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Food Insecurity in Orthopedic Surgery: A Systematic Review and Meta-Analysis of Prevalence, Associated Factors, and Clinical Outcomes

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ADMINISTRATIVE INFORMATION**Support** - Individual.**Review Stage at time of this submission** - Preliminary searches.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202670057**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 17 July 2026 and was last updated on 17 July 2026.**INTRODUCTION**

Review question / Objective This systematic review and meta-analysis aims to: (1) estimate the pooled prevalence of food insecurity among adult orthopedic surgical patients across subspecialties; (2) identify patient-level and clinical factors associated with food insecurity in orthopedic surgical populations; (3) characterize the association between food insecurity and postoperative clinical outcomes including surgical site infection, length of stay, readmission, reoperation, and patient-reported outcomes; and (4) describe current food insecurity screening and intervention practices within orthopedic surgical care settings.

Rationale Food insecurity is a well-established social determinant of health linked to poor surgical outcomes in general surgery, yet its prevalence and clinical significance within orthopedic surgery specifically remain poorly characterized. Orthopedic patients may face distinct risk: musculoskeletal injury often causes acute loss of

income and work capacity, perioperative recovery requires elevated caloric and protein intake for bone healing and tissue repair, and orthopedic care spans elective, optimizable procedures (arthroplasty, hand surgery) to emergent trauma, each offering different opportunities for screening. Existing evidence is fragmented across subspecialty-specific studies (trauma, arthroplasty, hand surgery, spine) that vary in screening tools, populations, and outcomes reported, with no synthesis to date consolidating this literature. This makes it difficult for clinicians and health systems to gauge the true scope of the problem or identify which populations most need screening and intervention. A systematic review and meta-analysis is needed to: (1) estimate pooled food insecurity prevalence across orthopedic surgical populations, (2) identify patient and clinical factors most strongly associated with food insecurity, (3) characterize its association with postoperative outcomes, and (4) document current screening and intervention practices.

This review is intended as a foundational step preceding a planned prospective intervention

study examining food insecurity screening and referral in orthopedic surgical patients. By systematically characterizing the existing evidence base, this review will clarify whether current literature supports clinical screening recommendations, identify subspecialties and settings where evidence gaps are most pronounced, and provide empirical justification for the design of the planned intervention.

Condition being studied Food insecurity, defined as limited or uncertain access to adequate and nutritionally appropriate food (USDA definition), among adult patients presenting to orthopedic surgery clinics or undergoing orthopedic surgical procedures across all subspecialties, including hand/upper extremity surgery, orthopedic trauma, total joint arthroplasty, spine surgery, and sports/general orthopedics. Food Insecurity.

METHODS

Search strategy A systematic search will be conducted in PubMed/MEDLINE, EMBASE (Ovid), CINAHL (EBSCO), and Cochrane Central Register of Controlled Trials (CENTRAL). Supplementary searches will include ClinicalTrials.gov, manual reference list review of all included full-text articles, and hand-searching of high-yield orthopedic journals (JBJS, CORR, JHS, JHSG, Spine) from 2020 to present. Grey literature sources will include ACS clinical resources, AAOS position statements, and CDC social determinants of health reports. No language restrictions will be applied at the search stage; non-English studies without available validated translation will be excluded at full-text review.

The PubMed search string is as follows:

("Food Insecurity"[MeSH] OR "food insecurity"[tiab] OR "food insecure"[tiab] OR "nutrition insecurity"[tiab] OR "food access"[tiab] OR "SNAP enrollment"[tiab] OR "Supplemental Nutrition Assistance"[tiab] OR "Z59.4"[tiab]) AND ("Orthopedic Procedures"[MeSH] OR "Orthopedics"[MeSH] OR "orthopedic"[tiab] OR "orthopaedic"[tiab] OR "arthroplasty"[tiab] OR "total joint replacement"[tiab] OR "fracture repair"[tiab] OR "orthopedic trauma"[tiab] OR "hand surgery"[tiab] OR "upper extremity surgery"[tiab] OR "spine surgery"[tiab] OR "spinal fusion"[tiab]).

Participant or population Adult patients aged 18 years or older presenting to an outpatient orthopedic clinic or undergoing orthopedic surgery, inclusive of all subspecialties: hand/upper extremity, orthopedic trauma, total joint arthroplasty, spine, and sports/general

orthopedics. Studies enrolling mixed-age cohorts are eligible provided adult-specific data are separately extractable. Pediatric-only populations (<18 years) are excluded.

Intervention This review examines food insecurity as an exposure rather than an administered intervention. Food insecurity is defined as limited or uncertain access to adequate food, assessed via any validated screening tool (Hunger Vital Sign 2-item, USDA 6-item or 18-item Household Food Security Survey Module), patient self-report, or ICD-10 code Z59.4. Studies using serum nutritional biomarkers alone (albumin, pre-albumin) without a validated food insecurity screen are excluded from the primary prevalence analysis but captured for the clinical outcomes synthesis.

Comparator Food-secure orthopedic surgical patients within the same clinical setting, where a comparator group is reported. For studies reporting food insecurity prevalence only, without a comparator group, inclusion is permitted for the primary prevalence meta-analysis. General surgical or non-orthopedic populations serve as a secondary reference comparator for contextualizing orthopedic-specific prevalence estimates.

Study designs to be included Cross-sectional studies, prospective cohort studies, retrospective cohort studies, pre-post intervention studies, and randomized controlled trials (RCTs). Case reports and case series (<10 patients), editorials, letters to the editor, commentaries, narrative reviews, conference abstracts without primary data, animal studies, and cadaveric studies are excluded.

Eligibility criteria

Inclusion:

Adult patients (≥ 18 years) presenting to an orthopedic clinic or undergoing orthopedic surgery across any subspecialty

Food insecurity assessed via validated screening tool (Hunger Vital Sign, USDA 6-item or 18-item scale), self-report, or ICD-10 Z59.4

Reports at least one of: food insecurity prevalence, patient-level factors associated with food insecurity, postoperative clinical outcome stratified by food insecurity status, or food insecurity screening/intervention uptake rate

Cross-sectional, prospective/retrospective cohort, pre-post intervention, or RCT study design

Published in English between January 1, 2000 and present

Peer-reviewed full-text articles

Exclusion:

Pediatric-only populations (<18 years) without extractable adult data
 Non-orthopedic surgical populations without a separable orthopedic subgroup
 Studies using nutritional biomarkers alone (albumin, pre-albumin, BMI) as the sole exposure without validated food insecurity screening
 Studies not reporting food insecurity prevalence, an outcome stratified by food insecurity status, or a food insecurity-related intervention
 Case reports/series (<10 patients), editorials, letters, commentaries, narrative reviews, conference abstracts without primary data
 Non-English publications without available validated translation
 Published before January 1, 2000
 Duplicate publications from overlapping cohorts (larger sample or more complete outcome data retained).

Information sources Electronic databases: PubMed/MEDLINE, EMBASE (Ovid), CINAHL (EBSCO), Cochrane Central Register of Controlled Trials (CENTRAL), and [ClinicalTrials.gov](https://www.clinicaltrials.gov). Supplementary searches will include manual review of reference lists of all included full-text articles and hand-searching of high-yield orthopedic journals (Journal of Bone and Joint Surgery, Clinical Orthopaedics and Related Research, Journal of Hand Surgery, Journal of Hand Surgery: Global Online, Spine) from 2020 to present. Grey literature sources will include ACS clinical resources, AAOS position statements, and CDC social determinants of health reports.

Main outcome(s) Primary outcome: pooled prevalence of food insecurity among adult orthopedic surgical patients, reported as a percentage with 95% confidence interval. Secondary outcomes (clinical): surgical site infection rate, wound complications, length of hospital stay, 30-day readmission rate, reoperation rate, and nonunion rate (trauma subspecialty), each stratified by food insecurity status and reported as odds ratios or weighted mean differences with 95% CI where poolable.

Additional outcome(s) Nutritional biomarkers: serum albumin (g/dL), pre-albumin (mg/dL), and vitamin D (ng/mL), stratified by food insecurity status
 Patient-reported outcome measures (PROMs): scores on validated instruments (PROMIS, DASH, HOOS, KOOS, VAS pain) stratified by food insecurity status

Patient-level and clinical predictors of food insecurity: race/ethnicity, insurance status, household income, Area Deprivation Index (ADI), Social Vulnerability Index (SVI), employment status, and comorbidity burden, reported as adjusted odds ratios where available

Food insecurity screening uptake rates and intervention practices: proportion of patients screened, referred to community resources, enrolled in SNAP, or receiving nutrition counseling.

Data management Search results from all databases will be exported in RIS format, combined, and imported into Covidence (Veritas Health Innovation, Melbourne, Australia) for automated deduplication and screening. Manual verification will be performed for near-duplicate flags. Title and abstract screening and full-text review will each be conducted independently by two reviewers, with disagreements resolved by consensus or adjudication by a senior author. Structured data extraction will be performed independently by two reviewers using a pre-piloted extraction form capturing study identification, design, population characteristics, food insecurity exposure definition and screening tool, prevalence data, clinical outcomes, and quality assessment items. Discrepancies will be resolved by discussion; a third reviewer will be consulted if consensus cannot be reached. For studies with insufficient reported data, corresponding authors will be contacted by email with up to two follow-up attempts over four weeks. All extracted data will be maintained in a password-protected shared database accessible only to the review team.

Quality assessment / Risk of bias analysis Methodological quality of included observational studies will be assessed independently by two reviewers using the Newcastle-Ottawa Scale (NOS) adapted for cross-sectional and cohort study designs, evaluating selection, comparability, and outcome domains (maximum 9 stars). Studies will be classified as low risk (NOS 7–9), moderate risk (4–6), or high risk (0–3) of bias. For any included RCTs, the revised Cochrane Risk of Bias tool (RoB 2) will be applied. Quality assessment results will be reported in a summary table and incorporated into pre-specified sensitivity analyses restricted to low-risk-of-bias studies.

Strategy of data synthesis Pooled prevalence of food insecurity will be estimated using a random-effects model with the DerSimonian-Laird estimator for between-study variance (τ^2). Prevalence estimates will be Freeman-Tukey double arcsine transformed prior to pooling to stabilize variance and back-transformed for

reporting. For secondary dichotomous outcomes (SSI, readmission, reoperation), pooled odds ratios with 95% CI will be calculated comparing food-insecure to food-secure patients using random-effects models. For continuous outcomes (length of stay, albumin, PROM scores), weighted mean differences (WMD) with 95% CI will be calculated. Outcomes reported by fewer than three studies will not be pooled and will be described narratively. Statistical heterogeneity will be quantified using the I^2 statistic and Cochran's Q test, interpreted as low (75%). Publication bias will be assessed using funnel plots and Egger's test for outcomes with ≥ 10 included studies, with trim-and-fill analysis performed if asymmetry is detected. All analyses will be conducted in R (version 4.4.x) using the meta and metafor packages.

Subgroup analysis The following subgroup analyses are pre-specified:

Orthopedic subspecialty (hand/upper extremity, trauma, total joint arthroplasty, spine, sports/general orthopedics)
Clinical setting (inpatient vs. outpatient)
Surgical context (elective vs. emergent/urgent)
Food insecurity screening tool used (Hunger Vital Sign vs. USDA scale vs. ICD-10 Z59.4 vs. other)
Geographic setting (United States vs. international)
Study design (cross-sectional vs. cohort)
Risk of bias (low vs. moderate/high NOS)

Subgroup differences will be assessed using the chi-squared test for subgroup interaction. Subgroup analyses will be reported only where three or more studies contribute to a given subgroup.

Sensitivity analysis The following sensitivity analyses are pre-specified:

Restriction to studies using validated food insecurity screening tools only, excluding studies relying solely on ICD-10 Z59.4 coding
Restriction to low-risk-of-bias studies (NOS ≥ 7 or RoB 2 low risk)
Exclusion of studies with sample size < 50
Exclusion of studies with substantial missing data in the NOS comparability domain (i.e., no adjustment for income or race/ethnicity)
Exclusion of studies from outside the United States, given the U.S.-specific nature of SNAP enrollment and ADI as moderator variables.

Country(ies) involved United States.

Keywords Food insecurity; food insecure; nutrition insecurity; social determinants of health;

orthopedic surgery; orthopaedic surgery; orthopedic trauma; total joint arthroplasty; total.

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