

LIRE Computable Phenotypes

Inclusion/Exclusion Criteria

Participants were included in the LIRE Trial if they were from a participating clinic, were 18 years or older, and had a PCP-ordered lumbar spine imaging study with available electronic report during the study enrollment period (10/1/2013 to 9/30/2016). Lumbar spine imaging was defined by the CPT codes in the table below.

CPT code	Description
72080	X-ray of middle and lower spine, 2 views
72100	X-ray of lower and sacral spine, 2 or 3 views
72110	X-ray of lower and sacral spine, minimum of 4 views
72114	X-ray lower and sacral spine including bending views minimum 6 views
72131	CT scan of lower spine
72132	CT scan of lower spine with contrast
72133	CT scan of lower spine before and after contrast
72148	MRI scan of lower spinal canal
72149	MRI scan of lower spinal canal with contrast
72158	MRI scan of lower spinal canal before and after contrast

The qualifying lumbar spine imaging was considered the participant's index image and the date of the imaging their index date.

Study exclusions were as follows:

- Lumbar spine imaging (one of the CPT codes in the table above) in the year prior to index imaging. This includes evidence of prior imaging in the electronic health records (EHRs) or in the health system's radiology information system (RIS).
- Index imaging found to be from an emergency department (ED) encounter or inpatient stay. EHR encounters have an encounter type field that identifies ED and inpatient encounters.
- Index imaging was "finalized" (report sign-off by radiologist) more than 4 days after imaging occurred. Dates related to imaging were captured from the health system's RIS.

Outcomes

Spine-related relative value units (RVUs)

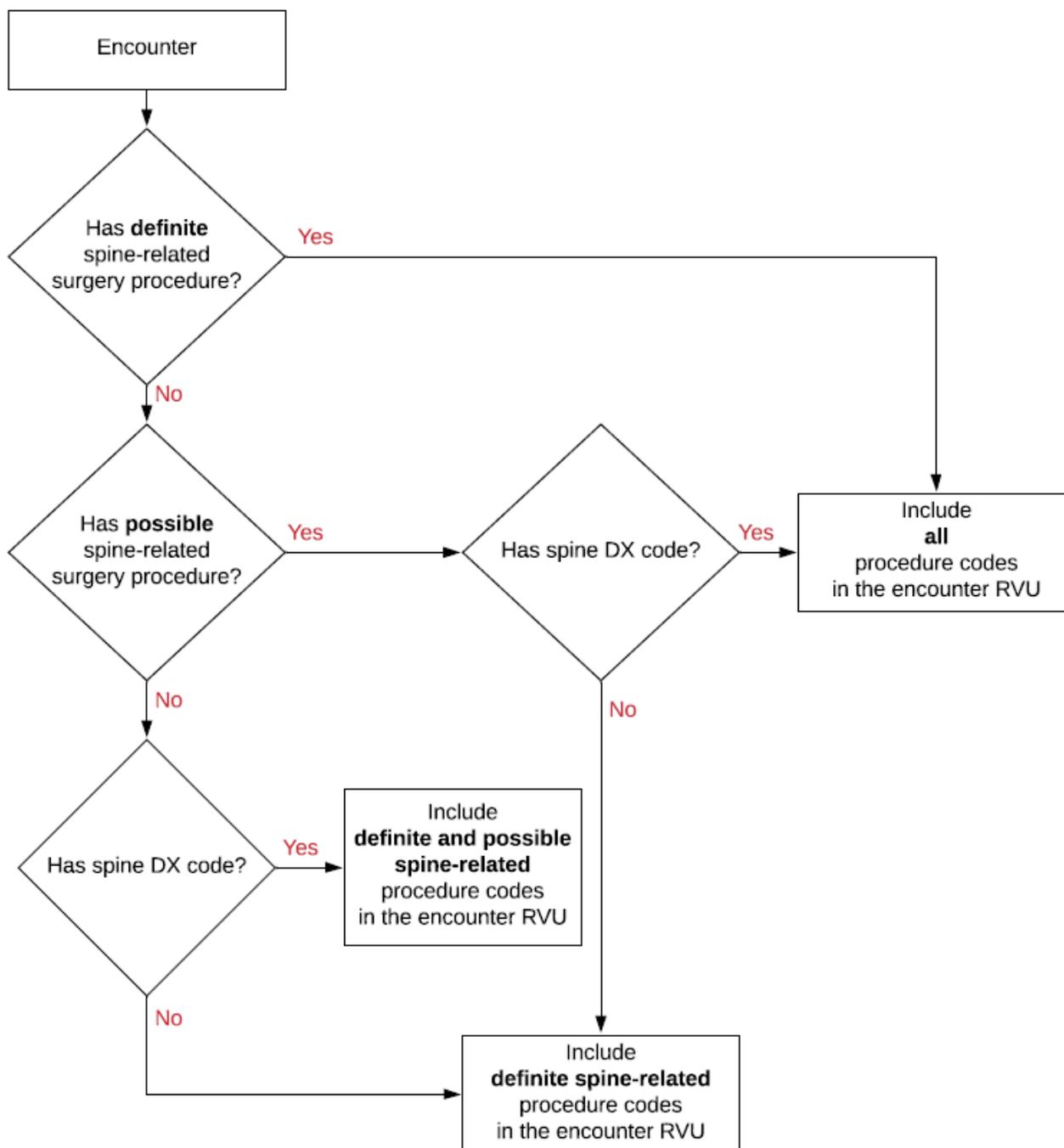
The primary outcome for the LIRE Trial was spine-related RVUs. The outcome was derived from EHRs related to inpatient and outpatient encounters and metadata mapping encounter diagnosis and procedure codes to categories of spine-relatedness and utilization.

All unique ICD-9 and ICD-10 diagnosis codes in the study database were assigned a status of spine-related or not. Encounters including one or more spine-related diagnosis codes were considered to be spine-related encounters.

All unique procedure codes in the study database were assigned one of three spine-relatedness categories: Not spine-related, definitely spine-related, or possibly spine-related. Codes determined to be definitely or possibly spine-related were further categorized by utilization type: manual (e.g. physical therapy), evaluation and management, injection, imaging, or surgery.

Common Procedural Technology (CPT) codes were mapped to RVUs using the CMS National Physician Fee Schedule Relative Value File. The median value over the study period (2013-2017) was used for each code. For some health systems, ICD-PCS codes and system-specific procedure codes were used in the medical record. We mapped such codes to their CPT equivalent.

Spine-related RVUs were assigned at the encounter level. “Definitely spine-related” procedures and “Possibly spine-related” procedures from encounters determined to be spine-related were included in the encounter RVUs. If the encounter included a spine-related surgery, all procedures regardless of spine-relatedness were included in the encounter RVUs. The diagram below illustrates RVU inclusion algorithm.



Opioid prescription within x days of index imaging

A secondary outcome for the LIRE Trial was an indicator of whether a participant had one or more outpatient opioid prescriptions from a LIRE provider within the first 90 days following the index image. "LIRE provider" was defined as any PCP who ordered a lumbar spine image for a participant in the LIRE Trial. The provider did not have to be the same provider who ordered the participant's index image.

Outpatient opioid prescriptions were identified by their drug name and order status. All unique drug names in the study database were reviewed by a doctor of pharmacy and assigned an outpatient opioid status (yes or no). Tramadol was included as an opioid but cough and cold products containing small amounts of opioids were not counted as opioids, nor were anti-diarrheal agents. Opioids almost certainly used in inpatient settings such as injectable or patient-controlled analgesia (PCA) were not counted as opioid medications. Prescription records with an order status of discontinued or dispensed were not counted as outpatient opioid prescriptions.

Opioids prescribed on a date that the patient was known to be an inpatient were excluded unless the prescription date coincided with the discharge date.

Participants were assigned an opioid prescription outcome of 1 if they had an outpatient opioid prescription from a LIRE provider within 90 days of index imaging and 0 otherwise.

Other opioid-related outcomes were: opioid prescription from a LIRE provider within 365 days, and opioid prescription from any provider (not just a LIRE provider) within 90 days and within 365 days.