Mode of Healthcare May Not Influence the Mental Disorder Diagnosis: An Observational Cross-Sectional Study on Telehealth for Canadian Adult Women

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Mental health concerns are pervasive in Canada with one in five Canadians experiencing a mental illness or addiction during their lifetime (Islam et al., 2014). The terms “mental health”, “mental disorder” and “mental illness” are used interchangeably across literature (Tiwari & Wang, 2008). Mental health can be described as a person's mental state that affects their capacity to operate in their environment (Bhugra et al., 2013; Tiwari & Wang, 2008). Two recent publications on the prevalence of mental health indicate that 15.3% of Canadians did not have access to a regular physician, which was further exacerbated during the COVID-19 pandemic (Islam et al., 2014; Benton et al., 2022). **N**ot having a family doctor who can diagnose and identify mental illnesses may lead to underreporting of mental disorder diagnoses (Islam et al., 2014). The underreporting of mental illnesses plays a significant role in the prevalence of disease and access to resources (Durwood et al., 2017).

Arguments to support attention to emerging adult’s mental health are at the core of the social and economic well-being of Canadian society as up to 75% of mental disorders have their first onset before the age of 25 (Malla et al., 2018). In this study, an emerging adult is defined as 18 years old to 24 years old based on guidelines established by existing literature (Malla et al., 2018). The prevalence of mental disorders increases within emerging adults and has long-lasting health, social and economic impacts on individuals, their families and society (Malla et al., 2018; Bulkes et al., 2022). Malla et al. (2018) explains that 20% of emerging adults experience symptoms of mental disorders and at least 50% require intervention. The restricted access to early mental health interventions and delayed care impedes emerging adults' social development

(Malla et al., 2018). The quality of life for those diagnosed with mental health disorders can be improved with different modalities of healthcare (Bulkes et al., 2022).

The integration of telemedicine into healthcare delivery introduces opportunities for more efficient health systems, enhanced quality of care, and increased access to care for rural and remote communities (LeBlanc et al., 2020). The terms “eHealth”, “telehealth”, “telemedicine” and “digital health”, used interchangeably, refer to the electronic means of receiving or giving care (LeBlanc et al., 2020). This study refers to telemedicine as a provision of care using video conferencing and telephone calls (Philippe et al., 2022). Reported benefits of telemedicine mental health interventions by Canadians include reduced travel time and increased likelihood of regular follow-ups (LeBlanc et al., 2020). Disadvantages cited for telemedicine mental health support include infringements of privacy, technological barriers to access, and a patient preference for face-to-face contact (LeBlanc et al., 2020; Richardson et al., 2020).

The existing research on telemedicine has provided valuable insights into various perspectives on mental health. Terekhova et al. (2017) and Toulany et al. (2021) contributed significantly to the understanding of current limitations within adult tele-mental health services in both Ontario and British Columbia. One primary limitation is that few population-based studies have examined female emerging adult perspectives (Terekhova et al., 2017). In a two-year prospective cohort study by Terekhova et al. (2017) that examined the frequency of telemedicine use, findings indicate that females in the emerging reproductive age group (18-25 years) are frequent users of telemedicine, comprising 64.3% of the sample demographic. Moreover, there is an increased prevalence of mental health diagnoses among emerging adult women utilizing telemedicine (Faravelli et al., 2013; Terekhova et al., 2017). Emerging adult women also exhibit a higher likelihood of perceived poor/fair telehealth consultations

(Terekhova et al., 2017). The gap in female adult perspectives on telemedicine hinders a comprehensive understanding of the effectiveness of telemedicine practice on varying demographics. Additionally, the existing literature predominately employs population-based studies assessing the frequency of consultations, but a statistical analysis assessing treatment quality is conspicuously limited within the literature (Nicholas et al., 2021; Toulany et al., 2021). Toulany et al. (2021) conducted a retrospective population-based study on tele-mental health services for children and emerging adults in Ontario. The study primarily employed a paired t-test on the frequency of patients accessing in-person and online care (Toulany et al., 2021). However, the limited evaluation of quality metrics in the study directly impacts patient outcomes and the comparative effectiveness of mental disorder diagnoses on different modalities of care (Toulany et al., 2021). Addressing the knowledge gap is imperative in understanding the perceived mental health outcomes in telemedicine and providing a holistic assessment of the current standards of telemedicine care on mental disorder diagnoses.

This study contributes to the improvement of diagnostic interventions and addresses the efficacy of treatment quality. The primary objective is to assess proportion of mental disorder diagnoses between female participants, aged 18 to 24, who self-reported accessing virtual/hybrid medical care (at least once) over the past 12 months, compared to participants who access in-person or no care. The secondary objective is to assess the differences in treatment quality metrics (duration of treatment, access to e-health resources, self-reported anxiety reduction during consultations) across three modes of healthcare access (in-person, virtual/hybrid, no care) in female participants aged 18-24 years old.

Methods

Study Design and Database

The study employed an observational cross-sectional study design with data taken from the 2020 Canadian Digital Health Survey, retrieved from Borealis. The annual survey is commissioned by Canada Health Infoway and distributed by a third-party firm. The survey is a repository of anonymized, voluntary, self-reported health information related to metrics tracking digital health services and investigates participants' interest in the use of digital health technologies across Canada (Canada Health Infoway, 2023). The report also focuses on Canadians' attitudes, expertise, and familiarity with health technologies (Canada Health Infoway, 2023). The survey was conducted between August 13th to August 31st, 2020, using Computer-Assisted Web Interviewing technology (Canada Health Infoway, 2023).

Study Participants

The database underwent a filtration process, narrowing down the study participants based on an inclusion criteria and exclusion of missing data. The inclusion criteria include: 1) Individuals diagnosed with (at least one) mental disorder 2) Participants spanning the age range of 18 to 24 years old inclusively 3) Participants that identified as female. The study includes participants diagnosed with mental health disorders ensuring that selected cohort addresses the specific demographic in this study's objectives. The research involved individuals aged 18 to 24 who identified as female, as this demographic remains underexplored in existing literature.

Study Outcomes

The primary and secondary outcomes consist of categorical, nominal variables. Primary outcome of this study is mental health disorder diagnosis (Q11r5). For the primary outcome, participants self-reported "Yes" or "No" when asked, "Have you been diagnosed for a mental

illness (e.g., anxiety, depression) by a physician?" The selection of the primary outcome was based on its clinical significance, given the underexplored prevalence of mental health conditions in the context of telemedicine, as highlighted by Terekhova et al. (2017). Secondary outcome evaluates treatment quality with three metrics: self-reported reduction of anxiety (Q32r9), duration of treatment (Q32r8) and access to e-health resources (Q32r4). For the secondary outcomes, participants were asked the following phrases: "Helped to reduce the physical and mental anxiety for me and my family from an in-person visit", "Allowed me to get treatment faster", "Allowed me to access e-mental health care that I would otherwise would not have access to". Participants were asked to rank these statements from strongly disagree (4), disagree (3), agree (2), and strongly agree (1). To enhance the reproducibility of this study, the study adopts comparable metrics for treatment quality as outlined by Zangani et al. (2022). Due to the small sample size, the continuous dependent variables Q6r1 and Q6r2 in the original database, which recorded the frequency of participants' visits to a family doctor or regular place of care, either virtually or in-person in the past 12 months, were transformed into a new nominal variable (Q6r5). This new variable assesses whether participants accessed care through a virtual/hybrid (both in-person and virtual), only in-person, or no care over the past 12 months. Variables and outcomes of interest were chosen due to their relevance to study objectives.

Additional Data Collection

The nominal and ordinal data is presented in Table 1. To visualize the spread of the participants, participants were asked, "What race category best describes you: White?" (Q53r1), where participants could self-report "Yes" or "No". Participants additionally self-reported their Province/Territory of Residence (Q2), Educational Background (Q55), Current Employment Status (Q56), and Household Income (Q45).

Statistical Analysis

The Shapiro-Wilk test of normality assessed normality in the descriptive data, dependent variable, primary and secondary outcomes. For the descriptive data, Table 1 describes as sample size (frequency) or n (%), due to the categorical nature of the variables. Given the nominal nature of the dependent and independent variables, along with the small sample size, a Chi-squared ($\chi 2$) test was used to determine the between-group difference in proportions of mental health diagnoses in participants that accessed hybrid/virtual, in-person and no care. There was no missing data for our independent variable and primary outcome. For the secondary objective, the dependent variables had missing cases that were removed and only data with complete cases for all variables was included in our complete analysis. Multinomial logistic regression was used to analyze the relationship between treatment quality (including duration of physician consultation, access to e-health resources, and self-reported anxiety reduction during consultations) and the three modes of health care accessed by participants. Due to the non-normal distribution and categorical nature of the variables, a multinominal logistic regression was used to predict the treatment quality. The reference category for the multinominal logistic regression is “none” from the dependent variable. Assumptions for chi-square analysis and multinominal logistic regression were met. Statistical analyses were performed with SPSS version 29 for MacOS (SPSS, IBM Corporation, Somers, USA). A p-value of <0.05 was considered significant for this study. Microsoft (MS) Excel was used to visualize data following the statistical analysis.

Results

Demographic Data

The large-scale 2020 Canadian Digital Health Survey dataset consisted of 6,002 Canadians over the age of 16. Of that number, 3058 (50.9%) were excluded for other gender identities besides women. Of the remaining 2944 women participants, only 347(11.7%) were included for the age range of interest which was 18-24 years old. Of these 347 cases, 282(81.2%) were excluded because of missing data for one of the secondary dependent variables (access to healthcare services). Next, 3(4.6%) more cases were removed due to missing values in another secondary dependent variable (treatment duration). Lastly, 3(4.8%) more participants were excluded due to missing data in our last secondary dependent variable (reduction in mental anxiety). Complete data were therefore available for our variables of interest for 59 women, aged 18-24. The demographic data for this study is found in Table 1. Within the inclusion criteria, 43(72.9%) participants self-reported as white. From the sample, 25(42.4%) self-reported to reside in Ontario and 10(16.9%) self-reported to reside in Quebec. Participants also self-reported that 19(32.2%) had, “No degree, diploma or professional designation” and 21(35.6%) of participants had part-time employment status.

Table 1

Descriptive characteristics of survey participants [N=59]

Demographic Information	Participants, n (%) [1]
Ethnicity	
White	43(72.9)
Non-White Population	16(27.1)
Location	
Newfoundland & Labrador	5(8.5)
Nova Scotia	6(10.2)
Prince Edward Island	0(0)
New Brunswick	2(3.4)

Quebec	10(16.9)
Ontario	25(42.4)
Manitoba	1(1.7)
Saskatchewan	0(0)
Alberta	6(10.2)
British Columbia	4(6.8)
Northwest Territories/Nunavut/Yukon	0(0)
Education	
PhD (or any equivalent doctoral degree)	1(1.7)
Professional degree (refers to medical and paramedical degrees only)	3(5.1)
Masters	0(0)
Bachelors	14(23.7)
All other credentials	14(23.7)
No degree, diploma or professional designation	19(32.2)
Unknown	2(3.4)
Prefer not to answer	6(10.2)
Current Employment Status	
FT Employment	14(23.7)
PT Employment	21(35.6)
Homemaker, no outside employment	1(1.7)
Unemployed	11(18.6)
Disabled	0(0)
Other	11(18.6)
Prefer not to answer	1(1.7)
Household Income	
Less than $24,999	6(10.2)
$25,000-$49,999	12(20.3)
$50,000-$79,999	3(5.1)
$80,000-$99,999	8(13.6)
$100,000-$149,999	12(20.3)
$150,000-$249,999	4(6.8)
$250,000 or more	2(3.4)
Prefer not to answer	12(20.3)

[1]Variable distributions are solely reported as n(%).
Abbreviations: FT, full-time; PT, part-time; PhD, Doctor of Philosophy.

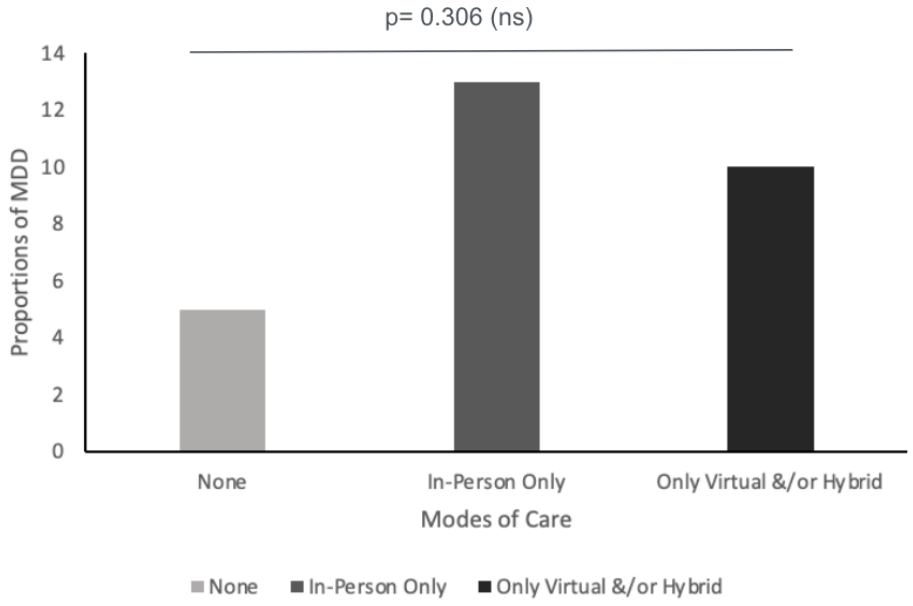
Objective 1: Proportions of mental disorder diagnoses between participants who accessed different modes of care

Figure 1 presents a visualization of the chi-squared analysis of the difference in proportions of mental disorder diagnoses between women who accessed neither in-person nor virtual mode of care, women who accessed in-person only mode of care, and women who accessed only virtual and/or hybrid mode of care. The proportions of mental disorder diagnoses were 31.25% for women who accessed no care, 52% for women who accessed only in-person care, and 55.56% for women who accessed only virtual and/or a hybrid mode of care. The results of the chi-squared analysis showed no difference in the proportions of mental disorder diagnoses between female participants (aged 18-24 years old) who accessed virtual/hybrid care compared to in-person only or neither mode of care over the past 12 months ($p<0.05$).

Figure 1

Bar chart with the proportion of people with a mental disorder diagnosis (MDD) between different modes of care (none, in-person, virtual/hybrid). X-axis represents the mode of care

participants accessed and Y-axis represents the proportions of people with a mental disorder diagnosed (MDD) by a physician. Chi-square test, p = 0.306 (p < 0.05). ns: not significant.



Objective 2: Participant Experience with Quality of Treatment with Different Modes of Healthcare Delivery

The findings in Table 3 summarize the fitted results of the multinominal regression model between only in-person, only online and both virtual and in-person consultations. According to the Omnibus Test of Model coefficients, the model containing all 3 predictors was not statistically significant (Chi-squared = 16.823, p<0.684), suggesting that the model was not able to predict cases based on the modality of healthcare. Only one predictor variable 'Reduction of Physical and Mental Anxiety' showed a significant contribution to the analysis model for virtual and hybrid consultations (sig < 0.001). There is no statistical significance for the 'Duration of Treatment', & 'Ability to Access E-Mental Health Resources' for the three modalities of care.

Table 2

Multinominal regression analysis on mode of healthcare delivery and the quality of treatment

Item	Coef	SE	95% CI [Lower to Upper]	Sig.
Only In-Person Consultations				
Intercept	-1.771	1.370		0.196
Duration of Treatment	0.341	0.514	[0.513 to 3.853]	0.507
Reduction of Physical and Mental Anxiety	0.665	1.008	[0.270 to 14.018]	0.510
Ability to access e-mental health resources	0.171	0.5	[0.445 to 3.159]	0.733
Both Virtual and Hybrid Consultations				
Intercept	17.240	5.005		<0.001
Duration of Treatment	-0.756	1.797	[0.014 to 15.891]	0.674
Reduction of Physical and Mental Anxiety	-17.288	1.539	[1.518E-9 to 56.341E-7]	<0.001***
Ability to access e-mental health resources	0.935	1.726	[0.87 to 74.989]	0.588
Neither In-Person or Virtual				
Intercept	-2.233	1.985		0.261
Duration of Treatment	-0.136	0.729	[0.209 to 3.642]	0.852
Reduction of Physical and Mental Anxiety	-0.779	1.403	[0.029 to 7.177]	0.579
Ability to access e-mental health resources	0.617	0.715	[0.456 to 7.527]	0.388

*** *P <0.001*

Discussion

For the primary objective, the findings suggest there is no difference between the proportions of mental disorder diagnoses and female participants (aged 18-24 years old) who accessed virtual/hybrid care compared to in-person only or neither mode of care over the past 12 months. For the secondary objective of this study, there was a relationship found between the reduction of physical and mental anxiety within only virtual/hybrid model. These results suggest that individuals who utilize virtual/hybrid consultations are more likely to receive faster treatment and better overall care.

The results found in this study compared to existing published findings share some similarities. Based on the findings from the primary objective, Bulkes et al. (2022) conducted a prospective study to compare the results of telemedicine and in-person mental health care in intensive-treatment-seeking adults. Bulkes conducted an ANOVA test to understand the prevalence of treatment delivery in-person versus through telemedicine on the clinical assessment of mental health outcomes. These results connect to this study's findings and describe how the mode of care delivered does not impact the clinical assessment of mental health outcomes. This data supports remote treatment as a viable alternative to in person mental health services (Bulkes et al., 2022). A study by McCall et al. (2019) looked at telemedicine to help African-American women manage anxiety and depression. 43.1% of participants agreed that video call was a better mode of health care for their anxiety. This relates to the significance found in the multinomial logistic regression on the relationship between reduction of anxiety and virtual/hybrid communication. The secondary objective relates to findings by Nicholas et al. (2021) who also found that most adults report that telehealth positively impacted healthcare service quality. Similarly, this study found that individuals who use virtual consultations are

more likely to receive faster treatment and better overall care. LeBlanc et al. (2020) also found that about 90% of existing articles report eHealth interventions positively, noting decreased travel time, time/ cost saving and increased access to services as primary benefits of eHealth. Furthermore, participants diagnosed with a mental health disorder partaking in different modes of care can see improvement in the delivery of their healthcare reduction of physical and mental anxiety within only online consultations and hybrid model is noted. This is also seen in LeBlanc et al. (2020) where ancillary benefits to eHealth included reduced anxiety. This study found that people who had a mental health diagnosis had a significantly higher number of visits compared to people who did not have a mental health diagnosis. This is supported by findings by Nicholas et al. (2021), where young people reported telehealth had not impacted their relationship with their clinicians; a majority of clinicians expressed high levels of interest in continuing to use telehealth to provide an increased level and service of care. This helps provide the increased level of care needed by those with a mental health diagnosis. This data further emphasizes the push towards eHealth modalities to increase access to care and levels of care for those with mental health diagnoses. Literature seems to agree with the utility of virtual consultations. This is further seen through the successful use of virtual doctor's appointments as discussed by Haleem et al. (2021). Researchers note that telemedicine has improved patient quality of life and reduced healthcare costs (Haleem et al., 2021). However, a limitation to consider includes the reduction in sample sizes when examining trends stratified by age and sex for large cross-sectional studies. Wilcock et al. (2023) also found participants with serious mental health concerns receiving care from practices had a higher level of telemedicine use during the COVID-19 pandemic. This study found no changes in observed quality metrics over time.

This study has several limitations. First, the term emerging adults was defined as ages 18-24, but there is no consensus in the literature on the age range for emerging adults as it depends on the field of research. Secondly, after dealing with the missing data, our sample size was small enough (n=59) for some of the categories of our dependent variable to have expected cell counts of less than 5 for the chi-squared analysis which could affect the generalizability of our results. Another limitation arose from the use of a chi-squared analysis which gives one p-value for all groups presenting a challenge to indicate which proportions were similar. Furthermore, as our dataset consisted of survey responses, there's a possibility of self-reported bias where survey conditions and participants' cognitive processes could have altered their responses (Bauhoff, 2014). Lastly, the use of an already existing database is a limitation as we are unaware of glitches in the data collection process that may be important to the interpretation of specific variables in the dataset. Regardless of the limitations, the study addresses the study objectives and has several implications.

Given the limited literature on women's mental health outcomes from telemedicine, future work should aim to explore a larger sample size with this participant group through more prospective, longitudinal studies. Further, future studies can explore new methodologies that avoid self-reported data biases. These findings underscore the importance of healthcare providers to consider the effectiveness of healthcare delivery on different conditions. Overall, the study defines importance of mental disorder treatment and contributes to optimizing resource allocation in healthcare delivery.

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