

Emotional Resiliency of Families Dealing with Autism in Social Media

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Abstract: Nowadays online social media is used extensively by families dealing with various health issues, such as autism, diabetes, obesity, etc., to share experiences with other members of the community. The interaction between members of health community can be systematically analyzed to build a knowledge base for others who are dealing with the same health conditions. In this study, we analyze one such health community, i.e., the autism community and evaluate stress dispersed among the community members using social network analysis along with sentiment analysis methodology. We found that the autism blogger community provides nominal stress during the interaction with other community members. Differences across various classified groups like autistic bloggers, mother bloggers with autistic kids, father bloggers with autistic kids, and autism support group blogs in different social media platforms (blogs and Twitter) were analyzed in context of stress. Families dealing with autism have a better quality of life with reduced stress by interacting with fellow autism community members in social media.

1 INTRODUCTION

Social media has provided users an open platform for discussions, communication, and information exchange on various health related topics. Families dealing with health issues like autism use social media almost daily to share their experiences with others. The information exchanged by the interactions of individuals dealing with same health problems are archived by default and has become an immense source of knowledge for others dealing with the same situation.

Approximately 1 in 68 children in the USA are diagnosed with Autism Spectrum Disorder (ASD) as estimated by Centers for Disease Control and Prevention (CDC, 2014). Governments and non-profit groups advocating autism awareness encourages autism community members to share their experiences freely in social media and get advice from others. Jordan in her noteworthy study found the benefits of the Internet technology in spreading the education and awareness of autism using Internet technologies (Jordan, 2010).

Shared experiences by an individual dealing with autism in the social media platform, especially blogs, Twitter and Facebook shed light on various issues of

autism. As a motto to generate an autism awareness premier non-profit organizations like Autism Speaks (www.autismspeaks.org) recognizes top autism bloggers based on feedback from families dealing with autism. For families dealing with autism, the shared know-how about autism helps them to lead a better life.

Stress can be defined as the non-specific response of the body to any demand for change (Selye, 1936). Stress arises when individuals perceive that they cannot adequately cope with the demands being made on or with threats to their well-being (Larzelere and Glenn, 2008).

The purpose of the current study is to provide a research-based understanding of the conversations in social media platforms among families dealing with autism and to shed light on community characteristics of autism toward its members. This study is aimed to analyze the topics of discussion among the members of the autism blogging community and deduce whether the families, individuals, or caregivers dealing with autism can utilize this information to enhance the quality of life. In this study, sentiment is quantitatively analyzed from the conversations of the autism community on blogs and Twitter to understand how autism blogger community engages with stress.

The autism community members promote disseminating positive and upbeat messages to counter stress often experienced by other members of the community on blogs and Twitter.

This paper is organized as follows: the prior related works are described in Section 2. Section 3 describes our proposed model to quantify stress in social media interaction. Section 4 depicts the methodology and data collection. Section 5 shows the result. Section 6 discusses about the inferences drawn from the study. We draw conclusions and possible future works in Section 7.

2 RELATED WORK

Many clinical studies have been conducted to get an in-depth knowledge of ASD. These studies provide understanding of the cause, issues and effectiveness of different therapy on autism. Clinical trial option being sluggish and costly, the use of social media content in research analysis to assess the different intervention mechanism for autism could be an economically viable option. Our study does not intend to provide a substitute for clinical tests of the intervention strategies. On the contrary, our methodology would provide a justification to build a knowledge base of the intervention strategies or the therapies from a receiver's perspective, which would help prioritizing resources on the testing procedures of intervention strategies for dealing with different health issues. In this study, however, we address a tiny part of this bigger research agenda, which is, does health communities like autism blogger community provide a feeling of solidarity to other community members? Are there differences in stress mitigation across various characteristics of autism bloggers (i.e., autistic bloggers, mother bloggers with autistic kids, father bloggers with autistic kids, and autism support group blogs) and in different social media platforms (e.g., blogs and Twitter)? Answers to these questions will help conduct a more systematic evaluation of interactions occurring on various online platforms, especially the social media, and thereby helping us evaluate the efficacy of a knowledge base constructed using social media based interactions.

Sociologists and health scientists have published profusely on the stress and health/wellbeing concepts. The link between stress and health is addressed by the buffering effect hypothesis. In the buffering effect hypothesis, social support enhances good health by reducing the impact of stressful life events (Wallace, 2005). Stress is linked to all leading physical causes of death - cancer, and stroke (Cohen et al., 2007).

3 STRESS: PROPOSED MODEL

Social science literature lacks a formal definition of stress. Selye defined stress as 'the non-specific response of the body to any demand for change' (Selye, 1936). We leverage various empirical definitions of stress available in social science along with computational science literature that overlap with the healthcare domain. Stress in an interaction between individuals can be approximately deduced by collectable statistics when influential factors groups can be evaluated.

3.1 Model Parameters

Below we examine factors that influence stress assessment and objectively measure these factors by collectable statistics from social media interactions.

- **Personal Concern:** American Psychological Association listed many causes of stress that include fear and uncertainty in personal domain like relationship conflicts and major life changes (APA, 2000). Measure of personal concern can be estimated using sentiment analysis methods.
- **Anger:** Studies indicate anger suppression as a significant factor in perceived stress within thin the sample of adults of America and Japan (Yamaguchi, 2015). Correlation study among cancer patients found high degree positive correlation among anger-out and anger-in (Lee et al., 2005). Anger expression can be measures by rating in the affective process of anger.
- **Anxiety:** Study by Vallee found positive correlation in adults between anxieties and stress (Vallée et al., 1999). Study shows academic stress would show a significant positive correlation with anxiety (Mishra and McKean, 2000). Expression of anxiety within a text can be measures by rating in the negative affective process of anxiety.

These three influence factors with the corresponding statistics collectable using sentimental analysis methodology are summarized in Table 1.

Table 1: Factors influencing stress assessment and their corresponding collectable statistics.

Influence Factors	Example	Influence Weight	Notation
Personal Concern	job, cash, owe	0.40	λ
Anger	hate, kill, annoyed	0.17	χ
Anxiety	Worried, fearful	0.43	θ

Our model uses sentiment analysis mechanism to get an approximation numerical value of stress. Stress in an interaction can be interpreted in terms of an influence by the three factors (or parameters): λ ; χ and θ . Hence, stress measure denoted by S in an interaction is given by,

$$\text{Stress (S)} = w_1 \lambda + w_2 \chi + w_3 \theta \quad (1)$$

where w_1 , w_2 and w_3 are the weights that can be determines the influence of the factors on stress. To determine the degree to which the factors influence assessment of stress, we consider the Google distance approach. Google distance uses Google search association between two pair of concepts (Cilibrasi and Vitanyi, 2004). Using the google similarity distance algorithm, corresponding values of w_1 , w_2 and w_3 were evaluated. The result of the Google similarity measure is shown in Table 1 in the influence weight column. Therefore, the mathematical formula used in the study to determine stress (S) in an interaction is evaluated using the Equation 2

$$\text{Stress (S)} = 0.40 \lambda + 0.17 \chi + 0.43 \theta \quad (2)$$

4 METHODOLOGY AND DATA COLLECTION

This study evaluates stress through the interactions among members of the autism blogger community using sentiment analysis and social network analysis concepts. The social network analysis features are used to assess the structural networking aspect of the propagation of stress within the autism community. Our methodology consists of collecting data from autism bloggers in different social media platform (blogs and Twitter). Data is then processed and filtered for noise. Topic and word analysis were performed to ensure that the subject of discussion is autism. For each social media platform, the network for the autism community is constructed to deduce stress propagation. Later analysis of sentiment for the content of interaction was performed. Lastly, the degree of stress propagated in the interaction was calculated and analyzed.

Presently there are more than a thousand active autism bloggers on the Internet. As an initial phase of the study, top 40 autism bloggers based on the recommended list of popular bloggers by the Autism Speaks organization were selected. The content of the blogs by the selected autism bloggers was extracted and analyzed. Further, we cross-referenced their blogger profile and Twitter profile (wherever the

blogger had provided a link to his/her Twitter profile) and collected their tweets, and other network information, including friends and followers. We retrieved the most recent permissible tweets (up to 3,200 each) for the 40 autism bloggers, resulting in 118,531 tweets.

Some of the tweets by autism bloggers are as follows, *"I myself am opaque, for some reason. Their eyes cannot see me. Yes, that's it: The world is autistic with..."*, *"Do not fear people with Autism, embrace them, Do not spite people with Autism unite them, Do not deny people."*

Profile analysis of the bloggers led to the classification of bloggers based on different characteristics. Classification of autism bloggers into different categories is done to deduce different capacities of social support based on defined blogger categories. Of the 40 autism bloggers, 13 were female bloggers with autistic kids who are termed as mothers. Male bloggers with autistic children termed as fathers are 10 in our database. Number of bloggers who blogged as groups to create autism awareness termed as autism support group are 13 and rest 4 termed as self-autistic bloggers who are diagnosed with autism and blogs for themselves.

To infer the amount of stress in text, we used psycholinguistic analysis methodology. Linguistic Inquiry and Word Count (LIWC) program (www.LIWC.net) (Pennebaker, Martha and Roger, 2001) and with part-of-speech (POS) tagging methodology was utilized to categorized the tweets and blog content into different psychological groups. The amount of stress in the text content is deduced primarily using the rating in the affective process of anger, anxiety and personal concern, captured using LIWC. Many researchers used LIWC for sentiment analysis and found promising results. Study found a consistent correlation between emotion rating values of LIWC with self-reported score for interaction within health community forum (Tov et al., 2013).

Topics of the tweets of the autism blogger community are analyzed using topic modeling methodology. We used Stanford Topic Modeling (nlp.stanford.edu/software/tmt) for topic modelling.

5 RESULTS

Many social network analysis methodologies was used in the study to get an understanding of autism blogger community characteristics. For social network analysis, the activities of the autism bloggers like blogpost, tweets, friends, followers, and mentions in Twitter were analyzed.

The friend and follower Twitter network of autism blogger community is shown in Figure 1. Different colors indicate various communities based on network modularity. Modularity is one of the effective function in community detection for the compound network like autism bloggers twitter network. This essentially means that there is an intensive communication between the members of the same community as compared to cross-community. From Figure 1, we can observe that autism groups tend to form one community and converse more closely among themselves. Most mothers, fathers, and autistic bloggers form another community and converse more with fellow mothers, fathers, autistic bloggers. Overall analyzed metrics of the Twitter friends and followers network is shown in Table 2.

Table 2: Overall Twitter data characteristics of the autism blogger community network.

Number of users	874
Total Edges	2060
In-Degree	6(Max), 1.15(Average)
Out-Degree	105(Max), 1.151(Average)
Connected Components	1 with 874 Maximum Vertices
Geodesic Distance (Diameter)	8(Max) , 3.952(Average)
Top Words in Tweet	autism, autistic, out
Top Hashtags in Tweet	autism , specialneeds, sensory

Table 2 shows distinct characteristics of the autism blogger network on Twitter where any member of the community can reach a colleague on average 4 hops (average geodesic distance), in compared to the widely known 4.74 degrees of separation (average geodesic distance) in Facebook network of active users (Backstrom, 2012).

The value modularity of the network of autism bloggers Twitter network is 0.623, which indicates that the community is well connected. The top hashtags ‘autism’, ‘sensory’, and ‘specialneeds’ indicates the autism bloggers network is highly focused on autism-based discussions.

Based on the author characteristics of the autism bloggers and choice of social media platform the sentiment in the text varies. LIWC provides the baseline values for psychological groups for the different style of text writing like control writing, emotional writing and science articles along with speech conversation communication.

Our study found that in Twitter, autism support group desimates less stress as compared to other autism blogger categories. The variation of stress based on author’s characteristics is shown in Figure 2. The autism bloggers’ community in Twitter and blogs as a whole indicates minimal stress as compared to other health support forum like alcohol support. Further, amount of stress shown by families dealing with autism in our study is nominal as compa-

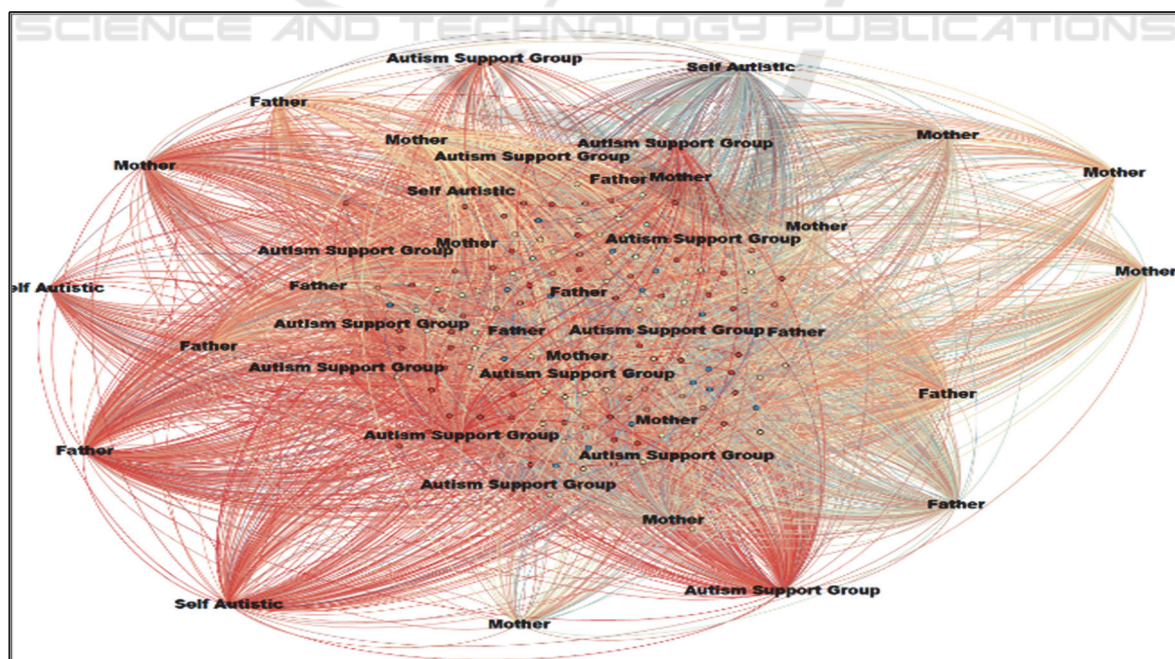


Figure 1: Friend and follower network of autism blogger community. The autism bloggers are annotated based on the classification. Their real identity is anonymized. Colors indicate different communities based on the network modularity.

red to emotional writing or novels that could indicate autism blogger community doesn't treat autism as a curse but as an opportunity.

Topic analysis of the Twitter data of the autism bloggers shows education, technology, sports, health, and science as the leading subjects of discussion. Table 3 displays the distribution of topics discussed in the Twitter by the autism bloggers community. The tweet content of the autism bloggers found to be involved in many topics related to autism, and the aim of the autism community bloggers' Twitter network seems to be spreading autism awareness.

Table 3: Distribution of Topics for the Tweet content by autism bloggers.

Topic	Fathers	Mothers	Autistic Bloggers	Group Bloggers
Education	25%	43%	56%	16%
Technology	26%	26%	16%	73%
Sports	21%	10%	4%	1%
Health	12%	5%	4%	3%
Disasters	5%	3%	1%	1%
Science	2%	2%	5%	1%
Others	9%	11%	14%	5%

6 DISCUSSION

The study sheds light on community characteristics of

online autism blogger community on the different social media platform. The stress mitigated during interactions with members of autism blogger community by identifying the bloggers, and the community members were unfolded in the study.

Our study revealed that the autism blogging community is tightly knit within community members. Members of the autism community relay minimal stress in the interaction between its community members, by providing emotional support. Members of the autism bloggers community in Twitter and blogs spread minimal stress as compared to members of other health groups like alcohol support forum. For the tweets of the mothers, the amount of stress provided is lower than fathers or autistic bloggers with a given amount of negative emotion, but the ratio is highest in emotional writing as compared to any interaction.

7 CONCLUSION AND FUTURE WORK

In this research, we analyzed online interaction among members of the autism blogger community in different social media platforms. The study extracts blogging activity of popular autism blogger and their Twitter activity including their friends, followers, tweets, retweets, mentions, and hashtags information. The tightly knit interaction within the autism blogging community was identified in our study. Our

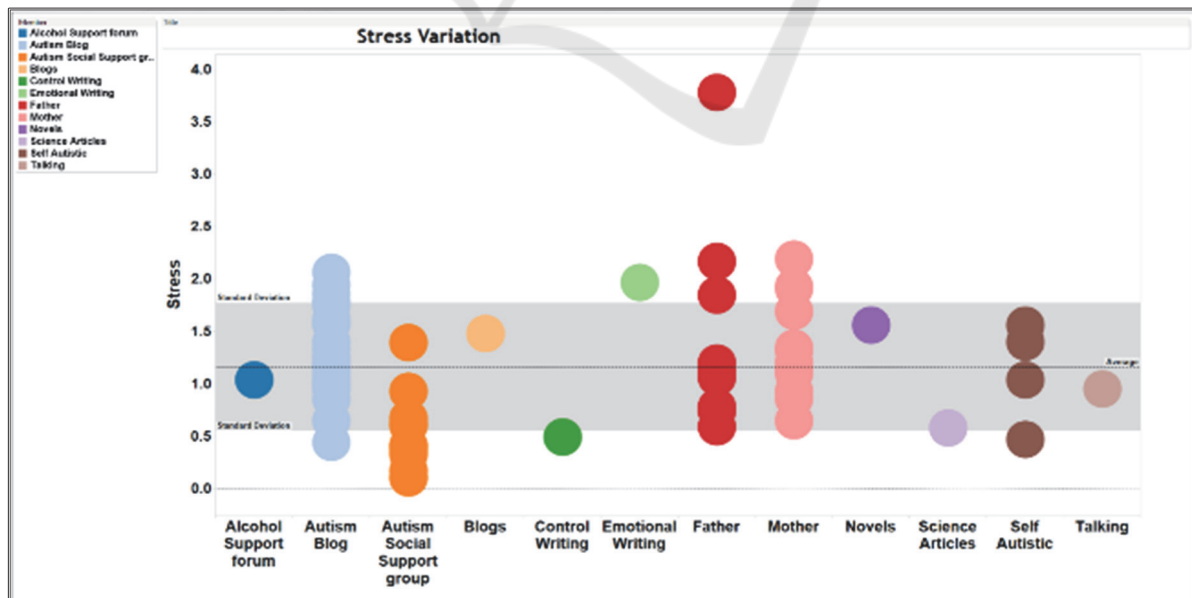


Figure 2: Variation of stress based on different characteristics. The vertical axis shows the amount of stress and horizontal axis represent different characteristics. Each circle represents a data point.

study revealed that Autism blogger community members on social media, especially on Twitter, indicates minimal stress in the interaction between its community members. While negative sentiments are reflected in some tweets, the minimal stress attributed by the autism blogger community restricts the propagation of stressful sentiments within community members. Stress indicated in the text content of autism bloggers varies based on blogging characteristics and social media platform.

We envision our study will provide a mechanism to access social interaction in online health communities. However, the fact that autism bloggers also use other social media platforms such as Facebook presents a limitation in our study. The findings of this study lay the groundwork to study our bigger research agenda, i.e., evaluating the efficacy of therapies for ASD as perceived by the caregivers through the experiences they have shared in online forums and social media. This will help build a knowledge base for interventions and experiences, which in turn could assist the clinical research in better understanding of behavioural interventions for various health disorders.

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