

## ABSTRACT

# Using clinician mental models to guide annotation of medically unexplained symptoms and syndromes found in VA clinical documents

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## Objectives

We sought to develop a guideline and annotation schema that can be consistently applied to identify medically unexplained syndromes (MUS) found in VA clinical documents. These efforts will support building a reference standard used for training and evaluation of a Natural Language Processing system developed for automated symptom extraction. Our overarching goal is to characterize the occurrence of MUS in Operation Enduring Freedom (OEF)/Operation Iraqi Freedom (OIF) veterans.

## Introduction

Medically unexplained syndromes are conditions that are diagnosed on the basis of symptom constellations and are characterized by a lack of well-defined pathogenic pathways.<sup>1</sup> The three most common MUS are chronic fatigue syndrome (CFS), irritable bowel syndrome (IBS), and fibromyalgia. Different types of persistent symptoms, originating from different organ systems, characterize these syndromes. Patients often meet the criteria for more than one MUS.

## Methods

Identification of MUS requires some level of inference on the part of annotators. For this reason we integrate clinician mental models with these review tasks. We demonstrate a practical approach that can be used to generate labeled data upon which additional layers of annotation can be added. Using this approach, annotated spans of text represent the most granular level of information necessary to identify symptoms and contextual features representing assertional information, and symptom duration. We developed an annotation guideline that provides definitions and examples of spans of text to annotate. Using a Protégé plugin called Knowtator,<sup>2</sup> we also developed an annotation schema used to mark spans of text representing symptoms and contextual features, along with the ability to link contextual features

with an annotated symptom. Once annotations have been created at the most granular level, additional assessments of medical explainability can be obtained from subsequent clinician review. We randomly sampled 492 clinical encounter documents from a cohort of OEF/OIF veterans, from the VA Region one and four Data Warehouse, who received health care services between 1 January 2007 and 12 December 2010. As part of tasks related to refining our annotation guideline, four reviewers annotated a random sample of 15 of these documents using the annotation guideline and schema. We report the estimated number of annotated symptoms and the number of symptoms that could potentially be included in non-mutually exclusive symptom constellations for the three most common MUS.

## Results

Preliminary testing shows promising results for these methods. The number of words in the 15 annotated documents varied from 554 to 3314, with an average of 17 symptom annotations per document. The number of annotations (unique mentions) for all four annotators was 1358 (583) overall with symptoms 1010 (477), followed by assertions 262 (53), and symptom duration 86 (53). Clinician *post hoc* review of the 477 unique symptom annotations revealed non-mutually exclusive symptom clusters of which 274 (57%) could potentially describe CFS, IBS 29 (6%), and 155 (32%) fibromyalgia.

## Conclusions

Our methods demonstrate a practical way of conducting annotation tasks that allow reuse of labels for other symptom surveillance efforts. Once symptoms have been annotated, additional layers of review can be done by another group of clinician annotators. Annotated data can be used to train NLP tools for related surveillance tasks including extracting symptoms representing known and

unknown syndromes of interest to clinicians, epidemiologists and, public health agencies.

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### References

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- 2 Ogren PV. Knowtator: a Protégé Plug-in for Annotated Corpus Construction. *Proceedings of the 2006 Conference of the North American Chapter of the Association for Computational Linguistics on Human Language Technology*. Association for Computational Linguistics: Morristown, NJ, USA, 2006. pp. 273–275.