

Paper Review #2

The Language of Social Support in Social Media
and its Effect on Suicidal Ideation Risk

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1. Introduction

1) Challenges of prior work

- Establishing a causal relationship between availability of online social support and mental health outcomes can be challenging.
- Most studies apply **retrospective procedures**, so it is difficult to identify comparable subpopulations of users who have the same set of initial symptoms.
- The challenges are compounded by the difficulty in gathering a **pre-morbid** group of individuals who participate in these online communities.
- This work seeks to address these methodological gaps in assessing the role of online social support in future risk to suicidal ideation.

2) Role of Social Support in Health and Well-Being

- **Social support** : the degree to which an individual's needs for affection, approval, belonging, and security are met by significant others.
- **Social Support Behavioral Code** : helpful categorization schema developed by social scientists.
- Social Support Behavioral code's five categories :
 - informational support**(information, advice),
 - instrumental support**(willingness to help),
 - esteem support**(communicating respect, complimenting),
 - network support**(communicating people with similar experiences)
 - emotional support**(concern, empathy)

3) Social support & Suicidal ideation

- Online support is effective in decreasing depression and increasing self-efficacy and quality of life.
- This work extends investigation by examining to what extent we can quantitatively discover links between support and **risk to suicidal ideation**.
- Researchers not only examined whether **social support can help or exacerbate risk**, but also what specific attributes of this **support are likely to be less or more beneficial to specific subpopulations**.

2. Data

1) Identifying At-Risk Individuals

- Researchers obtained access to a Reddit dataset of mental health posts from De Choudhury et al.
- The dataset included 79,833 posts from 44,262 unique users from **MH**(mental health subreddits) and **SW**(r/SuicideWatch). (Feb. 11, 2014 ~ Nov. 11, 2014)
- Following the method developed in prior work, researchers constructed two user classes. (MH→SW : 440 users, MH : 28,831 users(randomly sampling 440))

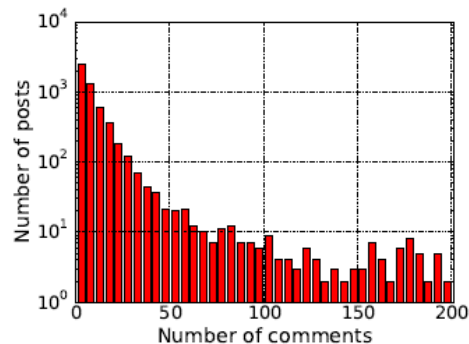
	MH		MH→SW	
	t_1	t_2	t_1	t_2
MH	✓	✓	✓	✓ or ×
SW	×	×	×	✓

t1 : Feb. 11, 2014 ~ Aug. 11, 2014

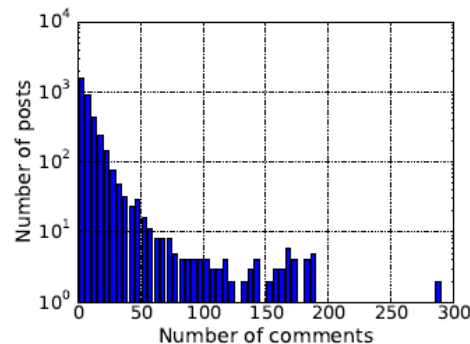
t2 : Aug. 12, 2014 ~ Nov. 11, 2014

2) Commentary Data

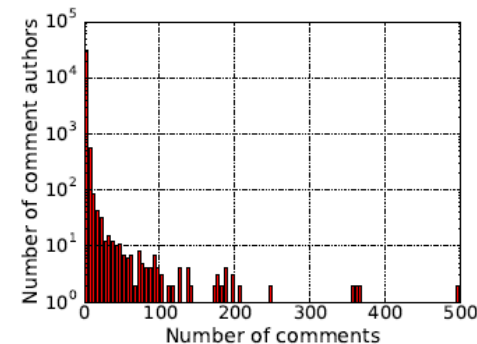
- Comments made on Reddit posts are proxies of social support.
- For each of the 880 users(MH + MH→SW), Researchers grouped their posts, and then employed the **official Reddit API** to obtain the entire comment thread(the last 1000 comments) of each post.
- The comment threads included **text, the author, timestamp in UTC.**
- **MH→SW** : 32,362 unique user, 62,024 comments
- **MH** : 21,358 unique user, 41,984 comments



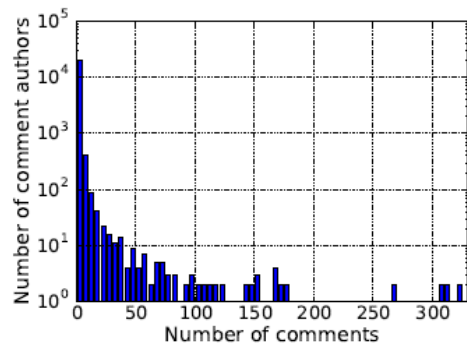
(a) Distribution of comments over posts in MH→SW.



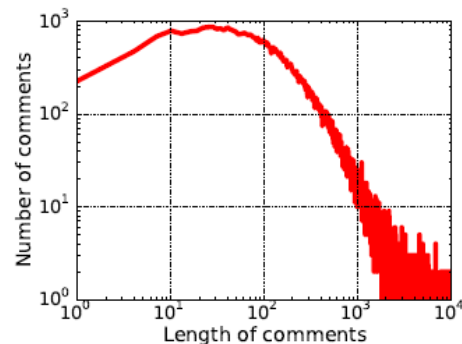
(b) Distribution of comments over posts in MH.



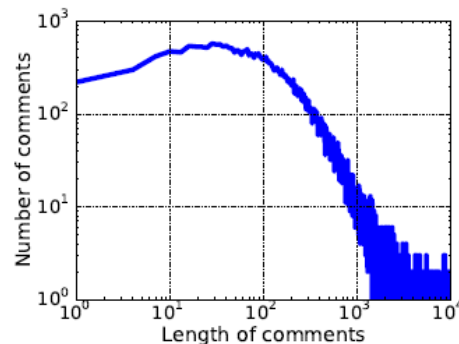
(c) Distribution of comments over authors in MH→SW.



(d) Distribution of comments over authors in MH.



(e) Distribution of comment lengths (in characters) for users in MH→SW.



(f) Distribution of comment lengths (in characters) for users in MH.

Figure 1: Characteristics of Reddit commentary data.

3. Methods

1) Intro

- The gold standard : **Randomized Controlled Trial(RCT)**
 - not always feasible, due to **ethical or practical limitations.**
- Alternative : **Potential outcomes framework of causal analysis**
- Also, apply a **High-dimensional stratified propensity score(hd-PS) method.**

2) Terminology and Data Preparation

- **linguistic tokens, or n-grams($n = 2$)**. (lower-cased and stop-word eliminated)
- **Treatment** : Receiving a comment containing the treatment token
- **Covariates** : All post and comment tokens in user's timeline that occur **before a given treatment**.
- **Result of analysis** : the difference in measured outcomes between the treatment and control groups. (conditioned on covariates)

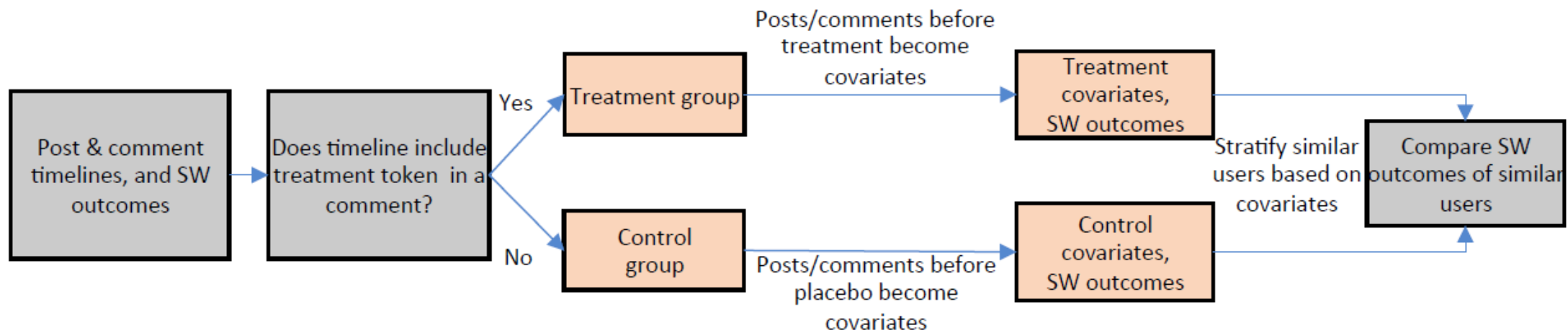


Figure 2: Schematic diagram of data processing and propensity score analysis procedure.

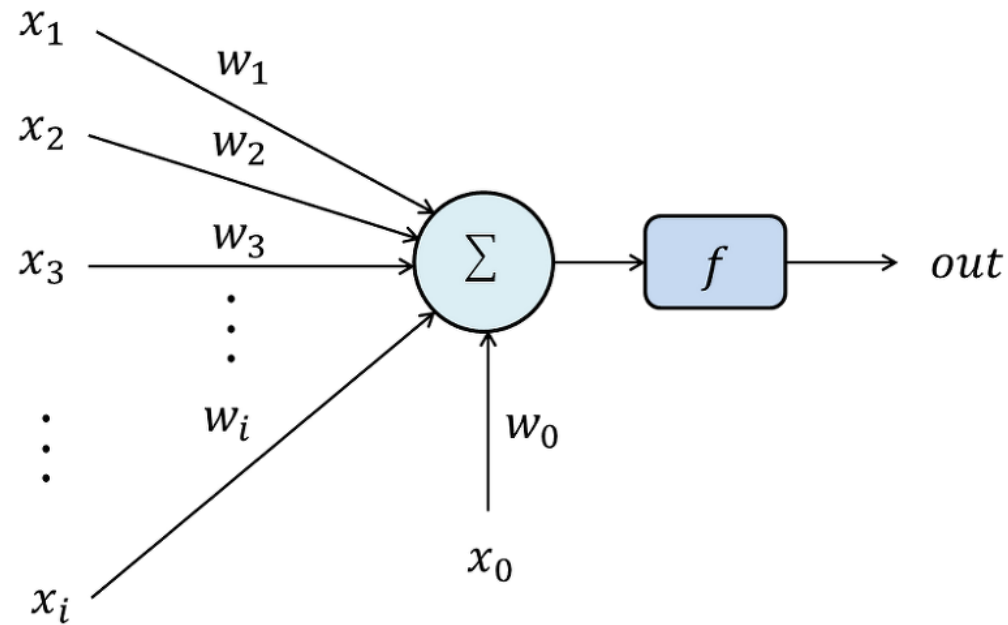
3) Stratified Propensity Score Analysis

Stratified Propensity Score matching

- Artificially approximating a **RCT**.
- **Treatment effect** : the difference between the measured outcomes of the treatment group and the control. (**percentage of participating in MH→SW**)
- **Common Support?**

4) Implementation

- The propensity score function is estimated using the **averaged perceptron learning algorithm**.



4) Implementation (Cont'd)

$$H = h_1, \dots, h_n$$

(h_i = treatment token)

- Using a **binary vector** representation of users' timelines.
- Dataset were divided into **10 strata**.

5) Validating Comparability

Ensuring that the stratified groups are **balanced** is critical!

(1) Qualitative + (2) Quantitative

Human Judgements
with Post pairs rating

Statistical Analysis
with LIWC lexicon

5) Validating Comparability

Qualitative Analysis of Balance

- Researchers randomly sampled 150 **comment tokens** with the **most positive (or negative) z-scores** for their ensuing qualitative assessment.

Negative treatment effect			
a reasonable heart and	lucky problem but	gently enjoys	shit you even think
Positive treatment effect			
pain and advice but	stay strong struggled	do well hating	not easy to respond



Token	Strata	Treatment post	Control post
High propensity strata			
not easy	6	a reason behind my depression is how small by body frame is. i've never cared much about muscle but it's obviously one of the reasons i've been alone (friendships and relationships) for my whole life.	i'm aware there's no way to avoid pain 100%, which is why i'm attempting to go for the least painful way. we've talked in detail about exactly why our issues are troubling for each of us, so he knows that already
advice but	6	i don't even know what all i feel. ashamed, angry, at myself and at the family that never did a thing to support me before. i'm seriously thinking about just pulling out i'm tired of trying, and failing, over and over again.	feeling like shit but noone to talk to, just need a friend who can cheer me up. noones online on facebook that i can talk to so just alone right now...
Low propensity strata			
seek	2	i realize that i'm having depression. i have not showered for a week now, unable to sleep and always thinking negative about myself	i noticed during the livestream, even though that he wasn't using their (i'm assuming) condenser microphone, i felt that his volume and the tones of his voice sounded much more "comfortable" with the headset.
slow down	1	an american football fan but i am intrigued by the world cup. i remember watching 4 years ago and was fascinated.	greetings people, i am a worthless nobody.i guess i want to take more of your time in the vain hopes that you'll somehow be able to make me feel better.

5) Validating Comparability

Qualitative Analysis of Balance (Cont'd)

- **Two raters** – qualitatively estimate balance in the post pairs.
- **Suicidal ideation markers aligned → balanced.**
- If not balanced? **Tuning!**

5) Validating Comparability

Qualitative Analysis of Balance (Cont'd)

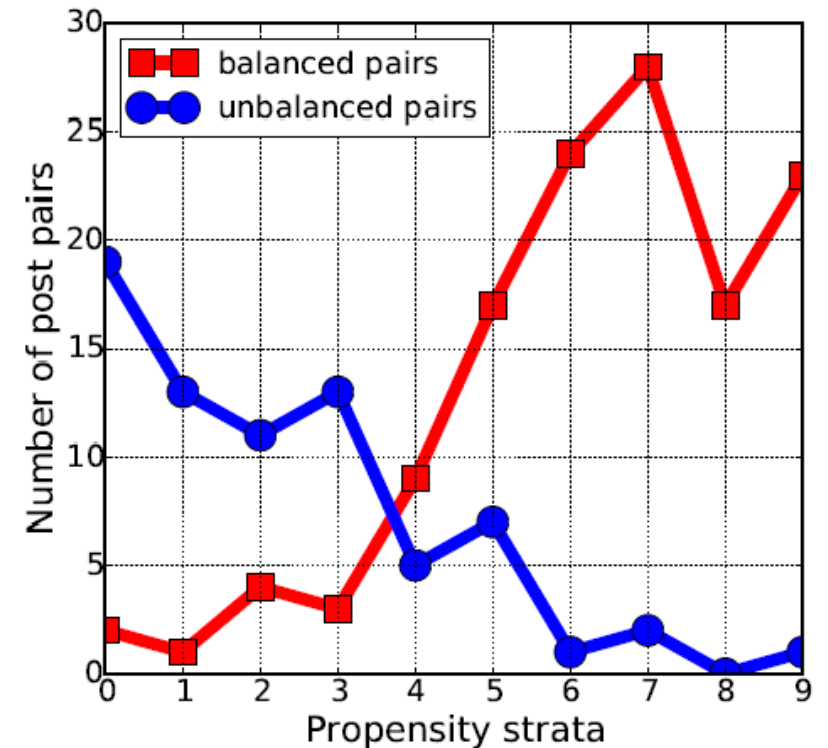
- Using a **codebook of suicidal ideation risk markers**

- 1 : balanced, 0 : imbalanced

- **Nearly mirror images**

- **Threshold : 3**

→ Balanced (strata > 3), imbalanced (strata ≤ 3)



5) Validating Comparability

Qualitative Analysis of Balance (Cont'd)

Token	Strata	Treatment post	Control post
High propensity strata			
not easy	6	a reason behind my depression is how small my body frame is. i've never cared much about muscle but it's obviously one of the reasons <u>i've been alone</u> (friendships and relationships) for my whole life.	i'm aware <u>there's no way to avoid pain 100%</u> , which is why i'm attempting to go for the least painful way. we've talked in detail about exactly why our issues are troubling for each of us, so he knows that already
advice but	6	i don't even know what all i feel. ashamed, angry, at myself and at the family that never did a thing to support me before. i'm seriously thinking about just pulling out i'm <u>tired of trying, and failing, over and over again.</u>	<u>feeling like shit but no one to talk to</u> , just need a friend who can cheer me up. no one online on facebook that i can talk to so just alone right now...
Low propensity strata			
seek	2	i realize that i'm having depression. i have not showered for a week now, unable to sleep and always thinking negative about myself	i noticed during the livestream, even though that he wasn't using their (i'm assuming) condenser microphone, i felt that his volume and the tones of his voice sounded much more "comfortable" with the headset.
slow down	1	an american football fan but i am intrigued by the world cup. i remember watching 4 years ago and was fascinated.	greetings people, i am a worthless nobody. i guess i want to take more of your time in the vain hopes that you'll somehow be able to make me feel better.

- The **high propensity strata post pairs** exhibit many of the markers of mental health challenges identified in codebook.
- The **lower's post pairs**, only one of the posts shows these markers of risk to suicidal ideation.

5) Validating Comparability

Quantitative Analysis of Subpopulation Differences

- Essentially, in what ways are the subpopulations of users who fall in the high and low propensity strata different?
- Researchers adopt the use of the **LIWC lexicon** to quantify the extent to which a variety of sociolinguistic measures are present in the posts of the two subpopulations. (strata > 3 : **H**, strata <= 3 : **L**)

5) Validating Comparability

Quantitative Analysis of Subpopulation Differences (Cont'd)

Measures	Diff.	<i>t</i>	<i>p</i>	Measures	Diff.	<i>t</i>	<i>p</i>
Affective attributes				Temporal References			
NA	-7.18	-2.95	*	future_tense	18.28	4.89	***
anger	<u>-12.46</u>	-3.55	**	Social/Personal Concerns			
sadness	<u>-9.40</u>	-3.01	*	<u>family</u>	6.04	2.64	*
Cognition and Perception				<u>friends</u>	20.23	4.62	***
cog. mech	<u>40.75</u>	6.65	***	<u>social</u>	23.67	5.08	***
inhibition	<u>-15.10</u>	-4.45	***	<u>health</u>	12.55	3.58	**
hear	9.40	3.09	**	work	8.98	3.08	**
Lexical Density and Awareness				Interpersonal Focus			
verbs	31.24	6.94	***	<u>1st p. sin.</u>	-20.69	-4.51	***
aux verbs	9.46	3.00	**	2nd p.	15.68	3.27	**
article	25.51	6.24	***	3rd p.	-20.69	5.77	***
adverbs	-10.00	-3.14	**	indef p.	18.76	4.67	***

Diff, T-test, Bonferroni correction

4. Results

1) Propensity Score Analysis

- Only for reliably balanced strata(>3), most negative or positive z scores.
- **Count** : who received the token in one of their comments
- **Coverage** : the proportion of users in our data who fell into an unclipped strata of the token
- **Effect** : the percent increase in likelihood of belonging to MH→SW in the future based on getting the token in a comment **in the past**
- **PMI** : Pointwise mutual information(PMI) between the comment token and the outcome

Feature	Count	Coverage	Effect	z-val	χ^2	PMI
Negative treatment effect (increased likelihood of being in MH)						
gently	43	0.3	-0.31	-2.18	2.55	0.02
sure of	43	0.49	-0.22	-2.04	2.31	0.15
is helpful	37	0.49	-0.12	-1.45	1.86	0.15
be tough	39	0.51	-0.25	-1.44	0.82	0.01
fight the	34	0.51	-0.23	-1.22	1.53	0.16
enjoyed it	46	0.3	-0.18	-1.1	0.71	0
be ready	39	0.49	-0.04	-1.06	1.41	0.18
nice i	54	0.39	-0.06	-1.06	1.01	0.13
really fun	35	0.2	-0.06	-1.01	1.23	0.13
totally agree	37	0.49	-0.05	-0.93	0.98	0.17
completed	54	0.4	-0.09	-0.91	0.25	0
enjoys	32	0.51	-0.08	-0.85	1.23	0.18
defeat	46	0.4	-0.28	-0.83	0.55	0
to defend	44	0.2	-0.08	-0.79	1.18	0.14
was nice	37	0.49	-0.12	-0.77	0.97	0.1
really liked	40	0.51	-0.1	-0.61	0.88	0.08
be super	42	0.6	-0.03	-0.54	1.38	0.17
instructions	54	0.39	-0.17	-0.53	0.32	0
your home	33	0.49	-0.11	-0.45	0.55	0.08
kindness	42	0.4	-0.11	-0.37	3.42	0.19
Positive treatment effect (increased likelihood of being in MH→SW)						
proud	127	0.6	0.31	5.35	4.14	0.55
a hobby	35	0.49	0.53	4.87	4.57	0.76
am sorry	34	0.49	0.53	4.77	4.69	0.77
suicide	123	0.49	0.28	4.67	4.21	0.49
you wish	32	0.49	0.55	4.54	4	0.8
together with	32	0.49	0.51	4.54	4.16	0.72
medication	114	0.49	0.35	4.51	4.13	0.56
friend you	32	0.49	0.52	4.43	3.8	0.74
your opinion	33	0.4	0.5	4.35	4.44	0.69
to respond	40	0.49	0.49	4.34	3.41	0.69
i care	40	0.4	0.55	4.31	4.57	0.81
depressed	187	0.4	0.3	4.28	5.01	0.53
seek	132	0.39	0.27	4.26	4.41	0.47
pain and	51	0.3	0.58	4.24	6.05	0.87
do well	44	0.4	0.56	4.11	4.32	0.82
stay strong	48	0.4	0.52	4.09	4.16	0.74
medical	133	0.49	0.19	4.05	2.67	0.37
vent	84	0.49	0.32	4.02	3.59	0.54
hating	39	0.49	0.52	3.99	3.02	0.74
misery	34	0.49	0.5	3.96	3.13	0.7

2) Exploring Context of Use of Comment Tokens

- How different types of social support relate to the outcome of being in MH→SW or MH.
- Randomly sampled a set of 100 comment :
 - 20 tokens : **decrease** the likelihood of being in MH→SW
 - 20 tokens : **increase** future risk to being in MH→SW.

Higher likelihood of being in MH	Higher likelihood of being in MH→SW
Emotional Support i <u>totally agree</u> . It is hard. I have been there and it is not easy to handle the financial stress, buying a house, girlfriend being eight months pregnant, car issues, job issues, family issues. (↓5%)	I've recently lost friends whom I've known for 10 years, due to me being 'insensitive'. So yes sadly it does happen, I get you and what you are doing through. you are <u>not alone</u> (↑16%)
Esteem Support cheers mate, <u>fight the</u> stigma, you can do it! (↓23%)	You have great potentials in self-actualizing your own situation and ending your <u>misery</u> . (↑50%)
Informational Support Ever thought of trying to find professional care? I suggest you do that. You need to give life a second chance it may surprise you a lot. I know it can <u>be tough</u> , but worth it (↓25%)	If your issue is with the taking of <u>medication</u> , talk to them about taking it, discuss your issues with it. Like the guy above said, it may help and could be worth a try, but it is good to discuss concerns about that sort of thing with the person prescribing it. (↑35%)
Instrumental Support Start by going for meditation. it can <u>gently</u> help you break habitual negative thought patterns, and might <u>also</u> help you get a little bit of that "distance" from yourself that you are looking for (↓31%)	Bro, eat healthy, run, keep your room clean, actively suppress negative thoughts, force yourself to do something productive, even if it's just pursuing <u>a hobby</u> . (↑53%)
Network Support There is no reason to be nervous and yet everyone here understands and have been precisely at the same place you are in your brave post. [...] i hope some of this discussion <u>is helpful</u> to you. (↓12%)	Thats not true at all. everyone in this community really wants to hear your story. They would want <u>to respond</u> . Everyones story is worth a listen don't you think? (↑49%)
Acknowledgments Exactly this. i would <u>be super</u> frustrated too. Anxiety is debilitating and very difficult to cope with (↓3%)	I understand you are <u>depressed</u> . Depression is the annihilation of motivation. So it's no wonder u quit the job (↑30%)

- Example comment excerpts containing one of the tokens identified to significantly decrease or increase likelihood of being in MH→SW or MH.

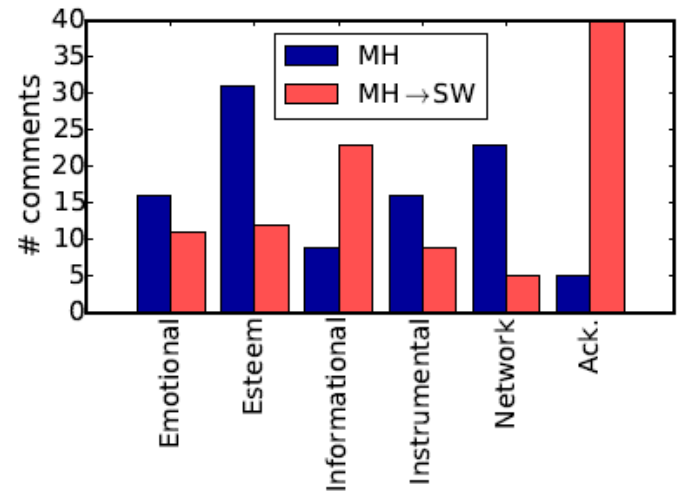
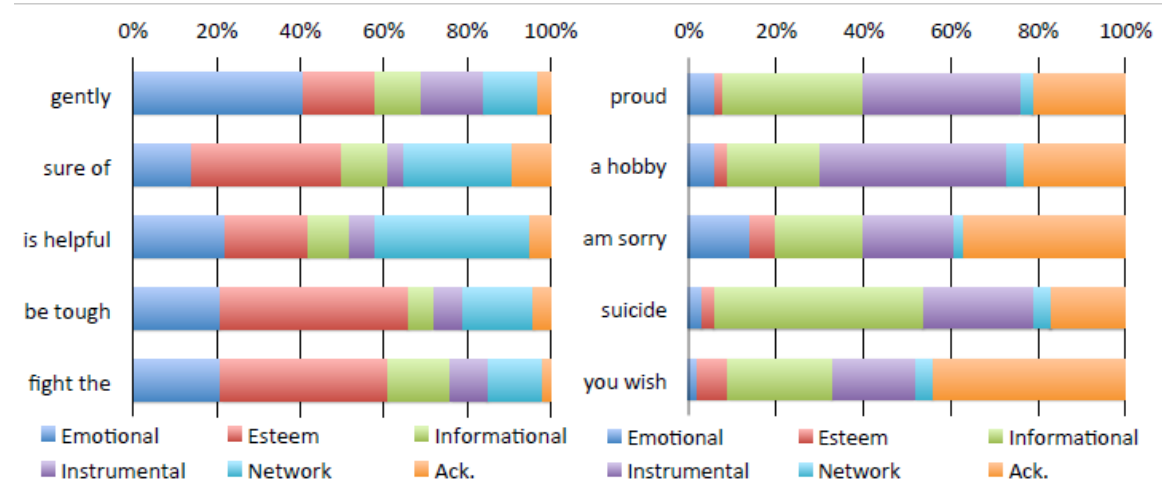


Figure 4: Distribution of different social support types.



(a) Top five comment tokens with negative treatment effects. (b) Top five comment tokens with positive treatment effects.

Figure 5: Relative distribution of support types for comment tokens with high (a) negative, and (b) positive treatment.

- **emotional, esteem, network support** : associated with negative treatment.
- **Acknowledgement, advice support** : associated with positive treatment.