an important global health issue (Fralick et al., 2022), which affects various body systems leading to increased rates of morbidity and mortality (Zakir et al., 2023). Diabetes is characterized as a complex and progressive disease; it demands effective management necessitating the implementation of diverse risk management strategies (Bereda, 2022). Among metabolic disorders, diabetes mellitus stands out as the most prevalent, with approximately 451 million individuals aged 18–99 years affected by it. This number is projected to increase to 693 million by the year 2045 worldwide (Dehghan et al., 2022). The condition arises from either a lack of insulin or its inefficiency, leading to a state of elevated blood sugar levels, known as hyperglycemia. Diabetes gives rise to various complications and mortality (Zakir et al., 2023).

In recent decades, the global prevalence of diabetes has surged significantly, reaching epidemic proportions (Alqahtani et al., 2023). According to the latest data from the International Diabetes Federation (IDF), approximately 9.1% of adults aged 20 to 79 years, totaling 463 million individuals, are affected by diabetes (Ogurtsova et al., 2022). Additionally, an estimated 374 million people have impaired glucose tolerance which increases the risk of developing diabetes later in life (Alqahtani et al., 2023). Alarmingly, half of the adults with diabetes (approx. 232 million), remain undiagnosed, potentially leading to complications as their condition goes untreated (Sardu et al., 2019). It is expected that this number will increase to 578 million in 2030 and 700 million in 2045. In Saudi Arabia, current estimation shows that there are 4 million diabetic patients (Almutairi & Abbod, 2023).

There is growing global attention towards diabetes, with a particular focus on Type II diabetes. This evaluation serves as a valuable tool for gauging the effectiveness of global policies, programs, and clinical interventions aimed at addressing diabetes (Ali et al., 2022). Contrary to the conventional belief associating diabetes primarily with affluent and developed regions, there is substantial documentation of high prevalence rates in developing countries (Ogurtsova et al., 2022).

Between 1990 and 2010, the disease's ranking decreased from 15th to 9th place, indicating a substantial 92.7% increase in burden over two decades (Babakhanian et al., 2022) The surge in diabetes prevalence in recent years is

attributed to factors like an aging population, genetic predisposition, obesity, and unhealthy lifestyles. In 2014, the prevalence of diabetes in individuals aged 18 and above stood at 8.5%, marking a significant rise over the past thirty years, particularly in low- and middle-income nations (World Health Organization, 2016; Babakhanian et al., 2022).

Over the past three years, there has been a tenfold rise in the incidence of diabetes cases in Saudi Arabia (Gollapalli et al., 2022). There has been a rise in diabetes rates in Saudi Arabia, marking the condition as an important public health concern. Approximately 17.1% of Saudi adults in 2022 were estimated to be affected by diabetes (Alwadeai & Alhammad, 2023). This prevalence represents a substantial increase from the 2.1% to 9% range recorded in the 1980s (Aljulifi, 2021).

Diabetes mellitus often evades detection for an extended duration due to the gradual development of hyperglycemia, with early stages exhibiting symptoms that may not be severe enough for patients to recognize the classic indicators. The prolonged subclinical phase of the condition is linked to heightened morbidity and mortality, increasing the risk of macro and microvascular complications.[3] Positive attitudes of patients toward diabetes management play an important role in modifying their behavior to regulate blood glucose levels compared to those with negative attitudes (Mansy et al., 2022).

Unrecognized diabetes poses significant risks like coronary heart disease, stroke, and peripheral arterial disease, alongside microvascular conditions like kidney disease, peripheral neuropathy, and retinopathy (Tomic et al., 2022). Previously, the identified shortcomings in the healthcare system include; a lack of essential infrastructure for diabetic care as a barrier that contributes to suboptimal processes and outcomes for individuals with diabetes. Despite the ongoing prevalence of the traditional complications linked to diabetes mellitus, there is a decline in the rates of these conditions, attributed to advanced management of diabetes mellitus (Tomic et al., 2022). Conventional guidelines outlined in programs like the National Diabetes Prevention Program (Draznin et al., 2022) advocate weight loss through energy deficits to enhance insulin sensitivity and slow disease progression.

These differing treatment priorities by patients and healthcare providers highlight the need for a deeper understanding. Therefore, the present study aims to explore the context barriers and beliefs related to recent diagnoses of diabetes mellitus type II from the viewpoint of the patients. Furthermore, the study examined the prior health experiences and how these patients interpreted symptoms upon being recently diagnosed with diabetes mellitus type II.

2. Method

2.1 Study Design

The present study has employed qualitative research methods that help in investigating patterns of meaning from the data, frequently articulated in the participants' language (Pope & Mays, 1995). The qualitative researcher's responsibility is to identify patterns within these expressions (and actions) and present them for scrutiny, all while maintaining proximity to the participants' original experiential framework. This qualitative study involved in-depth interviews with a cohort of adult patients recently diagnosed with diabetes. This approach allowed patients to articulate their interpretations and viewpoints, facilitating the identification and exploration of themes and hypotheses that might not have been initially foreseen.

The employment of grounded theory qualitative methods enabled us to deeply explore the context surrounding recent type II diabetes diagnoses to shed light on this complex process. The data collection approach provides rich insights into the sociological phenomenon under observation (White & Cooper, 2022).

2.2 Study Sample

The participants for this study were recruited from the Family Medicine Clinics and Primary Health Care clinics at the Heath Care Specialty Center (HCSC) which is part of King Abdulaziz Medical City in Riyadh KSA, from February to September 2022. The sample of this study comprised 32 patients for qualitative analysis. Most of the patients were soldiers in the National Gourd or their family members, most were intermediate social class and the health care system is free governmental health care services. Enrollment of patients was through file review of all diabetic patients referred to the health educator by the family physician or the Primary Health Care doctor in HCSC.

The study included patients who had received a diabetes diagnosis in the preceding six months to share their perspectives on the experience of being diagnosed. The time frame for diagnosis was confined to the six months leading up to the interview to gather their most vivid recollections of transitioning from undiagnosed to diagnosed diabetes. Both genders were included in the study. However, patients <18 years, diagnosed with gestational or type

1 diabetes, and diagnosed more than 6 months were excluded from the study.

2.3 Study Procedure

The data for this study was gathered through face-to-face interviews utilizing a semi-structured interview questionnaire (Appendix I). Each interview was for 15 to 20 minutes and conducted within the healthcare setting. Most of the questions are open-ended questions that enable the patient to express his or her perceptions, feelings, ideas, concerns, beliefs, and expectations about being diabetic. These questions are collected from previous studies that investigate the same issue.

2.4 Thematic Analysis

The transcripts from the interviews underwent thematic analysis, with each investigator independently examining them. Regular meetings were held among the three investigators, consisting of two family physicians and a health educator with expertise in qualitative methods. During these sessions, the team discussed emerging themes, reached consensus, and determined subsequent steps in sampling and questioning. Through the interviews with patients, socio-demographic barriers to diabetes diagnosis were identified, revealing racial disparities in undiagnosed diabetes. The assessment of the interview process's completeness was based on the point where new interviews failed to yield additional information.

2.5 Ethical Consideration

The researchers assured the ethics committee that all patients were informed and sought consent for their participation in this study. Explicit permission was obtained from the participants for the transcription of the interviews. It is imperative to note that the data and information acquired from the patients were exclusively utilized for this research. Patients were contacted following approval from the Department's Research Ethical Committee.

3. Results

Most of the patients recruited in this study were interviewed on the same day of diagnosis, and only 9 were diagnosed within 3 months of their interview. The patients' average age ranged between 33 to 71 years, with a mean age of 53 years. All of them are Saudi citizens and National Guard dependent. Educational attainment ranged from illiterate to high school. Healthcare was provided at the primary care level and was free of any charges. The analysis revealed prevalent themes among the majority of the participants that are summarized below;

3.1 Methods of Diagnosis

Individuals reported diverse paths to their diabetes diagnosis, with many experiencing it through accidental discovery, in response to distinct symptoms, or as a result of their proactive efforts. Notably, five participants underwent diagnosis after voluntarily opting for testing due to the recognition of symptoms that they associated with diabetes. One patient stated that;

"I always felt thirsty…even if I drink a whole bottle of water...my family advise me to have chick up." (Patient 7)

Eight patients received their diabetes diagnosis upon the discovery of elevated blood glucose levels during routine laboratory examinations conducted for the monitoring of other medical issues. The statements of patients in this context have been listed below;

"The rheumatologist, while conducting laboratory work for my rheumatoid disease, identified elevated blood sugar levels. Consequently, he referred me to family medicine for further evaluation and management." (Patient 10)

"I am known hypertension. I used to have blood work every 6 months. Then they discover that am diabetic." (Patient 13)

"My physician used to ask for some tests every 6 months to monitor my gland problem (hypothyroidism)…and in one day he told me that my sugar is too high." (Patient 22)

"It was accidental finding of high blood sugar when I went to emergency due to scorpion bite." (Patient 4)

Nineteen patients received their diabetes diagnosis as a result of symptoms reported during acute care visits. The patient stated that;

"I have been having this pain and burning sensation in my legs for a long time...so the doctor raises the possibility of diabetes." (Patient 16)

"I had this bad ear infecting…because of that the doctor advised for more tests." (Patient 1)

"I felt dizzy twice in one week … when I complained to the doctor … he suggested some labs" (Patient 30)

Furthermore, it was noted that none of the patients went through a specific diabetes screening program.

3.2 Patients' Concerns

Six out of 32 patients were worried about the diagnosis, some of them were concerned but not worried, however, most of them had never thought about it.

"I was worried about my general health." (Patient 2)

"I have a history of gestational diabetes. I was worried…I asked my doctor to do blood work for diabetes." (Patient 6)

"I was worried about diabetes, am known to have gestational diabetes, so I do ask the doctor to do blood work for me." (Patient 12)

"I can't say that I was worried about diabetes, but I was having some concerns because my age is above 60years and I consider myself obese." (Patient 11)

3.3 Awareness of Diabetes Symptoms

Most of the patients admitted that they were not aware of any symptoms of diabetes before they met their family physician. Only seven of 32 patients were aware of diabetic symptoms

"I was complaining from the generalized body each and low energy and I think this is related to diabetes because I have a history of gestational diabetes before so am aware of the symptoms." (Patient 6)

Most of the participants noticed one or more of the following symptoms: dry mouth, thirst, fatigue, frequent urination, loss of weight, and loss of energy, and most of them did not link it to diabetes until seen by the family physician.

"I was complaining from dry mouth, but I did not think that dry mouth has any relation to diabetes." (Patient 1)

"I notice frequent urination but I did not know that it is connected to diabetes until the doctor told me." (Patient 3)

"I have symptoms of dry mouth, loss of weight, and joint pain but I did not know that it is the symptoms of diabetes." (Patient 7)

"I was complaining of headaches, fatigability, and thirst, but I do not know it is linked to diabetes." (Patient 13)

"I was complaining from thirst and dry mouth, I was not aware it's related to diabetes until the doctor told me." (Patient 5)

Some patients believed that these symptoms highlighted something else like summertime, aging, hard work, etc, and not diabetes.

"I feel fatigued all the time…I thought that this because of caring for my five children" (Patient 15)

3.4 Family History of Diabetes

Nineteen out of 32 patients had a family history of diabetes; either one family member or more. The majority of these family members were closely related, with many also noting the presence of diabetes and its complications among friends and spouses. Yet it didn't cause enough worry for patients having diabetes; it was not the reason for many physicians to ask for blood work.

"Yes, my mother is diabetic but I never thought that diabetes runs in the family!" (Patient 13)

"Yes, my father was diabetic, he died a long time back, but this is not the reason for the doctor to have my blood work." (Patient 9)

A significant number of patients demonstrated limited awareness of diabetes symptoms. When questioned about diabetic symptoms, twenty-five patients acknowledged that they were not acquainted with most of these symptoms before consulting with a doctor or diabetic educator. The answer given by patients upon asking them about any other family members with diabetes is given below;

"Three of my brothers have it; one of them is using insulin ...also my uncles…I'm not sure if my father had it before he died" (Patient 8)

While asking about their family members' taking medication, the patient responded;

"They all complained that their diabetes is never right…some time it is high and other time it's low" (Patient 8)

To answer what extent were the patients familiar with diabetes before their diagnosis, one patient stated that;

"Nothing… but I know that some people are treated with tablets and some with insulin." (Patient 8)

Upon asking patients about any information, they heard from their bothers or the media about diabetic symptoms, the patient stated that;

"Maybe I did hear something …but at the time of the diagnosis I did think about it" (Patient 8)

3.5 Family Experience with Diabetes

Nineteen out of 32 patients had a family history of diabetes. The patients were asked specifically about their feelings when they were diagnosed and if their feelings had anything to do with their family history of diabetes. Most of them were not affected by their family's experiences. Only four patients reported bad feelings when they received the news about the diagnosis of diabetes.

"My mother's experience did not affect my thinking toward diabetes." (Patient 7)

"More than one person in my family is diabetic, although it would not affect me." (Patient 6)

"Everything is from God; my mother is diabetic but her history has not affected me when I have been diagnosed." (Patient 13)

3.6 Medical History

Twenty-four out of thirty-two patients were known to have other medical problems such as hypertension, osteoarthritis, hyperlipidemia, gestational diabetes, liver disease, and otitis media. Patients thought that the physicians did investigate them because of their other complaints.

"I am known to have hypertension, and every person I meet was telling me diabetes came with hypertension, so I ask my doctor to do blood work for diabetes." (Patient 14)

"I am known to have hypertension and my doctor followed my blood work every 6 months." (Patient 13)

"I was following up with my doctor for hypothyroid and hypertension when she discovered am diabetic." (Patient 12)

"I was doing blood work to my liver when they discovered high blood sugar." (Patient 11)

"I have no medical problem, but I have a history of gestational diabetes." (Patient 6)

3.7 Relation to Doctor

The patients were also questioned about possible barriers to their diagnosis. Most of them have a good experience with the medical system in a family medicine clinic. They do trust the doctor and the system.

"This is my 1st visit to National Gourd clinic, I have a good experience with them before, that's why I came again to them." (Patient 7)

Some patients were concerned about the appointment problems and delay in seeing the doctor but reported that these concerns were not the barrier to their seeking care for the problem.

"Everything is organized …but because of the pressure of patents sometimes…there is a delay in the appointments." (Patient 9)

"I do not have any bad experience with the medical system; I do know they have a lot of pressure. And I do trust the doctors." (Patient 17)

None of the patients said that time and schedule with their jobs and professional duties were a potential barrier to receiving care. Some of the patients wished to be followed by the same doctor each follow-up visit.

"I do trust the doctor and the medical system; I wish I have my follow-up with the same doctor each visit." (Patient 12)

"I have a good relation to my doctor; I wish I could see her every visit." (Patient 2)

4. Discussion

The findings from this in-depth exploration of the circumstances surrounding the diagnosis of individuals recently identified with type II diabetes indicate a significant likelihood that a considerable number of people with this condition remain undiagnosed. This lack of awareness about the significance of their symptoms appears to be a contributing factor. Among those with multiple significant risk factors for diabetes, the diagnosis of the condition often occurred by chance. The views of these patients suggest that the proactive implementation of diabetes screening due to their high-risk status was not a widely practiced approach.

Most of the patients deny that fear or worry about diabetes affects having a physician consultation, even (surprisingly) in those with a family history of diabetes. A similar study revealed that recognition of depression signs holds significance within clinical settings as individuals experiencing such symptoms might be hesitant to engage in discussions about self-care (Beverly et al., 2012). There is a necessity for interventions and evidence-backed strategies to enhance both the management of depressive symptoms and communication between physicians and patients regarding self-care. In the present study, the patients refused to have any issues of trust or communication with the health caregiver as a barrier. Moreover, the cost of medical care is not a concern for the patients. The present study signified that the main barrier to having early medical consultation for diagnosing diabetes is the nature of diabetes symptoms.

The individuals are more likely to neglect or misinterpret the signs leading to missed diagnosis of potential conditions like type II diabetes when confronted with the unclear symptoms characteristic of early-stage diabetes, coupled with a limited understanding of these manifestations. The deferment of seeking medical attention is likely as long as patients remain unaffected by the consequences of diabetes and do not perceive a decline in their well-being.[17] The individuals are prone to transition from perceiving themselves as in good health to recognizing an unwell state, after experiencing diabetes symptoms impacting their daily life facilitated by familial, social, or media influences. Consequently, seeking medical consultation becomes more probable. There is an increase in patients' perceived vulnerability that substantiates the effectiveness of educational initiatives (Dadkhah et al., 2018).

Conveying information about the unclear symptoms is likely to pose challenges in communication. Certain patient groups may experience delays in diagnosis due to their interpretation of early, indistinct symptoms and limitations in expressing them, both personally and when seeking lay consultation from their family and peers (Vaishnavi & Mishra, 2021). Individuals undergo the subjective experience of "illness," while physicians and healthcare providers engage in diagnosing the corresponding "disease." In this healthcare interaction, physicians play a crucial role in translating the patient's sociocultural explanation of the illness (Mariman et al., 2023). The occasional disparity between these clinical realities carries implications for how we conceptualize, categorize, and respond to diseases (Mariman et al., 2023). Importantly, a considerable proportion of "illnesses" may not come to the attention of a physician, potentially leading to further delays in diagnosis.

The study findings suggest the need for increased community awareness regarding diabetes and education regarding the significance of certain ambiguous symptoms. At the community level, it is suggested that both patients and physicians may benefit from reminders about the importance of diabetes screening, particularly for individuals at risk of the disease. It is noteworthy American Diabetes Association (ADA) has a significant positive impact on patients across the globe in collaboration with WHO (Fleming et al., 2020).

The primary rationale behind advising against population screening is the insufficient evidence supporting the fact that early detection leads to a reduction in morbidity and mortality (Harris et al., 2003). Despite this, it is established that proactive management of confirmed disease significantly decreases the likelihood of complications (Aljulifi, 2021). Nonetheless, the ADA recommends that healthcare providers are more careful in the detection of diseases and screening, particularly among individuals with significant risk factors (Aljulifi, 2021). These factors include belonging to specific minority groups or having a family history of diabetes, which were prevalent characteristics among the participants in the present study. It could be helpful not only to emphasize to patients with these risk factors that they are more susceptible and eligible for screening but also to promote the idea of screening for diabetes based on risk factors within primary care practices.

While this study has yielded valuable insights, it is important to acknowledge certain limitations. For instance, the study's qualitative analysis approach is the first limitation that focused on exploring the context from the participant's perspective and may not readily extend to broad generalizability across diverse settings. Despite this limitation, the study serves as a hypothesis-generating strategy, providing valuable information that could contribute to a more universally applicable investigation. Another limitation pertains to the perspective of patients from which the information was obtained. Consequently, the actual screening practices of physicians remain unknown. While patients initiated the diagnostic process based on their experiences, it is crucial to recognize that this retrospective sense-making might influence the accuracy of their accounts. Furthermore, the study's sample was drawn from clinics catering exclusively to National Guard dependents, a demographic characterized by unique features such as relatively lower educational levels and average income. This distinct profile may impact the generalization of the study's findings beyond this specific population.

In conclusion, the timely identification and management of diabetes are critical factors in preventing both microvascular and macrovascular complications associated with diabetes. A comprehensive understanding of the

patient's journey from the recognition of symptoms to the formal diagnosis of diabetes, holds significance for clinicians and policymakers alike, providing valuable insights to refine the strategies in diabetes care. This study has highlighted the potential value of targeted educational efforts directed at individuals with an elevated risk of diabetes. Enhancing awareness and knowledge regarding diabetes symptoms may facilitate early consultations with healthcare providers among those experiencing initial signs of the condition. As a result, prioritizing improved education for at-risk individuals emerges as a promising avenue for enhancing the early detection of diabetes.

The study recommended that healthcare initiatives should concentrate on the development and implementation of educational interventions tailored to high-risk populations. These interventions should emphasize the importance of early symptom recognition, encouraging timely medical consultations, and contributing to a proactive approach to diabetes detection. Future research should focus on assessing the efficacy of such educational programs, examining their impact on patient behavior and health outcomes, and exploring their adaptability across diverse healthcare settings. By refining and expanding educational strategies, it is possible to advance a more comprehensive and effective approach to diabetes diagnosis and care.

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Data Availability Statement

The data that support the findings of this study are available on request.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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Appendix

Appendix I: Interview Questions

1. Tell me about how you were diagnosed with diabetes.

2. Were you worried that you might have diabetes and asked that your doctor do a test to see if you had it? Why?

3. Were you having problems that caused the doctor to test for diabetes?

4. Did you have certain other diseases that worried you or your doctor that led to your being tested for diabetes?

5. Did you have other people in your family with diabetes and did that worry you or your doctor and lead to your being tested for diabetes?

6. How worried were you that you might have diabetes before you knew for sure? Why?

7. Did you have symptoms of diabetes before your diagnosis? What were they?

8. Did you recognize them as symptoms of diabetes at the time? How did you know?

9. How did knowing about your family's experience with diabetes influence you as far as coming to the doctor when you were first diagnosed with

10. diabetes?

11. How is your relationship with your doctor? Tell me about it.

12. Do you trust the medical system in general?

Any past bad or good experiences with the health care system that influenced your decision to go to the doctor?

Social Acceptance of Mobile Health Technologies Among the Young Population in Nigeria

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Abstract

Mobile devices are widely used in modernizing healthcare delivery because of their unique features related to accessibility, virtual interaction, and connectivity. While developing countries, with limited resources, strive to achieve high healthcare standards, and mobile health (mHealth) solutions could transform healthcare delivery systems in these countries, their functionality is currently limited. This study investigates the potential systematic introduction of mHealth services and their social acceptability in developing countries, with a particular focus on Nigeria. This cross-sectional study was conducted with a sample of university students. Structural equation modeling was used to test the study hypotheses, and descriptive statistics were used to analyze the sociodemographic characteristics of the participants. Psychological and personal characteristics, environmental characteristics, and conditions of use associated with mHealth technology adoption were examined based on eight constructs (health consciousness, trust, social influence, perceived risk, performance expectancy, facilitating conditions, effort expectancy, and behavioral intention). The results indicate that trust and performance expectancy are significant predictors of mHealth acceptance in the surveyed population. The future acceptance of mHealth among young people in developing countries holds great significance for improving healthcare delivery, addressing the unique challenges faced by developing countries, and leveraging the preferences of young individuals, which could contribute to the advancement of mHealth solutions and enhance healthcare accessibility. The findings shed light on the acceptance of mHealth technologies among the young populations of developing countries, with implications for future efforts to improve healthcare delivery and address the healthcare challenges of these countries.

Keywords: mHealth, mobile health, developing countries, healthcare accessibility, digital divide, sociocultural factors, young population, healthcare delivery

1. Introduction

Social acceptance of mobile health (mHealth) among the young populations of developing countries is a crucial aspect to consider when implementing and expanding mHealth initiatives. In recent years, mHealth initiatives have gained traction as a means of providing healthcare services through mobile devices. The rapid development of information and communication technologies has opened enormous opportunities for healthcare, especially in developing countries where there is a shortage of healthcare professionals (Cao et al., 2022). In this context, mHealth applications and technologies have been noted for their potential to enhance healthcare delivery in resource-poor countries with shortages of healthcare professionals (Adetunji et al., 2021). Thus, social acceptance of mHealth among the young population of developing countries is of great significance in today's digital era. Access to quality healthcare is a fundamental human right and the cornerstone of social and economic development. However, in developing countries, the realization of this right remains a persistent and complex challenge (Ilozumba et al., 2018; Tian et al., 2017; Torres-Quintero et al., 2020). Nigeria, one of the developing

countries in West Africa, is in the sub-Saharan Africa region and is the most populous nation in Africa. In Nigeria, an estimated 200 million people have health and medical histories linked to both traditional practices and modern (orthodox) healthcare systems; the latter as mainly established to serve the healthcare needs of the colonial administration and expatriate communities. There was a gradual shift post-independence—from 1960 onward—toward a more inclusive healthcare policy and a systematic healthcare approach, with investments in infrastructure, public health campaigns, and the establishment of hospitals and clinics (Aka & Balogun, 2022; Aregbeshola 2021; Scott-Emuakpor, 2010). This resulted in a health system approach segmented into primary, secondary, and tertiary levels of care (Figure 1). However, despite these efforts, the healthcare sector of the country is still consistently confronting various challenges, including a high incidence of diseases such as malaria and cholera, and an equally large number of cases of maternal and child deaths (Omoleke & Taleat, 2018). The system also faces challenges due to the lack of adequate infrastructure and qualified medical professionals (Oleribe et al., 2019). Addressing the complex challenges within Nigeria's healthcare system, which include the critical shortage of healthcare professionals and limited access to medical facilities in rural areas, mHealth technologies offer targeted solutions that harness the widespread use of mobile devices. Specifically, mHealth initiatives, such as telehealth services and mobile health information platforms, have the potential to bridge the gap in healthcare access. They enable remote consultations and health monitoring, thereby circumventing the logistical constraints of traditional healthcare delivery methods. Moreover, mHealth applications can facilitate disease tracking and health education, directly addressing issues of disease prevalence and public health awareness. This study visualizes the aforementioned mHealth interventions, assessing their capacity to tackle the acknowledged healthcare obstacles and examining their reception among the youth population in Nigeria.
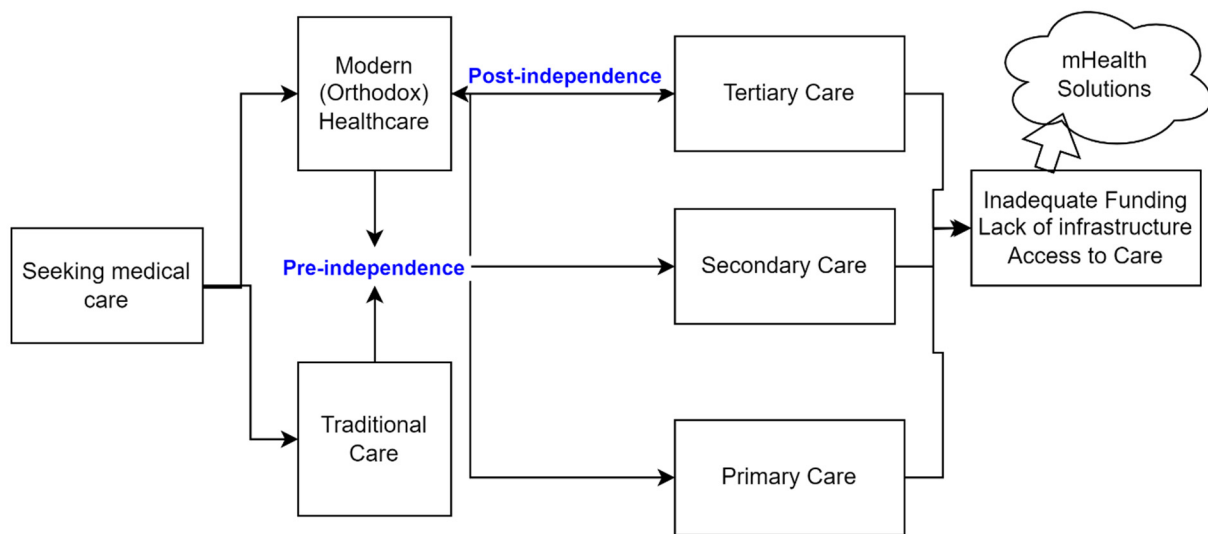
Figure 1. Nigeria's health system approach: Pre- and post-independence

The steps being taken to transform and augment healthcare delivery are evidenced by recent developments such as the National Health Insurance Scheme (NHIS) and public health programs focusing on polio and malaria, to name a few (Effiong et al., 2023; Gbolahan & Oyeranmi, 2023). However, funding issues, management inefficiencies, and uneven resource distribution continue to plague the system. In such an environment, mHealth technologies emerge as a potentially viable solution to some of these persistent problems. The current estimates of smartphones users in Nigeria are between 25 and 40 million, and it is projected to exceed 140 million by year 2025 (*Smartphone Users in Nigeria 2014-2025 | Statista, 2023*). Taking advantage of the fast rate and widespread nature of mobile phone use in Nigeria with over 32 percent penetration annual growth rate (Aimuengheuwa, 2023), particularly among the young generation between 18 to 40 years who represent over 70 percent of the population, mHealth has great potential to help transform healthcare provision by increasing access to medical information, enabling remote diagnosis where needed, and facilitating the efficient management of health services, particularly among people living in far-flung areas. The use of mHealth applications in developing countries holds promise for improving healthcare access and outcomes for individuals with limited access to healthcare facilities and services

(Tudor et al., 2022). However, there exists a lack of comprehensive understanding regarding how exactly mHealth can systematically address these challenges, as well as whether it will be socially acceptable within the Nigerian context. This study aims to fill this notable gap by examining the potential of mHealth in mitigating specific healthcare delivery issues in Nigeria and exploring the factors that influence its acceptance among young populations. Hence, our research problem centers on the exploration of how mHealth solutions can be optimized to effectively overcome the identified healthcare system challenges, while also considering the extent to which they will be embraced by Nigeria's youth population. This research utilizes the Unified Theory of Acceptance and Use of Technology (UTAUT) as a theoretical framework. The UTAUT combines principles from eight different theories in social and psychological disciplines (Venkatesh et al., 2003). This comprehensive framework outlines the various factors that influence technology adoption, which is essential for understanding the complexities surrounding the acceptance of mHealth. It enables the examination of the interplay between technological, psychological, and social factors that significantly impact the willingness to accept and future utilization of mHealth technologies among the young population.

1.1 Definition of mHealth

mHealth refers to the use of mobile technology such as smartphones and tablets in the provision of healthcare services and information (Karlyn et al., 2020). The World Health Organization (WHO) defines mHealth as the practice of medicine and public health supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices (Sakina et al., 2023). In addition, mHealth encompasses the use of mobile and wireless technologies to support the achievement of health objectives, providing health information and services through smartphones (Torres-Quintero et al., 2020). In the modern era, burgeoning interest in mHealth, particularly among young adults in technologically advanced countries such as Japan, has garnered the attention of researchers and healthcare professionals alike (Hu et al., 2022). Indeed, mHealth technology has been widely adopted in numerous countries, with the potential to significantly improve patients' compliance with treatment and aid them in managing their health by providing access to medical services from the comfort of their homes. One of the primary concerns associated with reliance on mHealth technologies in developing countries pertains to the digital divide. Despite the increasing penetration of mobile phones in these regions, disparities in access to smartphones and reliable internet connectivity persist. Consequently, the universality of mHealth applications may be limited by socioeconomic and infrastructural barriers, potentially exacerbating existing health inequities within these communities (Rahman et al., 2021).

Meanwhile, mHealth initiatives have been instrumental in extending the reach of healthcare services to remote and underserved areas, thereby bridging the gap between healthcare providers and patients (Tian et al., 2017). In addition, mHealth encompasses a wide range of services and applications, including remote patient monitoring, disease surveillance, health promotion, and information dissemination (Karlyn et al., 2020). In the context of this research, mHealth technology constitutes tools for improving the quality of healthcare provision and creating equal opportunities for healthcare in under-resourced areas, particularly in developing countries. The widespread availability of mobile phones and the increasing penetration of mobile technology make mHealth a promising tool for addressing healthcare challenges in developing countries (Swanepoel, 2017). This rapid increase in smartphone penetration has shown the potential for addressing healthcare challenges in low- and middle-income countries, where access to traditional healthcare services may be limited. Furthermore, the widespread adoption of mobile phones and communication technologies would contribute to empowering patients to actively manage the health issues they experience and the related risk factors.

1.2 Mobile Health in Developed and Developing Countries

In both developed and developing countries, mHealth technology has emerged as a transformative force (Karlyn et al., 2020), offering innovative solutions to enhance healthcare accessibility and delivery. Rapid advances in mobile technologies and applications, coupled with continued growth in the coverage of mobile cellular networks, have driven a transformative shift toward the utilization of mHealth applications in healthcare. In developed countries, substantial investments have been made to enhance healthcare access through mHealth initiatives; remote consultations and monitoring of chronic conditions have become possible in these countries due to mHealth technology (Shen et al., 2017). Meanwhile, the acceptance and adoption of mHealth initiatives in developing countries have encountered challenges. For instance, in Nigeria (Eze et al., 2022), socio-economic and cultural factors have been found to be pivotal in integrating mHealth into healthcare systems. As such, these nations are uncovering the intricate dynamics of mHealth acceptance and acknowledging the profound influence of cultural, economic, and technological elements. Countries such as India have witnessed a surge in mHealth initiatives, with studies indicating that perceived usefulness, ease of use, and trust significantly influence acceptance. The

affordability and accessibility of mobile technology also play a crucial role in the positive reception of mHealth services (Rajak & Shaw, 2021). In the context of Africa, the promise of mHealth has been recognized in South Africa, particularly in rural areas. The acceptance of mHealth in South Africa is influenced by factors similar to those in other regions, with an additional focus on privacy and security concerns (Van Der Pol et al., 2021). In Uganda, mHealth interventions targeting healthcare challenges (e.g., associated with maternal and child health) have also underscored the importance of mHealth in addressing digital literacy and infrastructure limitations (Palos-Sanchez et al., 2021; Takuwa et al., 2023). Nonetheless, mHealth has significant potential to address various healthcare challenges in developing countries despite the associated drawbacks that may limit its acceptance (Adcock et al., 2022).

1.3 Research Objectives

This study aimed to examine the social acceptability of mHealth among young populations in developing nations. Specifically, our focus was on understanding the factors that can contribute to the acceptance of mHealth tools among young individuals, who represent future consumers, compared to older demographics. This study drew inspiration from prior research offering valuable insights into the complexities surrounding the adoption of mHealth technology. For example, Alam et al. (2020) examined the factors affecting the adoption of mHealth services as well as the moderating effect of gender on the intention to use and the actual usage behavior of users of mHealth services; their results revealed that performance expectancy, social influence, facilitating conditions, and perceived reliability were found impacting the adoption of mHealth solutions in developing countries such as Bangladesh. Further, Alaiad et al. (2019) grounded their analysis in established models of technology acceptance, revealing a strong association between various factors, including performance, effort, and social influence, as well as the intention to use mHealth. They also noted the negative impacts of security and privacy concerns on such intentions. Karaegeorgos et al. (2019) synthesized findings from multiple studies to highlight the potential advantages of mHealth in improving healthcare systems in resource-limited settings in developing countries. Nevertheless, the specific sociocultural and economic factors influencing mHealth adoption in developing nations, from the perspective of prospective users' behavioral intention, remain unclear. Addressing this gap in prior knowledge is crucial for developing a strategy for mHealth social integration that aligns with developing nations' unique needs and ensuring its sustainability and effectiveness in these countries.

1.4 Significance of the Study

It is imperative to explore and address the specific social, cultural, and economic determinants that affect the acceptance, adoption, and use of mHealth technologies in developing countries. By doing so, we can tailor mHealth initiatives to the unique needs and preferences of the young population in developing countries, thereby enhancing the accessibility, affordability, and effectiveness of healthcare services. This need is particularly highlighted in the context of patients' acceptance of and willingness to use mHealth technologies in developing countries. As mHealth has gained attention as a form of technology effective for solving healthcare-related challenges, studying the social acceptance of mHealth among young populations in developing countries would help bridge the gaps in extant literature on health outcomes and the adoption of mHealth apps in global populations; in this regard, it is essential to further explore the socioeconomic and cultural factors that influence the use of these technologies (Palos-Sanchez et al., 2021). The unique needs and preferences of the young populations of developing countries call for a comprehensive understanding of the factors influencing the adoption of mHealth services. Although the potential of mHealth to transform healthcare services in developing countries is evident, its successful integration into healthcare ecosystems hinges on a multifaceted understanding of the factors influencing its social acceptance. As the adoption of mHealth is gaining traction in Nigeria, it is imperative to comprehend user perceptions influenced by socioeconomic and cultural determinants. This study, involving an undergraduate student population, sheds light on the facilitating or impeding factors related to health behavior, access, and quality healthcare services, specifically clarifying how mHealth impacts healthcare delivery within this demographic. The study is significant as it presents insights that could guide the development of tailored strategies and optimized solutions specific to young populations in developing countries; this could in turn promote equitable healthcare delivery through improved health outcomes, pave the way for broadening healthcare access, and foster a more transformative impact with respect to healthcare outcomes across diverse populations. The unique needs and preferences of the population in developing countries call for a comprehensive understanding of the factors influencing mHealth adoption (Namirad, 2023). Underscoring the multidimensional nature of mHealth acceptance in developing countries, driven by cultural, economic, and technological factors, is important to determine the barriers and challenges (e.g., associated with privacy and health literacy) that need to be addressed for successful implementation. These insights could provide a foundational understanding of the complex interplay of factors that may influence the social acceptance of mHealth services, which is essential for guiding the adoption of

mHealth services among young populations. Further, they could contribute to the existing body of knowledge by presenting a scholarly framework for understanding how specific factors can impact the social acceptance and future adoption of mHealth services.

1.5 Adapted Research Model and Hypotheses

This study employed an adapted version of the Unified Theory of Acceptance and Use of Technology (UTAUT) model used by Cao et al. (2022) in their study (Figure 2). The UTAUT model, originally proposed by Venkatesh et al. (2003), is a widely used framework for understanding the factors that influence the acceptance and use of technology. This model combines several other theories, including the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model, the Theory of Planned Behavior (TPB), a combined TAM and TPB model, the Model of PC Utilization, the Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT). These theories provide a framework for understanding and predicting individual behaviors and attitudes toward technology adoption and usage. For our study, we utilized the model expanded by Cao et al. (2022) with the inclusion of three additional constructs to the original UTAUT structure: health consciousness, perceived risk, and trust. Cao et al.'s (2022) model comprises four aspects—Psychological Dimension, including Personal Characteristics, Environmental Characteristics, and Conditions of Use—and eight constructs—Health Consciousness (HC), Trust (TR), Social Influence (SI), Perceived Risk (PR), Performance Expectancy (PE), Facilitating Conditions (FC), Effort Expectancy (EE), and Behavioral Intention (BI). This broadened framework enables a more detailed analysis of determinants linked to the adoption of and attitudes toward mHealth among the younger generation in Nigeria.
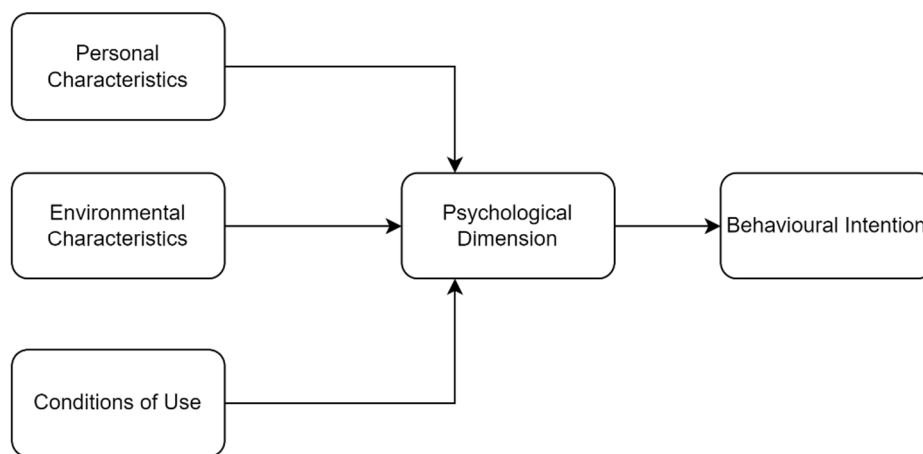
Figure 2. Adapted research model (Cao et al., 2022)

The study hypotheses are based on several relevant variables, as presented in Appendix A; these include perceived risk, trust, performance expectancy, effort expectancy, health consciousness, social influence, and facilitating conditions, each playing a crucial role in shaping user attitudes regarding and intentions to use mHealth services. Below, we briefly describe each of the variables.

Health Consciousness: This reflects the degree to which individuals are aware of their health status and concerned about their health. This is measured by asking how much attention is paid to one's health. Health consciousness has been reported to be correlated with a range of health-related behaviors (Acharya & Lee, 2022). Individuals with a heightened level of health consciousness reflect not only their physical condition but their overall well-being. Consequently, they tend to consider mHealth interventions as less risky.

Trust: Trust in mHealth services encompasses the elements of reliability, security, credibility, and user satisfaction. This is measured by asking if the questionnaire respondent trust technology providers or related personnels. High levels of trust in these services lead to a greater likelihood of their adoption and use among individuals seeking healthcare support (He, 2023).

Social Influence: In this study, social influence refers to the impact of societal and peer pressure on an individual's decision to use mHealth services (Alam et al., 2020). This is measured by asking if socially respected people would

value technology services in interest. This encompasses endorsements from social circles and community opinions, which can significantly affect the adoption of mHealth services.

Perceived Risk: In the context of mHealth acceptance in this study, perceived risk refers to the concerns of an individual regarding privacy, data security, and any potential errors in the applications (Klaver et al., 2021). This is measured by asking if the questionnaire respondent is afraid of risks such as privacy violation or potential abuse by cyber criminals. When individuals perceive a higher level of risk associated with using these technologies, they are less likely to adopt and use them (Fan et al., 2018).

Performance Expectancy: This refers to individuals' confidence in the ability of mHealth services to assist them in meeting or achieving their healthcare needs and goals (Zhao et al., 2018). This is measured by asking if the questionnaire respondent feels technology can help one's activities. It includes individuals' trust in how effective and beneficial these services are for enhancing their general state of health and meeting health objectives.

Facilitating Conditions: This variable captures the degree to which an individual believes that organizational and technological infrastructure exists to support the use of mHealth services (Almegbel & Aloud, 2021). This is measured by asking if the questionnaire respondent has necessary resources to enable technology use. It highlights the importance of accessible and user-friendly mHealth platforms.

Effort Expectancy: In this study, effort expectancy refers to the level of simplicity of mHealth technologies, which can invariably influence an individual's intention to use mHealth services (Semiz & Semiz, 2021). This is measured by asking if the questionnaire respondent feels interaction with technology is easy, clear, and understandable. A higher level of effort expectancy can positively influence one's behavioral intention to use mHealth services (Almegbel & Aloud, 2021).

Based on these constructs, we formulated the following hypotheses:

- Perceived risk negatively affects behavioral intentions to use mHealth technologies (H1).
- Trust positively influences behavioral intentions to use mHealth technologies (H2).
- Performance expectancy positively affects behavioral intentions to use mHealth technologies (H3).
- Effort expectancy positively affects behavioral intentions to use mHealth technologies (H4).
- Health consciousness has a negative impact on perceived risk (H5a), a positive impact on trust (H5b), and a positive impact on perceived usefulness (H5c) related to mHealth technologies.
- Social influence has a negative impact on perceived risk (H6a), a positive impact on trust (H6b), and a positive impact on perceived usefulness (H6c) related to mHealth technologies.
- Facilitating conditions positively affect effort expectancy regarding mHealth technologies (H7).

2. Methodology

2.1 Research Design

We employed a quantitative research design. A cross-sectional survey was conducted to obtain information from a sample of undergraduate students from various universities in Nigeria, recruited using convenience sampling. The survey was administered through a Google Form to gather information about the participants' perceptions and attitudes regarding mHealth. The questionnaire was based on the methodological approach described by Cao et al. (2022) (Appendix B). It was designed to evaluate participants' level of awareness about and intention to use mHealth services, by integrating the constructs of Performance Expectation (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), and Behavioral Intention (BI) as conceptualized within the UTAUT model (Venkatesh et al., 2003). The items on Health Consciousness (HC) were based on Guo et al.'s (2020) study, those on Perceived Risk (PR) based on Deng et al.'s (2018) study, and those on Trust (TR) based on Farid et al.'s research (2020). We adapted these questionnaire items due to their uniqueness and relevance, which aligned with the objectives of this study. All items were rated on a 5-point Likert scale from 'Strongly Disagree' to 'Strongly Agree'. This study was conducted without the need for ethics review board approval. It is based on the absence of interventions, invasive procedures, or sensitive data collection.

2.2 Sample Size

Determining an appropriate sample size is crucial to ensure that the study findings are statistically reliable and can be generalized to the target population (Althubaiti, 2022). In this study, the sample size was calculated using the following formula: $Z^2 * p * (1-p) / e^2$, with a confidence level of 95% ($Z = 1.645$), a margin of error of 5% ($E = 0.05$), and estimated proportion (p) = 50% (0.5) (Bujang, 2023). This calculation yielded an approximate sample

size of 270 respondents, aligning with accepted parameters for confidence levels and error margins (Bujang, 2023). However, owing to certain assumed research constraints, we initially targeted 250 respondents for our survey, and we received a total of 377 responses. Data cleaning was performed to ensure the quality and validity of the dataset. In this process, 39 responses with a variance less than 0.25 were excluded. Additionally, 54 duplicate entries and entries with missing or empty fields were excluded. This rigorous data-cleaning procedure resulted in our identification of 93 respondents with invalid entries, consequently excluded from the analysis. After data cleaning, we obtained a valid dataset of 284 respondents for subsequent analysis.

2.3 Data Collection

In this study, we used an online questionnaire developed using Google Forms to collect data. The questionnaire was distributed to undergraduate students from four universities in Nigeria. To facilitate widespread and efficient participation, links to the survey were shared through various social media platforms. Informed consent was obtained from the participants, only after which could they complete the questionnaire. Additionally, measures were taken to ensure the anonymity and confidentiality of respondents' information by removing any identifying details from the collected data. Data collection took place from December 2, 2022, to January 11, 2023, with a substantial number of responses received during this period that could be used for our data analysis. The online questionnaire was meticulously designed to prioritize participant privacy and avoid discussing sensitive topics. This emphasizes our commitment to ethical research practices, which align with the guidelines governing studies of this kind. The voluntary participation of all respondents, along with clear communication about the study's objectives and the confidentiality of their responses, was highly valued. Our adherence to these principles demonstrates a thorough examination of ethical standards, reinforcing the integrity of our study without necessitating formal ethics board review.

2.4 Data Analysis

Data analysis was conducted using SmartPLS 4, a robust software for structural equation modeling (SEM), enabling the exploration of relationships between variables and a more profound examination of the factors influencing the social acceptance of mHealth. Further, SPSS version 28 was used to perform descriptive analyses, enhancing the comprehensiveness of our approach. It revealed the socio-demographic profiles of the participants, including gender, age, education level, career, income, and mobile usage experience. This dual approach allowed for a comprehensive understanding of the data, with SmartPLS 4 focusing on the model's structural aspects and SPSS providing foundational insights into the dataset's characteristics. To assess the validity and reliability of the measurement model, Variance Inflation Factors (VIF) were employed with a threshold of less than 5, providing insights into multicollinearity among the independent variables. Additionally, path model analysis was conducted to investigate the relationships between the latent constructs.

3. Findings, Analysis, and Interpretation

The demographic composition presented in Table 1 shows the varied profiles of the participants, enhancing the generalizability and applicability of our findings. With a near-even split between male (48.90%) and female (51.10%) participants, our study ensured a balanced representation based on sex. The age distribution indicates a concentration of participants within the 21–30 age group (69.70%), and a significant representation of those aged 20 years or younger (26.10%). Regarding participants' education level, the majority hold undergraduate degrees (90.80), this robust representation underscores the alignment of our research focus with the intended participant group. The prevalence of undergraduates in our sample validates that our study is appropriately directed towards this specific cohort, providing a solid foundation for drawing meaningful conclusions and insights within the context of mHealth acceptance. In terms of career, majority of the participants are students (88.00%), while participants from enterprises, civil services, education, freelancing, and other professions collectively contribute to a diverse sample in terms of occupational background (11.00%). The income distribution aspect highlights the socioeconomic diversity of our participants, with a substantial majority earning 0–100,000 naira per month (92.60%). Lastly, participants' varied mobile phone usage experience, ranging from 1 to 3 years to more than 10 years, suggests a nuanced exploration of mHealth acceptance across participants with diverse levels of technological familiarity.

Table 1. Demographic information of the participants

Sex		
Male	139	48.90%
Female	145	51.10%
Age range (years)		
≤ 20	74	26.10%
21–30	198	69.70%
31–40	9	3.20%
41–50	2	0.70%
51–60	1	0.40%
Education level		
High school	15	5.30%
Undergraduate degree	258	90.80%
Master's degree	9	3.20%
Doctoral degree or higher	2	0.70%
Career		
Students	250	88.00%
Enterprises (state or foreign owned)	7	2.50%
Civil servants	2	0.70%
Educators	7	2.50%
Freelancers	2	0.70%
Others	16	5.60%
Monthly income (Naira)		
0–100,000	263	92.60%
101,000–200,000	12	4.20%
210,000–300,000	6	2.10%
301,000–400,000	1	0.40%
≥ 400,000	2	0.70%
Mobile phone usage experience (years)		
1–3	95	33.40%
4–7	80	28.20%
8–10	51	18.00%
> 10	58	20.40%
	284	100.00%

An important aspect of our research involved a thorough VIF analysis, further details of which are presented in Appendix C. Notably, the columns constituting section "B" (in the table presented in Appendix C) show results from analyses specifically conducted to guide the elimination of constructs deemed invalid. In section "A" of the table, we observe generally low VIF values, affirming the overall independence of our model's variables. However, items HC2 and HC3, with VIF values of 5.579 and 5.333, respectively, indicate a potential issue of multicollinearity. Subsequently, section "B" of the table was generated with a focus on refining our model. In section "B," the absence of HC2 and HC3 suggests their exclusion from further analysis, aligning with our intention to eliminate constructs that might introduce multicollinearity and compromise the validity of our findings. The overall pattern in section "B" continues to display consistently low VIF values, reinforcing the robustness of

the refined model. This strategic VIF analysis (especially reported in section "B") serves as a crucial step in enhancing the reliability of our research results by ensuring the exclusion of constructs that could introduce redundancy or interdependence.

The assessment of the measurement model (Appendix D) involved evaluating the outer loadings, Cronbach's alpha, composite reliability (rho_a), and average variance extracted (AVE) for each construct. For Perceived Risk (PR), the outer loadings ranged from 0.796 to 0.897, indicating satisfactory convergent validity. The high Cronbach's alpha (0.917) and strong composite reliability measures (rho_a = 0.917) suggest robust internal consistency, with an AVE of 0.751, thus indicating good reliability. Facilitating Conditions (FC) exhibited outer loadings ranging from 0.843 to 0.893, a Cronbach's alpha of 0.844, and strong composite reliability (rho_a = 0.852), supported by an AVE of 0.761, indicating good reliability. Social Influence (SI) demonstrated strong reliability and convergent validity, with a Cronbach's alpha of 0.911, robust composite reliability (rho_a = 0.912), and an AVE of 0.849. Effort Expectancy (EE) displayed good convergent validity, with outer loadings ranging from 0.872 to 0.909, a Cronbach's alpha of 0.917, and strong composite reliability (rho_a = 0.918), supported by an AVE of 0.801. Performance Expectancy (PE) exhibited strong reliability and convergent validity, with outer loadings ranging from 0.883 to 0.925, a Cronbach's alpha of 0.893, and robust composite reliability (rho_a = 0.898), as confirmed by an AVE of 0.824. Trust (TR) demonstrated strong reliability and convergent validity, with a Cronbach's alpha of 0.928, robust composite reliability (rho_a = 0.929), and an AVE of 0.823. Health Consciousness (HC) displayed excellent internal consistency, with a Cronbach's alpha of 0.929 and convergent validity with outer loadings ranging from 0.901 to 0.914, strong composite reliability (rho_a = 0.93), and an AVE of 0.824. Behavioral Intention (BI) also demonstrated strong internal consistency with a Cronbach's alpha of 0.919 and convergent validity with outer loadings ranging from 0.917 to 0.943, robust composite reliability (rho_a = 0.92), and an AVE of 0.861.

Heterotrait-Monotrait Ratio (HTMT) analysis (Appendix E) was conducted to assess the discriminant validity among the latent constructs. The results demonstrated strong discriminant validity, with all HTMT values well below the widely accepted threshold of 0.85. Notably, Behavioral Intention (BI) to Effort Expectancy (EE) showed an HTMT value of 0.803, and BI to Facilitating Condition (FC) showed a value of 0.782, manifesting substantial separation. These values firmly establish the distinctiveness of these constructs, aligning with our expectations. Although Performance Expectancy (PE) to Effort Expectancy (EE) displayed a slightly elevated value of 0.942, Health Consciousness (HC) to Behavioral Intention (BI) displayed a value of 0.94, and Trust (TR) to Behavioral Intention (BI) showed a value of 0.932, indicating a potential shared variance among these constructs; yet, the values fall within the acceptable range when considering the holistic view of the model. The HTMT values for Social Influence (SI) to Facilitating Condition (FC) of 0.787, SI to Effort Expectancy (EE) of 0.808, and SI to Performance Expectancy (PE) of 0.839, all point to good discriminant validity. The lowest HTMT values reported between Perceived Risk (PR) and other constructs, such as Behavioral Intention (BI) at 0.431, Effort Expectancy (EE) at 0.418, and Performance Expectancy (PE) at 0.376, affirm strong discriminant validity. The value for Trust (TR) to Health Consciousness (HC) of 0.926, although high, does not exceed the threshold, suggesting sufficient discriminant validity. Our decision to use HTMT analysis, along with careful consideration of the absence of a universally agreed-upon threshold, strengthens the validity of our results and contributes to the ongoing discourse on the discriminant validity of latent constructs in SEM.

3.1 Results of Hypotheses Testing

Hypotheses concerning the variables that may predict the acceptance of mHealth technologies were tested by examining the relationships between Health Consciousness, Social Influence, Facilitating Conditions, Perceived Risk, Trust, Performance Expectancy, and Effort Expectancy, and their impact on Behavioral Intentions in the context of mHealth. The SEM diagram (Figure 3) explains the relationships between various constructs believed to influence the acceptance of mHealth technologies. The model includes both exogenous and endogenous variables. The exogenous variables are Health Consciousness (HC), Social Influence (SI), and Facilitating Conditions (FC). These are independent constructs hypothesized to influence the endogenous variables, which include Perceived Risk (PR), Trust (TR), Performance Expectancy (PE), Effort Expectancy (EE), and Behavioral Intentions (BI). The relationships between the variables are depicted by arrows pointing from the predictive constructs to the outcomes, with each arrow labeled with a beta coefficient indicating the strength and direction of the relationship. The R-squared values are shown in the circles next to the endogenous variables, representing the amount of variance in the outcomes explained by the model.
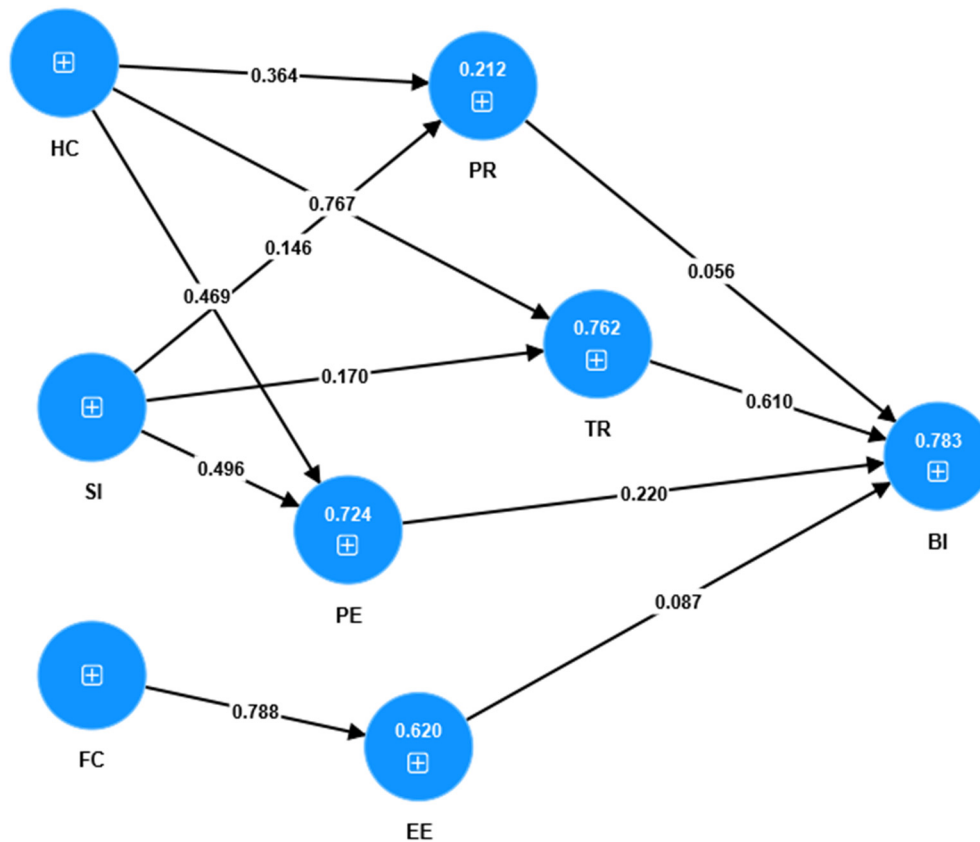
Figure 3. Structural model

H1 was predicated on the idea that concerns about privacy, data security, or potential errors might deter users' intentions to use mHealth services. However, a beta coefficient of 0.056 with a p-value of 0.091 did not support this hypothesis, suggesting that perceived risk does not significantly deter users' intentions to use mHealth services.

H2 suggests that trust in the reliability, security, and credibility of mHealth services encourages users to engage with such technologies. The results support this hypothesis, revealing a strong positive relationship between trust and behavioral intentions to use mHealth technologies. Users who trust mHealth services are more likely to use them, as suggested by a high beta coefficient of 0.61 and a p-value of 0.

H3 suggests that mHealth would be beneficial and improve health outcomes, and is expected to impact the intention to use these services positively. This hypothesis was supported, as indicated by a beta coefficient of 0.22 and a p-value of 0.001, suggesting that performance expectancy is a significant predictor of users' behavioral intentions to use mHealth technologies.

H4 posits that if mHealth services are perceived as user-friendly and easy to use, this would increase the likelihood of their adoption by users. Contrary to this hypothesis, the beta coefficient of 0.087, with a p-value of 0.204, suggests that effort expectancy may not significantly influence behavioral intentions to use mHealth technologies.

H5a suggests that individuals who are more conscious of their health would perceive mHealth to be less risky. This hypothesis was supported, as reflected by a beta coefficient of 0.364 and a p-value of 0, indicating that higher health consciousness is associated with lower perceived risk in the context of mHealth.

H5b suggests that individuals who prioritize their health are more likely to trust mHealth applications, potentially because of a greater propensity to seek and use health-related technologies. This hypothesis was supported by the results, with a beta coefficient of 0.767 and a p-value of 0, suggesting a strong positive relationship between health consciousness and trust in mHealth technologies.

H5c posits that those with higher levels of health consciousness would perceive mHealth as more important and develop an interest in mHealth to support their health goals. This was supported by a beta coefficient of 0.469 and

a p-value of 0, indicating that health-conscious individuals find mHealth services to be more beneficial.

H6a proposes that the influence of peers and social networks could alleviate concerns about mHealth risks as users might rely on the experiences and recommendations of others. The beta coefficient of 0.146, with a p-value of 0.048, supports this hypothesis, suggesting that social influence reduces the perceived risks associated with mHealth technologies.

H6b suggests that endorsements from social circles would enhance trust in mHealth services, positing that social validation enhances trust. A beta coefficient of 0.170 and a p-value of 0 support this hypothesis, indicating that social influence positively affects trust in mHealth technologies.

H6c posits that social influence could lead to a higher perception of mHealth benefits, as users often take cues from others' successful use of mHealth technologies. A beta coefficient of 0.496 and a p-value of 0 support the idea that social influence enhances the perceived usefulness of mHealth technologies.

H7 suggests that the presence of supportive conditions makes it easier for individuals to use mHealth technologies, thereby positively affecting their intention to engage with such services. A beta coefficient of 0.788 and a p-value of 0 support this hypothesis.

Table 2. Hypotheses testing results

Hypothesis	Beta coefficient	Standard deviation	T statistics	P values	Result
PR -> BI	0.056	0.033	1.691	0.091	Not supported
TR -> BI	0.610	0.062	9.914	0	Supported
PE -> BI	0.220	0.067	3.263	0.001	Supported
EE -> BI	0.087	0.068	1.27	0.204	Not supported
HC -> PR	0.364	0.068	5.34	0	Supported
HC -> TR	0.767	0.032	23.702	0	Supported
HC -> PE	0.469	0.046	10.239	0	Supported
SI -> PR	0.146	0.074	1.978	0.048	Supported
SI -> TR	0.170	0.036	4.743	0	Supported
SI -> PE	0.496	0.045	10.984	0	Supported
FC -> EE	0.788	0.024	33.169	0	Supported

4. Discussion

The scope of healthcare delivery is increasingly being shaped by the evolution and integration of mHealth technologies (Kageyama et al., 2022). Studies—spanning from basic to applied research—indicate that technological advancements related to mHealth tools and their impact on healthcare provision, incorporating various mHealth applications and devices such as wearable sensors, mobile apps, and remote monitoring systems, have greatly contributed to the improvement of healthcare delivery and patient outcomes (Hashiguchi et al., 2021; Niwa et al., 2022). Understanding the social value through social enterprises (Kurata et al., 2023) will also foster the adoption rates of these technologies across different populations, ensuring equitable access and maximizing their potential benefits. Exponential growth in mHealth research indicates a shift from health policy to the development and social application of mHealth technologies, reflecting a changing focus in the mHealth field (Cao et al., 2021), thus increasing its relevance and role in healthcare delivery within developing countries. The current study involved a comprehensive analysis based on the UTAUT model and the dimensions and constructs proposed by Cao et al. (2022; explained above) to investigate the acceptance and use of mHealth technologies in developing nations. Our findings revealed a significant positive influence of Trust (with a beta coefficient of 0.610 and a p-value of 0) and Performance Expectancy (with a beta coefficient of 0.220 and a p-value of 0.001) on the behavioral intentions to use mHealth technologies in the future among the young population in Nigeria. This indicates that both trust in mHealth services and the perceived benefits regarding performance are central to users' decision-making process. These results underscore the necessity of initiatives aimed at building trust in mHealth services and demonstrate their effectiveness in ensuring future acceptance. Contrary to our initial hypotheses,

Effort Expectancy (EE) and Perceived Risk (PR) were not as influential as anticipated, with Effort Expectancy showing a beta coefficient of 0.087 and a p-value of 0.204 and Perceived Risk presenting a beta coefficient of 0.056 and a p-value of 0.091. This suggests that the ease of use of mHealth applications and the potential risks associated with them may not be significant determinants of their adoption among young Nigerians. This suggests that while usability and risk considerations are relevant, they do not serve as the primary drivers in the adoption of mHealth services within this demographic. Meanwhile, regarding Personal Characteristics (PC), Health Consciousness (HC) demonstrated a significant positive effect on both Perceived Usefulness (PE) (with a beta coefficient of 0.469 and a p-value of 0) and Trust (TR) (with a beta coefficient of 0.767 and a p-value of 0). This indicates that individuals who are more health conscious are likely to perceive mHealth as both useful and trustworthy. This finding suggests that mHealth initiatives should focus on raising health awareness to enhance positive perceptions and credibility of their services. Moreover, the role of Social Influence (SI) was found to be significant, positively affecting Perceived Usefulness (PE) (with a beta coefficient of 0.496 and a p-value of 0) and inversely affecting Perceived Risk (PR) (with a beta coefficient of 0.146 and a p-value of 0.048). This reflects the importance of social networks in shaping perceptions of mHealth in Nigeria, where community and peer opinions play a crucial role in reducing apprehensions and reinforcing the perceived advantages of mHealth services. Lastly, the Conditions of Use dimension, represented by Facilitating Conditions (FC), had a significant positive effect on Effort Expectancy (EE), as evidenced by a beta coefficient of 0.788 and a p-value of 0. This finding emphasizes the importance of providing accessible and user-friendly mHealth platforms with adequate support to facilitate their adoption among young individuals. The implications of these findings for developing countries are substantial. The pivotal roles of trust and performance expectancy indicate that mHealth initiatives should focus on developing credible and effective solutions. Additionally, the influence of health consciousness and social dynamics on the acceptance of mHealth services highlights the need for targeted strategies to enhance the acceptance of mHealth. However, the lesser importance of effort expectancy and perceived risk suggests that other factors should be prioritized over mere usability and risk mitigation for the successful adoption of mHealth services in these regions.

5. Conclusion

Our study on the social acceptance of mHealth among the young population in Nigeria highlights the systematic nature of the future integration of mHealth into the healthcare delivery system. The empirical findings reveal that factors such as Trust (TR), Performance Expectancy (PE), Health Consciousness (HC), and Social Influence (SI) play crucial roles in shaping behavioral intentions to use mHealth technologies. Trust and perceived effectiveness of mHealth technologies have been identified as primary drivers of their adoption among the young population, emphasizing the need for dependable and effective mHealth solutions. Health Consciousness emerges as a significant personal characteristic that influences perceptions of the usefulness and trustworthiness of mHealth technologies, thus highlighting the potential of mHealth initiatives to enhance health awareness. Social Influence further underscores the importance of community and peer opinions in shaping mHealth perceptions, reducing apprehension, and reinforcing perceived advantages. However, this study identified several potential barriers to the widespread acceptance and effectiveness of mHealth technologies in Nigeria. These include the digital divide, sociocultural factors, policy and regulatory gaps, and concerns regarding data privacy and security. Addressing these barriers requires a systematic approach involving governments, healthcare providers, technology developers, and communities (rural and urban). The insights obtained from our investigation not only provide a deeper understanding of the intricate dynamics surrounding mHealth acceptance in Nigeria but also emphasize the wider relevance of these findings in similar developing environments laying the groundwork for developing strategies to enhance the effectiveness and accessibility of mHealth solutions in different regions facing similar healthcare delivery challenges. The current health situation in Nigeria, characterized by inadequate infrastructure, healthcare personnel shortages, and a high disease burden, presents both challenges and opportunities for mHealth. Although mHealth has the potential to bridge healthcare gaps, enhance disease management, and improve health education, its success depends on effectively overcoming these barriers. Overall, this study contributes to a deeper understanding of the factors influencing the social acceptance of mHealth in developing countries such as Nigeria. It provides insights for tailoring mHealth initiatives to meet the specific needs and preferences of young individuals, thereby enhancing the accessibility, affordability, and effectiveness of healthcare services in these regions.

5.1 Recommendations

Developing targeted mHealth programs for prevalent health issues in Nigeria is crucial. Collaborative initiatives with telecomunication companies to improve network infrastructure in rural and expanding urban areas will ensure wider mHealth service accessibility, thus increasing its acceptance rate. The establishment and enforcement of government policies to support and regulate mHealth services are vital for maintaining their quality and reliability.

Training healthcare professionals to use mHealth tools will be increasingly important for improving patient engagement and care management in young populations. Public awareness campaigns among the young population are recommended to continuously educate the expanding population about the benefits and usage of mHealth services, building trust and acceptance. These are possible measures that can be taken to fully exploit the potential of mHealth to revolutionize healthcare delivery in Nigeria while keeping pace with its young population.

5.2 Limitations and Future Research

Although informative, the current study has limitations that should be addressed in future studies. First, the sample was limited to undergraduate students, suggesting a potential bias that may restrict the applicability of the findings to other demographics or populations. Additionally, as a cross-sectional study, the results only reflect attitudes and behaviors at a specific time point without considering potential changes over time. Furthermore, there might be additional variables that were not considered that could affect mHealth use. Future studies should aim for more diverse samples, consider longitudinal designs to observe changes over time, and include a wider range of variables to comprehensively understand the factors influencing mHealth use. Recognizing the rapid evolution of mHealth technologies and considering the influence of cultural factors is extremely important. These factors can greatly affect the relevance of our findings. Future research can also focus on key areas that can enhance the effectiveness of mHealth, like user interface design. Addressing these areas will not only improve mHealth services in Nigeria but also provide a blueprint for their adaptation and successful implementation in other developing countries facing comparable healthcare challenges.

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The data that support the findings of this study are available on request.

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The authors declare that there are no competing or potential conflicts of interest.

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Appendix A

Hypotheses Based on Constructs from Cao et al.'s (2022) Study

Hypothesis	Description
H1	Perceived risk negatively affects behavioral intentions regarding mHealth technologies.
H2	Trust positively influences behavioral intentions regarding mHealth technologies.
H3	Performance expectancy has a positive effect on behavioral intentions regarding mHealth technologies.
H4	Effort expectancy has a positive effect on behavioral intentions regarding mHealth technologies.
H5a	Health consciousness has a negative effect on the perceived risk of mHealth technologies.
H5b	Health consciousness has a positive effect on trust related to mHealth technologies.
H5c	Health consciousness has a positive effect on the perceived usefulness of mHealth technologies.
H6a	Social influence has a negative effect on the perceived risk of using mHealth technologies.
H6b	Social influence has a positive effect on trust related to mHealth technologies.
H6c	Social influence has a positive effect on the perceived usefulness of mHealth technologies.
H7	Facilitating conditions have a positive effect on effort expectancy regarding mHealth technologies.

Appendix B

Survey Items Based on Cao et al.'s (2022) Study

Construct		Items description
Performance Expectancy (PE)	PE1	I find mHealth services useful in my daily life.
	PE2	Using mHealth services helps me accomplish things more quickly.
	PE3	Using mHealth services increases my productivity.
Effort Expectancy (EE)	EE1	Learning how to use mHealth services is easy for me.
	EE2	My interaction with mHealth services is clear and understandable.
	EE3	I find mHealth services easy to use.
	EE4	It is easy for me to become skillful at using mHealth services.
Social Influence (SI)	SI1	People who are important to me think that I should use mHealth services.
	SI2	People who influence my behavior think that I should use mHealth services.
	SI3	People whose opinions I value prefer that I use mHealth services.
Facilitating Conditions (FC)	FC1	I have the resources necessary to use mHealth services.
	FC2	I have the knowledge necessary to use mHealth services.
	FC3	mHealth is compatible with other technologies I use.
Perceived Risk (PR)	PR1	I am afraid that mHealth providers cannot guarantee the confidentiality of user information.
	PR2	I am worried that my personal privacy information will be used for other purposes if I use mHealth services.
	PR3	I am worried that when using mHealth services, my personal information will be abused by cyber criminals.
	PR4	I am worried that my personal health-related information is not protected by law when using mHealth services.
	PR5	I am afraid that the rights and interests of users cannot be ensured because of the lack of specific law enforcement on mHealth services.
Trust (TR)	TR1	I have trust in academic researchers working on mHealth service projects.
	TR2	I have trust that mHealth services provide great value to the society.
	TR3	I have trust that the government will improve relevant regulations on mHealth services.
	TR4	I have trust that mHealth providers will improve user privacy management.

Health Consciousness (HC)	HC1	I reflect about my health a lot.
	HC2	I am very self-conscious about my health.
	HC3	I am generally attentive to my inner feelings about my health.
	HC4	I am constantly examining my health conditions.
	HC5	I think that I take health matters into account a lot in my life.
	HC6	I think it is important to know well how to eat healthily.
Behavioral Intention (BI)	BI1	I intend to use mHealth services in the future.
	BI2	I will always try to use mHealth services in my daily life.
	BI3	I plan to use mHealth services frequently.

Appendix C

Variance Inflation Factor Results

Items	A Path Coe	Stand. Dev.	T statistics	P values	VIF	B Path Coe.	Stand. Dev.	T statistics	P values	VIF
BI1	0.915	0.014	64.949	0	3.021	0.915	0.014	65.545	0	3.021
BI2	0.944	0.008	123.186	0	3.983	0.943	0.008	121.534	0	3.983
BI3	0.925	0.013	73.838	0	3.327	0.925	0.012	74.022	0	3.327
EE1	0.909	0.012	75.223	0	3.269	0.909	0.012	75.262	0	3.269
EE2	0.902	0.015	60.939	0	3.066	0.901	0.015	60.546	0	3.066
EE3	0.902	0.014	62.874	0	3.058	0.902	0.014	63.024	0	3.058
EE4	0.866	0.02	42.882	0	2.521	0.867	0.02	43.174	0	2.521
FC1	0.832	0.024	35.408	0	1.903	0.834	0.023	35.849	0	1.903
FC2	0.899	0.015	59.706	0	2.24	0.898	0.015	58.098	0	2.24
FC3	0.884	0.015	60.823	0	1.992	0.883	0.014	60.917	0	1.992
HC1	0.908	0.015	58.955	0	4.116	0.91	0.014	63.591	0	3.426
HC2	0.933	0.01	96.341	0	5.579					
HC3	0.932	0.011	88.367	0	5.333					
HC4	0.902	0.014	65.126	0	4.058	0.905	0.013	69.665	0	3.329
HC5	0.881	0.023	38.741	0	3.365	0.9	0.019	47.092	0	3.204
HC6	0.908	0.015	60.638	0	4.176	0.915	0.012	76.237	0	3.475
PE1	0.916	0.012	76.504	0	2.794	0.915	0.012	76.409	0	2.794
PE2	0.925	0.012	80.28	0	3.109	0.925	0.012	79.839	0	3.109
PE3	0.882	0.02	44.87	0	2.363	0.883	0.019	45.404	0	2.363
PR1	0.817	0.023	35.631	0	2.029	0.817	0.023	35.723	0	2.029
PR2	0.903	0.012	75.494	0	3.788	0.903	0.012	75.816	0	3.788
PR3	0.889	0.016	55.549	0	3.301	0.889	0.016	55.376	0	3.301
PR4	0.878	0.023	37.56	0	4.129	0.878	0.023	38.011	0	4.129
PR5	0.838	0.024	35.391	0	2.956	0.837	0.024	35.277	0	2.956
PV1	0.875	0.021	42.107	0	2.323	0.874	0.021	41.748	0	2.323
PV2	0.934	0.009	105.018	0	3.465	0.934	0.009	103.435	0	3.465
PV3	0.908	0.014	63.455	0	2.726	0.909	0.014	65.447	0	2.726
SI1	0.919	0.011	81.56	0	2.992	0.919	0.011	80.994	0	2.992

SI2	0.928	0.012	75.864	0	3.375	0.928	0.012	76.612	0	3.375
SI3	0.918	0.011	80.085	0	2.955	0.917	0.012	78.882	0	2.955
TR1	0.89	0.019	46.658	0	2.933	0.89	0.019	46.796	0	2.933
TR2	0.931	0.009	102.296	0	4.153	0.931	0.009	102.797	0	4.153
TR3	0.908	0.015	62.17	0	3.366	0.907	0.015	61.989	0	3.366
TR4	0.901	0.018	49.678	0	3.281	0.9	0.018	48.752	0	3.281

Appendix D

Summary of Construct Validity Results

Items	Outer loadings	Cronbach's alpha	Composite reliability (rho_A)	Average variance (AVE)
EE	0.917	0.918	0.942	0.801
FC	0.844	0.852	0.905	0.761
HC	0.929	0.93	0.949	0.824
PE	0.893	0.898	0.934	0.824
PR	0.917	0.917	0.938	0.751
SI	0.911	0.912	0.944	0.849
TR	0.928	0.929	0.949	0.823
BI	0.919	0.92	0.949	0.861

Appendix E

Discriminant Validity Results

. Before

	BI	EE	FC	HC	PE	PR	TR
BI							
EE	0.803						
FC	0.782	0.89					
HC	0.93	0.753	0.697				
PE	0.853	0.942	0.866	0.806			
PR	0.431	0.418	0.438	0.469	0.376		
SI	0.701	0.808	0.787	0.601	0.839	0.378	
TR	0.932	0.786	0.76	0.915	0.83	0.413	

After

	BI	EE	FC	HC	PE	PR	SI	TR
BI								
EE	0.803							
FC	0.782	0.89						
HC	0.94	0.759	0.704					
PE	0.853	0.942	0.866	0.813				
PR	0.431	0.418	0.438	0.479	0.376			
SI	0.701	0.808	0.787	0.604	0.839	0.378		
TR	0.932	0.786	0.76	0.926	0.83	0.413	0.648	

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Exploring the Impact of Anosmia on Daily Living: An Examination of Residents in Benghazi, Libya

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Abstract

The main objective of this study was to investigate how patients with anosmia cope with their daily lives in the second-largest city in Libya, Benghazi. Three dimensions are used to examine: (1) quality of life (QOL); (2) personal safety; and (3) social life. The data of the 34 patients was collected by distributing a questionnaire in two medical centres in Benghazi, Libya. After conducting the One-Sample Wilcoxon Signed Rank test and the Kruskal-Wallis test, the results demonstrate that the anosmia has no statistically significant effect on the QOL or personal safety. The results of social life, on the other hand, found that anosmia has no serious negative impact on patients' social lives. Furthermore, the results reveal that there are no statistically significant differences in questionnaire replies between patients with different ages, durations of anosmia, and genders, except that it found a statistically significant difference between patients with different anosmia durations and the QOL.

Keywords: Anosmia, quality of life, personal safety, social life

1. Introduction

The absence of the sense of smell known medically as anosmia greatly affects a person's quality of life and daily activities (Hummel., 2017). Anosmia can be due to many causes, like infections, head injuries, sinonasal diseases and neurological issues (Pellegrino., 2020). Though often overshadowed by deficiencies like vision or hearing loss, anosmia brings about distinct hurdles that go beyond just perception to impact lifestyle choices, safety measures, eating habits and social engagements (Croy, Nordin, &Hummel, 2014). Recent studies on the impacts of anosmia have highlighted its effects on individuals' well-being and societal involvement (Bochicchio et al.,2023; Joshi & Hummel, 2024; Nagi, Singh & Mahajan, 2024). However, most research originates from contexts with a focus on understanding anosmia in places like Benghazi, Libya from a medical standpoint not its effect on lifestyle. This gap in knowledge leaves much to learn about how individuals cope with the loss of smell, in this region characterized by diversity and unique socio-political dynamics alongside healthcare obstacles.

In this setting delving into how anosmia affects the people of Benghazi presents a chance to understand how losing the sense of smell influences aspects of daily life such, as the quality of life (QOL), safety measures, and social connections. Studies focusing on these experiences amongst patients with anosmia living in Benghazi are limited despite their influence on lifestyle. Therefore, this study aims to bridge that gap by exploring the multidimensional effects of olfaction impairment affecting people living in Benghazi, exposing their lived realities, hardships and adaptation mechanisms. This paper deals with a localised examination of how it influences lifestyle, safety rules, and social interactions in a Libyan city named Benghazi. Consequently, this survey seeks to expose the unique challenges people living with a lack of a sense of smell go through and also what they do to change their lifestyles. Therefore, the main questions of the research are:

1) How is QOL affected for patients with anosmia?

2) How is personal safety affected for patients with anosmia?

3) How is social life affected for patients with anosmia?

2. Material and Methodology

In collecting the data, this research relied on a questionnaire prepared for this purpose. The questionnaire consists of two sections. The first section relates to the participant's data, such as gender, age, extent of loss of sense of

smell, and whether the participant suffers from any diseases. The second section consists of the three axes of the research; these axes are as follows:

- First axis: items that are related to QOL (seven questions).

- Second axis: items that are related to personal safety (seven questions).

- Third axis: items that are related to social life (seven questions).

Thus, the total number of questions in the axes is 21. The researcher used the 5-Likert scale, where the number 1 is given for the answer: strongly disagree, and the number 5 is given for the answer: strongly agree. The questionnaire was distributed at (1) the Speciality Surgical Center, which is a government teaching centre for Urology and ENT in Benghazi; and (2) the Al-Rowad Specialized Center, which is a private centre in Benghazi for ENT and speech therapy, over the period from November 2023 to March 2024. The approval for distributing the questionnaire has been obtained from both centres. The researcher emphasised the necessity of responding to the questionnaire from only patients who lost their sense of smell and did not regain it.

The researcher collected 34 valid questionnaires, which were analysed by employing the following: (1) Cronbach's alpha test to examine the internal consistency of the items; (2) the Kolmogorov-Smirnov test to investigate the normality of the distribution of the replies; (3) the descriptive statistics by calculating the mean, standard deviation, and median; (4) the One-Sample Wilcoxon Signed Rank test, to explorer whether the median of the answers regarding the items above is significant from the testing median, which is 3; (5) the Kruskal-Wallis test to investigate whether there are significant differences in the respondents with different gender, age, and smell loss period. It is worth mentioning that One-Sample Wilcoxon Signed Rank and Kruskal-Wallis tests compare the median, not the mean, where the median is more appropriate for non-normally distributed data. Also, 0.05 is the significant level for all the above tests.

3. Results

3.1 Results of Respondents' Characteristics

The results in Table 1 below present the characteristics of the 34 patients who responded to the questionnaire. With 22 (65%) patients out of 34, the results indicate that the majority of the patients are female. In terms of age, most of the patients are between 41 and 60 years old, with 16 (47%) patients, followed by the age range of 20 to 40 years old, with 13 (38%) patients. In terms of the duration of anosmia, half of the patients (17) stated that they had lost their sense of smell for more than a year and 9 patients in less than a month, while the other was between 1 month and 12 months. Only 9 (26%) out of 34 patients stated that they have received medical or psychological support, while the others reported that they have not. Finally, 19 (56%) patients reported that they were infected with COVID-19, while 9 patients reported that they were suffering from allergic rhinitis, and the other 9 reported that they were suffering from chronic sinusitis. Besides, only one patient had a head trauma, and 4 had other medical issues, while the other six patients stated that they had no medical history.

Table 1. Respondents' Characteristics

Respondents Characteristics	No.	(%)
Gender:		
Male	12	35%
Female	22	65%
Age:		
Under 20	2	6%
20-40	13	38%
41-60	16	47%
61-80	2	6%
Over 80	1	3%
Duration of Anosmia:		
Less than 1 month	9	26%
1-3 months	3	9%

3-6 months	2	6%
6-12 months	3	9%
More than 12 months	17	50%
Received any medical or psychological support:		
Yes	9	26%
No	25	74%
Past Medical History:		
Allergic Rhinitis	9	26%
Chronic Sinusitis	9	26%
Head Trauma	1	3%
Covid-19	19	56%
Others	4	12%
No Medical History	6	18%

3.2 Results of Cronbach's alpha and Kolmogorov-Smirnova test

The Cronbach's alpha test was performed twice. Firstly, it was conducted separately on the answers to the three factors that this study analyses. These factors are the QOL, personal safety, and social life; each item has seven questions. Then Cronbach's alpha test was re-conducted for the answers to all 21 questionnaires. Table 2 below shows the results of Cronbach's alpha as well as Kolmogorov-Smirnova test, respectively. In terms of the items, Cronbach's alpha is between 0.670 and 0.752. According to Taber (2018), if the alpha value is between 0.67 and 0.87, it is considered reasonable. However, when taking into account the alpha value for the questionnaire as a whole, the value reaches 0.827, and this is considered fairly high, according to Taber (2018). Furthermore, it is evident from the results of Kolmogorov-Smirnova that all p-values are less than 0.05, and hence, the responses are not normally distributed. Therefore, this research employs the nonparametric tests.

Table 2. Results for Reliability and Normality of the Answers

Items	Cronbach's Alpha		Kolmogorov-Smirnov[a]		
	No. Items	Value	Statistic	df	Sig.
Items related to QOL.	7	0.670	0.132	34	**0.020***
Items related to personal safety.	7	0.711	0.170	34	**0.014***
Items related to social life.	7	0.752	0.169	34	**0.015***
Overall	**21**	**0.827**			

*Significant at a 0.05 level.

3.3 Results of QOL Investigation

The main objective of this section is to examine how QOL is affected by patients with anosmia. The investigation results of the QOL after conducting the One-Sample Wilcoxon Signed Rank test are presented in Table 3 below. For the total QOL items, with a median equal to 3.214, the p-value equals 0.160, which is greater than 0.05, thus, the results indicate that the median of the answers does not differ significantly from the testing median of 3. Thus, the anosmia does not affect the QOL of the patients. In terms of the items in QOL, which represent the QOL interactions, it is noted that all p-values are statistically significant, except items two and three. Although the research has not clarified the relationship between the loss of the sense of smell and taste, many studies have shown that there is a strong connection between them (Borsetto, Hopkins & Philips, 2020; Javed et al., 2022). In this research, the participants significantly lost some of their weight, although there was no change in their appetite after losing their sense of smell.

Table 3. Results of QOL Investigation

	Items related to QOL	Mean	Std.	Median	Significant
	Total	*3.176*	*0.739*	*3.214*	*0.160*
1	My current quality of life is not good enough.	3.67	1.384	4.00	0.010*
2	To what extent is the magnitude of your joy from eating and drinking following your loss of smell?	3.21	1.516	4.00	0.449
3	How often do you feel unsatisfied or irritated because you cannot smell?	2.85	1.460	3.00	0.418
4	How has losing your sense of smell affected how you go through everyday activities like preparing meals and tidying up a house?	2.55	1.325	3.00	0.044*
5	I am not sure that I can manage my daily activities well with my smell loss.	3.42	1.091	3.00	0.031*
6	Since I lost my smell, it seems that I have lost some weight.	4.30	1.045	5.00	0.000*
7	My appetite has changed since I lost my sense of smell.	2.09	1.378	1.00	0.001*

Test value = 3, *Significant at a 0.05 level.

3.4 Results of Personal Safety Investigation

The main objective of this section is to examine how personal safety is affected by patients with anosmia. Table 4 below displays the findings of the One-Sample Wilcoxon Signed Rank test about the personal safety investigation. For the total personal safety items, the results show that there is no significant difference between the testing median of 3 and the median of the replies (3), with a p-value of 0.372, which is greater than 0.05. Therefore, patients' safety is unaffected by the anosmia. Except for items 6 and 7, all items related to personal safety are statistically significant. It comes to the forefront that patients do not rely often on other sensory cues due to their anosmia. Also, participants were not exposed to any risks resulting from anosmia, nor did they take any precautions in this regard. Thus, they are not concerned about their safety. However, according to the questionnaire responses, out of 34 patients, only 3 reported that they were exposed to food burning when cooking without being aware of it due to the loss of their sense of smell. Another patient mentioned that his pants were exposed to a minor fire due to cigarette smoke without being aware of it as well. Finally, patients stated that they did not attend any courses for risk management regarding anosmia.

Table 4. Results of Personal Safety Investigation

	Items related to Personal Safety.	Mean	Std.	Median	Significant
	Total	*3.097*	*0.511*	*3.00*	*0.372*
1	How often do you rely on what you see or other senses to detect things such as gas leaks or rotten foodstuffs which might be dangerous?	2.30	1.425	2.00	0.003*
2	Have any dangerous accidents occurred because of smell loss?	1.76	1.062	1.00	0.000*
3	There is no additional safety procedures were taken for me to reduce the risk of losing my sense of smell.	4.30	1.075	5.00	0.000*
4	Are you apprehensive about personal safety and security considering your inability to perceive smells?	2.39	1.248	2.00	0.006*
5	There are no specific guidelines or training on managing the safety aspects related to the lack of olfaction.	4.73	0.452	5.00	0.000*
6	I avoid any situation that could be dangerous to me because of my loss of smell.	3.18	0.528	3.00	0.132
7	My loss of smell has interfered with detecting the presence of any dangerous odour, for instance, smoke and gas leaks among others.	3.15	0.712	3.00	0.225

Test value = 3, *Significant at a 0.05 level.

3.5 Results of Social Life Investigation

The main objective of this section is to examine how social life is affected by patients with anosmia. After employing the One-Sample Wilcoxon Signed Rank test, the social effect findings are shown in Table 5 below. For the total social life items, the findings demonstrate that, with a p-value of 0.000, there is a statistically significant difference between the testing median of 3 and the reply median of 1.920. Consequently, anosmic patients significantly do not agree that the loss of smell influences their social lives. Furthermore, every item on social life has a statistically significant value. Where patients do not feel embarrassed when eating in public places, however, there is also no clear support from family and friends regarding their diagnosis. The results also found that there is no change in their relationship or social life because of smell loss, and they are not anxious about attending any social event.

Table 5. Results of Social Life Investigation

	Items related to Social Life.	Mean	Std.	Median	Significant
	Total	*2.121*	*0.672*	*1.920*	*0.000**
1	I can't stand eating food in public places due to a lack of smell.	1.58	0.902	1.00	0.000*
2	There is no encouragement from friends and relatives when it comes to dealing with my lost sense of smell.	3.91	1.308	5.00	0.001*
3	When someone else eats, talks about or enjoys a good aroma I am left alone.	2.45	1.543	2.00	0.022*
4	I feel anxious about how the smell loss I suffer interferes with communicating with others	1.88	1.269	1.00	0.000*
5	It makes me tense going for social activities that involve food because of smell loss.	1.64	1.025	1.00	0.000*
6	Other people did not fully understand or know what anosmia was all about and how it affected me.	2.09	1.208	2.00	0.000*
7	Have you noticed any changes in your social life or relationships since the sense of smell has been lost?	1.42	0.936	1.00	0.000*

Test value = 3, *Significant at a 0.05 level.

3.6 Results of the Differences in the Replying

Finally, as mentioned earlier, the Kruskal-Wallis test is used to examine whether there are statistically significant differences among the respondents to the questionnaire for different ages, anosmia periods, and genders. With p-values bigger than 0.05, the results in Table 6 below asserted that there are no significant differences in the responses for the QOL, personal safety, and social life questions between different ages and genders. However, there are statistically significant differences in the replies between different anosmia durations regarding the QOL (p-value = 0.031), while in personal safety as well as in social life, the differences are not statistically significant.

Table 6. Results of the Differences in the Replies

	Total Number n (%)	QOL (p-value)	Personal Safety (p-value)	Social life (p-value)
Age				
Less than 20 years	2 (6%)			
Between 20 and 40	13 (38%)			
Between 41 and 60	16 (47%)	0270	0.568	0.728
Between 61 and 80	2 (6%)			
More than 80	1 (3%)			

Anosmia Duration				
Less than 1 month	9 (26%)			
Between 1 and 3 months	3 (9%)			
Between 3 and 6 months	2 (6%)	**0.031***	0.655	0.191
Between 6 and 12 months	3 (9%)			
More than 12 months	17 (50%)			
Gender				
Male	12 (35%)	0.444	0.557	0.118
Female	22 (65%)			

*Significant at a 0.05 level.

4. Discussion

This study aimed to investigate how daily life is affected for patients with anosmia. The examination of this study is conducted by testing (1) the QOL; (2) personal safety; and (3) social life. The data on the 34 patients was collected through a questionnaire. 22 of the patients are female, and most of the patients are between 41 and 60 years old. Moreover, the majority of patients lost their smell for more than a year. After analyzing the data, the results indicate that there is no statistically significant impact of anosmia on the QOL or personal safety. The results of social life, on the other hand, found that smell loss significantly does not affect negatively their social life. Also, the results indicated that there are no statistically significant differences in questionnaire replies between patients with different ages, durations of anosmia, and genders, except that there is a significant difference only between patients with different anosmia durations and the QOL.

The results of this research are interesting since they differ from the majority of other previous studies. For instance, in terms of QOL, Miwa et al. (2001) found that patients with a perceived resolution of olfactory compromise have a higher QOL than those with continuing olfactory impairment. Similarly, Brämerson, Merkonidis et al. (2015), Winter et al. (2023), and Gary et al. (2023) asserted that anosmia negatively affects the QOL of patients. These results are supported by other studies (Elkholi, Abdelwahab, & Abdelhafeez, 2021; Bakhsh et al., 2023; Mattos et al., 2023). Also, 40%–76% of patients experienced depressive episodes following olfactory impairment (Elkholi et al., 2021). Joshi and Hummel (2024) found a significant relationship between smell sensitivity and well-being. Furthermore, taste, smell, and nutrition are closely related to one another. Consequently, deficiencies in these senses have a major impact on the effectiveness of nutrition (Alkanat & Arslan, 2024). The results of this research are in line with the results of Stevenson et al. (2020) concerning patients' appetites not changing due to their smell loss. Also, the results of Ball et al. (2021) and Tan et al. (2022) are consistent with the results of this study regarding the clear lack of medical support for anosmic patients, which constitutes an incentive for research into this topic.

Although anosmia affects patients' ability to recognize odours that indicate danger, such as a gas leak or fire (Elkholi et al., 2021; Bakhsh et al., 2023), the results of this study did not find any effect of the anosmia on the personal safety of patients. While other studies confirmed the existence of a strong relationship between old age and death due to the loss of smell (Pinto, 2014; Liu, 2019; Van Regemorter et al., 2020). Regarding this point, the reason might be that the majority of the participants in this research were between 20 and 60 years old, whereas only 3 participants were older than 60. This, in turn, did not show a relationship between old age and loss of sense of smell. Lee et al. (2024) found that around 60% of the participants in their study worked to reduce the risks related to olfactory dysfunction, such as installing gas detectors and relying on the assistance of others with their sense of smell. However, this study found that the majority did not employ any precautions or safety actions in this regard. Anosmic patients reported that they have been exposed to serious accidents such as fire, gas leakage, and poisoning (Santos et al., 2004; Pence et al., 2014). This was also confirmed in this study, where one of the participants mentioned that he had a slight fire in his pants due to smoke residue, and he did not notice it. Another patient reported that the food was burned in the kitchen, and he did not notice it until after the neighbours alerted him.

When Lee et al. (2024) asked in their study whether patients with smell loss were concerned about safety, 371 patients (85.9%) said they were, 31 (7.2%) said they weren't, and 30 (6.9%) patients said they had not given it any attention. The researcher believes that the result of this research regarding the lack of a relationship between

anosmia and personal safety is most likely because, fortunately, the 34 members of the sample were not exposed to serious danger due to loss of smell, except 2 of them. Hence, they are unable to fully define this topic. Furthermore, participants might face some fear of eating because of their inability to distinguish between edible food and spoiled food or food with an unpleasant smell. This was confirmed in this research when one of the patients stated that if he had any doubts about the validity of the food, he would ask his relatives or neighbours to check its smell and validity. The differences between the results of this study and other studies regarding the effect of anosmia on QOL and personal security might be because the social conditions or risks are different between countries, which is called a cultural consideration.

The results of this research concerning anosmia do not negatively affect the social lives of the patients, which is also considered a paradox of interest. Since many previous studies found that anosmia interfered with the social lives of patients. For example, people with congenital anosmia reported far greater rates of sadness and increased social insecurity as compared to controls (Croy et al. 2012). The negative impact of anosmia on a social life may be due to a lack of understanding by society and the people surrounding the patient about the presence of their suffering (zou et al., 2016). It is also confirmed in this research that there is no clear support from friends and family in this regard. Also, some participants in this research stated that they feel some frustration due to their inability to distinguish body odours that may be bad. Therefore, they started bathing more than usual and using more perfume and deodorant.

This research found a statistically significant difference in the responses to the questionnaire regarding the QOL between patients with different periods of smell loss. The reason is mostly because 50% of the study's sample lost their sense of smell for a period exceeding a year, while 26% lost it in a period less than a month. Therefore, it is expected that patients who have lost their sense of smell for more than a year have relatively adapted to their new life, unlike patients who lost their sense of smell in less than a month, as they are at the beginning of their suffering regarding the QOL compared to the other group.

5. Conclusion

Although the study found that anosmia neither positively nor negatively affects the overall QOL or personal safety of patients with anosmia (p-value = 0.160, p-value = 0.372, respectively), the research also revealed that it does not significantly appear to hurt their social life as well (median =1.920, p-value =0.00). This means that, according to the analysis, anosmia does not damage the social life of such people. In comparison with what would be expected if there were no effects from losing one's sense of smell, and hence, patients who lose their sense of smell do not report having substantially lower social functioning than anticipated. However, other influences on individuals' social abilities need to be considered too, in light of these findings about people suffering from smelllessness. It is worth mentioning that smell is much more than recognizing odours; it is intricately associated with our social experiences and encounters. Whether through mom's cooking, which brings families together, or subtle scents that remind us of good times with friends, olfaction plays a fundamental role in our social lives. Therefore, feeling connected and having a support network around us is crucial for one's mental and emotional well-being. Even though social interaction itself may not be directly affected by a loss of the sense of smell in this paper, it remains important also to critically look at why quality and personal safety have not been significantly affected. At the end of this research, anosmia should not only be considered a patient-specific organic disease but other factors, such as social factors and personal safety, must also be considered. Otherwise, the patient may suffer from loneliness and isolation. Thus, healthcare authorities should help patients find services to manage their psychosocial burden and prepare them for the possibility that symptoms could last for years. Unfortunately, this does not seem to exist in Libya at this time.

Informed Consent

Obtained.

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Data Availability Statement

The data that support the findings of this study are available on request.

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The Benefits of Breast Massage: A Qualitative Study

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Abstract

Massage therapy has grown as a profession, and its use in the traditional medical setting is rapidly increasing. Massage therapy has been shown to have positive physical, psychological, and biochemical effects. The aim of this study is to review the reasons patients choose breast massage therapy and the benefits of breast massage therapy.

Ten female patients of 18 years and older participated and completed the survey.

Of the ten patients, the average age was 37.5 years. Most common reasons for choosing breast massage include: improve overall health (90%) and overall well-being (80%), relieve muscle tension (80%), reduce stress (70%), and increase size/firmness/elasticity (70%). Almost all patients reported an improvement in quality of life. Bust size increased for nine patients. Most patients reported a reduction in breast pain, reduction in breast swelling, increase in breast size, increase in breast firmness, improved skin elasticity, improved physical health, improved psychological health, and improved overall health and well-being.

Breast massage has positive effects on physical and psychological health and well-being. Its use is increasingly sought after to improve breast health and overall health and wellness. Physicians, healthcare providers, and patients should consider breast massage therapy as complementary and alternative medicine.

Keywords: massage, massage therapy, breast massage

1. Background

Massage therapy has grown as a profession, and its use in the traditional medical setting is rapidly increasing (Government of Canada). In 2007, it was estimated that annual medical costs for complementary medicine such as massage, totaled $34 billion in the United States (Nahin, 2009). Massage therapy has been shown to have positive physical, psychological, and biochemical effects (Field, 2016). Studies have shown beneficial effects on varying conditions including pain conditions such as arthritis and fibromyalgia, hypertension, autoimmune conditions such as multiple sclerosis, immune conditions such as cancer, and aging conditions such as dementia (Field, 2016). Its use among breast cancer patients has been beneficial in managing fatigue and lymphedema and improving quality of life and physical functioning (Wang, 2021; Donahue et al., 2023; Greenlee et al., 2017). Breast massage in particular, is increasingly being sought after by patients, and the reasons for choosing breast massage as well as the benefits and outcomes of breast massage therapy among non-cancer patients remain unclear. Its benefits among healthy patients with no underlying medical conditions remain undocumented.

The aim of this study is to review the reasons patients choose breast massage therapy and the benefits of breast massage therapy. This is a pilot study to determine feasibility and interest of patients to participate in the study, as well as provide clarity and direction for a further larger study.

2. Methods

Ten female patients who received breast massage voluntarily consented and completed a survey regarding their reasons for choosing breast massage and outcomes from the breast massage session.

2.1 Study Participants and Study Design

Study Population: Participants were recruited from a single massage therapy facility in the metropolitan city of Vancouver, located in British Columbia, Canada. Female patients age 18 years and older, with no current or previous diagnosis of breast cancer, who received breast massage therapy at the clinic were eligible to participate. Patients do not require referrals for massage or breast massage. Patients are charged a fee per session, although some may have additional insurance coverage for reimbursement. Participation in the study was optional and

voluntary.

Inclusion Criteria: Female patients age 18 years and older, with no current or previous diagnosis of breast cancer, who received breast massage therapy at the clinic were eligible to participate.

Study Design: Patients who consented were asked to complete a self-reported survey following their breast massage session. All collected data was confidential and participants were able to skip any question(s) they did not wish to answer. This project was reviewed by an ethics board prior to enrollment.

2.2 Breast Massage Session

Breast Massage Technique: Each breast massage session lasted 15 minutes and was performed by the same massage practitioner. The specific breast massage technique is unique and includes the neck, chest, and breasts, excluding the nipple and areola. To prepare and relax the patient, a few drops of massage oil was used, and then the massage practitioner started to massage the neck and work their way down to the chest and breast. This technique specifically targets the breast lobes, and the network of lobules connected to the lymphatic system.

Bust Measurements: Bust measurements were taken with a standard tape measure, with both arms relaxed at the sides and the tape measure lined up across the nipple line. Measurements were recorded before the start of the massage session and then again immediately after the massage session.

2.3 Survey

The survey was a self-reported survey containing questions regarding demographics (age, pregnancy status, breast feeding status), reasons for choosing breast massage therapy, and their views about the breast massage therapy session.

To assess reasons for selecting breast massage therapy, patients were asked to check any (or all) reasons from a list of items. Items included: a) reduce breast pain, b) relieve breast pain during pregnancy, c) relieve breast pain during breastfeeding, d) reduce breast swelling/swelling in arms/chest, e) increase breast size/firmness/skin elasticity, f) breast cancer detection, g) relieve muscle tension, h) reduce stress, i) improve overall health, and j) improve overall well-being.

To assess their views about breast massage therapy, participants were asked to rate the extent to which they agree with various statements using a Likert scale (strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree). Questions included: How strongly do you agree or disagree with the following statements: Breast massage has… a) reduced my breast pain, b) reduced breast swelling or swelling arms, chest, c) increased my breast size, d) improved breast firmness, e) improved skin elasticity, f) improved my physical health, g) improved my psychological health, h) improved my overall health, and i) improved my overall well-being.

Patients were also asked to complete the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983), a ten-question instrument for assessing perceived stress levels.

Patients were also asked to rate their overall pain level, on a scale of 0 (no pain) to 10 (worst pain), both before and after the session.

Patients were also asked to rate their overall quality of life, on a scale of 0 (worst) to 100 (best), both before and after the session.

3. Results

Data from ten female patients were analyzed. The average age was 37.5 years (range: 28 – 57 years). None of the patients were currently pregnant or breast feeding. Six of the patients had received breast massage in the past.

3.1 Reasons for Choosing Breast Massage

Most common reasons for choosing breast massage include: improve overall health (9/10 patients) and overall well-being (8/10 patients), relief muscle tension (8/10 patients), reduce stress (7/10 patients), and increase size/firmness/elasticity (7/10 patients) (Table 1).

Table 1. Reasons for Choosing Breast Massage

Reasons for Choosing Breast Massage	Number of Patients (Percentage of Patients)
Reduce breast pain	3 (30%)
Reduce swelling	1 (10%)
Increase size, firmness, elasticity	7 (70%)
Breast cancer detection	3 (30%)
Relief muscle tension	8 (80%)
Reduce stress	7 (70%)
Improve overall health	9 (90%)
Improve overall well-being	8 (80%)

3.2 Self-Reported Outcomes

Five of the ten patients reported a reduction in breast pain and breast swelling. All ten patients reported an increase in breast size. Almost all reported an increase in breast firmness (9/10 patients), improved skin elasticity (9/10 patients), improved physical health (9/10 patients), improved psychological health (9/10 patients), and improved overall health and well-being (9/10 patients) (Table 2).

Table 2. Self-Reported Benefits of Breast Massage

Self-Reported Outcomes	Number of Patients (Percentage of Patients)				
	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Agree
Reduce breast pain	3 (30%)	2 (20%)	5 (50%)	0 (0%)	0 (0%)
Reduce breast swelling	2 (20%)	3 (30%)	5 (50%)	0 (0%)	0 (0%)
Increase breast size	5 (50%)	5 (50%)	0 (0%)	0 (0%)	0 (0%)
Improve breast firmness	5 (50%)	4 (40%)	1 (10%)	0 (0%)	0 (0%)
Improve skin elasticity	6 (60%)	3 (30%)	1 (10%)	0 (0%)	0 (0%)
Improve physical health	4 (40%)	5 (50%)	1 (10%)	0 (0%)	0 (0%)
Improve psychological health	4 (40%)	5 (50%)	1 (10%)	0 (0%)	0 (0%)
Improve overall health	4 (40%)	4 (40%)	2 (20%)	0 (0%)	0 (0%)
Improve overall well-being	5 (50%)	4 (40%)	1 (10%)	0 (0%)	0 (0%)

The average perceived stress level was moderate (average score 19.5), with 4 patients classified as having "Low" stress levels, 5 patients classified as "Moderate" stress levels, and one patient classified as having "High" stress levels.

All patients who reported pain prior to the session, reported a reduction in pain following the session.

An improvement in overall quality of life was reported by 8 of the 10 patients, with an average increase in 18 points.

All ten patients would recommend breast massage to family and friends.

3.3 Bust Size

Bust size increased after the massage session for nine of the patients, with an average increase of 1.2 inches.

4. Discussion

The results of this pilot study show that a majority of patients choose breast massage therapy to improve overall health and overall well-being, as well as relieve muscle tension and reduce stress. Other reasons include increase size/firmness/elasticity, reduce breast swelling and pain, and improve lymphatic drainage.

This study shows several physical and psychological benefits of breast massage therapy among non-cancer patients. Half of patients reported self-perceived reduction in breast pain and breast swelling. Most patients reported a self-perceived increase in breast size, increase in breast firmness, improved skin elasticity, improved physical health, improved psychological health, and improved overall health and well-being.

Breast massage is likely to provide benefits similar to massage therapy by stimulating pressure receptors, which in turn enhance vagal activity and reduce cortisol levels (Wang, 2021). In addition to reduced cortisol levels, increases in levels of serotonin and dopamine, both activating neurotransmitters, have been documented after massage therapy (Van Pelt et al., 2021; Field et al., 2005). This in turn reduces stress and promotes relaxation and improves health and well-being. Reductions in cortisol and heart rate were consistently noted even after single massage therapy sessions (Moraska et al., 2010).

Bust size increased after the massage session for almost all patients. Self-reported increases in bust size have been widely reported following breast massage, and an increasing number of patients are seeking breast massage to increase bust size. This has not been previously studied and the impact of breast massage on bust size remains unclear. Previous research has suggested that massage can be beneficial in combating atrophy and increasing muscle mass; however, this has not been documented in other types of breast tissue specifically (Van Pelt et al., 2021). This may also be a local inflammatory reaction in response to the massage therapy, as massage therapy alters the signaling pathways involved with the inflammatory response (Van Pelt et al., 2021).

There is a lack of studies of breast massage therapy in the general healthy population; however, there are studies among specific populations such as cancer patients and breastfeeding women. The results of this pilot study show similar self-perceived benefits of massage, as documented in other published studies. Massage has been shown to be beneficial among breast cancer patients, including alleviating negative emotion and fatigue among breast cancer patients (Warren et al., 2022; Pan et al., 2014). Breast massage has been shown as an effective treatment in reducing pain among women with breastfeeding problems (Anderson et al., 2019; Abushukur et al., 2022). Breast massage may also have benefits in preventing mastitis after childbirth (Crepinsek et al., 2020).

4.4 Limitations

Although the results of this study are promising and show several self-perceived benefits among non-cancer patients, it is important to note that there are several limitations to this study. Many of these limitations are related to the small sample size, as this study only involved ten participants. Due to resource constraints, including funding, this pilot project included only ten participants to test the feasibility and interest of patients in participating in the study, as well as to provide clarity and direction for a further larger study in the future. Small sample sizes in this qualitative study also allowed for the exploration and understanding of individual participants' experiences, rather than solely relying on data-driven statistics and statistical generalizations. The results of this study are self-reported and qualitative; therefore, they cannot be generalized to the general population, and causal associations should not be made. The data obtained from this study, however, can be used to guide future studies and directions. Furthermore, this study was conducted at a single clinic with a single population in Richmond, British Columbia, Canada. This population may have a different demographic or ethnic composition compared to other populations. As these views and outcomes are self-reported, racial and ethnic variations may influence perspectives and self-reported outcomes. Further studies evaluating a more diverse population, including longitudinal perspectives over time, would be beneficial in gaining a comprehensive understanding of the role of breast massage therapy in the medical setting. Furthermore, studies are required to determine the optimal technique, duration, and frequency of breast massage to yield benefits.

5. Conclusions

Breast massage has positive self-perceived effects on the physical and psychological health and well-being of patients. Its use is increasingly sought after to improve breast health and overall health. Physicians, healthcare providers, and patients should consider breast massage therapy as complementary and alternative medicine, which can be beneficial to patients.

Author Contribution

Ryan Brown contributed to the conception of the study, design of the study, data collection and analysis, writing of the manuscript, and revisions of the manuscript. Marianne Wong contributed to the design of the study, data collection and analysis, writing of the manuscript, and revisions of the manuscript.

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The data that support the findings of this study are available on request.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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