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Computational Sentiment Analysis of an Online LVAD Support Forum: Positivity Predominates

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Disclosures

- None

Background

- Heart failure rates are growing, leading to increased patient need for continuous-flow left-ventricular assist device (CF-LVAD) intervention
- Technologic advancements now allow patients to survive a mean 7+ years on LVAD support → new focus on reducing morbidity and improving device complication profiles
- There is little data to support that the primary concerns of physicians align with the primary concerns of patients → physicians can find ways to better understand patient perception

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2. Danielsen R, Thorgeirsson G, Einarsson H, Ólafsson Ö, Aspelund T, Harris TB, et al. Prevalence of heart failure in the elderly and future projections: the AGES-Reykjavík study. *Scand Cardiovasc J* [Internet]. 2017;51:183–9. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/28366010>

3. Miller LW, Pagani FD, Russell SD, John R, Boyle AJ, Aaronson KD, et al. Use of a continuous-flow device in patients awaiting heart transplantation. *N Engl J Med* [Internet]. 2007;357:885–96. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17761592>

4. Gosev I, Kiernan MS, Eckman P, Soleimani B, Kilic A, Uriel N, et al. Long-Term Survival in Patients Receiving a Continuous-Flow Left Ventricular Assist Device. *Ann Thorac Surg* [Internet]. 2018;105:696–701. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0003497517312183>

Background

- In efforts to seek out shared experiences, patients have turned to internet forums to gain better insight into their conditions and provide mutual support
- Studies have concluded that this behavior effectively allows information exchange and creates a network that provides reassurance and understanding
- Currently the largest online LVAD patient forum is [mylvad.com](https://www.mylvad.com/)
 - Mission: "Improve the quality of life and outcomes for people living in the LVAD world... [and] provide information, support, direction and inspiration for those who live with LVADs"
 - Allows patient-to-patient and patient/caregiver-physician interaction
 - New intersection of care that might reveal data on psychosocial well-being and overall health for patients with LVADs

5. Cipolletta S, Simonato C, Faccio E. The Effectiveness of Psychoeducational Support Groups for Women With Breast Cancer and Their Caregivers: A Mixed Methods Study. Front Psychol [Internet]. 2019;10:288. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/30833920>

6. Boyce S, Christensen D. myLVAD.com [Internet]. 2019 [cited 2019 Jan 10]. Available from: <https://www.mylvad.com/>

Aim

- Evaluation of the opinions on mylvad.com may provide new clues to the patient experience and guide physicians on how to better approach issues within the LVAD patient population.
- **AIM:** Conduct a sentiment analysis on the mylvad.com forum in order to develop a cohesive understanding of the LVAD patient experience and allow clinicians to gain better insight into patient psychosocial well-being and predominant concerns

Inclusion Criteria

- Posts from mylvad.com between 04/21/2017 – 10/1/2019 were selected for analysis
- Text taken from this website include:
 - titles of individual posts
 - The post itself
 - subsequent comments left by users
- In order to limit bias, posts and comments were not filtered for content



Data Extraction

- Entirety of mylvad.com discussion forum (12 pages total) from April 24, 2017 to October 1, 2019 was chosen as the data source
- Python script was used to automate text extraction
 - “urllib” package allowed Python to open mylvad.com and read its contents
 - “BeautifulSoup” library allowed Python script to open each link
 - Uniform Resource Locators (URLs) for these posts totaled 228 links.
- Data was pasted in a text file for further analysis

Statistical Analysis

- R software was used to:
 - "clean" and "pre-process" text file
 - "TM" library – removed punctuation, numbers, converted all letters to lowercase
 - "SnowballC" – removed extraneous white spaces
 - Assign positive or negative sentiment to words
 - "bing" library in "tidytext" package
 - Pre-established positive and negative words list developed by Bing Liu et al from the University of Illinois at Chicago → assigned +1 or -1 to each word
 - Analyze word frequency and create visual representation
 - "ggplot2" package – create word clouds and bar graphs

Results

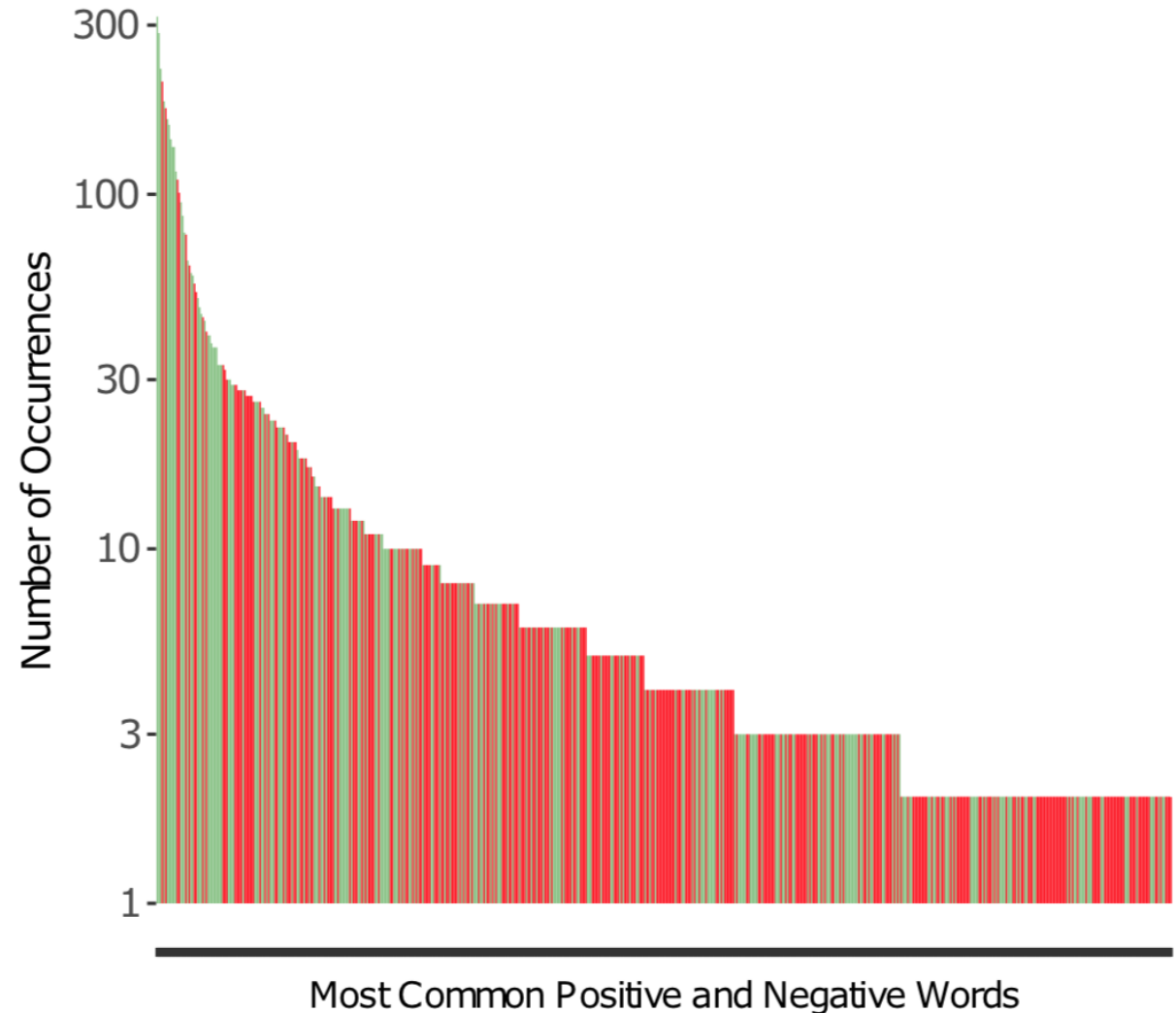
- 66,821 unique words
 - **positive sentiment:** 4,623 (6.9%)
 - **negative sentiment:** 3,248 (4.8%)
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- Net sentiment ratio = $\frac{\# \text{ of positive words} - \# \text{ of negative words}}{\# \text{ of total words}} = 2.1\%$
 - Odds ratio of non-neutral words = $\frac{\# \text{ of positive words}}{\# \text{ of negative words}} = 1.42$

Positivity predominates

Results

Macro-scale visualization

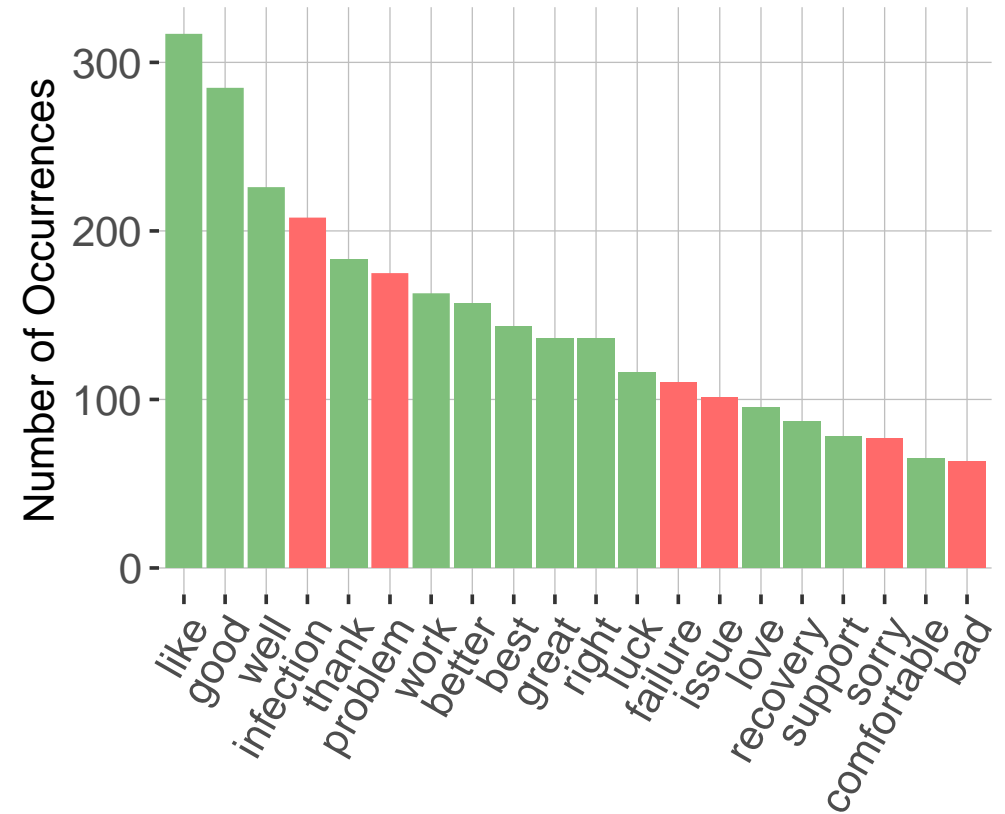
- Graph of all words used on mylvad.com forum
- Green = positive sentiment
- Red = negative sentiment
- Can see a higher density of green on left side (most frequent words)
- Distribution varies as words occur less frequently



Results

Top 20 most frequent words

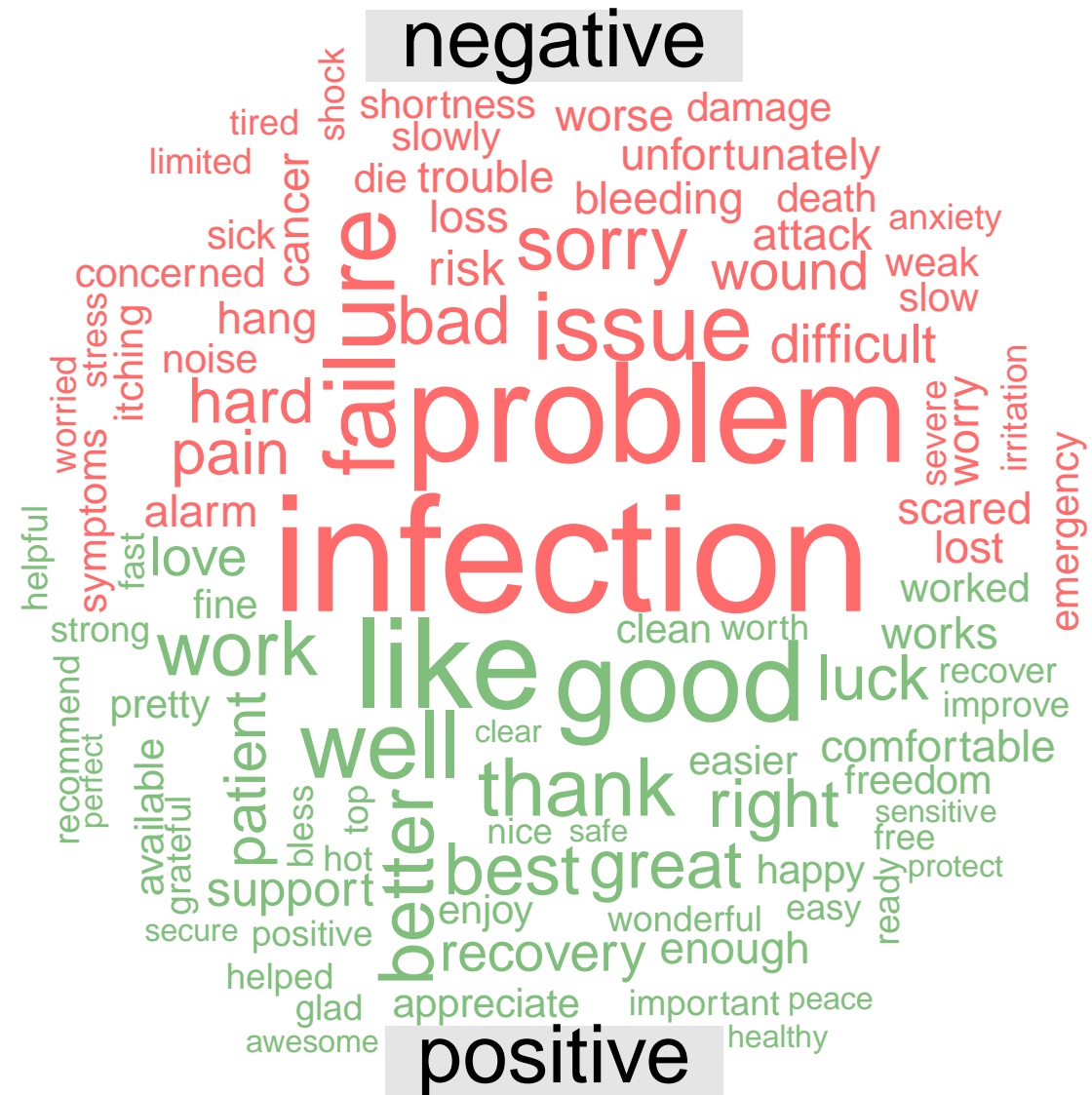
- Green = positive sentiment
- Red = negative sentiment
- Clear that positivity predominates in top 20 most used words on mylvad.com forum



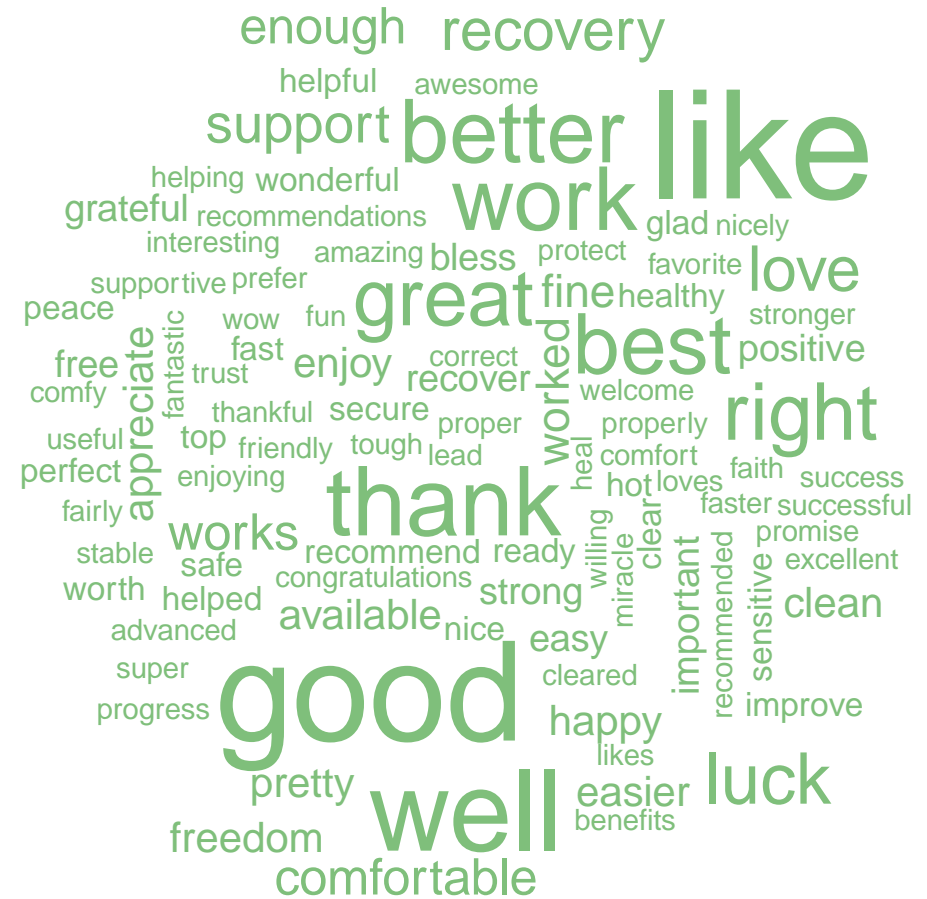
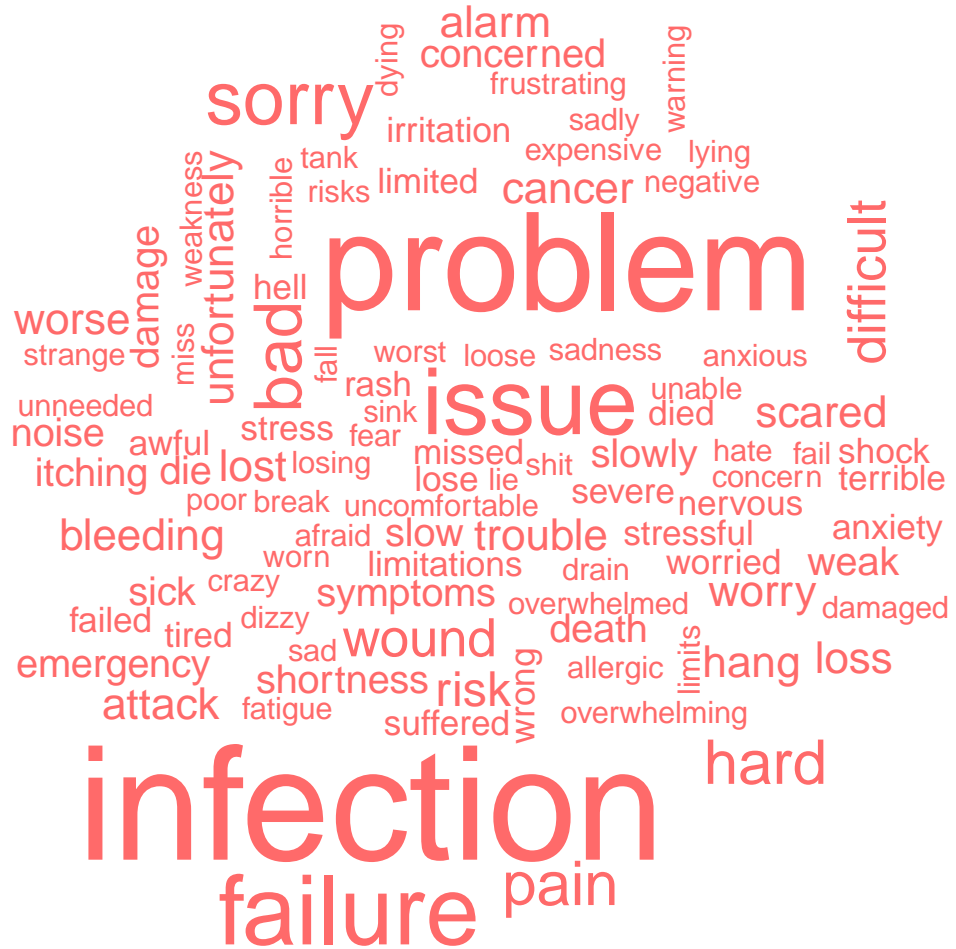
Results

Word Cloud visualization

- Bigger words = more frequently used
- Provides a direct visual comparison that describes the positive and negative sentiment in the forum



Results



Limitations

- Self-selection bias
 - people voluntarily choose to share experiences
 - Skewed towards people who are familiar w/ technology
 - Patients/caregivers with overwhelmingly positive or negative experiences are more likely to put in the effort to use the forum
- Analysis does not take into account words with double meanings
- Tangential life experiences (diet after LVAD, travel, etc.) are also discussed
- There is no clear, unbiased way to filter out posts unrelated to LVADs

Conclusions

- Overall positive sentiment on evaluation of patient, caregiver and provider posts/comments with respect to mechanical circulatory support devices
- Infection is the predominant concern discussed on the forum
- Further research is required to provide a more detailed assessment of patient and caregiver experience with LVADs

Thank you!