Prevalence and Determinants of Generalized Anxiety Disorder Symptoms in Residents of Fort McMurray 12 Months Following the 2020 Flooding

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Background: The flood in Fort McMurray (FMM) which occurred between April 26 and May 2, 2020, is known to have displaced an estimated population of 1,500 people, and destroyed or damaged about 1,230 buildings. In all, it is estimated to have caused about $228 million in losses.

Objective: This study aims to identify the prevalence and determinants of likely Generalized Anxiety disorder (GAD) in among respondents 12-months after the 2020 flooding.

Methods: Data for the study were collected through a cross-sectional survey sent through REDCap and hosted online from the 24th of April to the 2nd of June 2021. The self-administered questionnaire was emailed to respondents using community, government, school, and occupational platforms. Demographic, flooding-related variables, and clinical data were collected. A validated instrument, the GAD-7 was used to collect information on likely GAD. Consent was implied by completing the survey forms, and the University of Alberta Health Research Ethics Committee approved the study.

Results: Of the 249 residents surveyed, 74.7% (186) respondents completed the online survey, 81.6% (80) were above 40 years, 71% (132) were in a relationship, 85.5% (159) were females, and 94.1% (175) were employed. The prevalence of likely GAD was 42.5% in our study. Predictors of likely GAD among respondents included positive employment status (OR = 30.70; 95% C.I. 2.183–423.093), prior diagnosis of depression (OR = 3.30; 95% C.I. 1.157–9.43), and the perceived need to have mental health counseling (OR = 6.28; 95% C.I. 2.553–15.45).

Conclusion: This study showed that there was an increased magnitude of moderate to high anxiety symptoms among respondents following the natural disaster particularly the
INTRODUCTION

Natural disasters like floods, earthquakes, tsunamis, and wildfires are known to cause havoc including disruption to life and damage to properties across affected countries and communities (1). Businesses, employment, housing, and lives are negatively impacted, causing survivors of such disasters to suffer financial, emotional, psychological, and physical health problems. Natural disasters particularly flooding could and usually do affect different populations, but a subset of those exposed usually suffer from symptoms of stress, and anxiety (2, 3) that are clinically significant and may require the intervention of mental health professionals (3).

Floods are considered the most frequent form of natural disaster and occur usually when there is an overflow of water that submerges land that is usually dry (4).

Evidence of the psycho-social effect of flood events suggests that flooding can pose substantial mental health and social problems that may continue over extended periods of time (5). Flooding can affect the psycho-social resiliency of the hardest of people who are affected by the flooding itself, or by secondary stressors that are indirectly related to the initial extreme event such as economic stress associated with re-building and that which arise as people try to recover their lives, property, and relationships (5).

The effects of flooding include homelessness, financial crisis, displacements, disruption to lives, shortages of foods and supplies, disruption of electricity or power supply, and potable water supply to the affected communities (6). Individuals exposed to these stressors commonly struggle with mental health challenges ranging from Generalized Anxiety Disorder GAD, substance use disorders, and depression (7).

The flooding in FMM in 2020 resulted in the displacement of an estimated 1,500 people and destroyed or damaged about 1,230 buildings between April 26 and May 2, 2020, and is estimated to have caused about $228 million in losses (6). Published research suggests that Generalized Anxiety Disorder (GAD) symptoms are increased following disasters, such as flooding (8, 9). As in other populations, we postulate that the flood has led to a rise in mental health disorders, particularly GAD (10) in FMM after the disaster. GAD is defined as “an uncontrollable disposition to worry about one’s welfare and that of one’s immediate kin” (11). The symptoms usually associated with GAD include arousal, vigilance, tension, irritability, unrestful sleep, and gastrointestinal distress (12).

The people of Fort McMurray have had to endure some traumas resulting from the 2016 wildfires, the COVID-19 pandemic and the attendants job losses and restrictions as well the flooding in 2020. These situations motivated the authors to carry out a study to estimate the level of trauma and the associated predictors caused by the flooding in 2020.

This study aims to estimate the prevalence and identify the determinants of likely GAD in residents of Fort McMurray (FMM) 12-months after the 2020 flooding.

METHODOLOGY AND MATERIALS

Setting and Design
This study was undertaken in Fort McMurray (FMM), an urban service area of the Northern Alberta Regional Municipality of Wood Buffalo in Canada. It is composed of a diverse population of ~111,687 as of the 2018 municipal population census (13). FMM is made of mainly temporary project accommodation facilities and has some surrounding rural communities (14).

The data for the study were collected through an online cross-sectional survey sent through REDCap (15). The REDCap is an online electronic platform for the capturing of data for research. The online survey link was sent to various electronic platforms, including the public and catholic school boards, the Canadian Mental Health Association, Keyano College and other community platforms from the 24th of April to the 2nd of June, 2021. The questionnaire was self-administered as respondents accessed them online. Consent was implied if the survey was completed, and the Alberta Health Research Ethics Committee approved the study.

General Measure
The GAD-7 scale was used to assess the presence of anxiety symptoms amongst respondents. This scale consists of seven self-reported items that define the symptoms of GAD. Items on the scale are rated on a 4-point Likert-type scale. The responses for the questions were; Not at all (0), Several days (1), Over half the days (2), and Nearly every day (3). Scores ranged from 0 to 21 with higher scores indicating more severe symptoms of GAD (16). This study classified two types of anxiety; low anxiety is characterized by a score <10 and moderate to high anxiety (Likely anxiety) is characterized by scores of 10 or >10. The scale is known globally to show consistency and a one-factor structure in its usage (17) and shows that all its items are representative of one construct. The GAD-7 scale has been recommended as the most valid tool for assessing the severity of GAD symptoms in research and clinical practice (18, 19) Test-retest reliability was also found to be good (intraclass correlation = 0.83). Comparison of scores obtained from the self-report scales with those derived from the MHP-administered versions of the same scales yielded similar outcomes (intraclass correlation = 0.83), indicating good procedural validity. The internal consistency of the GAD-7 was excellent (Cronbach α = 0.92) (18, 19).
Sample Size Estimation
With a population of 111,687 as of the 2018 census (Owusu et al. Determinants of Generalized Anxiety), to examine all the variables in association with the likely anxiety, square or Fisher exact (for small sample sizes) analysis was done using imputations, representing the true and complete responses. With an expected survey response rate of 20%, we planned to reach 5,290 residents with the online survey link.

Collected Data and Statistical Analysis
A combination of socio-demographic factors (e.g., age, sex at birth, relationship status), clinical factors (e.g., clinical history of depression, anxiety), and flood-related variables (e.g., witnessing the flood or being fearful for one or others’ lives) were collected through this survey. Statistical analysis for this study was completed using SPSS Version 25 (IBM 2011) (20). For demographic, clinical, and flood-related variables, descriptive statistics were used and centered on the respondents’ age. Chi-square or Fisher exact (for small sample sizes) analysis was done to examine all the variables in association with the likely anxiety. The significant ($p \leq 0.05$) or near significant ($0.1 > p > 0.05$) variables obtained from the univariate analysis were included in a logistic regression model. Correlational analysis was used to rule out any strong inter-correlations (Spearman’s correlation coefficient of 0.7 to 1.0 or $-0.7$ to $-1.0$) between the variables. The logistic regression model was employed to identify significant predictors of likely anxiety. Confidence intervals and odds ratios (OR) were used to determine the predictor variables, including wildfire-related factors for respondents to self-report likely anxiety-related factors for respondents to self-report likely anxiety after the 2016 wildfires in FMM. The reported data is devoid of imputations, representing the true and complete responses of respondents.

RESULTS
Demographic Characteristics
Table 1 presents the demographic characteristics of the participants. In all, 186 out of the 249 residents who accessed the online survey completed it, giving a completion rate of 74.7%. Descriptive data of demographic, clinical, and flood-related data from the 186 respondents were analyzed against their age groupings as presented in Table 1. In all, 159 (85.5%) were females of which 80 (81.6%) were aged more than 40 years. Of the total respondents, 132 (71%) were in a relationship and 175 (94.1%) were employed with 50% of them employed by the school board. On the flood-related data, 176 (94.6%) of the respondents have ever received a mental health diagnosis with a similar proportion within both age groups (49% of respondents aged $= \geq 40$ years and 48.0% of respondents aged $> 40$). Seventy-eight (41.9%) of all respondents were diagnosed specifically with Generalized Anxiety Disorder by a mental health professional. Within the age group $= \leq 40$ years, 44.3% of them were diagnosed with GAD compared to 39.8% of respondents aged $> 40$ years.

Other diagnoses by a mental health professional reported by respondents included depression (68.8%), bipolar disorder (3.2%), personality disorders (1.1%), and none of the respondents reported a diagnosis of schizophrenia (0.0%). Sixty-six, 35.5% of

| Variables | Age in years | Total, n (%) |
|-----------|-------------|--------------|
| To which gender do you identify? | | |
| Male | 9 (10.2%) | 18 (18.4%) | 27 (14.5%) |
| Female | 79 (89.8%) | 80 (81.6%) | 159 (85.5%) |
| Are you currently employed? | | |
| Yes | 82 (93.2%) | 93 (94.9%) | 175 (94.1%) |
| No | 6 (6.8%) | 5 (5.1%) | 11 (5.9%) |
| If employed, where? | | |
| School boards | 41 (50.6%) | 46 (49.5%) | 87 (50.0%) |
| Healthcare industry | 5 (6.2%) | 5 (5.4%) | 10 (5.7%) |
| Keyano college | 9 (11.1%) | 11 (11.8%) | 20 (11.1%) |
| Oil Sands industry | 7 (8.6%) | 6 (6.5%) | 13 (7.5%) |
| Municipal or Government Agency | 6 (7.4%) | 7 (7.5%) | 13 (7.5%) |
| Other | 13 (16.0%) | 18 (19.4%) | 31 (17.8%) |
| Marital status | | |
| In a relationship | 62 (70.5%) | 70 (71.4%) | 132 (71.0%) |
| Not in a relationship | 26 (29.5%) | 28 (28.6%) | 54 (29.9%) |
| Did you reside at FMM during the 2020 flood? | | |
| No | 7 (8.0%) | 3 (3.1%) | 10 (5.4%) |
| Yes | 95 (96.9%) | 176 (94.6%) | |
| Area of residence | | |
| No flooding areas | 70 (86.4%) | 75 (78.9%) | 145 (82.4%) |
| Flooding areas | 11 (13.6%) | 20 (21.1%) | 31 (17.6%) |
| Where did you live prior to the 2020 FMM flooding? | | |
| Own home | 61 (69.3%) | 80 (81.6%) | 141 (75.8%) |
| Renting | 27 (30.7%) | 18 (18.4%) | 45 (24.2%) |
| Where do you live now? | | |
| Own home | 65 (73.9%) | 80 (81.6%) | 154 (87.0%) |
| Renting | 23 (26.1%) | 18 (18.4%) | 41 (23.0%) |
| Where did you live just prior to the 2020 FMM flooding? | | |
| In FMM | 76 (95.0%) | 91 (96.8%) | 167 (96.0%) |
| Other | 4 (5.0%) | 3 (3.2%) | 7 (4.0%) |
| Did you witness the flooding of homes or structures in Fort MM? | | |
| No | 23 (24.5%) | 43 (24.7%) | |
| Yes | 60 (75.0%) | 71 (75.5%) | 131 (75.3%) |
| Fearful of life and lives of family and friends during flood | | |
| No | 55 (68.8%) | 68 (72.3%) | 123 (70.7%) |
| Yes | 25 (31.3%) | 26 (27.7%) | 51 (29.3%) |
TABLE 2 | Clinical characteristics by age of respondents.

| Variables                                      | ≤40 (n) | >40 (n) | Total, n (%) |
|------------------------------------------------|---------|---------|--------------|
| Prior history of depression diagnosis from a mental health professional |          |         |              |
| Yes                                           | 27 (30.7%) | 61 (69.3%) | 88 (100.0%) |
| No                                            | 31 (31.6%) | 67 (88.4%)  | 98 (52.7%)  |
| Prior history of Bipolar diagnosis from a mental health professional |          |         |              |
| Yes                                           | 86 (97.7%) | 94 (95.9%)  | 180 (96.6%) |
| No                                            | 4 (1.3%)   | 2 (3.2%)    | 6 (3.2%)    |
| Prior history of anxiety diagnosis from a mental health professional |          |         |              |
| Yes                                           | 49 (55.7%) | 59 (60.2%)  | 108 (58.1%) |
| No                                            | 40 (44.3%) | 39 (39.8%)  | 79 (41.9%)  |
| Prior history of Schizophrenia diagnosis from a mental health professional |          |         |              |
| Yes                                           | 88 (100.0%) | 98 (100.0%) | 186 (100.0%)|
| No                                            | 0 (0.0%)   | 0 (0.0%)    | 0 (0.0%)    |
| Prior history of personality disorder diagnosis from a mental health professional |          |         |              |
| Yes                                           | 87 (98.9%) | 97 (99.0%)  | 184 (98.9%) |
| No                                            | 1 (1.1%)   | 1 (1.0%)    | 2 (1.1%)    |
| Prior history of other mental health diagnosis from a health professional |          |         |              |
| Yes                                           | 78 (88.6%) | 91 (92.9%)  | 169 (90.9%) |
| No                                            | 10 (11.4%) | 7 (7.1%)    | 17 (9.1%)   |
| Prior history of mental health diagnosis (if any) from a health professional |          |         |              |
| Yes                                           | 39 (44.3%) | 51 (52.0%)  | 90 (48.4%)  |
| No                                            | 45 (55.7%) | 47 (48.0%)  | 92 (51.6%)  |
| Prior history of Antidepressants medication use |          |         |              |
| Yes                                           | 61 (69.3%) | 66 (73.7%)  | 127 (68.3%) |
| No                                            | 27 (30.7%) | 32 (23.7%)  | 59 (31.7%)  |
| Prior history of Antipsychotic medication use |          |         |              |
| Yes                                           | 86 (97.7%) | 96 (98.0%)  | 182 (97.8%) |
| No                                            | 2 (2.3%)   | 2 (2.0%)    | 4 (2.2%)    |
| Prior history of benzodiazepines use           |          |         |              |
| Yes                                           | 83 (94.3%) | 91 (92.9%)  | 174 (93.5%) |
| No                                            | 5 (5.7%)   | 7 (7.1%)    | 12 (6.5%)   |
| Prior history of mood stabilizers use          |          |         |              |
| Yes                                           | 79 (98.8%) | 86 (87.8%)  | 165 (88.7%) |
| No                                            | 9 (10.2%)  | 12 (12.2%)  | 21 (11.3%)  |
| Are you on any medication for a mental health concern? |       |         |              |
| Yes                                           | 87 (98.8%) | 96 (98.0%)  | 183 (98.4%) |
| No                                            | 1 (1.1%)   | 2 (2.0%)    | 3 (1.6%)    |
| Are you on any of the following medication for a mental health concern? |          |         |              |
| Not on MH Rx                                   | 57 (84.8%) | 63 (84.3%)  | 120 (64.5%) |
| Yes on MH Rx                                   | 31 (35.2%) | 35 (35.7%)  | 66 (35.5%)  |
| Have you received mental health counseling in the past? |          |         |              |
| No                                            | 46 (52.3%) | 68 (69.4%)  | 114 (61.3%) |
| Yes                                           | 42 (47.7%) | 30 (30.6%)  | 72 (38.7%)  |
| Would you like to receive mental health counseling? |          |         |              |
| No                                            | 33 (37.5%) | 55 (56.1%)  | 88 (47.3%)  |
| Yes                                           | 55 (62.5%) | 43 (43.9%)  | 98 (52.7%)  |

TABLE 3 | Source of information, degree of damage and support for participants.

| Variables                                      | ≤40 (n) | >40 (n) | Total, n (%) |
|------------------------------------------------|---------|---------|--------------|
| During the 2020 FMM flooding, how frequently did you watch television images about the devastation caused by the floods? |          |         |              |
| Daily                                         | 46 (67.5%) | 70 (74.5%)  | 116 (66.7%) |
| >Daily                                        | 20 (25.0%) | 17 (18.1%)  | 37 (21.3%)  |
| Did not watch at all                           | 14 (17.5%) | 7 (7.4%)   | 21 (12.1%)  |
| During the 2020 FMM flooding, how frequently did you read newspaper or internet articles related to the devastation caused by the flooding? |          |         |              |
| Daily                                         | 62 (77.5%) | 70 (75.3%)  | 132 (76.3%) |
| >Daily                                        | 16 (20.0%) | 19 (20.4%)  | 35 (20.2%)  |
| Did not read at all                           | 2 (2.5%)   | 4 (4.3%)    | 6 (3.5%)    |
| Did you lose property as a result of the floods in FMM? |          |         |              |
| Home was completely destroyed                  | 88 (100.0%) | 98 (100.0%) | 186 (100.0%)|
| Home suffered substantial damages              | 0 (0.0%)   | 0 (0.0%)    | 0 (0.0%)    |
| Business was completely destroyed by the floods |          |         |              |
| Unchecked                                     | 86 (97.7%) | 91 (92.9%)  | 177 (95.2%) |
| Checked                                       | 2 (2.3%)   | 7 (7.1%)    | 9 (4.8%)    |
| Car was completely destroyed                   | 85 (96.6%) | 95 (96.9%)  | 180 (96.8%) |
| Suffered no loss of property in the floods     | 3 (3.4%)   | 3 (3.1%)    | 6 (3.2%)    |
| Did you live in the same house you lived in before the floods? |          |         |              |
| Yes                                           | 68 (86.1%) | 79 (84.0%)  | 147 (85.0%) |
| No even though my home was not affected        | 10 (12.7%) | 12 (12.8%)  | 22 (12.7%)  |
| No because my home was affected                | 1 (1.3%)   | 3 (3.2%)    | 4 (2.3%)    |
| Did you receive family support during or after the floods? |          |         |              |
| Some to high level of support                  | 51 (65.4%) | 49 (55.1%)  | 100 (59.9%) |
| Limited or no support                         | 27 (34.6%) | 40 (44.9%)  | 67 (40.1%)  |
| Did you receive support from the Red Cross during or after the floods? |          |         |              |
| Some to high level of support                  | 6 (7.6%)   | 13 (14.1%)  | 19 (11.1%)  |
| Limited or no support                         | 4 (5.1%)   | 13 (14.1%)  | 17 (9.9%)   |
| Not impacted by the floods                    | 69 (87.3%) | 66 (71.7%)  | 135 (78.9%) |
| Did you receive support from the Government of Alberta during or after the floods? |          |         |              |
| Some to high level of support                  | 6 (7.6%)   | 12 (13.0%)  | 18 (10.5%)  |
| Limited or no support                         | 4 (5.1%)   | 14 (15.2%)  | 18 (10.5%)  |
| Not impacted by the floods                    | 69 (87.3%) | 66 (71.7%)  | 135 (78.9%) |
TABLE 4 | Chi-squared test of association between demographic, clinical, flood-related variables and likely GAD.

| Variables                        | Low anxiety | Likely GAD | Chi-square | p-Value |
|----------------------------------|-------------|------------|------------|---------|
| **Gender**                      |             |            |            |         |
| Male                             | 15 (65.2%)  | 8 (34.8%)  | 0.653      | 0.499   |
| Female                           | 81 (56.3%)  | 63 (43.8%) | 0.115      | 0.734   |
| **Age (years)**                  |             |            |            |         |
| <40                              | 40 (51.9%)  | 37 (48.1%) | 1.792      | 0.210   |
| ≥40                              | 56 (62.2%)  | 34 (37.8%) | 0.792      | 0.371   |
| **Employment status**           |             |            |            |         |
| Unemployed                       | 1 (11.1%)   | 8 (88.9%)  | 8.371      | 0.005   |
| Employed                         | 95 (60.1%)  | 63 (39.9%) | 0.935      | 0.334   |
| **Place of employment**         |             |            |            |         |
| School boards                    | 50 (66.7%)  | 25 (33.3%) | 8.290      | 0.142   |
| Healthcare industry             | 5 (44.4%)   | 6 (55.6%)  | 0.013      | 1.000   |
| Keyano college                   | 10 (50.0%)  | 10 (50.0%) | 0.000      | 1.000   |
| Oil Sands industry              | 6 (50.0%)   | 6 (50.0%)  | 0.000      | 1.000   |
| Municipal or Government Agency   | 10 (83.3%)  | 2 (16.7%)  | 0.105      | 1.000   |
| Other                            | 50 (66.7%)  | 25 (33.3%) | 0.000      | 1.000   |
| **Marital status**              |             |            |            |         |
| In a relationship                | 73 (60.3%)  | 48 (39.7%) | 1.455      | 0.293   |
| Not in a relationship            | 23 (50.0%)  | 23 (50.0%) | 0.000      | 1.000   |
| **Did you reside in FMM during the 2020 flood?** | | | | |
| No                               | 4 (66.7%)   | 2 (33.3%)  | 0.215      | 0.703   |
| Yes                              | 92 (57.1%)  | 69 (42.9%) | 0.115      | 0.734   |
| **Housing status prior to the flooding** | | | | |
| Own home                         | 78 (60.5%)  | 51 (39.5%) | 2.060      | 0.191   |
| Renting                          | 18 (47.4%)  | 20 (52.6%) | 0.013      | 1.000   |
| **Current housing status**       |             |            |            |         |
| Own home                         | 78 (58.6%)  | 55 (41.4%) | 0.361      | 0.565   |
| Renting                          | 18 (52.9%)  | 16 (47.1%) | 0.244      | 0.745   |
| **Prior history of depression** |             |            |            |         |
| Yes                              | 19 (35.8%)  | 34 (64.2%) | 14.871     | 0.000   |
| No                               | 77 (67.5%)  | 37 (32.5%) | 0.115      | 0.734   |
| **Prior history of bipolar disorder** | | | | |
| Yes                              | 3 (80.0%)   | 1 (20.0%)  | 0.013      | 1.000   |
| No                               | 93 (57.4%)  | 69 (42.6%) | 0.115      | 0.734   |
| **Prior history of generalized anxiety disorder** | | | | |
| Yes                              | 29 (41.4%)  | 41 (58.6%) | 12.713     | 0.000   |
| No                               | 67 (69.1%)  | 30 (30.9%) | 0.115      | 0.734   |
| **Prior history of personality disorder** | | | | |
| Yes                              | 0 (0.0%)    | 100 (100.0%) | 0.000   |         |
| No                               | 96 (67.8%)  | 44 (32.2%) | 0.000      | 1.000   |
| **Prior history of a mental health diagnosis** | | | | |
| Yes                              | 41 (47.7%)  | 45 (52.3%) | 6.983      | 0.012   |
| No                               | 55 (67.9%)  | 26 (32.1%) | 0.115      | 0.734   |
| **Received antidepressants before the flood** | | | | |
| Yes                              | 24 (45.3%)  | 29 (54.7%) | 4.730      | 0.043   |
| No                               | 72 (63.2%)  | 42 (36.8%) | 0.115      | 0.734   |

(Continued)

TABLE 4 | Continued

| Variables                        | Low anxiety | Likely GAD | Chi-square | p-Value |
|----------------------------------|-------------|------------|------------|---------|
| **Received anti-psychotics before the flood** | | | | |
| Yes                              | 2 (66.7%)   | 1 (33.3%)  | 0.105      | 1.000   |
| No                               | 94 (57.3%)  | 70 (42.7%) | 0.031      | 1.000   |
| **Received Benzodiazepine before the flood** | | | | |
| Yes                              | 0 (0.0%)    | 4 (100.0%) | 5.541      | 0.031   |
| No                               | 96 (58.9%)  | 67 (41.1%) | 0.031      | 1.000   |
| **Received mood stabilizers before the flood** | | | | |
| Yes                              | 5 (50.0%)   | 5 (50.0%)  | 0.244      | 0.745   |
| No                               | 91 (58.0%)  | 66 (42.0%) | 0.031      | 1.000   |
| **Received sleeping tablets before the flood** | | | | |
| Yes                              | 8 (44.4%)   | 10 (55.6%) | 1.404      | 0.313   |
| No                               | 88 (59.1%)  | 61 (40.0%) | 0.031      | 1.000   |
| **No medication for mental health concern** | | | | |
| Yes                              | 28 (48.7%)  | 32 (53.3%) | 4.484      | 0.050   |
| No                               | 68 (63.6%)  | 39 (36.4%) | 0.050      | 1.000   |
| **Receive MH counseling in the past** | | | | |
| Yes                              | 23 (36.5%)  | 40 (63.5%) | 18.215     | 0.000   |
| No                               | 73 (70.2%)  | 31 (29.8%) | 0.050      | 1.000   |
| **Would like MH counseling**     |             |            |            |         |
| Yes                              | 31 (35.2%)  | 57 (64.8%) | 37.708     | 0.000   |
| No                               | 65 (62.3%)  | 34 (37.7%) | 0.050      | 1.000   |
| **Place of residence just prior to the McMurray 2020 flooding** | | | | |
| In Fort MM                       | 92 (56.5%)  | 70 (43.5%) | 1.701      | 0.242   |
| Other                            | 5 (83.3%)   | 2 (16.7%)  | 0.000      | 1.000   |
| **Witnessed flooding of homes**  |             |            |            |         |
| No                               | 23 (56.1%)  | 18 (43.9%) | 0.043      | 0.857   |
| Yes                              | 73 (57.9%)  | 53 (42.1%) | 0.043      | 0.857   |
| **Fearful of life and lives of family and friends during flood** | | | | |
| No                               | 75 (63.6%)  | 43 (36.4%) | 6.072      | 0.016   |
| Yes                              | 21 (42.9%)  | 28 (57.1%) | 0.016      | 0.887   |

Source of Information and Support for Participants by Age Category

About 85% of the total respondents were monitoring the news and images relating to the floods at least daily on TV (66.7% watched daily and 21.3% watched more than daily) and about 96% read newspapers or internet-related articles at least daily (76.3% read daily and 20.2% read more than daily). Some respondents, 100 (59.9%) received some high level of support from the family after the flooding, 19 (11.1%) from the Red Cross, and 18 (10.5%) from the government of Alberta (Table 3).
TABLE 5 | Association between participants’ source of information, degree of damage, support and likely GAD.

| Variables | Low anxiety | Likely GAD | Chi-square | p-Value |
|-----------|-------------|------------|------------|---------|
| Frequency watching TV images of the flooding | | | | |
| Daily | 55 (50.0%) | 55 (50.0%) | 7.765 | 0.022 |
| <Daily | 27 (75.0%) | 9 (25.0%) | | |
| Did not watch | 14 (66.7%) | 7 (33.3%) | | |
| Frequency reading newspapers about the flood | | | | |
| Daily | 66 (52.4%) | 60 (47.6%) | 7.765 | 0.022 |
| <Daily | 25 (73.5%) | 9 (26.5%) | | |
| Did not read | 4 (66.7%) | 2 (33.3%) | | |
| Frequency reading newspapers about the flood | | | | |
| Daily | 66 (52.4%) | 66 (52.4%) | 5.119 | 0.074 |
| <Daily | 25 (73.5%) | 25 (73.5%) | | |
| Did not read | 4 (66.7%) | 4 (66.7%) | | |
| Lose property due to the flood: | | | | |
| Home suffered substantial damage | | | | |
| Unchecked | 93 (58.9%) | 65 (41.1%) | 2.270 | 0.171 |
| Checked | 3 (33.3%) | 6 (66.7%) | | |
| Home suffered slight damage | | | | |
| Unchecked | 94 (58.0%) | 68 (42.0%) | 0.645 | 0.652 |
| Checked | 2 (40.0%) | 3 (60.0%) | | |
| Car was completely destroyed | | | | |
| Unchecked | 93 (57.1%) | 70 (42.9%) | 0.514 | 0.657 |
| Checked | 3 (75.0%) | 1 (25.0%) | | |
| Business was completely destroyed | | | | |
| Unchecked | 94 (58.0%) | 68 (42.0%) | 0.645 | 0.642 |
| Checked | 2 (40.0%) | 3 (60.0%) | | |
| Suffered no loss of property | | | | |
| No loss | 88 (59.9%) | 59 (40.1%) | 2.842 | 0.147 |
| Yes loss | 9 (40.0%) | 12 (60.0%) | | |
| Live in same house prior to the flood | | | | |
| Yes | 84 (58.6%) | 57 (40.4%) | 2.174 | 0.357 |
| No (although home was not destroyed by flood) | 9 (42.9%) | 12 (57.1%) | | |
| No (home destroyed by flood) | 2 (50.0%) | 2 (50.0%) | | |
| Family support after the flood | | | | |
| Some to high level of support | 56 (57.7%) | 41 (42.3%) | 0.074 | 0.870 |
| Limited support or no support | 35 (55.6%) | 28 (44.4%) | | |
| Support from Red Cross after the flood | | | | |
| Some to high level support | 9 (52.9%) | 8 (47.1%) | 1.059 | 0.310 |
| Limited or no support | 8 (47.1%) | 9 (52.9%) | | |
| NA (Not impacted by flood) | 77 (59.2%) | 53 (40.8%) | | |
| Support from Government of Alberta after the flood | | | | |
| Some to high level support | 7 (41.2%) | 10 (58.8%) | 2.021 | 0.365 |
| Limited or no support | 10 (58.8%) | 7 (41.2%) | | |

Association Between Demographic, Clinical, Flooding-Related Variables and General Anxiety Disorders

The univariate analysis of Table 4 is made of 23 demographics, clinical, and flooding related variables and their association with likely GAD. Chi-squared and Fisher exact test showed a significant association between likely GAD and nine variables: employment status, prior history of having been diagnosed with depression, prior history of anxiety disorder, prior history of any mental disorder diagnosis, taking antidepressants as well as taking benzodiazepine medication, taking no medication for a mental health concern, received mental health counseling, fear of life and lives of friends and families during the flooding.

Association Between Participants’ Source of Information, Degree of Damage, Support, and General Anxiety Disorders

Table 5 shows chi-squared and Fisher exact analyses of participants’ source of information, source of support for participants, and their association with likely GAD. The frequency of watching TV and images during the flood was found to be significantly associated with GAD symptoms among the study participants. Also, there was a significant association between GAD symptoms and the frequency of reading internet-related articles. No significant relationship was found between variables related to loss of property due to the flood, source of support, and likely GAD.

The Model Predicts Likely Anxiety Among Respondents

Illustrated in Table 6 below is the multivariate logistic regression model that was employed to predict likely GAD among respondents. The model included nine out of the 12 chi-square predictor variables. This was after removing three variables' prior history of mental health diagnosis, taking Benzodiazepines, and prior history of receiving mental health counseling which showed a high correlation with some other variables ($r_\text{corr} > 0.7$).

The logistic regression model was statistically significant; $X^2$ (df = 12; $n = 161$) = 75.39, $p < 0.001$, indicating that the model...
TABLE 6 | Multivariate logistic regression model for respondents’ likelihood to present with moderate to severe anxiety.

| Characteristics                                      | $B$    | SE     | Wald  | df | p-Value | Odds ratio | 95% C.I. for odd’s ratio |
|------------------------------------------------------|--------|--------|-------|----|---------|------------|--------------------------|
| Employment status                                    | 3.425  | 1.349  | 6.444 | 1  | 0.011*  | 30.709     | 2.183–423.093             |
| Prior history of depression                          | 1.195  | 0.535  | 4.985 | 1  | 0.026*  | 3.303      | 1.157–9.429               |
| Prior history of generalized anxiety disorder        | 0.446  | 0.557  | 0.643 | 1  | 0.423   | 1.563      | 0.525–4.651               |
| Received Antidepressants before the flood            | −0.631 | 0.607  | 1.078 | 1  | 0.299   | 0.532      | 0.162–1.750               |
| Received Mental Health counseling in the past         | 0.220  | 0.493  | 0.198 | 1  | 0.656   | 1.245      | 0.474–3.273               |
| Would like to receive a Mental Health counseling      | 1.837  | 0.459  | 16.000| 1  | 0.000*  | 6.280      | 2.553–15.450              |
| Fearful of life and lives of family and friends during flood | 0.451  | 0.440  | 1.053 | 1  | 0.305   | 1.571      | 0.663–3.720               |
| Frequency of watching TV images of the flood          |        |        |       | 2  | 0.184   |            |                          |
| Daily                                                | 3.389  |        |       | 2  |         | 0.056      | 1.149                    |
| Less than daily                                      | −1.371 | 0.770  | 3.163 | 1  | 0.075   | 0.254      | 0.056–1.149               |
| Did not watch                                        | −0.710 | 0.723  | 0.962 | 1  | 0.327   | 0.492      | 0.119–2.030               |
| Frequency of reading internet related articles about flooding |        |        |       | 2  | 0.052   |            |                          |
| Daily                                                | 0.099  |        |       | 2  |         | 0.175      | 3.887                    |
| Less than daily                                      | −0.191 | 0.790  | 0.059 | 1  | 0.809   | 0.826      | 0.075–7.482               |
| Did not read                                         | −0.289 | 1.174  | 0.061 | 1  | 0.806   | 0.749      | 0.075                    |
| Constant                                             | −1.668 | 0.385  | 18.804| 1  | 0.000   | 0.189      |                          |

*Statistically significant predictors at $p \leq 0.05$.

could differentiate between respondents who could or could not exhibit any likely anxiety during the 2020 FMM flooding. The model could account for 37.4% (Cox and Snell $R^2$) to 50.1% (Nagelkerke $R^2$) of the variance. Using the Hosmer–Lemeshow goodness-of-fit test, the model was adequately fit ($\chi^2 = 10.0; p = 0.27$) and correctly classified 75.8% of cases according to the goodness-of-fit statistic.

Three variables, namely positive employment status (OR = 30.70; 95% C.I. 2.183–423.093), prior history of depression diagnosis (OR = 3.30; 95% C.I. 1.157–9.43) and will like to receive mental health counseling (OR = 6.28; 95% C.I. 2.553–15.45) were the only independent significant predictors of likely GAD in the model. Employed respondents were 30 times less likely to present with likely GAD, with all other variables in the model controlled for.

Also, respondents with a history of depression were three times more likely to meet the criteria for likely GAD as opposed to those without that history.

It was also seen from the study that respondents who were willing to receive any mental health counseling were six times more likely to present with GAD symptoms.

**DISCUSSION**

The prevalence of likely GAD was 42.5% in our study. This prevalence was much higher in comparison to similar studies conducted 6 and 18 months after the wildfires in 2016 in the same community (20 and 18%, respectively) (7). Plausibly due to the huge impact of the flooding on the general wellbeing of the people within the setting of this study. Additionally, this study was carried out at a time when the people of FMM may not have fully recovered from the effects of the wildfires in 2016 when the flooding occurred. Furthermore, the effects of the COVID-19 pandemic and its attendant restrictions and job losses were still at play when the study was conducted.

Three key variables independently predicted likely GAD in this study when all variables were controlled for. These were positive employment status, prior history of depression, and the perceived need for mental health counseling. Respondents who were gainfully employed were 30 times less likely to present with likely GAD compared to their unemployed counterparts. This particular study outcome or finding is consistent with previous studies which reported a link between losing a job or job insecurity to various mental health conditions including but not limited to GAD, and psychological distress (21). According to a cohort study conducted in Australia, people who had job insecurity were found to be four times more likely to express severe psychological distress compared to those employed during the pandemic (22). During the periods of crippling economic activities, many individuals report being at risk of inability to cope with unexpected expenses, paying of ordinary bills and buying food (23). This has the likely tendency to impact negatively on mental health and increase the susceptibility to mental health problems, particularly GAD symptoms (24).

The present study also established that underlying depression diagnosis independently predicted the presence of likely GAD. Those who reported having a diagnosis of depression at the time of the survey were three times more likely to present with moderate to high anxiety symptoms. This is in concordance with previous literature, in which people who had previously established mental health conditions were found to be at a higher risk of developing mental illness post-disaster (17,25). Similarly, a study by McPherson et al. (26) reported that preexisting mental health conditions were a key
determining factor for psychological distress early in the study phase, but the effect was weakened later in the study. The possible explanation for this observation is that, people who have a well-established diagnosis of depression may be in a poorer position to deal with the stress and build resilience toward the post-disaster crisis than those without a preexisting depression diagnosis.

The willingness to receive any mental health counseling was also found to be a determinant for the likelihood of GAD. Respondents who reported a need for mental health counseling were found to be six times more likely to develop symptoms of GAD than those who were not willing to. The desire to have any mental health counseling communicates a psychological need (27, 28). This finding is in agreement with earlier studies that identifies psychological distress as a need to be addressed (28, 29). Another study established that, problems relating to hyperactivity were found to be reduced significantly after the application of the required intervention techniques including counseling in individuals who go through any form of crisis (30). Furthermore, understanding the importance of one’s own existence and fixing and nurturing one’s own self helped the survivors of disasters to enhance the quality of their wellbeing (30, 31). Other researchers also examined the emotional domain as a protective factor (30).

**Limitations**

The relatively small sample size may be considered a limitation to generalizing inferences from this study. Whereas a more representative sample would have been desirable, in practice this was not possible given the limitations to direct data collection occasioned by the COVID-19 pandemic and attendant restrictions. Our approach of reaching the residents by email via intermediaries such as government, employers, schools, and community organizations was pragmatic, and ethically approved. We were, thus unable to report response rates but completion rates. Further, our findings should be interpreted with caution as it may more appropriately be reflective of Fort McMurray residents accessible via these social and occupational intermediaries, rather than the general population of the city. Additionally, this paper is focused on determining only the effects of the flooding on the anxiety level of the respondents and did not include the possible impact of the trauma caused by the prevailing COVID-19 pandemic as a contributory factor to the increased anxiety in respondents. The self-report nature of the likely GAD measurement scale takes away some objectivity and possible clinical assessment of the data provided by the respondents. Notwithstanding the limitations stated above, this study still adds to the limited literature of the predictors of GAD symptoms after natural or man-made disasters.

**CONCLUSION**

The study established the prevalence and determinants of GAD symptoms among the residents of FMM 1 year after the 2020 flooding. Positive employment status, history of depression diagnosis, and a need to have mental health counseling were found to independently predict likely GAD. Policymakers need to put the necessary policies in place to ameliorate the suffering of the survivors after disasters. Counseling, as well as psychological and other mental health services should be made readily available to serve as support for survivors. It is believed that increasing the awareness of the people’s perspective in managing flood risks will not only improve the effectiveness of the flood resilience-building process but also provide simultaneous benefits for social systems coping with the potential threat posed by climate extremes and climate change. Therefore, governments and provincial leaders as well as the local people should collaborate with mental health experts in managing pre and post-disaster challenges. Post-disaster, governments can implement population level interventions such as supportive text messaging programs, which have been found to be evidence based, easily scalable and cost effective (32–38). Finally, people with pre-existing mental health conditions should be considered as part of the vulnerable population and access to care and support services should be made available to them in order to help them cope with trauma that comes with any forms of disasters.

**DATA AVAILABILITY STATEMENT**

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

**ETHICS STATEMENT**

The studies involving human participants were reviewed and approved by Alberta Health Research Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

**AUTHOR CONTRIBUTIONS**

The study was conceived and designed by VA. RS performed the analysis and EO put together the initial manuscript. EE was involved in data collection. All other authors made significant contributions in reviewing and revising the final manuscript.

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**SUPPLEMENTARY MATERIAL**

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2022.844907/full#supplementary-material
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