Discovering symptom clustering patterns during a pulmonary exacerbation in people with cystic fibrosis

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Background: Pulmonary exacerbations (PExs) in people with cystic fibrosis (CF) are characterized by worsening symptoms, and more research is needed to understand how symptoms group together during PEx. A symptom cluster is defined as co-occurrence of two or more related symptoms. Symptom clusters in chronic obstructive pulmonary disease are associated with greater health care use and mortality. Symptom clusters have not been systematically studied in CF. The purpose of this study was to identify distinct symptom clustering patterns during a CF PEx.

Methods: This study (N = 120) was a secondary, longitudinal analysis. Children aged 10 and older and adults being treated with intravenous (IV) antibiotics for a CF PEx were enrolled from six Cystic Fibrosis Foundation-accredited centers across the United States. The CF Respiratory Symptom Diary (CFRSD), a valid, reliable tool, was used to measure eight symptoms associated with greater health care use and mortality. Symptom clusters needed to understand how symptoms group together during PEx. A K-means clustering algorithm was used to analyze symptom severity, predicting forced expiratory volume in 1 second, race, sex, Pseudomonas aeruginosa infection, type of insurance, nutrition, or smoke exposure. On day 7, symptoms continued to cluster based on severity. Cluster 1 (n = 60) was low symptom severity, mean symptom burden 2.6 ± 1.7, and cluster 2 (n = 30) was high symptom severity, mean symptom burden 8.7 ± 3.3. All eight symptoms continued to be significantly different between clusters 1 and 2 except feverish and chills or sweats. Most symptoms significantly improved between days 1 and 7 in both clusters.

Conclusions: Symptoms cluster significantly based on severity on days 1 and 7 of a PEx in people with CF. There was not a significant difference in lung function between clusters 1 and 2 on day 1, suggesting that higher symptom burden is not associated with worsening lung disease severity. On day 1, participants grouped into cluster 2 spent significantly more days in the hospital than those in cluster 1, suggesting that people with higher symptom burden may be at greater risk of spending more days in the hospital. The findings that symptoms improved significantly between days 1 and 7 suggest that symptoms are sensitive to IV antibiotic therapy.