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2019 Update on Medical Overuse

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Abstract

IMPORTANCE—Medical overuse is an important cause of patient harm and medical waste.

OBSERVATION—This structured literature review of English-language articles supplemented by examination of tables of contents of high-impact journals published in 2018 identified articles related to medical overuse. Articles were appraised for their methodologic quality, clinical relevance, and influence on patients. Of 1499 candidate articles, 839 addressed medical overuse. Of these, 117 were deemed to be most significant, with the 10 highest-ranking articles selected by author consensus. The most important articles on medical overuse identified issues with testing, including that procalcitonin does not affect antibiotic duration in patients with lower respiratory tract infection (4.2 vs 4.3 days); incidentalomas are present in 22% to 38% of common magnetic resonance imaging or computed tomography studies; 9% of women dying of stage IV cancer

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are still screened with mammography; and computed tomography lung cancer screening offers stable benefit and higher rates of harm for patients at lower risk. Articles related to overtreatment reported that urgent care clinics commonly overprescribe antibiotics (in 39% of all visits, patients received antibiotics) and that treatment of subclinical hypothyroidism had no effect on clinical outcomes. Three studies highlighted services that should be questioned, including using opioids for chronic noncancer pain (meta-analysis found no clinically significant benefit), stress ulcer prophylaxis for intensive care unit patients (mortality, 31.1% with pantoprazole vs 30.4% with placebo), and supplemental oxygen for patients with normal oxygen levels (mortality relative risk, 1.21; 95% CI, 1.03–1.43). A policy article found that state medical liability reform was associated with reduced invasive testing for coronary artery disease, including 24% fewer angiograms.

CONCLUSIONS AND RELEVANCE—The findings suggest that many tests are overused, overtreatment is common, and unnecessary care can lead to patient harm. This review of these 2018 findings aims to inform practitioners who wish to reduce overuse and improve patient care.

Medical overuse has gained traction in the national health care conversation.[1] In the United States, deeper understanding about the contributions of medical overuse to the opioid epidemic[2,3] has led to reduced prescribing by practitioners. The public is also learning about harms from inappropriate use of medical devices through articles that detail large investigations,[4] books,[5] and even film.[6]

The burgeoning public conversation about overuse has been accompanied by continued efforts within the medical community to address it. Initiatives have included professional meetings (such as the Preventing Overdiagnosis[7] and High Value Practice Academic Alliance conferences)[8]; quality improvement initiatives at the institutional, payer, and state levels[9,10]; and targeted collections in medical journals, such as the Less is More series in *JAMA Internal Medicine*. The present series of updates in overuse in adult medicine[11–15] has given rise to updates in pediatric[16–18] and dermatology overuse (unpublished data, Arash Mostaghimi, Ashley Pournamdari, Elizabeth Tkachenko, John Barbieri, and Adewole Adamson, 2019). Additional consequences of overuse receiving attention is how overuse affects practitioners. A 2018 survey[19] of physicians, nurses, and advanced practice practitioners found that self-reported provision of inappropriate or futile care was common and associated with burnout. This finding replicated previous studies of critical care practitioners[20,21] and implies that reducing overuse could enhance practitioner wellness.[19]

This article examines and describes 10 of the most important studies published in 2018 concerning medical overuse in the care of adult patients. We divided the articles into the following categories: overtesting, overdiagnosis, services to question, and methods to reduce overuse.

Methods

Literature Search and Article Selection

We selected articles through a structured review of studies published in 2018 that were indexed in PubMed under the Medical Subject Headings term *health services misuse* or with any of the following words in the title: *overuse, overtreatment, overdiagnosis, inappropriate*, and *unnecessary*. In Embase, we performed a search using these same terms with the

additional Emtree term *unnecessary procedure*. We excluded articles with *overuse injury* in the title. Searches were limited to humans and English language. One of us (D.J.M., S.S.D., E.R.C., and D.K.) reviewed all titles for relevance to medical overuse. One of the same 4 authors reviewed all 2018 titles from 10 major medical journals (Figure) and read abstracts and full journal articles for those of potential relevance. We based our search methods on the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline.[22]

The structured literature review identified 1499 articles, 839 of which addressed medical overuse. After excluding 45 pediatric articles and 124 editorials, opinion pieces, letters without data, case reports, or review articles, 670 articles remained (Figure). Of these, 117 (17.5%) were ranked as most relevant by at least 1 of us based on methodologic quality, clinical relevance, and influence on patients. From these 117 highest-rated articles, the 10 most relevant were selected by consensus among all authors and are highlighted in this article. These articles are organized into the categories of overtesting, overdiagnosis, overtreatment, services to question, and methods to reduce overuse. The 10 next most influential articles are listed for honorary mention (Table).[23–32]

Results

Overtesting

Association of Procalcitonin Measurement With Duration of Antibiotic Prescriptions Under Real-world Conditions—Huang et al[33] found that procalcitonin measurement does not reduce duration of antibiotic prescriptions under real-world conditions.

Background: Procalcitonin is a peptide that is associated with bacterial infections. A prior randomized clinical trial[34] found that a mandated procalcitonin guideline decreased antibiotic prescribing for acute lower respiratory tract infection (LRTI) in Europe. Less is known about how procalcitonin measurement affects antibiotic prescribing and duration in the real world.

Results: A total of 1656 patients presenting to 14 US emergency departments with acute LRTI were randomized to procalcitonin measurement with treatment threshold suggestions and an improvement bundle (education, prompts, and feedback) or usual care. An intention-to-treat analysis demonstrated no difference in days of antibiotic use (mean, 4.2 days for the treatment group and 4.3 days for the usual care group; difference, −0.05 day; 95% CI, −0.6 to 0.5 days) or adverse outcomes attributable to withholding antibiotics at 30 days (11.7% for the treatment group and 13.1% for the usual care group; difference, −1.5 percentage points; 95% CI, −4.6 to 1.7 percentage points). Similarly, a per-guideline subgroup analysis of patients for whom practitioners were completely adherent to procalcitonin guideline recommendations demonstrated no difference in antibiotic use.

Implications: Real-time knowledge of procalcitonin values and an improvement bundle did not affect antibiotic prescribing for patients with acute lower respiratory tract infection (LRTI) (patients for whom practitioners were uncertain if they needed antibiotics). Although

procalcitonin may be associated with bacterial infection, it does not improve antibiotic use by practitioners.

Comprehensive Review of Incidentalomas—In a comprehensive review, O'Sullivan et al[35] found widespread detection of incidentalomas.

Background: Incidentalomas are abnormalities detected on imaging procedures unrelated to the indication for testing. As the visual resolution and use of advanced imaging have increased, the possibility of incidentally detecting abnormalities of questionable clinical significance has become more common. However, data are too sparse to guide practitioners and patients in incidentally discovered abnormalities.

Results: A systematic review and meta-analysis of 20 prior systematic reviews (involving 240 primary studies) investigating incidentaloma prevalence demonstrated high rates of incidentaloma detection across imaging modalities and organ systems. The proportion of patients who received imaging and were diagnosed with an incidentaloma was highest for computed tomographic (CT) colonography (38%; 95% CI, 21%−57%), cardiac magnetic resonance imaging (MRI) (34%; 95% CI, 22%−46%), spinal MRI (22%; 95% CI, 19% −26%), and brain MRI (22%; 95% CI, 14%−31%). Of incidentally detected abnormalities, those most likely to be malignant cancers involved the breast (42%; 95% CI, 31%−54%) and the thyroid (28%; 95% CI, 20%−37%).

Implications: Before imaging is performed, patients and their physicians should consider the high likelihood of detecting incidentalomas, which can increase patient anxiety and lead to additional testing and interventions of unknown benefit and harm.

Mammograms and Resultant Additional Testing in Women With Advanced Cancer—Sadigh et al[36] found that many women with advanced cancer undergo mammography and resultant additional testing.

Background: Breast cancer screening affects mortality at approximately 10 years after its execution.[37] As such, it is not recommended for women with life expectancies of fewer than 10 years because of a lack of benefit,[37] which is a Choosing Wisely recommendation.[38]

Results: Investigators used Surveillance, Epidemiology, and End Results Medicare data to evaluate rates of screening mammography and subsequent follow-up breast imaging in women with stage IV colorectal or lung cancer. Overall, 9% of women underwent screening mammography, among whom 11% underwent subsequent follow-up breast imaging (most commonly diagnostic mammography) within 9 months. Rates of resulting invasive procedures were not reported.

Implications: A significant proportion of women with advanced cancer had unnecessary screening mammography similar to the findings of a study[39] of older women with limited life expectancy. The high rate of downstream imaging implies harm and waste to patients and the health care system. Practitioners ordering screening tests should limit screening to patients with sufficient life expectancy to benefit from screening.

Overdiagnosis

Harms and Benefits of Lung Cancer Screening in Relation to Underlying Risk of Lung Cancer—Caverly et al[40] reported that lung cancer screening reduced harms but diminished benefits as the risk of lung cancer decreases.

Background: Computed tomographic lung cancer screening is recommended based on the National Lung Screening Trial.[41] A concurrent Veterans Health Affairs lung cancer screening project found a higher false-positive rate than the National Lung Screening Trial (58% vs 26%), and early-stage lung cancer was rarely detected.[42] These findings have led to questions about patient benefit. Investigators sought to compare the expected outcomes of higher observed false-positive rates in the Veterans Health Affairs among patients of varying risk.

Results: Basing the value of screening on trials that found an approximately 20% relative risk reduction in death from lung cancer, investigators modeled benefits according to patients' baseline lung cancer risk stratified by quintiles. Patients in the lowest risk quintile had a number needed to screen of 6903 to prevent 1 lung cancer death, and those in the highest risk quintile had a number needed to screen of 687. Harms were similar across all risk groups, with approximately 55% of false-positive results requiring tracking and 2% of these needing further diagnostic evaluation.

Implications: Screening tests, including those focused on lung cancer, have effectiveness that is dependent on the pretest risk of disease. The greatest benefit to harm ratio accrues to patients with the highest risk of having cancer. Harms are relatively stable across groups. Screening programs should be tailored to individual patient risk to achieve the desired favorable outcomes.[43]

Overtreatment

Association of Urgent Care With Use of Antibiotics—Palms et al[44] found an association between urgent care and overuse of antibiotics.

Background: The number of urgent care centers has increased markedly, with more than 10 000 clinics nationwide.[45] Urgent care generally provides immediate medical evaluation with a practitioner who does not have a relationship with the patient. Infectious symptoms are a common reason for evaluation.

Results: On the basis of the Truven administrative claims data from more than 150 million visits in 2010 to 2011, inappropriate antibiotic prescribing for patients with viral illnesses occurred most frequently in urgent care centers (in 45.7% of patient visits for viral illness [n = 201 682] compared with 24.6% of such emergency department visits and 17% of primary care office visits). Antibiotics were prescribed at 39% of all urgent care visits.

Implications: Antibiotic treatment for nonindicated conditions is among the most common forms of overuse in ambulatory care and given in more than one-third of urgent care visits. Patients should be encouraged to seek care from their primary care physicians whenever

possible. Urgent care centers lack sustained relationships with patients, and although they are a convenient alternative to primary care, they should improve their tendency to overtreat.

Treatment of Subclinical Hypothyroidism Among Patients With Mild to Moderate Symptoms—Feller et al[46] recommend that treatment of subclinical hypothyroidism be avoided among patients with mild to moderate symptoms.

Background: Subclinical hypothyroidism is the laboratory combination of an elevated thyrotropin level and a normal range free thyroxine level. Approximately 13 million people in the United States have subclinical hypothyroidism,[47] most of whom qualify for thyroid hormone treatment based on existing guidelines.[48]

Results: A systematic review and meta-analysis of 21 randomized clinical trials comparing thyroid hormone therapy with placebo or no treatment among 2192 nonpregnant adults with subclinical hypothyroidism found that thyroid hormone therapy was not associated with quality of life (standardized mean difference, −0.11; 95% CI, −0.25 to 0.03) or thyroid-related symptoms (standardized mean difference, 0.01; 95% CI, −0.12 to 0.14). In addition, no significant differences were found in secondary outcomes, including mood-related outcomes, cognitive function, systolic blood pressure, or body mass index. Among the 7 trials that measured hypothyroid symptoms at enrollment, the burden of symptoms was mild to moderate.

Implications: Practitioners should not routinely prescribe thyroid hormone therapy to patients with subclinical hypothyroidism and mild to moderate symptoms. Consequently, thyrotrophin testing in patients who are asymptomatic or have nonspecific symptoms may need to be reconsidered.[49]

Services to Question

Effectiveness of Opioids in Patients With Chronic Noncancer Pain—Busse et al[50] report that opioids may be ineffective in patients with chronic noncancer pain.

Background: The opioid crisis has focused on opioid harms, with limited attention to the potential benefits of these medications. Opioids are commonly used to treat chronic noncancer pain, but their effectiveness on pain and functioning in this population compared with alternative treatments is unclear.

Results: A systematic review and meta-analysis of 96 randomized clinical trials evaluated the association of opioids with pain and functioning in diverse patients with chronic noncancer pain. In the pooled analysis, opioids were associated with more reduced pain compared with placebo; although the reduction was statistically significant, the magnitude of effect (−0.79 cm on a 10-cm visual analog scale) did not reach the threshold for clinical significance (for all trials and those with high-quality evidence). Similarly, there was a small, statistically significant improvement in physical functioning associated with opioids compared with placebo that did not reach clinical significance. Pooled analysis of moderate-quality evidence found no difference in pain relief between nonsteroidal anti-inflammatory drugs and opioids or between tricyclic antidepressants and opioids.

Implications: In 2018, many studies focused on harm from opioids, including the risk of long-term use and overdose in patients prescribed presumably short-term opioids after dental work or surgery.[51] Opioids have a small and likely clinically insignificant association with chronic noncancer pain and may not be superior to nonsteroidal anti-inflammatory drugs or tricyclic antidepressants.

Routine Stress Ulcer Prophylaxis in Patients Admitted to an Intensive Care Unit—According to Krag et al,[52] the benefit of routine stress ulcer prophylaxis in patients admitted to an intensive care unit (ICU) is negligible.

Background: Because patients admitted to the ICU have increased risk for stress-related gastrointestinal bleeding, proton pump inhibitors are commonly prescribed prophylactically to reduce risk. Proton pump inhibitors have been associated with *Clostridium difficile* infection, pneumonia, renal failure, and other adverse events.[53]

Results: In this multicenter, randomized, blinded pragmatic trial, 3298 patients admitted to the ICU with at least 1 risk factor for gastrointestinal bleeding were randomly assigned to 40 mg of intravenous pantoprazole or placebo. Patients with prior treatment with acid suppressants and with gastrointestinal bleeding during the index hospital admission were excluded. At 90 days, no statistically significant difference in mortality (31.1% in the pantoprazole group and 30.4% in the placebo group) or a composite of clinically important gastrointestinal bleeding, pneumonia, *C difficile* infection, or myocardial ischemia (21.9% in the pantoprazole group and 22.6% in the placebo group) was found. Clinically important gastrointestinal bleeding was present in 2.5% of patients randomized to the pantoprazole group vs 4.2% of patients randomized the placebo group (relative risk, 0.58; 95% CI, 0.40–0.86).

Implications: Stress ulcer prophylaxis should not be routinely used for hospitalized patients. Patients prescribed stress ulcer prophylaxis often have the treatment continued unnecessarily past ICU admission and even after discharge.[54]

Association of Liberal Use of Oxygen Therapy With Risk of Mortality Among Acutely Ill Patients—Chu et al[55] found that liberal use of oxygen therapy increases the risk of mortality among acutely ill patients.

Background: Supplemental oxygen is commonly provided to acutely ill, nonhypoxemic patients. There is biologic plausibility for harms associated with hyperoxia, including increased vasoconstriction, inflammation, and oxidative stress.[56]

Results: A systematic review and meta-analysis of 25 randomized clinical trials of 16 037 acutely ill adults found that a liberal oxygen therapy strategy (supplementing those with a median baseline oxygen saturation as measured by pulse oximetry (SpO_2) of 96%; interquartile range, 96%−98%) increased in-hospital mortality (relative risk, 1.21; 95% CI, 1.03–1.43) and 30-day mortality (relative risk, 1.14; 95% CI, 1.01–1.28) compared with a conservative oxygen therapy strategy. The number of patients needed to be treated with a liberal oxygen approach to result in 1 patient death was 71 patients (95% CI, 37–1000).

Implications: Routine provision of oxygen to acutely ill adults without baseline hypoxemia increases their risk of death. Supplemental oxygen should be avoided for baseline SpO_2 values higher than 94%.

Methods to Reduce Overuse

Association of Medical Liability Reform With Less Invasive Testing—According to Farmer et al,[57] medical liability reform may lead to less invasive testing.

Background: Defensive medicine related to fear of malpractice is the most common explanation for overuse cited by physicians.[58] Although malpractice reform has seldom reduced health care costs or general rates of use,[59] the effect of malpractice reform on discretionary or unnecessary care is poorly understood. Invasive cardiac procedures are known to be overused and often of uncertain appropriateness.[60]

Results: A quasi-experimental study evaluated the association of state-level malpractice damage caps with diagnostic testing in Medicare patients with suspected coronary artery disease. The study included physicians in 9 states that introduced damage caps between 2002 and 2005 and 20 states with no caps. After adjusting for patient and county characteristics, physicians in new-cap states ordered 24% fewer initial coronary angiograms and performed 23% less revascularization after cap introduction. There was a trend toward more noninvasive stress tests. Appropriateness of specific services was not assessed.

Implications: Malpractice damage caps may be associated with less invasive diagnostic testing in patients with suspected coronary artery disease. Although a prior study[59] suggested that malpractice reform has a mixed and generally small association with overall spending, it may be associated with reductions in overuse or a shift toward less aggressive care.[57] This finding may represent a promising lever for protecting patients from unnecessary harm.

Limitations

This analysis has limitations. Only top medical journals or those with specific keywords related to medical overuse were reviewed. In addition, which articles to include and key points were subjective decisions by us.

Conclusions

In 2018, the published medical literature on overuse identified research on testing, including findings that procalcitonin does not affect antibiotic treatment duration in LRTI, incidentalomas are present in 22% to 38% of common MRI or CT studies, mammography screening is performed for 1 of 10 women with stage IV cancer, and CT lung cancer screening achieves 10-fold benefit if used in the highest-risk patients. Overtreatment was well documented, including that 39% of all patients visiting urgent care facilities received antibiotics and that detection and treatment of subclinical hypothyroidism had no effect on clinical outcomes. Three studies[50,52,55] highlighted questionable services, including the use of opioids for chronic noncancer pain, stress ulcer prophylaxis in ICU patients, and

supplemental oxygen for hospitalized patients with SpO_2 greater than 94%. State medical liability reform was associated with reduced invasive testing for coronary artery disease.

As with past updates,[11–15] this abstraction identified many routine current practices that are unequivocally unnecessary. These practices are often theoretically beneficial based on a physiologic rationale with minimal clinical evidence. Examples from this category included opioids for noncancer chronic pain, proton pump inhibitors for prophylaxis in the ICU, treatment of subclinical hypothyroidism, and liberal use of oxygen therapy. Notable additions from honorary mention articles included the commonly used subacromial decompression surgery, which was no better than sham surgery,[27] and evidence that most patients with appendicitis do not need appendectomy.[28] Such work highlights the peril of creating practice standards based on low-level evidence or simply on a physiologic basis and then requiring high-level evidence to question or reverse such practices.[61]

New models of care delivery are changing the context in which patients are interacting with the health care system and professionals. The increasing number of urgent care facilities, which provide immediate care without patient relationships, is particularly notable.[44] In some ways, this is similar to past experiences of indigent populations, uninsured persons, and those without a personal physician seeking primary care in emergency departments. Urgent care often results in excessive use of antibiotics, inappropriate emergency department referrals, and likely other unnecessary tests and treatments.

Individual physicians continue to be pressured to see more patients and pushed to take on too many responsibilities to do all things well.[62] In many settings, physicians are incentivized to order tests and treatments. Financial incentives for physicians may take the form of payments from pharmaceutical companies[63] or fee-for-service payment or health insurance metrics that reward blanket population-level strategies and disincentivize patient-centered screening and treatment decisions.[64] Because of these demands, burnout is increasing and may be associated with providing unnecessary care and overuse. Restructuring medicine to disincentivize tests and unneeded treatments may increase fulfillment in clinical practice. Decreasing the burden of documentation, increasing the time spent in patient contact, and encouraging care delivery that is aligned with patients' goals and best evidence may optimize value in health care with rewarding experiences for both patients and physicians.

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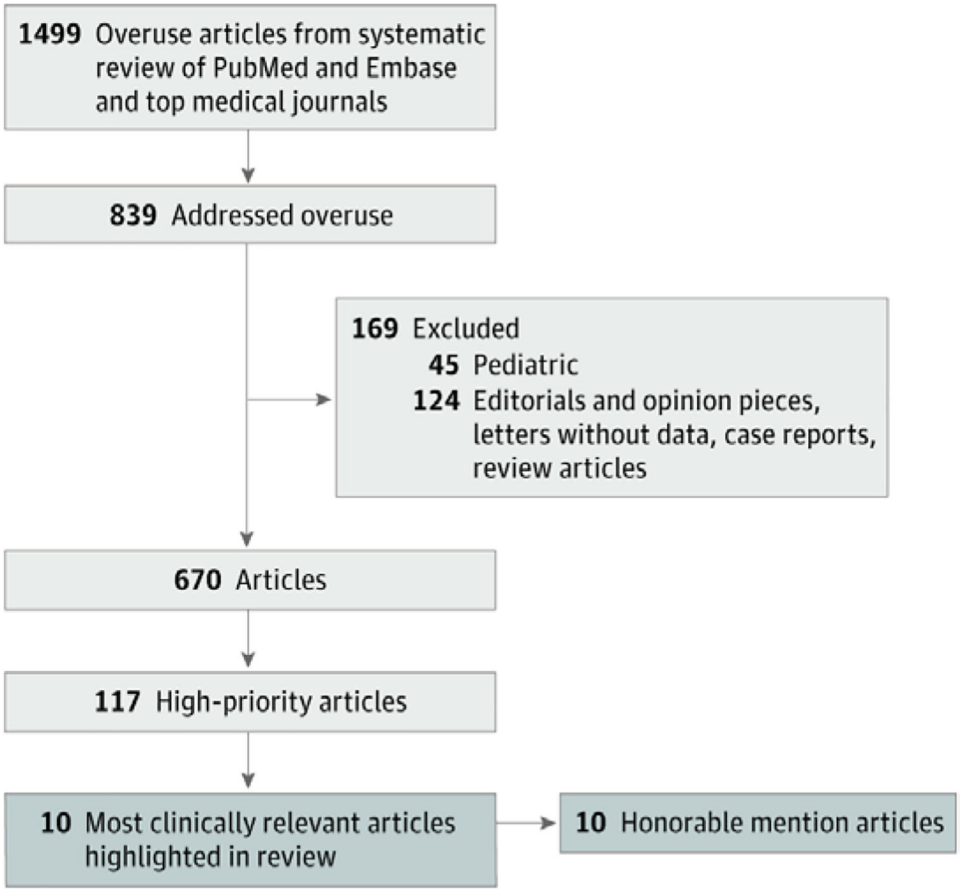

Figure. Review Process for All 12018 Articles From 10 Major Journals

Major journals include *Lancet, JAMA, JAMA Internal Medicine, Annals of Internal Medicine, Medical Care, PLoS Medicine, Journal of General Internal Medicine,* and *Journal of Hospital Medicine*

Table.

Honorary Mention Articles

Journal	Article	Article Title
JAMA Internal Medicine	Dvorin et al[23]	High Frequency of Systemic Corticosteroid Use for Acute Respiratory Tract Illnesses in Ambulatory Settings
BMJ	Gafoor et al[24]	Antidepressant Utilisation and Incidence of Weight Gain During 10 Years' Follow-up: Population Based Cohort Study
BMJ	Khera et al[25]	Impact of 2017 ACC/AHA Guidelines on Prevalence of Hypertension and Eligibility for Antihypertensive Treatment in United States and China: Nationally Representative Cross Sectional Study
American Journal of Hospice and Palliative Care	Lambden et al[26]	Association of Perceived Futile or Potentially Inappropriate Care With Burnout and Thoughts of Quitting Among Health-Care Providers
BMJ	Paalova et al[27]	Subacromial Decompression Versus Diagnostic Arthroscopy for Shoulder Impingement: Randomised, Placebo Surgery Controlled Clinical Trial
JAMA	Salminen et al[28]	Five-Year Follow-up of Antibiotic Therapy for Uncomplicated Acute Appendicitis in the APPAC Randomized Clinical Trial
Journal of Preventive Medicine & Public Health	Seo and Langabeer[29]	Determinants of Potentially Unnecessary Cervical Cancer Screenings in American Women
American Journal of Clinical Pathology	Sun et al[30]	Repeating Critical Hematology and Coagulation Values Wastes Resources, Lengthens Turnaround Time, and Delays Clinical Action
Journal of General Internal Medicine	Zhou et al[31]	Regional Supply of Medical Resources and Systemic Overuse of Health Care Among Medicare Beneficiaries
Journal of Emergency Medicine	Zitek et al[32]	Most Transfers From Urgent Care Centers to Emergency Departments Are Discharged and ManyAre Unnecessary

Abbreviations: ACC, American College of Cardiology; AHA, American Heart Association; APPAC, Appendicitis Acuta.