

# Supplementary Materials

**Supplementary Table 1** | Definitions of each of the 19 pre-defined issue tags.

| Issue Tags                    | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>3rd Party</i>              | Seeking support for another person who is in crisis (the third party).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <i>Abuse, emotional</i>       | Emotional abuse, also known as psychological abuse, is when someone threatens, bullies and intimidates another person; Can include things like name calling/insulting someone, humiliating a person in public, ridiculing someone, abusing someone else in front of a young person, threatening to leave someone, threatening to hurt someone/something a person cares about, telling someone they're a bad person, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Abuse, physical</i>        | Physical abuse includes physically harming a person in some way (e.g., slapping, biting, scratching, biting, strangling, throwing objects, hitting, punching, shaking, choking, using an object to cause pain/harm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Abuse, sexual</i>          | Sexual abuse is when a person uses sexual acts as a way to demonstrate power or authority over someone else or when and adult is involved in any kind of sexual activity with a minor. Sexual abuse often involves physical contact, but it can also happen without touching; This can include touching a person's genitals or making them touch someone else's genitals, having sex or trying to have sex with a young person, taking off a person's clothes or forcing them to watch as someone else takes off their cloths (especially in a sexual way), making sexual comments about a person's body, forcing someone to watch others have sex, making someone watch pornography, taking pictures of someone without their clothes on, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>Anxiety/Stress</i>         | Feelings of worry, nervousness and panic; A reaction to a perceived threat; A perception of pressure and/or a physical response in body to pressure/heighted emotions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Bully</i>                  | When someone intentionally uses their power to hurt, frighten, exclude or insult someone in-person; Harmful and unwanted behaviour (e.g., can be physical, emotional, social, internet-based) that can make someone feel embarrassed, offended, intimidated or unsafe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Depressed</i>              | Depression here is not meant to represent a formal diagnosis, about feeling depressed/sad/etc.; Persistent feelings of sadness: may include inactivity, hopelessness; losing interest in things you enjoy; crying a lot; feeling helpless or hopeless; feeling sad, down or low                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>Did Not Engage (DNE)</i>   | Did not respond to greeting or first message.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>Eating Body Image</i>      | Body image is how someone perceives their body/how they look, can include discussing things like body dysmorphia, how their body looks in different clothing/fashion; May be positive or negative perceptions .A range of irregular eating behaviors that may or may not warrant a diagnosis of a specific eating disorder; May include restricting eating, excessive dieting, purging, bingeing, having changes in appetite (e.g. eating less, eating more, etc.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Gender/Sexual Identity</i> | Sexual orientation, gender identity, gender expression, gender transition, or other topic relating to gender and/or sexual identity/orientation; A person's gender identity may be the same as or different from their assigned sex at birth; Could be about someone's own identity or questions about it in general;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Grief</i>                  | Mourning or grieving a loss of any kind (e.g., a person, a significant change, an animal, an experience)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Isolated</i>               | Feeling alone, companionless, unsupported, isolated; withdrawing from friends and family                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Other</i>                  | Issue does not fit any of these categories.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Prank</i>                  | Playing a practical joke. Not in crisis/seeking support.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Relationship</i>           | Relationships - With family member(s) (e.g., parents/guardians, siblings, etc.) e.g., parents/guardians, siblings, etc.; Concerns, dynamics, relationship building or breakdown, stress, or preoccupation with family; for example, talking about healthy/unhealthy relationships with specific people or in general, talking about toxic relationships, etc.<br>Relationships - With friend(s)/peer(s) e.g., classmates, colleagues, team mates, community friends, etc.; Concerns, dynamics, relationship building or breakdown, stress, or preoccupation with friends/peers; for example, talking about healthy/unhealthy relationships with specific people or in general, talking about toxic relationships, etc.<br>Relationships - With partner(s) (e.g., boyfriend/girlfriend, spouse, romantic partners) e.g., boyfriend/girlfriend, spouse, romantic partners; Concerns, dynamics, relationship building or breakdown, stress, or preoccupation with romantic relationships; for example, talking about healthy/unhealthy relationships with specific people or in general, talking about toxic relationships, etc.<br>Relationships - Other relationships(s) e.g., strangers, online relationships, professional relationships, etc.; Concerns, dynamics, relationship building or breakdown, stress, or preoccupation with other relationships; for example, talking about healthy/unhealthy relationships with specific people or in general, talking about toxic relationships, etc. |
| <i>Self Harm</i>              | When a person purposely hurts their body without trying to kill themself (Non-fatal self-injury). People who self-injure might cut, burn, hit or bite themselves, pull out their own hair or pick at sores on their skin. Many people who self-injure say hurting themselves gives them an immediate sense of relief.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Substance Abuse</i>        | Addiction to legal/illegal substances e.g., Alcohol, prescription medication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>Suicide</i>                | Intentionally and voluntarily attempting, self-directed injurious behavior with an intent to die OR suicidal ideation-thinking about, considering, or planning suicide.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Testing</i>                | Testing the system (e.g., asking if this number is real, KHP employee testing functionality of the service)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

**Supplementary Table 2** | Summary of the performance of four transformer models fine-tuned for multi-label classification tasks on 50,000 conversations.

|                              | <b>Longformer</b> | <b>BERT</b> | <b>DialogLED</b> | <b>MVP</b> |
|------------------------------|-------------------|-------------|------------------|------------|
| <b>Accuracy</b>              | 0.938             | 0.936       | 0.922            | 0.351      |
| <b>Exact Accuracy</b>        | 0.336             | 0.339       | 0.206            | 0.000      |
| <b>Sample Avg. Precision</b> | 0.660             | 0.650       | 0.430            | 0.200      |
| <b>Sample Avg. Recall</b>    | 0.530             | 0.540       | 0.320            | 0.820      |
| <b>Sample Avg. F1</b>        | 0.560             | 0.560       | 0.350            | 0.310      |

Supplementary Figure 1 | FAIIR Review Interface Screenshot of first a and second b interface for the survey presented to experts to review each conversation.

a.

Kids Help Phone

Conversation 01

1. Select all of the MAJOR ISSUES discussed in this conversation. MAJOR, meaning they are the most prominent issue(s) being discussed.

2. Select all of the MINOR ISSUES discussed in this conversation. MINOR, meaning they are not the most prominent issue(s) at hand, are less obvious/predictable, and are secondary to the issue(s) identified as MAJOR.

Progress

Conversation 1 of 20

Service User: Hello, is it me you're looking for?

Crisis Responder: Hi there, I'm here to help. Can you tell me a bit about what's going on?

Service User: I can see it in your eyes, I can see it in your smile.

Crisis Responder: It sounds like you're feeling quite perceptive. Can you share more about how you're feeling?

Service User: You're all I've ever wanted and my arms are open wide.

Crisis Responder: It seems like you're expressing a need for connection and support. I'm here to listen and help however I can. Can you tell me more about what's been going on?

Service User: 'Cause you know just what to say, and you know just what to do.

Crisis Responder: It sounds like you're looking for someone who understands you. I'm here to provide support and guidance. Can you tell me more about what's been troubling you?

Service User: And I want to tell you so much, I love you.

Crisis Responder: It's important to express your feelings, and I'm here to listen. Can you tell me more about what you're feeling right now?

Select all of the MAJOR ISSUES:  
Issue tag definitions are found at the bottom of this page.

3rd Party

Abuse emotional

Abuse physical

Abuse sexual

Anxiety/Stress

Bully

Depressed

DNE

Eating Body Image

Gender/Sexual Identity

Grief

Isolated

Other

Prank

Relationship

Self Harm

Substance Abuse

Suicide

Select all of the MINOR ISSUES:  
Issue tag definitions are found at the bottom of this page.

3rd Party

Abuse emotional

Abuse physical

Abuse sexual

Anxiety/Stress

Bully

Depressed

DNE

Eating Body Image

Gender/Sexual Identity

Grief

Isolated

Other

Prank

Relationship

Self Harm

Substance Abuse

Suicide

Previous Page

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b.

Kids Help Phone

Conversation 02

1. Do you agree the following ISSUE TAGS align with what is being discussed in this conversation?

2. Any additional ISSUE TAGS that were not captured which are being discussed in this conversation?

Progress

Conversation 2 of 20

Service User: Hello, is it me you're looking for?

Crisis Responder: Hi there, I'm here to help. Can you tell me a bit about what's going on?

Service User: I can see it in your eyes, I can see it in your smile.

Crisis Responder: It sounds like you're feeling quite perceptive. Can you share more about how you're feeling?

Service User: You're all I've ever wanted and my arms are open wide.

Crisis Responder: It seems like you're expressing a need for connection and support. I'm here to listen and help however I can. Can you tell me more about what's been going on?

Service User: 'Cause you know just what to say, and you know just what to do.

Crisis Responder: It sounds like you're looking for someone who understands you. I'm here to provide support and guidance. Can you tell me more about what's been troubling you?

FAIIR issue tag definitions

3rd Party  
Seeking support for another person who is in crisis (the third party).

Abuse, emotional  
Emotional abuse, also known as psychological abuse, is when someone threatens, bullies and intimidates another person. Can

Do you agree?

If this conversation was tagged with...

DNE

Do you agree this is a correct tag?

YES

NO

If this conversation was tagged with...

Suicide

Do you agree this is a correct tag?

YES

NO

Select any additional ISSUE TAGS:  
Issue tag definitions are found at the bottom of this page.

3rd Party

Abuse emotional

Abuse physical

Abuse sexual

Anxiety/Stress

Bully

Depressed

DNE

Eating Body Image

Gender/Sexual Identity

Grief

Isolated

Other

Prank

Relationship

Self Harm

Substance Abuse

Suicide

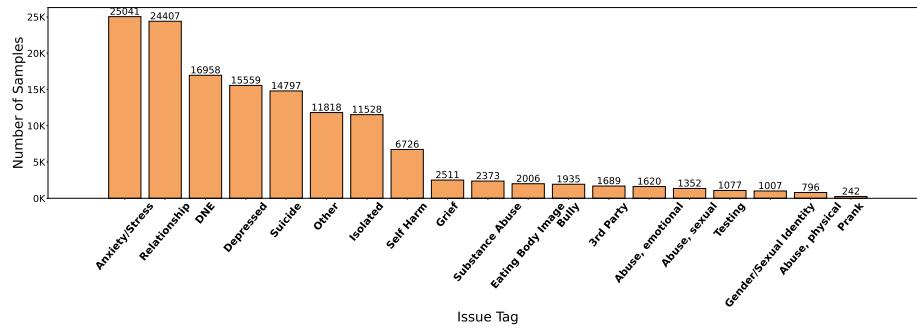
If you do not think any additional tags are needed, please scroll down and click "next".

↓

Previous

Next

**Supplementary Figure 2 | Silent Testing Issue Tag Distribution.** Summary of the performance of four transformer models fine-tuned for multi-label classification tasks on 50,000 conversations.



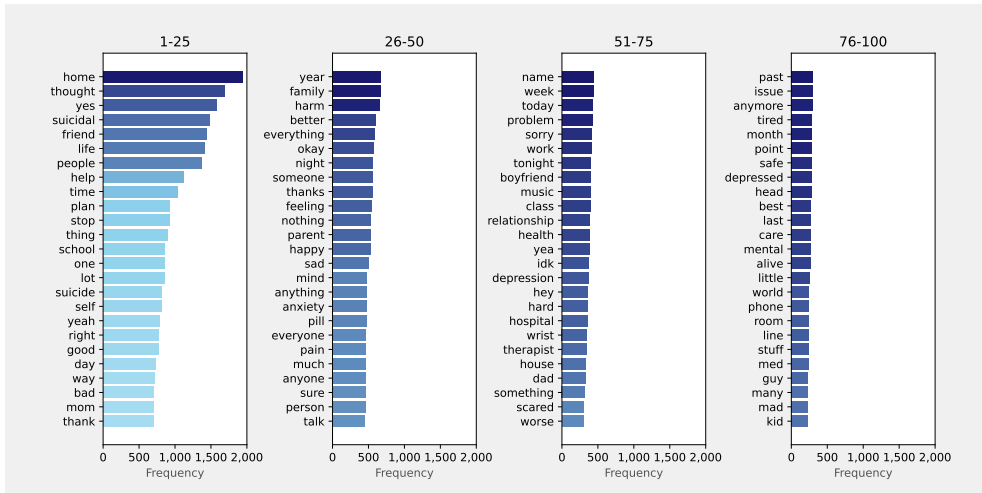
**Supplementary Table 3** | Sub-group distributions as a percentage of total counts in respective demographic category.

| Type               | Categories #(%)          |                             |                   |                                 |                       |                       |                             |                    |
|--------------------|--------------------------|-----------------------------|-------------------|---------------------------------|-----------------------|-----------------------|-----------------------------|--------------------|
| <b>Gender</b>      | <i>Male</i>              | <i>Female</i>               | <i>Trans Male</i> | <i>Trans Female</i>             | <i>Non-binary</i>     | <i>Agender</i>        |                             |                    |
|                    | 15.4                     | 75.6                        | 2.3               | 0.4                             | 5.8                   | 0.5                   |                             |                    |
| <b>Orientation</b> | <i>Heterosexual</i>      | <i>Gay or Lesbian</i>       | <i>Bisexual</i>   | <i>Asexual</i>                  | <i>Unsure</i>         |                       |                             |                    |
|                    | 55.5                     | 6.5                         | 27.0              | 3.3                             | 7.8                   |                       |                             |                    |
| <b>Identity</b>    | <i>Canadian Culture</i>  | <i>Disabled</i>             | <i>Refugee</i>    | <i>Spiritual</i>                | <i>Deaf</i>           | <i>First Nations</i>  | <i>Invisible Disability</i> | <i>Other</i>       |
|                    | 16.9                     | 1.2                         | 4.6               | 5.7                             | 0.9                   | 0.8                   | 67.3                        | 2.7                |
| <b>Ethnicity</b>   | <i>European Ancestry</i> | <i>African or Carribean</i> | <i>Indigenous</i> | <i>East or South-East Asian</i> | <i>Middle Eastern</i> | <i>Latin American</i> | <i>South Asian</i>          | <i>Unspecified</i> |
|                    | 78.1                     | 4.2                         | 2.1               | 6.3                             | 2.2                   | 2.7                   | 2.8                         | 1.7                |

**Supplementary Table 4** | The fine-grained performance of the main FAIIR tool (ensemble of Longformer models) on the retrospective test set (n=140,795) across the conversations divided into two main priority levels in the dataset (“Medium” and “High”). Results are provided as averages across all samples for classification thresholds of 0.5 and 0.25. The Weighted Avg. column provides the sample-averaged results for each respective metric.

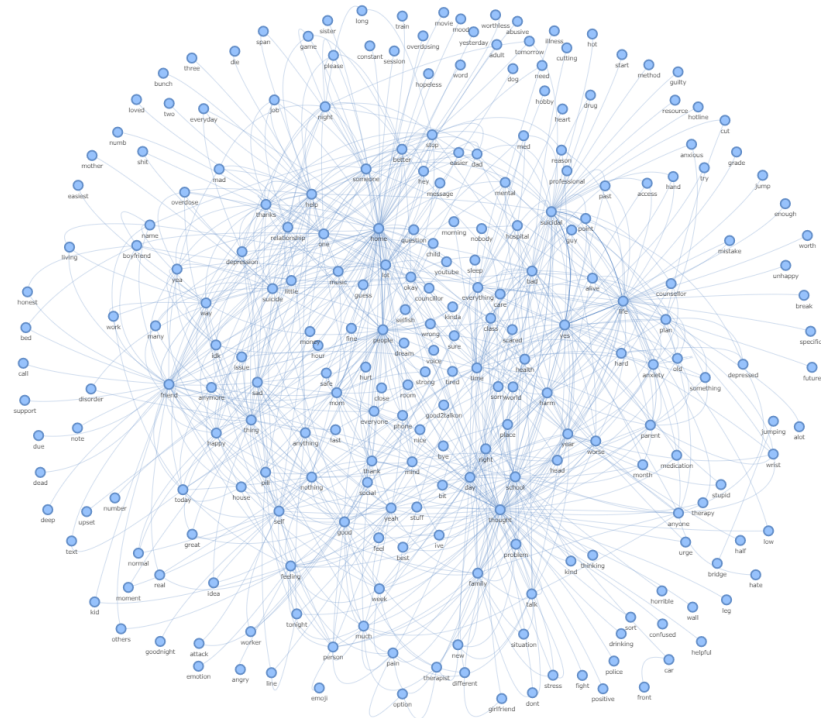
|                  |           | 3rd Party | Abuse, Emotional | Abuse, Physical | Abuse, Sexual | Anxiety/Stress | Bully | Depressed | DNE  | Eating Body Image | Gender/Sexual Identity | Grief | Isolated | Other | Prank | Relationship | Self Harm | Substance Abuse | Suicide | Testing | Weighted Avg. |
|------------------|-----------|-----------|------------------|-----------------|---------------|----------------|-------|-----------|------|-------------------|------------------------|-------|----------|-------|-------|--------------|-----------|-----------------|---------|---------|---------------|
| Medium Priority  |           |           |                  |                 |               |                |       |           |      |                   |                        |       |          |       |       |              |           |                 |         |         |               |
| Threshold - 0.25 | AUC ROC   | 0.99      | 0.96             | 0.98            | 0.99          | 0.87           | 0.96  | 0.96      | 0.86 | 0.98              | 0.99                   | 0.95  | 0.87     | 0.74  | 0.97  | 0.90         | 0.98      | 0.98            | 0.94    | 0.97    | -             |
|                  | Precision | 0.62      | 0.34             | 0.32            | 0.48          | 0.62           | 0.29  | 0.68      | 0.52 | 0.52              | 0.54                   | 0.34  | 0.48     | 0.28  | 0.34  | 0.65         | 0.55      | 0.34            | 0.55    | 0.42    | 0.54          |
|                  | Recall    | 0.94      | 0.70             | 0.78            | 0.91          | 0.82           | 0.80  | 0.86      | 0.80 | 0.89              | 0.92                   | 0.83  | 0.70     | 0.47  | 0.67  | 0.86         | 0.92      | 0.87            | 0.84    | 0.74    | 0.80          |
|                  | F1        | 0.75      | 0.46             | 0.45            | 0.63          | 0.70           | 0.43  | 0.76      | 0.63 | 0.65              | 0.68                   | 0.48  | 0.57     | 0.35  | 0.45  | 0.74         | 0.69      | 0.49            | 0.67    | 0.53    | 0.64          |
| Threshold - 0.5  | Precision | 0.68      | 0.52             | 0.50            | 0.58          | 0.80           | 0.46  | 0.80      | 0.69 | 0.64              | 0.62                   | 0.45  | 0.66     | 0.40  | 0.47  | 0.77         | 0.63      | 0.45            | 0.68    | 0.61    | 0.69          |
|                  | Recall    | 0.92      | 0.50             | 0.61            | 0.82          | 0.58           | 0.67  | 0.76      | 0.52 | 0.81              | 0.87                   | 0.75  | 0.42     | 0.24  | 0.56  | 0.67         | 0.83      | 0.77            | 0.65    | 0.60    | 0.60          |
|                  | F1        | 0.78      | 0.51             | 0.55            | 0.68          | 0.67           | 0.54  | 0.78      | 0.59 | 0.72              | 0.72                   | 0.57  | 0.51     | 0.30  | 0.51  | 0.72         | 0.72      | 0.57            | 0.67    | 0.61    | 0.63          |
| High Priority    |           |           |                  |                 |               |                |       |           |      |                   |                        |       |          |       |       |              |           |                 |         |         |               |
| Threshold - 0.25 | AUC ROC   | 1.00      | 0.96             | 0.98            | 0.98          | 0.83           | 0.96  | 0.94      | 0.80 | 0.98              | 0.99                   | 0.95  | 0.84     | 0.73  | 0.94  | 0.88         | 0.95      | 0.94            | 0.92    | 0.97    | -             |
|                  | Precision | 0.71      | 0.38             | 0.37            | 0.43          | 0.51           | 0.32  | 0.51      | 0.44 | 0.42              | 0.43                   | 0.34  | 0.4      | 0.29  | 0.31  | 0.53         | 0.56      | 0.23            | 0.80    | 0.36    | 0.56          |
|                  | Recall    | 0.98      | 0.72             | 0.85            | 0.92          | 0.68           | 0.75  | 0.77      | 0.81 | 0.81              | 0.93                   | 0.82  | 0.64     | 0.30  | 0.52  | 0.82         | 0.93      | 0.81            | 0.93    | 0.59    | 0.81          |
|                  | F1        | 0.82      | 0.49             | 0.52            | 0.59          | 0.58           | 0.45  | 0.62      | 0.57 | 0.55              | 0.59                   | 0.48  | 0.49     | 0.30  | 0.39  | 0.64         | 0.70      | 0.35            | 0.86    | 0.45    | 0.65          |
| Threshold - 0.5  | Precision | 0.75      | 0.56             | 0.53            | 0.49          | 0.72           | 0.45  | 0.65      | 0.59 | 0.56              | 0.48                   | 0.45  | 0.61     | 0.39  | 0.44  | 0.68         | 0.65      | 0.32            | 0.85    | 0.56    | 0.68          |
|                  | Recall    | 0.96      | 0.51             | 0.72            | 0.81          | 0.37           | 0.59  | 0.65      | 0.46 | 0.66              | 0.84                   | 0.71  | 0.31     | 0.10  | 0.44  | 0.57         | 0.87      | 0.64            | 0.86    | 0.42    | 0.62          |
|                  | F1        | 0.84      | 0.53             | 0.61            | 0.61          | 0.49           | 0.51  | 0.65      | 0.52 | 0.61              | 0.61                   | 0.55  | 0.41     | 0.16  | 0.44  | 0.62         | 0.74      | 0.43            | 0.86    | 0.48    | 0.63          |

**Supplementary Figure 3 | Natural Keywords for *Suicide* Issue Tag** Top 100 natural keywords extracted from 10,000 conversations labelled with the *Suicide* issue tag.

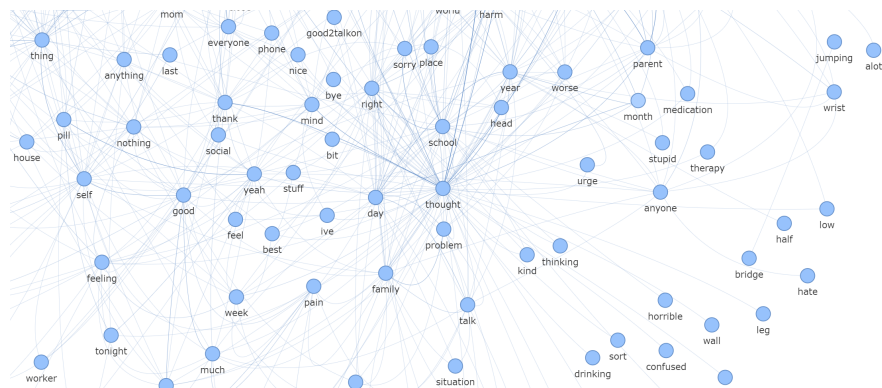


**Supplementary Figure 4 | *Suicide* Issue Tag Keyword Bigrams.** Graph of keyword bi-grams that have a co-occurrence frequency of 10 or above for the *Suicide* issue tag. **a** Full graph **b** Zoomed-In Section.

a.

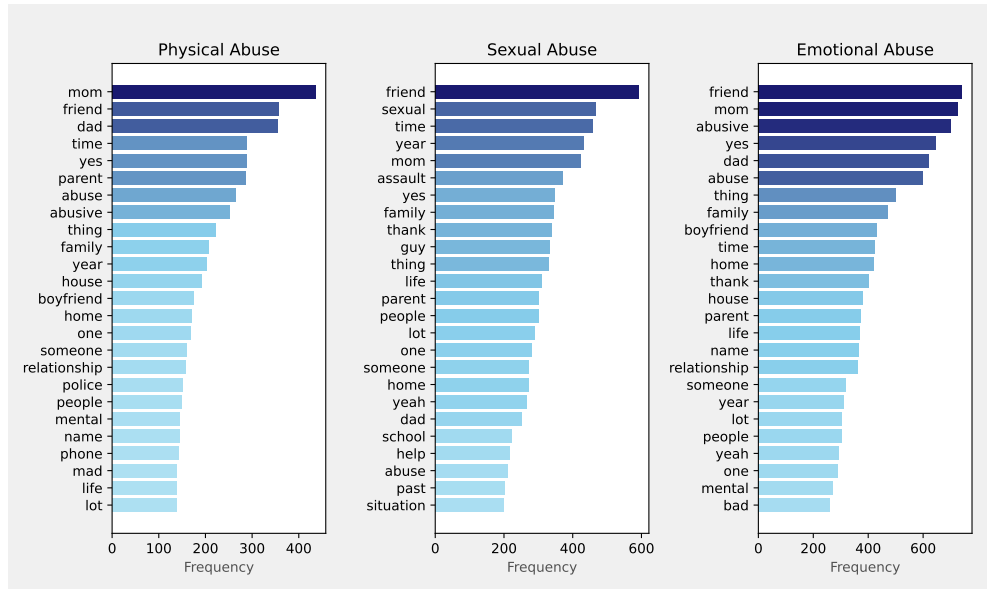


b.



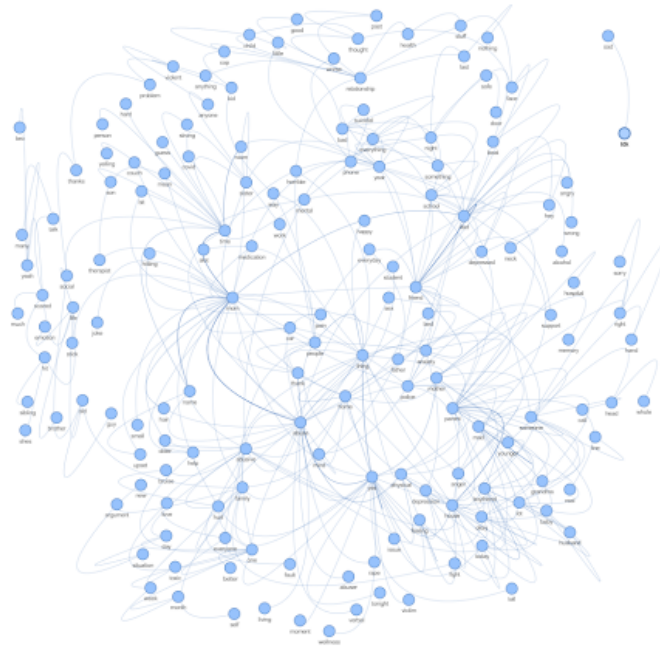


**Supplementary Figure 5 | Top Natural Keywords for Abuse Tags.** Top 25 natural keywords extracted from 1673 conversations labelled with *Abuse, Physical*; 2598 conversations with *Abuse, Sexual*; and 3367 conversations with *Abuse, Emotional*). Top 25 natural keywords extracted from 1673 conversations labelled with *Abuse, Physical*; 2598 conversations with *Abuse, Sexual*; and 3367 conversations with *Abuse, Emotional*).

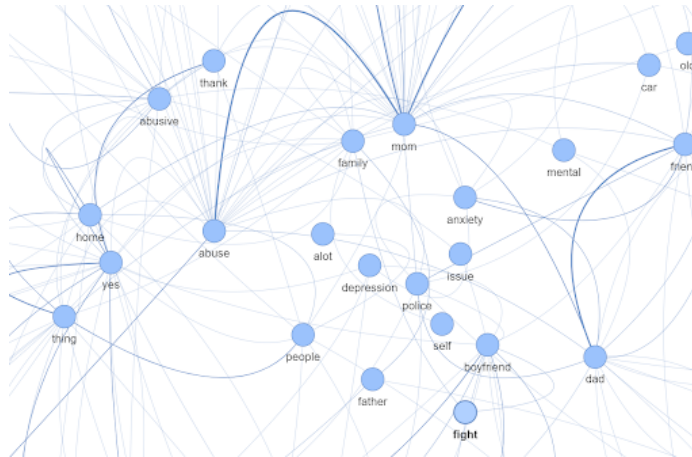


**Supplementary Figure 6 | Frequently Associated Natural Keywords for *Abuse, Physical Issue* Tag** Graph of keyword bi-grams that have a co-occurrence frequency of 5 or above for the *Abuse, Physical* tag. **a** Full graph **b** Zoomed-In Section.

**a.**



**b.**



**Supplementary Figure 7 | Visualization of Keywords Related to *Abuse, Emotional Issue* Tag.** Using GloVe embeddings on the top 100 keywords closest to the issue tag *Abuse, Emotional*, centering on the word “fight”. PCA is then employed to reduce the dimensionality of the original 50-dimensional GloVe word vectors, enhancing the visualization of the semantic relationships between these keywords.

