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# 2018 Update on Medical Overuse

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**IMPORTANCE** Overuse of medical care is a well-recognized problem in health care, associated with patient harm and costs. We sought to identify and highlight original research articles published in 2017 that are most relevant to understanding medical overuse.

**OBSERVATIONS** A structured review of English-language articles published in 2017 was performed, coupled with examination of tables of contents of high-impact journals to identify articles related to medical overuse in adult care. Manuscripts were appraised for their quality, clinical relevance, and impact. A total of 1446 articles were identified, 910 of which addressed medical overuse. Of these, 111 articles were deemed to be the most relevant based on originality, methodologic quality, and scope. The 10 most influential articles were selected by author consensus. Findings included that unnecessary electrocardiograms are common (performed in 22% of patients at low risk) and can lead to a cascade of services, lipid monitoring rarely affects care, patients who were overdiagnosed with cancer experienced anxiety and criticism about not seeking treatment, calcium and vitamin D supplementation does not reduce hip fracture (relative risk, 1.09; 95% CI, 0.85-1.39), and pregabalin does not improve symptoms of sciatica but frequently has adverse effects (40% of patients experienced dizziness). Antipsychotic medications increased the severity of delirium in patients receiving hospice care and were associated with an increased risk of death (hazard ratio, 1.7; $P = .003$), and robotic-assisted radical nephrectomy was without benefits by being slower and more costly than laparoscopic surgery. High-sensitivity troponin testing often yielded false-positive results, as 16% of patients with positive troponin results in a US hospital had a myocardial infarction. One-third of patients who received a diagnosis of asthma had no evidence of asthma. Restructuring the electronic health record was able to reduce unnecessary testing (from 31.3 to 13.9 low-value tests performed per 100 patient visits).

**CONCLUSIONS AND RELEVANCE** Many current practices were found to represent overuse, with no benefit and potential harms. Other services were used inappropriately. Reviewing these findings and extrapolating to their patients will enable health care professionals to improve the care they provide.

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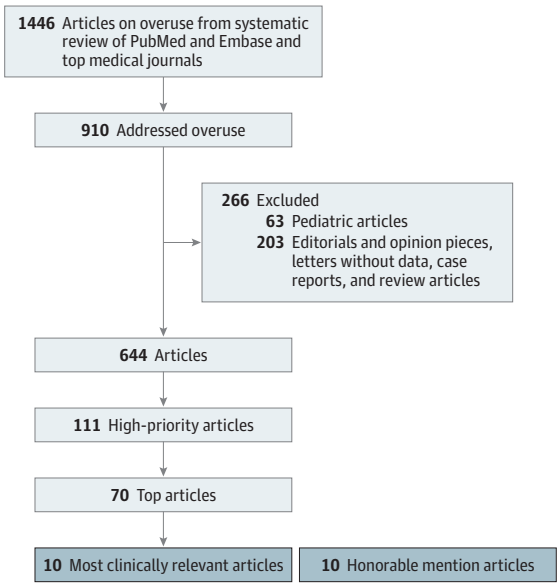
This article is the fifth annual update on medical overuse.[1-4] The body of literature continues to expand, with growing attention on overuse noted in the published literature in 2017. Among patients surveyed in the National Poll on Healthy Aging, only 14% believed that for "medical treatment, more is usually better,"[5(p1)] while 25% thought that their clinicians recommended medications, tests, or procedures they did not need. These newer findings are in contrast with older studies reporting that patients desired more care and distrusted recommendations for less care; these newer findings suggest a possible shift in patient attitudes. In a similar vein, a survey of physicians from the American Medical Association Physician Masterfile discovered that physicians estimated that 21% of medical care was unnecessary.[6]

There is a growing sentiment that overuse stems largely from the misinterpretation of clinical evidence. A systematic review of clinicians' understandings of the benefits and harms of treatment identified a tendency to overestimate benefit and underestimate harm.[7] A similarly positioned editorial highlighted how the often-cited recommendation to finish a course of antibiotics is without evidence and is likely to be more harmful than beneficial in patients who are feeling better.[8] The sham-controlled ORBITA (Objective Randomised Blinded Investigation with optimal medical Therapy of Angioplasty in stable angina) trial of percutaneous coronary artery intervention (PCI) for stable angina, which found no benefit to placing stents in lesions in patients with stable angina, drew extensive attention.[9] An accompanying editorial questioned if ORBITA was the "last nail in the coffin for PCI in stable angina,"[10(p3)] recognizing that this procedure generally represents overuse.

Within the clinical community, there were also signs of opposition to the focus on medical overuse. High-profile criticism included a *New England Journal of Medicine* perspective piece implying that medical overuse was a crusade that oversimplifies medical

Figure. Review Process for All 2017 Titles From 10 Major Journals




The major medical journals included *The Lancet*, *The BMJ*, *JAMA*, *JAMA Internal Medicine*, *New England Journal of Medicine*, *Annals of Internal Medicine*, *Medical Care*, *PLOS Medicine*, *Journal of General Internal Medicine*, and *Journal of Hospital Medicine*.

care, focusing on cost savings rather than individualized patient need.[11] This piece likely captured the sentiments of physicians who are resistant to questioning of their practices and fear that reducing overuse would inevitably lead to diminished autonomy and challenges in securing needed care for their patients. Eloquent responses appeared in Medscape[12] and *The BMJ*[13] identifying the contention as a defense of the status quo and highlighting the important repercussions of not reducing unnecessary care, which may ultimately result in poorer patient care and further increases in costs. This article examines and describes 10 of the most important studies published in 2017 concerning medical overuse in the care of adult patients.

## Methods

### Literature Search and Article Selection Process

We selected articles through a structured review of studies, coupled with examination of tables of contents of high-impact journals, published in 2017 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 human studies and English language. One of 4 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 of us reviewed the titles of all articles published in 2017 in 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 guidelines.[14]

Table. Articles Identified as Important for Medical Overuse

| Title | Journal | Author and Year |
|---|---|---|
| US Drug Marketing: How Does Promotion Correspond With Health Value? | *The BMJ* | Greenway and Ross,[25] 2017 |
| Effect of Intra-Articular Triamcinolone vs Saline on Knee Cartilage Volume and Pain in Patients With Knee Osteoarthritis: A Randomized Clinical Trial | *JAMA* | McAlindon et al,[26] 2017 |
| Changes in Percutaneous Coronary Interventions Deemed Inappropriate by Appropriate Use Criteria | *Journal of the American College of Cardiology* | Hannan et al,[27] 2017 |
| The Frequency of Unnecessary Testing in Hospitalized Patients | *American Journal of Medicine* | Koch et al,[28] 2018 |
| Women's Awareness of and Responses to Messages About Breast Cancer Overdiagnosis and Overtreatment: Results From a 2016 National Survey | *Medical Care* | Nagler et al,[29] 2017 |
| Priority Levels in Medical Intensive Care at an Academic Public Hospital | *JAMA Internal Medicine* | Chang et al,[30] 2017 |
| Percutaneous Coronary Intervention in Stable Angina (ORBITA): A Double-Blind, Randomised Controlled Trial | *The Lancet* | Al-Lamee et al,[9] 2018 |
| Breast Cancer Screening in Denmark: A Cohort Study of Tumor Size and Overdiagnosis | *Annals of Internal Medicine* | Jørgensen et al,[31] 2017 |
| Effect of Using the HEART Score in Patients With Chest Pain in the Emergency Department: A Stepped-Wedge, Cluster Randomized Trial | *Annals of Internal Medicine* | Poldervaart et al,[32] 2017 |
| Dual Health Care System Use and High-Risk Prescribing In Patients With Dementia: A National Cohort Study | *Annals of Internal Medicine* | Thorpe et al,[33] 2017 |

The structured literature review identified 1446 articles, 910 of which addressed medical overuse (Figure). After excluding 63 pediatric articles and 203 editorials or opinion pieces, letters without data, and case reports or review articles, 644 articles remained. Of these, 111 articles (17.2%) were ranked as the most relevant by at least 1 of the same 4 of us based on quality of methods, magnitude of clinical effect, and number of patients potentially affected (Figure). Using the same criteria, all of us evaluated these 111 articles. From the 70 most highly rated articles, the 10 most relevant studies[15-24] were selected by consensus among all of us and are highlighted in this article, organized into the categories of *overuse of testing*, *overdiagnosis*, *overtreatment*, *services to question*, and *methods to reduce overuse*. The 10 next most relevant articles are listed in the **Table**.[9,25-33]

## Results

### Overtesting

#### Unnecessary ECGs Appear to Be Common and May Lead to a Cascade of Downstream Services

**Background** | Guidelines recommend against routine electrocardiograms (ECGs) in low-risk asymptomatic adults.[15,34] Rates of ECG testing in low-risk patients have been described in the United

States,[35,36] but the extent to which unnecessary ECGs lead to additional cardiac testing or clinical harm to patients had not been well characterized.

**Results** | A population-based study evaluated rates of unnecessary ECGs in more than 2.8 million low-risk patients in Ontario, Canada, between 2010 and 2015 and assessed resultant downstream services.[15] Eligible patients were adults without hypertension or diabetes who were seen in primary care who had no documented cardiac diagnoses or prior procedures. Overall, 22% of low-risk patients had a "low-value" (or not indicated) ECG performed within 30 days of a primary care visit. Substantial geographic variation (<1% to 24%) and individual physician variation (7% to >50%) was noted. Compared with patients who had no ECG testing, those who had undergone ECG testing had higher odds of subsequent stress testing (adjusted odds ratio, 6.5), echocardiograms (adjusted odds ratio, 7.1), and cardiologist consultation (adjusted odds ratio, 5.4). Adverse cardiac outcomes were rare in both groups.

**Implications** | Unnecessary ECGs appear to be common and may be associated with additional cardiac services, including testing and specialty consultation. Despite general acceptance that a single overused test or treatment may lead to a cascade of additional downstream services, this is one of the few studies to characterize the overuse cascade. Although these associated downstream services represent waste in the system, infrequent demonstrable clinical harm to patients is reassuring. However, the scope of assessed harms was limited to adverse cardiac events. For a more comprehensive understanding of the consequences of overuse, future studies should extend the assessment of harms to also capture psychological effects, cost, and treatment burden.[37] Downstream testing and associated negative consequences may result from seemingly innocuous tests done "just to be safe."

### Lipid Panels Commonly Ordered in Statin-Treated Patients Appear to Seldomly Affect Care

**Background** | European and US guidelines for lipid-lowering therapy are currently based on assessment of overall risk for cardiovascular disease and not on lipid values, with no specified goal for cholesterol level.[16,38,39] However, recommendations for periodic monitoring of lipids in patients treated with statins are not clear, with some directives to repeat as often as every 3 months. Since the shift to risk-based prescribing, lipid testing practices and the extent to which lipid values should contribute to clinical decision making in patients treated with statins has not been described.

**Results** | Medical record review of 210 randomly selected primary care patients being treated with statin therapy assessed the frequency of lipid panel testing and documented the rationale for testing and resultant changes in lipid-lowering therapy during a 3-year period.[16] A total of 634 lipid tests were performed, with a median of 3 tests per patient (range, 0-11). Basic rationale was documented for 87.1% of tests (n = 183) and listed most commonly as "monitoring" (69.5% [n = 146]); patient request was a rare driver of tests (4.3% [n = 9]). There was no change in therapy after 86.4% of tests (548 of 634).

**Implications** | Lipid testing remains common in patients being treated with statin therapy but rarely leads to therapeutic adjustments. Lipid testing is justified primarily to monitor and enhance adherence.[38,39] Although lipid testing is associated with statin adherence, clinician visits are actually more highly correlated with statin adherence,[40] so testing may not be necessary to optimize adherence. This study's finding that testing seldom results in treatment changes suggests that frequent lipid testing may represent overuse. Clinicians should perform lipid testing in patients being treated with statin therapy only if it will affect care. Future guideline panels should reconsider testing recommendations.

## Overdiagnosis

### Overdiagnosed Cancer Can Be Difficult on Patients

**Background** | Most thyroid cancers diagnosed in the United States are likely overdiagnosed.[17,41,42] That is, they represent "disease" that would never have an effect on patients such that discovering them leads to more patient harm than benefit. Little is known about the experience of patients who are aware they have been overdiagnosed with thyroid or other cancers.

**Results** | Of 22 participants who questioned the need for physician-recommended interventions for an asymptomatic thyroid finding that was suspicious for or known to contain cancer, 18 decided not to be treated.[17] In semistructured interviews, participants reported being told they were "stupid," "wrong," or "crazy" for not pursuing the recommended care and experienced significant anxiety about this decision. Participants expressed a desire to support other patients who pursued nonintervention, but they were rarely successful in connecting with such patients. Participants were equally divided about whether they were glad that the abnormality was discovered in the first place.

**Implications** | Patients who were aware that they were likely overdiagnosed with thyroid cancer experienced anxiety and isolation surrounding their diagnosis. Similar issues are likely faced by patients who are potentially overdiagnosed with other cancers and diseases. Efforts to support these patients are needed, including teaching clinicians how to care for overdiagnosed patients and developing peer support networks.

## Services to Question

### Calcium and Vitamin D Supplementation Do Not Appear to Reduce Fracture Risk Among Community-Dwelling Adults

**Background** | Osteoporotic fractures are common among older adults, resulting in morbidity with significant economic and social burdens.[18] Published meta-analyses vary in relation to the purported benefit of calcium and vitamin D supplementation for fracture reduction and did not include several recently published randomized trials.

**Results** | A meta-analysis of 33 randomized trials involving 51 145 community-dwelling adults older than 50 years found that supplementation with calcium, vitamin D, or combined calcium and vitamin D did not reduce risk of fracture compared with placebo or no treatment.[18] Specifically, supplementation did not reduce risk for the

primary outcome of hip fracture (calcium: relative risk, 1.53; 95% CI, 0.97-2.42; vitamin D: relative risk, 1.21; 95% CI, 0.99-1.47; combined calcium and vitamin D: relative risk, 1.09; 95% CI, 0.85-1.39) or the secondary outcomes of nonvertebral fracture, vertebral fracture, and total fracture. Subgroup analyses based on sex, history of fractures, baseline vitamin D levels, dietary calcium intake, and calcium or vitamin D dose similarly demonstrated no benefit to supplementation.

**Implications** | Supplementation with calcium and vitamin D for community-dwelling adults should be discouraged. A second systematic review of supplementation for the US Preventive Services Task Force similarly found no fracture benefit but found an increase in kidney stones among patients treated with calcium and vitamin D, suggesting net harm from supplementation.[43] As with many vitamin and mineral supplements, although a physiological rationale can be invoked, clinical benefit is elusive.

### Pregabalin May Be Ineffective for Sciatica, With Frequent Adverse Effects

**Background** | Use of gabapentinoids (gabapentin and pregabalin) for the treatment of chronic pain has risen dramatically in the United States and the United Kingdom since 2012.[19] There are growing concerns about overprescribing of gabapentinoids by physicians, the potential for abuse, and resultant patient harm, including suicidality and death.[44,45] Sciatica, defined in this study as posterior or posterolateral radiating leg pain, is a common condition for which evidence of effective therapies is limited. Given the possible effectiveness of gabapentinoids for other forms of neuropathic pain, such as diabetic neuropathy,[46] clinicians have been prescribing these drugs to patients with sciatica.

**Results** | A randomized trial compared pregabalin (n = 106) with placebo (n = 101) in adults with moderate to severe sciatica with a duration of 1 week to 1 year; study drug doses were escalated as tolerated to a maximum (for pregabalin) of 600 mg daily.[19] There were no differences between the groups in any efficacy outcomes including leg pain at 8 weeks (the primary outcome) or 1 year, disability, back pain, or quality of life. This study included patients with both subacute and chronic pain; results did not differ between patient groups based on symptom duration. Although serious adverse events were rare, adverse effects were more common in the pregabalin group, particularly dizziness (39.6% [42 of 106] vs 12.9% [13 of 101]).

**Implications** | Pregabalin appears to be ineffective in patients with sciatica, yet adverse effects are common, so it should not be prescribed. Similarly, a recent meta-analysis of 9 randomized trials evaluated the effectiveness of anticonvulsants in patients with low back pain and found minimal to no pain relief with these medications, yet the significant adverse effects included dizziness, fatigue, and difficulties with mentation.[47] Taken together, these results remind physicians to limit prescribing of gabapentinoids to conditions and patients for whom direct evidence supports benefits that will outweigh the well-described potential harms.

### No Apparent Benefit of Antipsychotics for Delirium in Palliative Care

**Background** | Antipsychotic medications are commonly used for delirium despite limited supporting data.[20] Rigorous trials of antipsychotics for delirium in the intensive care unit found no benefit,[48,49] although select studies have professed certain benefits. Many patients receiving palliative care experience delirium.

**Results** | In an 11-site, double-blind trial, 247 patients with delirium who were receiving palliative care in Australia were randomized to receive placebo, haloperidol, or risperidone.[20] The primary outcome, severity of delirium at day 3, was increased for patients receiving haloperidol ($P$ = .009) and risperidone ($P$ = .02). Patients receiving haloperidol or risperidone had more extrapyramidal effects, and those given haloperidol (compared with placebo) were at an increased risk of earlier death (hazard ratio, 1.7; $P$ = .003).

**Implications** | Antipsychotics do not appear to improve and may worsen delirium among patients receiving palliative care. Furthermore, this well-conducted trial supports previous meta-analyses reporting no benefit to antipsychotics for the prevention or treatment of delirium generally.[50] Antipsychotics are frequently used for their sedating effects in patients with dementia, but growing evidence calls into question their effectiveness and association with increased mortality.

### Robotic-Assisted Surgery for Radical Nephrectomy Does Not Appear to Improve Outcomes

**Background** | The use of robotic surgery has increased in recent years as hospitals feel compelled to offer the latest innovations.[21,51]

**Results** | A retrospective cohort study found that the use of robotic-assisted radical nephrectomy increased from 1.5% of all radical nephrectomy procedures in 2003 to 27.0% of all radical nephrectomy procedures in 2015 ($P$ < .001 for trend).[21] There were no significant differences in postoperative complications compared with laparoscopic nephrectomy, but robotic-assisted radical nephrectomy had higher rates of prolonged (>4 hours) operating room time (46% vs 26%; 95% CI for absolute difference, 14%-27%) and higher mean 90-day direct hospital costs (increase of $2678; 95% CI, $838-$4519).

**Implications** | Robotic surgery for radical nephrectomy increased operating room time and costs without improving clinical outcomes. Robotic surgery does not appear to improve outcomes compared with laparoscopic surgery.[52] Novel technologies should be scrutinized to ensure that they add value; higher costs must have accompanying improved outcomes compared with the standard of care.

### High-Sensitivity Troponin Test Results Rarely Reflect Myocardial Infarction

**Background** | High-sensitivity troponin tests are commonly used worldwide and are being rapidly adopted in the United States.[22]

**Results** | A prospective cohort study measured results of high-sensitivity troponin tests in 8500 patients who presented to the emergency departments in the United Kingdom and United States.[22] In 1054 unselected consecutive patients in the United Kingdom, 144 (13.7%) had elevated troponin concentrations but only 1.6% of these reflected traditional (or type 1) myocardial infarction (in which coro-

nary artery thrombus results in myocardial infarction). In patients for whom physicians ordered troponin testing, the positive predictive value for myocardial infarction was 59.7% in the United Kingdom and 16.4% at a US hospital. Only 51% of US patients whose troponin levels were tested had chest pain. Among patients tested in the United States, troponin levels were elevated in 25.4% of patients, although only 4.2% had a myocardial infarction; patients with true-positive troponin test results more commonly had chest pain, electrocardiographic changes, and cardiovascular risk factors.

**Implications** | High-sensitivity cardiac troponin levels are commonly elevated in unselected patients who present to the emergency department but rarely reflect myocardial infarction. The positive predictive value of elevated troponin levels for myocardial infarction is particularly low when used indiscriminately, as done in the United States. Troponin tests, like other diagnostic tests, are most helpful when ordered thoughtfully, particularly when the pretest probability of a positive result is neither very high or low.

## Methods to Reduce Overuse

### Many Patients With a Diagnosis of Asthma Do Not Have Asthma

**Background** | Asthma guidelines recommend using spirometry for diagnosis and stepping down treatment when patients achieve good control of their disease.[23,53] Poor physician compliance with these guidelines has been reported,[54] which could result in misdiagnosis of asthma and unnecessary treatment.

**Results** | Among 613 Canadians sampled via random digit telephone dialing who reported receiving a diagnosis of asthma in the last 5 years, 203 (33.1%) had asthma ruled out by the study's assessments, including longitudinal spirometry testing and weaning from asthma medication.[23] Participants were more likely to retain a diagnosis of asthma if (1) their original diagnosis was made with spirometry, (2) they were using asthma medications daily, and (3) they reported symptoms, such as dyspnea and wheezing. A total of 213 participants had all asthma medications successfully tapered to discontinuation. Twelve patients were found to have alternative diagnoses, including several serious cardiopulmonary conditions that had been misdiagnosed as asthma.

**Implications** | A sizeable proportion of patients who believe they have asthma no longer have or never had asthma. Greater use of spirometry at diagnosis, reevaluation of asthma diagnoses, and the commitment to appropriately taper down asthma treatments can both unburden patients from having asthma diagnoses and treatments and potentially uncover serious conditions misdiagnosed as asthma. Improving compliance with guidelines has the potential to improve the quality of patient care and reduce unnecessary treatment and labeling.

### Restructuring the Electronic Health Record to Prevent Overtesting

**Background** | Testing is common in the US health care system, with more than 4 billion tests ordered annually.[24] The electronic health record allows for more organized and streamlined test ordering. Many electronic health record–based ordering innovations have been focused on improving the ease of ordering without regard to appropriateness, which was the case in Portugal. Investigators performed a cluster randomized trial[24] that had 2 main components: removal of low-value tests and creating evidence-based support based on US Preventive Services Task Force recommendations (color coding in the order entry system reflecting recommendations for or against tests).

**Results** | Investigators evaluated the number of tests ordered per visit before and after the intervention across 14 primary care clinics (7 intervention and 7 control), 117 physicians, and more than 20 000 patients from June 1, 2012, to January 31, 2013.[24] Clinics in the intervention group decreased the use of removed low-value tests from 31.3 to 13.9 tests performed per 100 visits ($P < .001$). With the evidence display function, US Preventive Services Task Force nonrecommended tests decreased modestly from 11.8 to 9.8 tests performed per 100 visits ($P < .01$).

**Implications** | Modifying the electronic health record to make low-value tests less easy to order, coupled with recommendations about the value of tests, decreased test ordering by physicians. This study is an important addition to the burgeoning evidence supporting interventions to reduce unnecessary testing, many of which leverage the electronic health record.[55] This form of diagnostic stewardship that guides testing without restricting tests has promise as a first step toward sustainably reducing overtesting.

## Discussion

In 2017, the literature on overuse continued to expand, with the identification of services that are being overused and reporting of strategies or approaches to reduce such tests and therapeutics. Overuse is increasingly recognized as common by both patients and physicians.[5,6]

These 10 most relevant studies revealed 3 major themes related to overuse: overenthusiasm for new services driving overuse, new evidence exposing previously accepted practices as overuse, and methods to limit unnecessary care. In the first category, we saw rapid growth in the use of robotic surgery, inappropriate prescribing of gabapentinoids, and overreliance on high-sensitivity troponin tests among patients presenting to the emergency department. In each of these cases, enthusiasm for a new test, treatment, or procedure spread rapidly in situations that were not supported by the evidence, which led to excessive use and potential patient harm.

This article includes studies that questioned traditional medical approaches. "Routine" ECGs and lipid testing were revealed as widespread but unnecessary, antipsychotic medications were found to be harmful in patients with delirium who were receiving palliative care, and calcium and vitamin D did not improve fracture outcomes in community-dwelling older adults. Furthermore, clinical diagnoses of asthma were found to be frequently reversible, emphasizing the need for clinicians to continuously challenge our own assumptions.

A few studies highlighted the methods for reducing overuse and the repercussions of doing so. In a Portuguese study,[24] the electronic health record was successfully leveraged to promote guideline-

concordant care to reduce overtesting with an approach that is probably broadly applicable. We also included a study[17] that describes the experience of patients who, along with their physicians, challenged the medical culture of doing "everything," revealing feelings of isolation and fear among patients treated conservatively for overdiagnosed thyroid cancer. As the paradigm shifts toward less aggressive care, the medical community must remain aware of shifting patient needs and improve our ability to manage the harms of overuse, including the psychological effect on patients.

## Conclusions

The field of medical overuse seeks to ensure the application of best clinical evidence. Interest in this area continues to grow. Training the medical community and the next generation of physicians to use societal resources most appropriately to ensure the best and most humane delivery of medical care is critical for medicine to effectively serve the public.


### ARTICLE INFORMATION

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*Concept and design:* Morgan, Dhruva, Coon, Wright.
*Acquisition, analysis, or interpretation of data:* All authors.
*Drafting of the manuscript:* Morgan, Dhruva, Korenstein.
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