

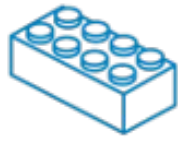


Reduce, Reuse, & Recycle: Going “Green” with Atlas Reusables

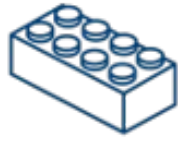
**Ajit A. Londhe^{1,4}, Brad Rechkemmer^{2,4}, Gregory Klebanov^{3,4},
Alexey Manoylenko^{3,4}, Anton Abushkevich^{3,4}, Sergey Suvorov^{3,4}**

- 1) At development time: Amgen, Inc. Thousand Oaks, CA, USA; Currently: Boehringer Ingelheim, Ridgefield, CT, USA
- 2) SimulStat, Inc. Solana Beach, CA, USA
- 3) Odysseus Data Services, Inc., Cambridge, MA, USA
- 4) Observational Health Data Sciences and Informatics (OHDSI), New York, NY, USA

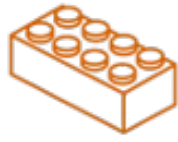
Criteria logic and attributes are building blocks of cohort analyses



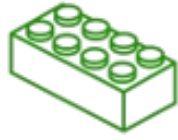
Conditions



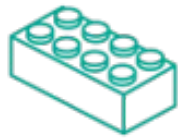
Drugs



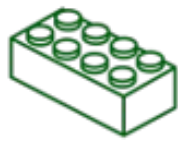
Procedures



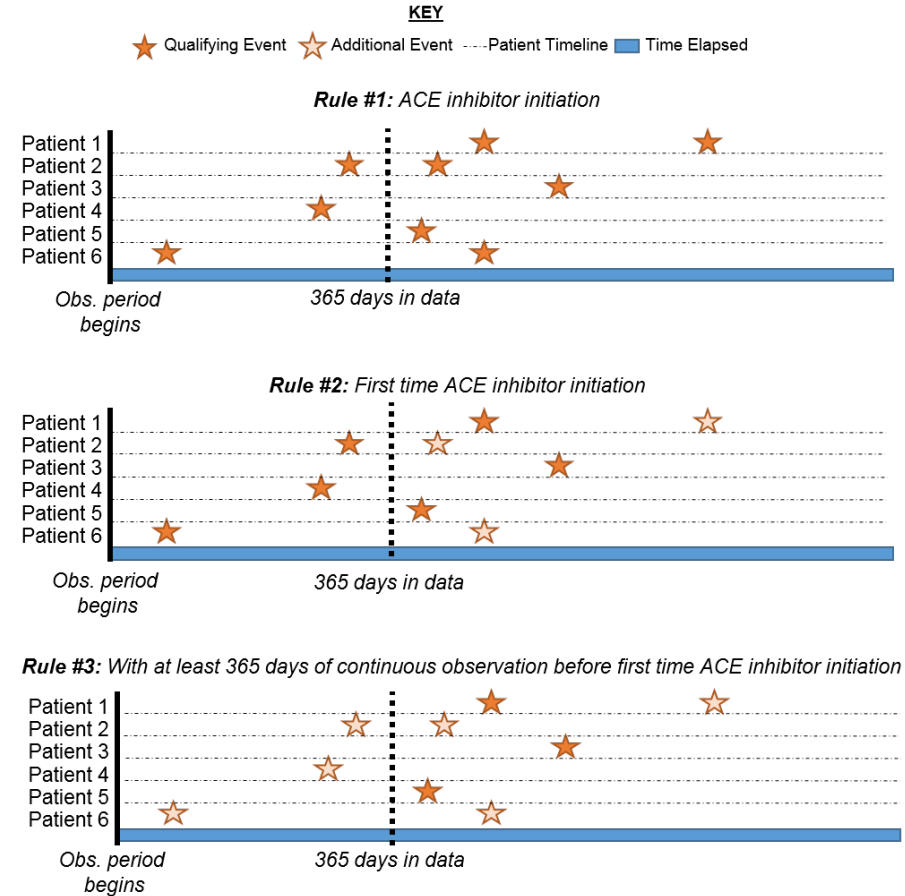
Measurements



Observations



Visits



Constructing a COVID-19 cohort in 2020

The screenshot displays a cohort builder interface with a central panel titled "Cohort Entry Events". This panel lists five main criteria for cohort entry, each with multiple nested conditions. The interface includes various dropdown menus for event types (e.g., "Inpatient Visit", "Trauma observations"), time intervals (e.g., "0 days After", "1 days After"), and logical operators (e.g., "all", "at least 1"). A blue box highlights the central criteria list, and a text overlay asks, "How can we ensure accuracy? What if we need to use this algorithm again?".

Cohort Entry Events

People may enter the cohort when observing any of the following:

- visit occurrences of 'Inpatient Visit'; with all of the following criteria:
 - having no condition occurrences of 'Labor and Delivery Conditions', starting between 0 days after and all days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'.
 - having no procedure occurrences of 'Labor and Delivery procedures', starting between 0 days after and all days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'.
 - having no condition occurrences of 'Trauma conditions', starting between 0 days after and 1 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'.
 - having no observations of 'Trauma observations', starting between 0 days after and 1 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'.
- with any of the following criteria:
 - having at least 1 measurement of 'RNA Test (LOINC)', starting between 1 days after and 10 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'; who are >= 18 years old; starting between February 1, 2020 and August 2, 2020; with value as concept: "positive".
 - having at least 1 measurement of 'Antigen Test (LOINC)', starting between 1 days after and 10 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'; who are >= 18 years old; starting between February 1, 2020 and August 2, 2020; with value as concept: "positive".
 - having at least 1 condition occurrence of 'U07.1 or J12.81 or J12.89 or J80', starting between 1 days after and 10 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'; who are >= 18 years old; starting between February 1, 2020 and August 2, 2020.
 - having at least 1 condition occurrence of 'B97.29 OR B34.2', starting between 1 days after and 10 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'; who are >= 18 years old; starting between February 1, 2020 and April 30, 2020.
- condition occurrences of 'U07.1 or J12.81 or J12.89 or J80', who are >= 18 years old; starting between February 1, 2020 and August 2, 2020; having at least 1 visit occurrence of 'Inpatient or ED Visit', starting between 0 days after and 28 days after 'U07.1 or J12.81 or J12.89 or J80' start date; with all of the following criteria:
 - having no condition occurrences of 'Labor and Delivery Conditions', starting between 0 days after and all days after 'Inpatient or ED Visit' start date; at same visit as 'Inpatient or ED Visit'.
 - having no procedure occurrences of 'Labor and Delivery procedures', starting between 0 days after and all days after 'Inpatient or ED Visit' start date; at same visit as 'Inpatient or ED Visit'.
 - having no condition occurrences of 'Trauma conditions', starting between 0 days after and 1 days after 'Inpatient or ED Visit' start date; at same visit as 'Inpatient or ED Visit'.
 - having no observations of 'Trauma observations', starting between 0 days after and 1 days after 'Inpatient or ED Visit' start date; at same visit as 'Inpatient or ED Visit'.
- condition occurrences of 'B97.29 OR B34.2', who are >= 18 years old; starting between February 1, 2020 and April 30, 2020; having at least 1 visit occurrence of 'Inpatient or ED Visit', starting between 0 days after and 28 days after 'B97.29 OR B34.2' start date; with all of the following criteria:
 - having no condition occurrences of 'Labor and Delivery Conditions', starting between 0 days after and all days after 'Inpatient or ED Visit' start date; at same visit as 'Inpatient or ED Visit'.
 - having no procedure occurrences of 'Labor and Delivery procedures', starting between 0 days after and all days after 'Inpatient or ED Visit' start date; at same visit as 'Inpatient or ED Visit'.
 - having no condition occurrences of 'Trauma conditions', starting between 0 days after and 1 days after 'Inpatient or ED Visit' start date; at same visit as 'Inpatient or ED Visit'.
 - having no observations of 'Trauma observations', starting between 0 days after and 1 days after 'Inpatient or ED Visit' start date; at same visit as 'Inpatient or ED Visit'.

Limit cohort entry events to the following criteria:
Restrict entry events to with:

- having no measurement of 'RNA Test (LOINC)', starting between 1 days after and 10 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'; who are >= 18 years old; starting between February 1, 2020 and August 2, 2020; with value as concept: "positive".
- having no measurement of 'Antigen Test (LOINC)', starting between 1 days after and 10 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'; who are >= 18 years old; starting between February 1, 2020 and August 2, 2020; with value as concept: "positive".
- having no condition occurrence of 'U07.1 or J12.81 or J12.89 or J80', starting between 1 days after and 10 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'; who are >= 18 years old; starting between February 1, 2020 and August 2, 2020.
- having no condition occurrence of 'B97.29 OR B34.2', starting between 1 days after and 10 days after 'Inpatient Visit' start date; at same visit as 'Inpatient Visit'; who are >= 18 years old; starting between February 1, 2020 and April 30, 2020.

How can we ensure accuracy?
What if we need to use this algorithm again?

or with at least 1 using all occurrences of:
a condition occurrence of U07.1 or J12.81 or J12.89 or J...
occurrence start is: between 2020-02-01 and 2020-08-02
with age Greater or Equal To 18
where event starts between 1 days After and 10 days After index start date
The index date refers to the visit of Inpatient Visit.
restrict to the same visit occurrence

From
complex to
simple,
algorithms
are utilized
frequently
within and
across
studies

Section 1: Vascular Lab Criteria

Ankle brachial index <0.9 at rest or post exercise; ankle systolic blood pressure >255 mmHg, or any ABI >1.4

Exclude non-atherosclerotic causes of PAD:

≥2 occurrences of the following codes

747.22, 237.7, 443.1, 446.0, 446.4, 446.5, 446.6, 446.7, 447.6, 710.1, 747.1, 747.64.

Section 2: ICD-9-CM Diagnosis Codes For PAD

440.2×, 440.3×, or 440.8×.

Section 3: Procedure Codes Related To PAD

One of the ICD-9-CM/CPT-4 procedure codes for lower extremity artery angiography: 88.48, 75710, 75711, 75712, 75716, 75717, 75718, 75630, 75631. PLUS one (concurrent) of the codes below for non coronary vessel stents: 39.50, 39.90, 37205, 37206, 37207, 37208, 37184, 37185, 37186.

OR

One of the ICD-9-CM/CPT-4 procedure codes for lower extremity artery surgical and percutaneous vascular interventions: 38.18, 39.50, 39.25, 39.29, 38.08, 38.38, 38.48, 39.49; 39.56, 39.57, 39.58, 39.90, 35302, 35303, 35304, 35305, 35306, 35331, 35351, 35355, 35361, 35363, 35371, 35372, 35381, 35452, 35454, 35456, 35459, 35470, 35472, 35473, 35474, 35481, 35482, 35483, 35485, 35491, 35492, 35493, 35495, 35521, 35533, 35537, 35538, 35539, 35540, 35541, 35546, 35548, 35549, 35551, 35556, 35558, 35563, 35565, 35566, 35571, 35582, 35583, 35585, 35587, 35621, 35623, 35637, 35638, 35641, 35646, 35647, 35651, 35654, 35656, 35661, 35663, 35665, 35666, 35671, 35226, 35256, 35286, 35700, 35721, 35741, 35876, 35879, 35881, 35883, 35884, 37184, 37185, 37186, 37205, 37206, 37207, 37208.

Exclude if one of the following ICD-9-CM codes for alternate reasons for surgery is also present:

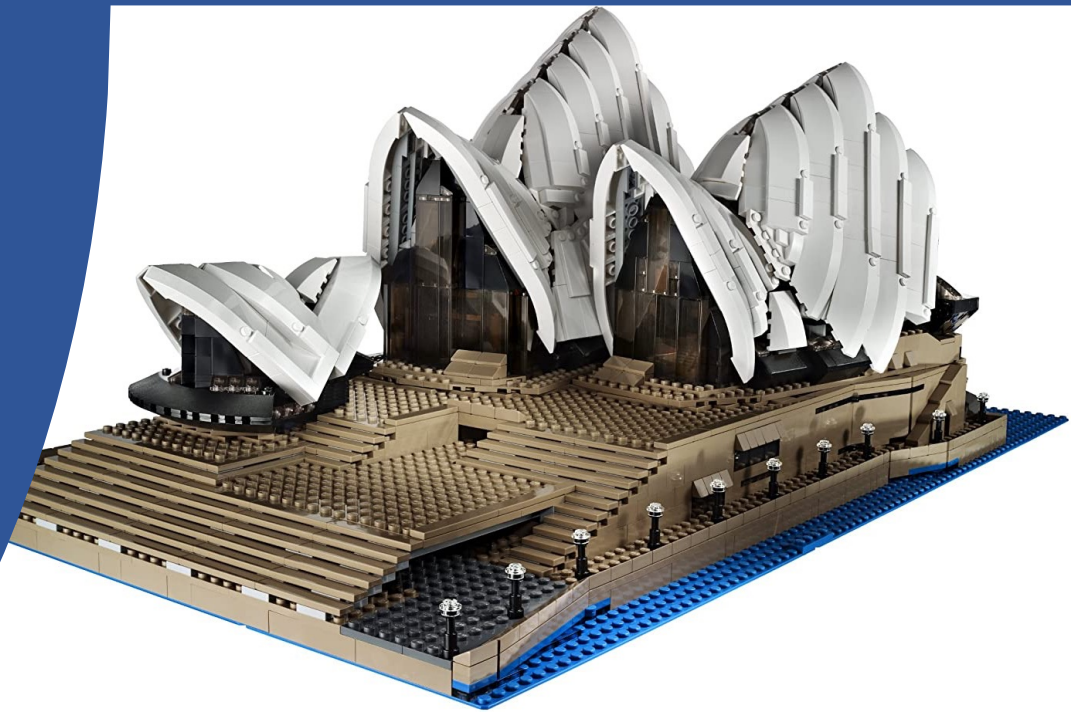
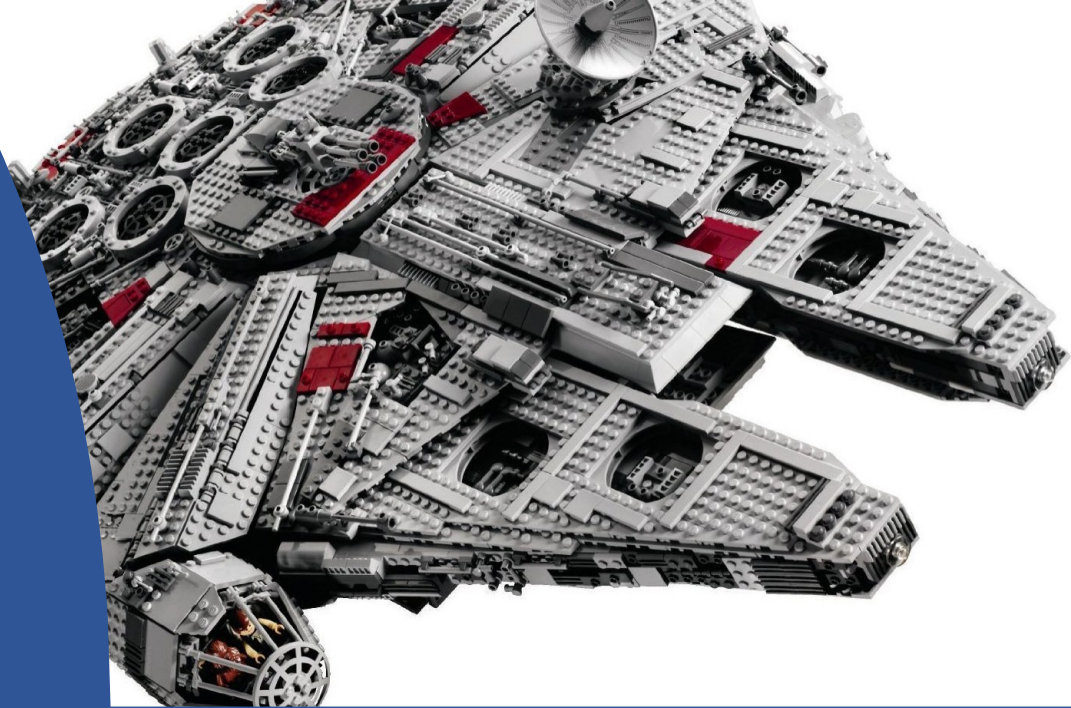


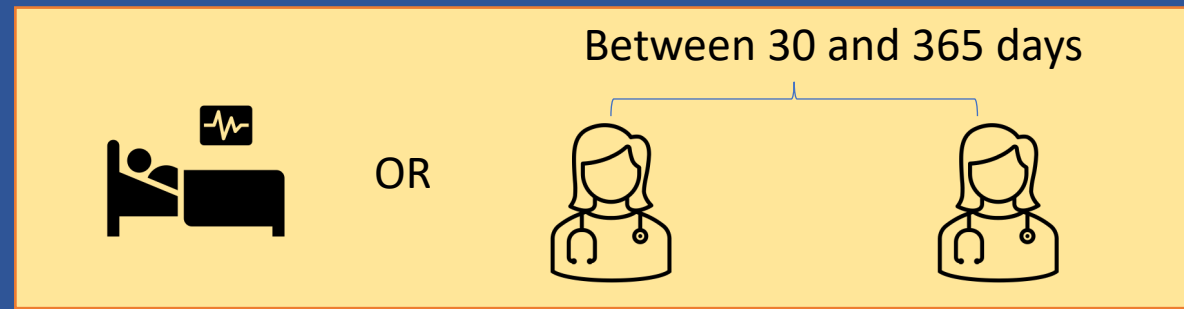
OR



Between 30 and 365 days

How do we
scale
algorithms?





Reusable Type

Initial/Censoring Event reusables are only applicable to cohort Initial/Censoring Events.
Criteria Group reusables are applicable to any **subgroup** of criteria including Characterization subgroups, Feature Analysis subgroups, and Stratify criteria.

⚠ Attention: You can switch (and save) between both types in one reusable but only one type can be active at one time (toggle).

Initial/Censoring Event

Parameters

[New parameter](#)

Show entries

| Name | Type | Actions |
|-------------|-------------|------------------------|
| Parameter 1 | Concept Set | Remove |

Showing 1 to 1 of 1 entries

Design

Events having any of the following criteria:

a condition occurrence of

✗ with a Visit occurrence of: [Add](#) [Import](#)

a condition occurrence of

✗ with a Visit occurrence of: [Add](#) [Import](#)

✗ having of the following criteria:

with using all occurrences of:

a condition occurrence of

✗ with a Visit occurrence of: [Add](#) [Import](#)

where between days and days [add additional constraint](#)

The index date refers to the condition occurrence of Parameter 1.

☐ restrict to the same visit occurrence

☐ allow events from outside observation period

Atlas Reusables: Write Once, Use Many

Import Into All Study Designs

+ Add Initial Event... ▾

Add Condition Era

Find patients with specific diagnosis era.

Add Condition Occurrence

Find patients with specific diagnoses.

Add Death

Find patients based on death.

Add Device Exposure

Find patients based on device exposure.

Add Dose Era

Find patients with dose eras.

Add Drug Era

Find patients with exposure to drugs over time.

Add Drug Exposure

Find patients with exposure to specific drugs or drug classes.

Add Measurement

Find patients based on Measurement.

Add Observation

Find patients based on observations.

Add Observation Period

Find patients based on Observation Period.

Add Payer Plan Period

Find patients based on Payer Plan Period.

Add Procedure Occurrence

Find patients that experienced a specific procedure.

Add Specimen

Find patients based on Specimen.

Add Visit occurrence

Find patients based on visit information.

Add Visit detail

Find patients based on visit detail information.

From Reusable

Add criteria from list of reusables

Insert from Reusable

1 IP 2 OP (first event, 30 to 365 days)

Parameter 1 ▾ Any Condition ▾

Events having any of the following criteria:

a condition occurrence of ▾ Parameter 1 ▾

with a Visit occurrence of: Inpatient Visit Add Import

a condition occurrence of ▾ Parameter 1 ▾

with a Visit occurrence of: Outpatient Visit Add Import

having all ▾ of the following criteria:

with at least ▾ 1 ▾ using all occurrences of:

a condition occurrence of ▾ Parameter 1 ▾

with a Visit occurrence of: Outpatient Visit Add Import

where event starts between

30 ▾ days After ▾ and 365 ▾ days After ▾ index start date add additional constraint

The index date refers to the condition occurrence of Parameter 1.

☐ restrict to the same visit occurrence

☐ allow events from outside observation period

Back to list

Confirm

Cohort definitions, characterization subgroups or custom features, incidence rate strata

Reusables Features

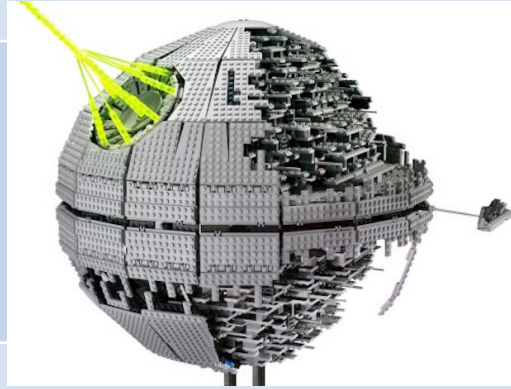
An imported Reusable
acts like a manually
created set of logic

Compatible with all
existing versions of Atlas

Can create
parameterized
algorithms with design-
time tokenization

Can string together 1 or
more Reusables, leading
to multi-part algorithms
with more modularity

Conclusions



Reusables are a powerful new method in Atlas for streamlined design and reproducibility



Reduces design complexity and improve study design accuracy

Thank You!

- Co-Authors

- Simulstat

- Brad Rechkemmer

- Odysseus

- Gregory Klebanov

- Alexey Manoylenko

- Anton Abushkevich

- Sergey Suvorov

- Special Thanks

- Deborah Kim (Amgen), Christopher Knoll (Janssen), Anthony Sena (Janssen)