

# Rational test ordering in family medicine

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A 54-year-old man, P.H., presented to his GP for a “health check.” He was well, with no relevant past medical history or family history. The GP examined him and requested “routine screening bloods” from the computer software program: full blood count; electrolyte, urea, and creatinine levels; liver function tests (LFTs); blood glucose level; lipid levels; thyroid-stimulating hormone level; iron studies; prostate-specific antigen level; and vitamin B12, folate, and vitamin D levels. The test results were all normal apart from mildly elevated transaminase levels. The GP telephoned P.H. and suggested repeating the LFTs in 1 month. The repeat test results were abnormal and P.H. was referred for hepatitis serology and an antinuclear antibody test (the results of both were normal), and for an upper abdominal ultrasound scan. The ultrasound results were normal apart from an incidental 3.5-cm lesion in the right kidney suggestive of an angiomyolipoma (AML), with a recommendation for further investigation. The patient was recalled, causing him great anxiety about a possible malignant cause. A computed tomography (CT) scan confirmed the AML, although it led to a further recommendation for follow-up in 12 months to monitor size. Repeat LFT results were normal.

## Issues with nonrational test ordering

This case study illustrates a number of issues associated with nonrational test ordering. These include the following:

- failure to apply evidence-based guidelines (in this case, appropriate screening tests for asymptomatic patients);
- interpretation and monitoring of mildly abnormal test results;
- investigation momentum—the cascade of tests following an inconclusive result;
- potential for incidental, non-significant findings to provoke anxiety; and
- potential for patient harm (in this case radiation from repeated CT scans as well as psychological morbidity).

## Evidence

Pathology, imaging, and other investigations are essential elements of screening for and diagnosing disease, and monitoring response to therapy. Laboratory testing and diagnostic imaging have increased markedly in many countries,<sup>1-3</sup> and family physicians initiate a large proportion of these tests.<sup>4</sup>

While some of this increase might be appropriate, reflecting advances in technology and knowledge, overtesting is increasingly recognized as an important issue

in family practice.<sup>2,5</sup> Many commonly ordered tests are identified areas of concern, including measurement of vitamin D level<sup>6</sup> and prostate-specific antigen level,<sup>7</sup> screening mammography,<sup>8</sup> lumbar spine x-ray scans,<sup>9</sup> and shoulder imaging.<sup>10</sup> Australian data suggest 25% to 75% of pathology testing is unsupported by evidence or expert opinion.<sup>4</sup>

As well as the cost of unnecessary tests, unexpected abnormal results can create management dilemmas.<sup>11</sup> For example, tumours of questionable clinical importance identified during medical imaging, so-called incidentalomas, might be problematic to interpret and manage (as in the case study above).<sup>12</sup> Although nonrational test ordering might occasionally identify serious occult disease (for example, if the AML in the case above had been a renal cell cancer), such testing is nonetheless unjustified owing to poor positive predictive value.

Difficulty interpreting false-positive and non-significant abnormal results can precipitate a cascade of further tests.<sup>13,14</sup> Beyond cost, inconvenience, and patient anxiety, this cascade has patient safety implications. For example, CT scanning in children in 1 year in the United States is projected to cause nearly 5000 future cancers.<sup>15</sup> Overtesting might also lead to overdiagnosis of conditions that will produce neither symptoms nor premature mortality.<sup>5</sup> Subsequent treatment then risks iatrogenic harm.

Influences on test ordering include doctors, patients, practices, and systems.<sup>16-21</sup> The decision to order investigations involves a complex interplay of often conflicting considerations.<sup>22</sup>

## Practical approaches

In this evidence-based summary for family physicians, we propose a number of practical approaches to rational test ordering.

**Undertake a thorough clinical assessment.** The physical examination skills of doctors have been described as having declined,<sup>23</sup> with “excessive reliance on the results of empirical tests” replacing clinical acumen.<sup>24</sup> History taking and physical examination remain paramount in patient assessment<sup>25</sup> and in estimating pretest probabilities. Investigations should be only an adjunct to comprehensive clinical assessment.

**Consider the probability and implications of a positive test result.** Before any test is ordered, sensitivity,

specificity, predictive values, pretest probability, and likelihood ratios must be considered.<sup>26</sup> In the low pretest probability setting of family practice, false-positive results are common, even for tests with reasonable specificity. For example, a healthy person subjected to 10 unnecessary tests has a 40% chance of at least 1 false-positive result.<sup>24</sup> Clinicians will infrequently know exact pretest probabilities but can act upon informal understanding of the probability of illness based on wider information and their clinical experience.<sup>27</sup>

**Practise patient-centred care.** Patient-centred communication is associated with ordering fewer diagnostic tests.<sup>28</sup> A patient-centred approach identifies patients' concerns and expectations, and involves patients in decision making.<sup>29</sup> This includes discussion of the risks and benefits of tests and how they will influence management.

**Follow clinical guidelines or seek other specialist guidance.** Test ordering should be guided by evidence-based clinical guidelines where they exist. Examples include guidelines for the investigation of fatigue,<sup>30</sup> and preventive health and screening.<sup>31</sup> Other sources of guidance include the clinical laboratory or appropriate non-family physician specialists.


**Do not order tests to reassure the patient.** The need to reassure the patient is a common driver of overtesting.<sup>32,33</sup> However, requesting diagnostic tests for patients with a low risk of serious illness does little to reassure patients or reduce anxiety.<sup>34</sup>

**Accept a degree of uncertainty.** Undifferentiated presentations are common in family practice, and many patients will not receive firm diagnoses.<sup>35</sup> A low tolerance for uncertainty is a causative factor in overtesting.<sup>22</sup> A number of strategies for managing uncertainty have been described<sup>36</sup>—these include “watchful waiting,” allowing time for the illness to resolve or declare itself<sup>37</sup>; and “safety netting,” provision of specific information on what to expect and what to do if the patient deteriorates.<sup>38</sup>

**Use serial rather than parallel testing.** Overtesting can be driven by the imperative to “strike while the iron’s hot.” However, tests should be ordered serially (requesting further tests based on initial test results), rather than testing all at once (parallel testing).<sup>19</sup> Tests should only be requested that are indicated for that specific problem at that time, and not “just in case.” Serial test ordering allows refinement of the pretest probability before decisions are made regarding further testing. Clinicians should also avoid indiscriminate use of disease-specific test panels (eg, “polyarthritis screen” in their computer software, so-called batch testing).<sup>39</sup>

**Reflect and critically appraise test ordering.** Reflection on practice can be self-reflection or can be facilitated by a clinical supervisor or peer.<sup>40</sup> Education, audit, and targeted feedback are effective in reducing test ordering.<sup>16,21,41-43</sup> Reflection is predicated on information on best practice and on harms associated with particular tests. Test ordering is also reduced when providers are made aware of test costs.<sup>44</sup> A number of specific education and training resources have been developed to support best practices in rational test ordering, including dedicated medical journal series such as *Less is More*<sup>45</sup> and *Primum Non Nocere*,<sup>46</sup> and campaigns such as *Too Much Medicine*<sup>47</sup> and *Choosing Wisely*.<sup>48</sup>

## Conclusion

Overtesting is increasingly common and can lead to unnecessary costs to the health care system, cause patient anxiety and inconvenience, and create management dilemmas. Family physicians generate a large proportion of these unnecessary tests and have an important role to play in reducing overtesting. A practical approach can facilitate rational test ordering in family practice and contribute to a reduction in the harms associated with unnecessary tests. 

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### Competing interests

None declared

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