# Descriptive Statistics on Physiologic Measurements and MS Symptoms by Disease Modifier
## Early Data from the Duke MS Mosaic Study

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DREAMS — DUKE CENTER FOR RESEARCH IN AUTOIMMUNITY & MULTIPLE SCLEROSIS

## OBJECTIVE

Evaluate for potential differences in physiologic measurements or symptoms across MS populations defined by disease modifier
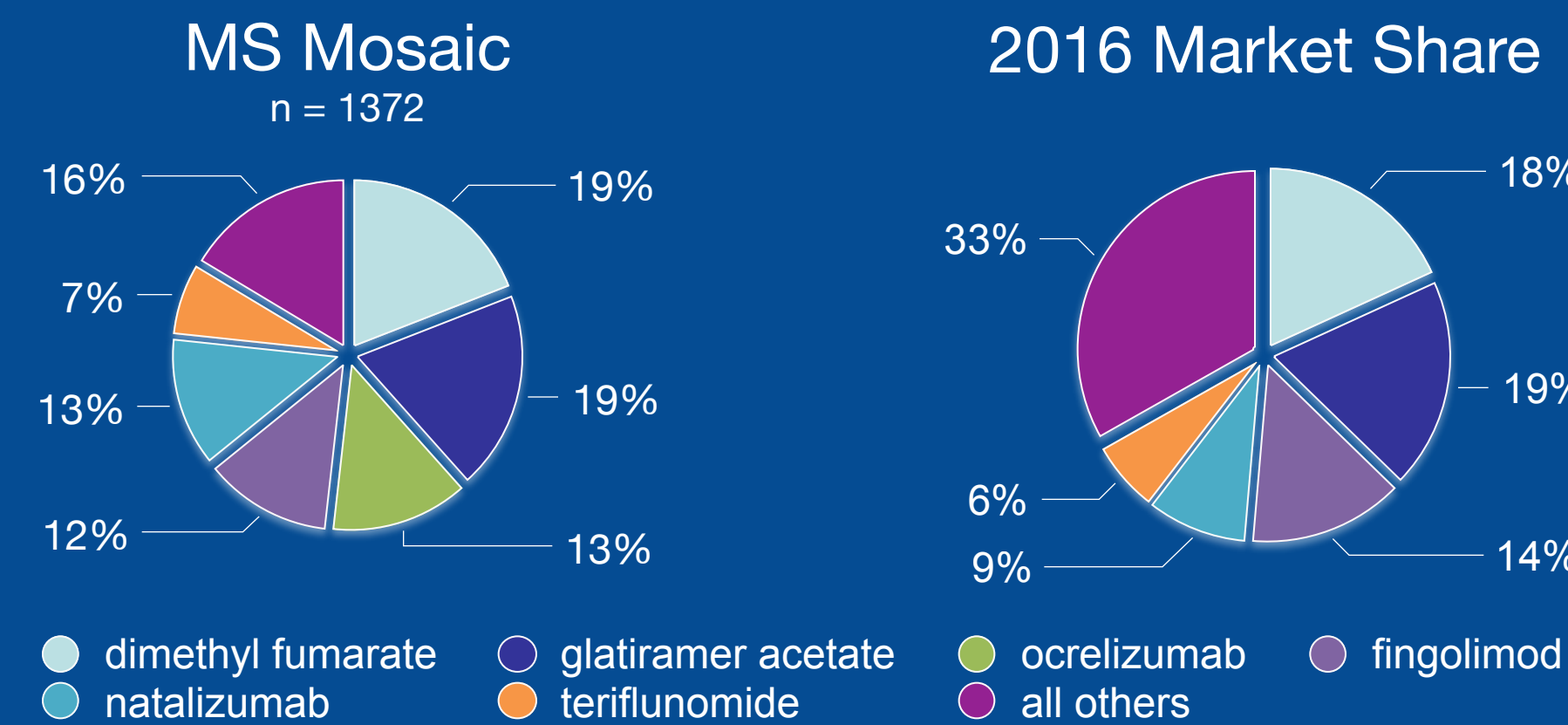
## BACKGROUND

- Progress in understanding and managing MS will require more frequent symptom reporting, continuous data collection on effect modifiers, and analytic tools capable of interpreting multiple data types.

- Over 80% of MSers are mobile users, making smartphones a convenient means of collecting information on disease experience useful to researchers, the user, and to clinicians.

- Preliminary summary statistics on continuous physiologic measurements and MS symptoms stratified by disease modifier presented here.
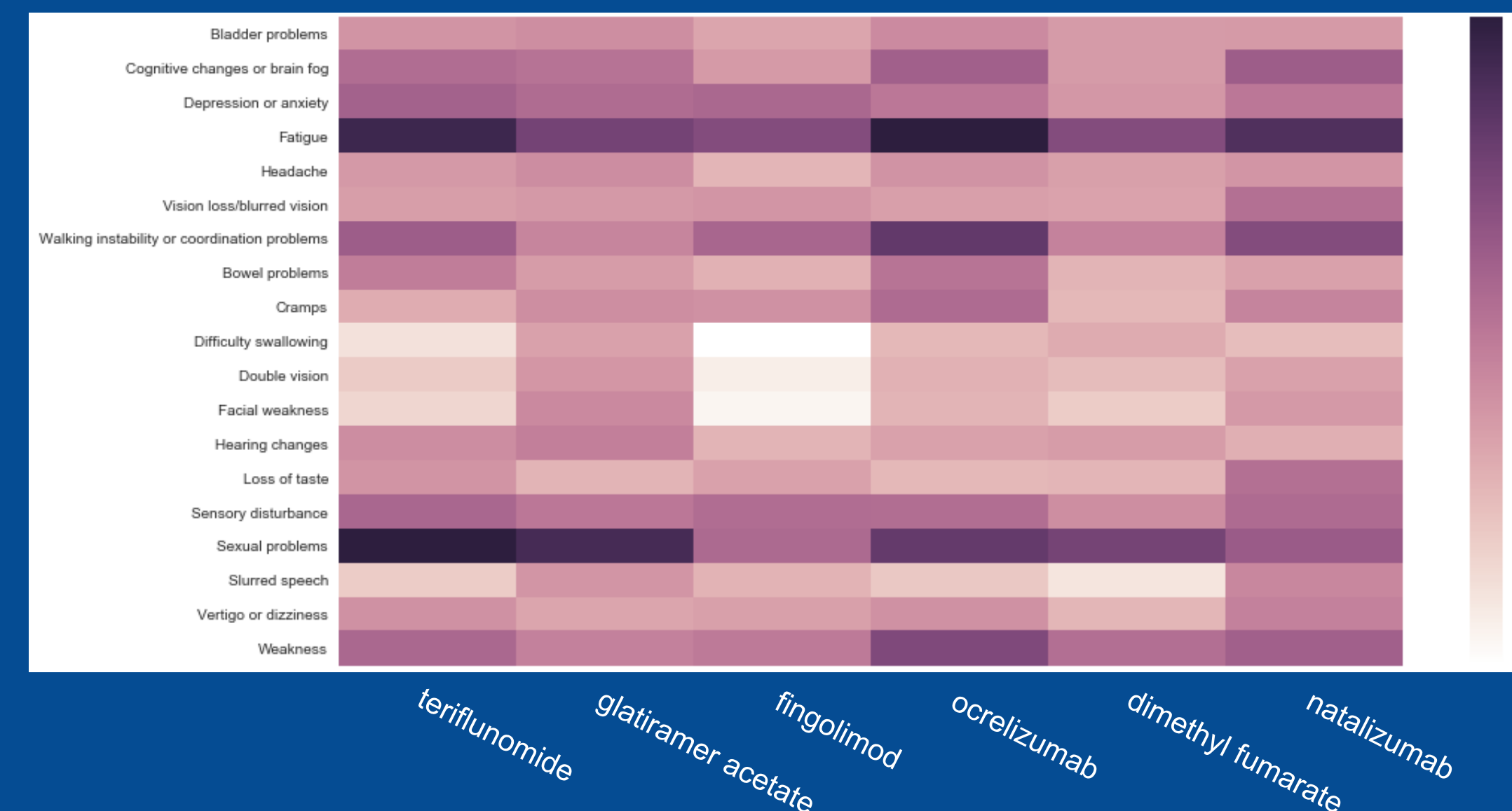
## INSTRUMENTATION & METHODS
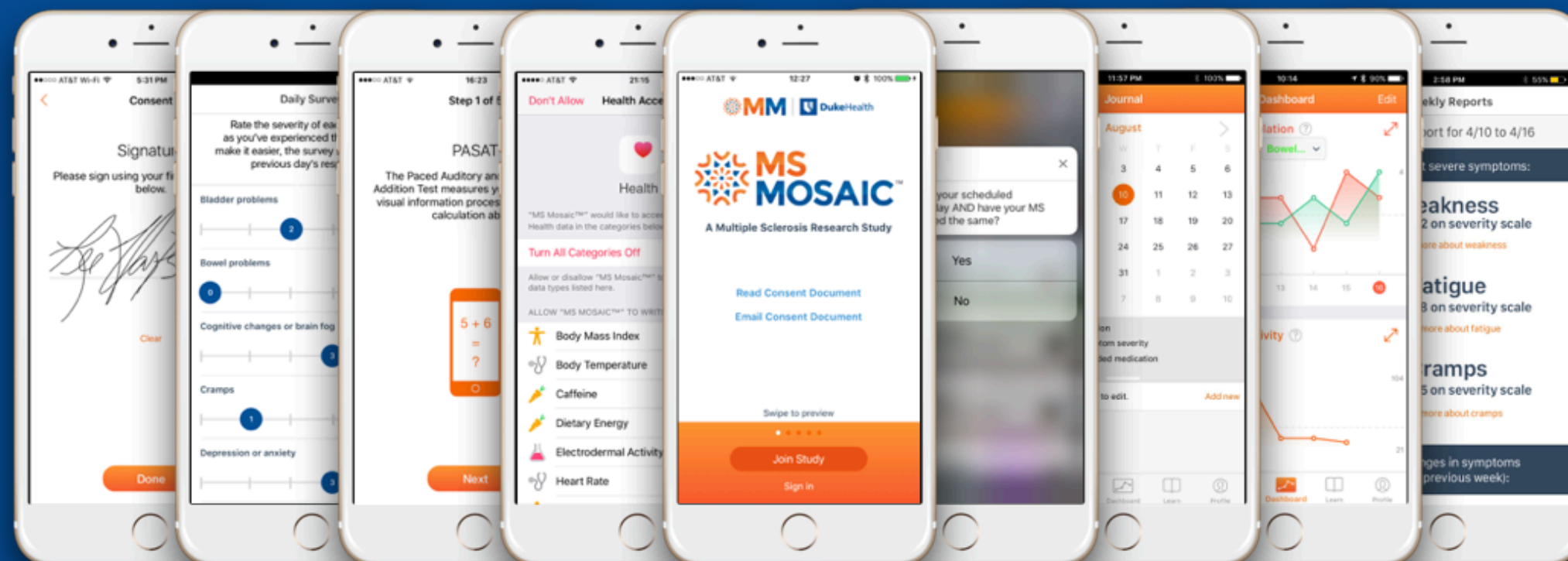


- As part of a larger longitudinal study ((NCT02845635) MS Mosaic is an app released in October 2017 designed to collect:
  - Complete Background & Disease History Survey
  - Daily Symptom & Medication Diaries. MSFC tasks bi-weekly
  - Data from HealthKit-compatible devices collected passively
- Using conventional statistical methods, we examined daily step data, weight, and symptom constellations stratified by disease modifier.
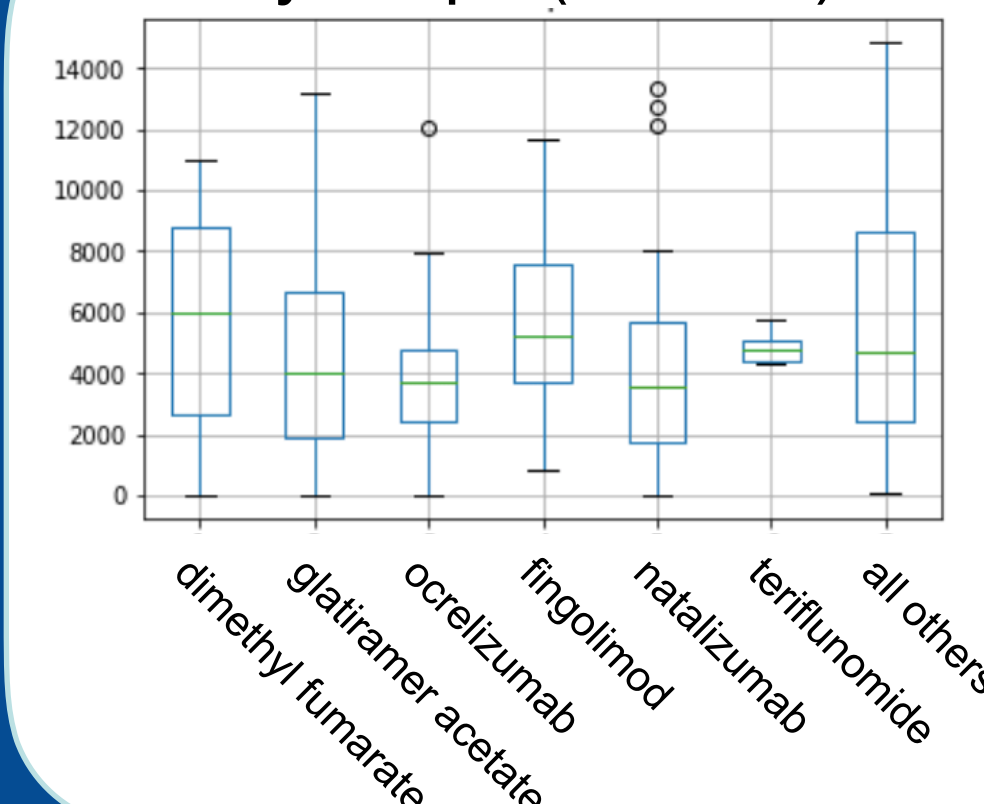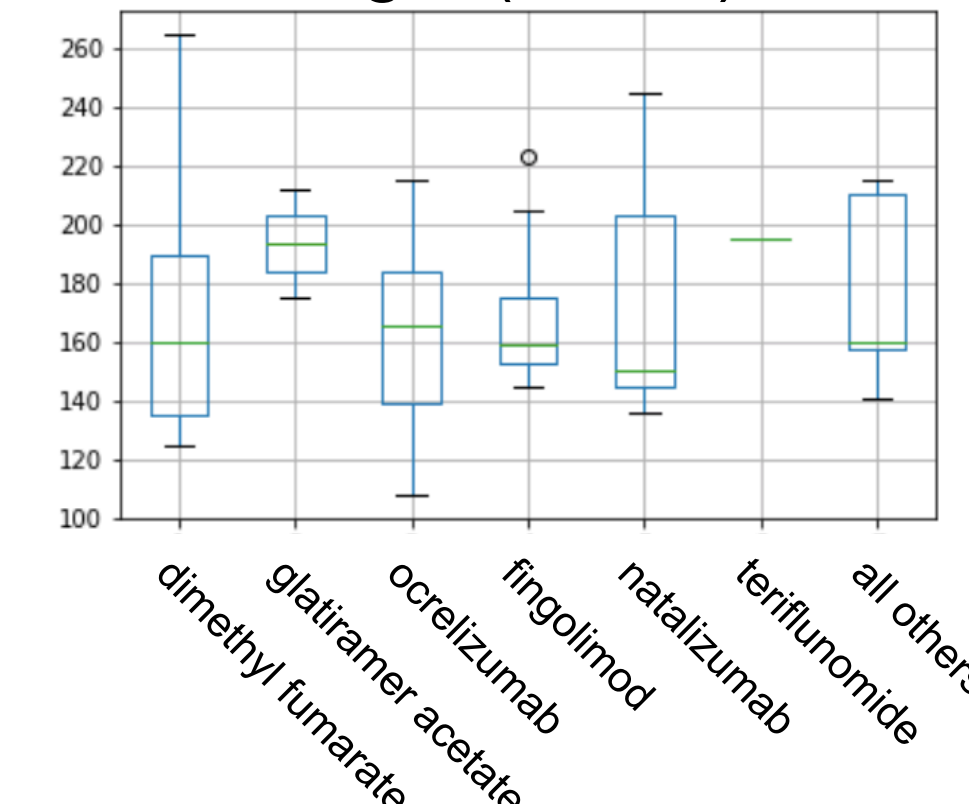
## FINDINGS

### MS Mosaic
n = 1372


16% 19% 7% 19% 13% 13% 12%

### 2016 Market Share


33% 18% 6% 19% 9% 14%

- dimethyl fumarate
- glatiramer acetate
- ocrelizumab
- fingolimod
- natalizumab
- teriflunomide
- all others

### Average Symptom Severity by Disease Modifier (1220 daily participants)



### Daily Steps (n=1372)



### Weight (n=430)



## DISCUSSION

- Sexual problems are reported more across all disease modifiers than commonly described within the Duke Clinic, which deserved further exploration. In light of greatest reported average severity among teriflunomide patients (though still mild) we should explore subject definitions of sexual problems.

- Fatigue is universally reported as one of the more common and severely experienced symptoms, which is consistent with previously reported studies.

- A downtrend in daily steps is observed comparing non-infusion based medications against infusion based, which may represent a limitation of phone or wearable sensor algorithms to identify gait with assistive devices in a subject population with more severe disease

- Subjects using glatiramer tend to have higher average weight, which must be taken into account when interpreting average daily step data.

- These are largely descriptive statistics that do not control for many variable, and so significant additional analysis will be needed.

## NEXT STEPS

- Will explore this data utilizing more robust machine learning methods

- Continuously collected data from participants' daily symptom surveys, medication diaries, and mobile sensors will be analyzed through a Bayesian generative hierarchical model that uses a Dirichlet process at a higher level and then represents the observed data at a lower level, providing a particular patient's "physiometry sub-group" membership and attempts to predict their current disease modifier use (if any).

- Pilot study with MRI data incorporation among local MS Mosaic participants to begin Autumn 2018, enabling greater evaluation of any possible symptom and/or lesion patterns by disease modifier (and much more).

## REFERENCES

1. Westad A et al. The multiple sclerosis market. Nat Rev Drug Discov. 2017 Oct;16(10):675-6.