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## Guarding Against Overtesting, Overdiagnosis, and Overtreatment of Older Adults: Thinking Beyond Imaging and Injuries to Weigh Harms and Benefits

Most of us assume that “knowledge is power” is so obviously axiomatic that it has to be true. But right at the start of “the information age,” more than 20 years ago and thus well before our current era of big data, Ken Ringel wrote a prescient warning in the lay press about unintended negative consequences likely to derive from the wholesale acquisition of data . . . the meaning of which we do not always understand.<sup>1</sup> Ringle furthermore stressed the importance of distinguishing between data (a collection of isolated facts), information (recognition of the pattern that such data implies), knowledge (an understanding of what that information means), and wisdom (knowing how to apply knowledge in a way that improves outcomes).

In this issue of the *Journal of the American Geriatrics Society*, Jawa and colleagues present their evaluation of the information contained in a large dataset in which they found that, of the subset of older adults hospitalized after a ground-level fall, many had a second spinal injury found on advanced imaging. They go on to speculate about missed injuries that may have been present in individuals who did not have equivalent imaging and ultimately suggest a need for greatly enhanced diligence with all older adults who present after a fall.<sup>2</sup>

We have three areas of concern with regard to this analysis. The first, and least important, has to do with the “information” they believe they were able to glean from their data. Both the reliability and accuracy of large data sets like theirs have been appropriately challenged,<sup>3,4</sup> and the fact that this particular data set “has previously been used for research” should provide no reassurance in this regard. Furthermore, findings in admitted patients who underwent extensive imaging—ostensibly because of a clinical indication in at least some of them—should never be generalized to individuals in whom providers felt no need to pursue such imaging (not to mention those who were evaluated but had nothing felt to require hospitalization). Finding additional fractures in the former group may not mean that older adults routinely harbor occult fractures after a ground-level fall but merely that clinicians appropriately evaluated the subgroup of those who had relevant symptoms.

Still, we are willing to believe that the authors’ conclusions about what they found are qualitatively, if not precisely quantitatively, accurate; they seem reasonable and are consistent with results of many studies in other groups of individuals with spinal injury.<sup>5–8</sup> If young, healthy

individuals with a primary spinal fracture often harbor a second, less clinically obvious fracture, it only makes sense that the same might be true in older, frail individuals.

A much larger concern relates to the “knowledge” that supposedly derives from these findings, in particular the assumed benefit of seeking and finding every occult fracture. It is critically important to distinguish between disease-oriented outcomes (DOOs), which are typically “objective” findings that are relatively easy to measure, and person-oriented outcomes (POOs), which are effects that people actually experience. The former are often assumed to be surrogate markers for the latter, and furthermore, “fixing” the former is often believed to be important to prevent, or treat, the latter. Nevertheless, although doctors can follow an individual’s glycosylated hemoglobin, and even “treat” it, it is far more important to know whether doing so changes the likelihood that the individuals will experience preventable diabetes mellitus-related morbidity—such as crushing chest pain, nausea and vomiting due to kidney failure, or inability to speak and move one side of the body—or even to die (the ultimate POO). Challenges to traditional received wisdom about the value of following—no less attempting to normalize—many DOOs—bone density, cholesterol, blood pressure in the face of intracranial hemorrhage, prostate-specific antigen levels, among many others—are increasingly recognized as valid and important.<sup>9–12</sup> Similarly, there are calls to stop using the word “cancer” to describe cells that are unlikely to produce any clinical harm, even though they are in fact “neoplastic” under the microscope.<sup>13</sup>

Thus it is important to distinguish finding a fracture from finding a fracture that will lead to some intervention that would improve some POO. It seems highly likely that the physicians who treated the individuals included in this study did something about at least some of those extra fractures that were discovered, but surely this by no means implies that most (or even any) of the individuals so treated benefited from such action. Geriatricians know better than anyone that many spinal fractures in elderly adults are asymptomatic, and not only would routine intervention not lead to benefit, it would almost certainly produce substantial (and avoidable) harm for many of these people.<sup>14–16</sup>

This leads to our most important concern, about whether and to what extent we can derive any degree of

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“wisdom” from studies like this one—which is the critical importance of weighing any possible benefit from the proposed change in management against the possible harm that is inevitable after any large-scale medical intervention, no matter how seemingly benign. Randomized controlled trials (RCTs), appropriately considered the criterion standard for evaluating the potential benefit of an intervention, are notoriously poor at evaluating potential harm. RCTs are almost always underpowered to look for harm, they rarely look for (and thus fail to identify) harms that were not expected before the study was conducted, they almost never last long enough to evaluate harms that occur over time, and (as geriatricians so well know) they typically exclude precisely those individuals who are most at risk. But our failure to pay adequate attention to harm is not due solely to the fact that RCTs do such a poor job in this area. There is now documentation that although virtually every type of research about virtually any type of intervention places laser-like focus on the possibility of benefit, possible harm is routinely downplayed, if it is even considered at all. This is equally true of systematic reviews and of metaanalyses.<sup>17–19</sup>

With regard to the conclusions of Jawa and colleagues, even if we assume that the information derived from this data set is accurate, and also assume that at least some individuals—including even some without any clinical indication for further imaging—would benefit from enhanced vigilance, and finally also assume that such benefit would be important (in that it would improve POOs), we should never endorse an approach without knowing whether and to what degree it would also cause harm, and whether any such harm would be likely to outweigh such benefit.

The harms that can accrue from medical testing—whether screening or diagnostic—have recently been the subject of increased attention. This can be related to false-positive findings, identification of “incidentalomas,” and most importantly overdiagnosis.<sup>20–22</sup> Overdiagnosis occurs when a test finds an abnormality that is technically “true positive,” in that the individual has the pathology that is diagnosed, but that in this particular case, would never have caused actual illness even if undiscovered and untreated. Concern about overdiagnosis has been largely focused on cancer screening, where it is well known to be a major problem, but it is becoming clearer that overdiagnosis occurs, and has the potential to cause great harm, in many other areas—if not for just about every category of “disease” (infectious, vascular, genetic) and injury that exists. Because “better and better” technology can find more and more of less and less—findings that prove to be “true” (it really is a cancer cell . . . or a blood clot . . . or a fracture) under the microscope or on DNA, but would never lead to person-oriented harm if undiscovered—the common notion that advanced technology will satisfactorily mitigate this problem is not merely incorrect; in fact the more sophisticated the technology, the greater the chance of overdiagnosis.<sup>23</sup> This explains why computed tomographic pulmonary angiography leads to far more overdiagnosis of pulmonary embolism than does chest x-ray,<sup>24</sup> why advanced imaging greatly magnifies cancer overdiagnosis,<sup>25</sup> and even why we should worry that individualized genomic testing will likely create a firestorm of overdiagnosis in the near future.<sup>26</sup>

It should not be hard to imagine the potential for harm that would result if we started routinely looking for occult fractures in older adults who have undergone a trauma, particularly in individuals without a clinical indication. Should we start imaging asymptomatic older adults after a ground-level fall, we would surely find many “true positive” abnormalities (as well as false-positive ones), which would hardly be limited to fractures. It is unclear how many such people, if any, would benefit from knowing about these findings, but it is certain that at least some of them would end up being harmed through downstream additional testing and “treatment.”

Many articles conclude by calling for “further studies.” Although this is surely reasonable in at least some instances we would argue that a far more important mandate is that whatever study is done needs not merely to identify the information contained in the data that was evaluated, but also to consider whether the knowledge gained is truly important, in that it may ultimately have some effect on POOs, rather than merely on surrogate markers. Finally, we need researchers to pay attention to the possible wisdom that can be acquired from this knowledge—and this can occur only when equal attention is paid to its potential for causing harm as is almost universally, in the current medical literature, paid to the possibility of benefit.

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## REFERENCES

1. Ringle K. When more is less: The Smithsonian's dazzling, Orwellian “information age.” *Washington Post*. May 6, 1990.
2. Jawa R, Singer A, Rutigliano D et al. Spine fractures in elderly patients admitted after falling from a low-level: Incidence and outcomes. *J Am Geriatr Soc* 2016; (in press).
3. Cooper RJ. NHAMCS: Does it hold up to scrutiny? *Ann Emerg Med* 2012;60:722–725.
4. Hoffman GJ, Hays RD, Shapiro MF et al. Claims-based identification methods and the cost of fall-related injuries among US older adults. *Med Care* 2016;54:664–671.
5. Pal JM, Mulder DS, Brown RA et al. Assessing multiple trauma: Is the cervical spine enough? *J Trauma* 1988;28:1282–1284.
6. Powell JN, Waddell JP, Tucker WS et al. Multiple-level noncontiguous spinal fractures. *J Trauma* 1989;29:1146–1150.
7. Dai LY, Jia LS. Multiple non-contiguous injuries of the spine. *Injury* 1996;27:573–574.
8. Keenen TL, Antony J, Benson DR. Non-contiguous spinal fractures. *J Trauma* 1990;30:489–491.
9. Gandhi GY, Murad MH, Fujiyoshi A et al. Patient-important outcomes in registered diabetes trials. *JAMA* 2008;299:2543–2549.

10. la Cour JL, Brok J, Götzsche PC. Inconsistent reporting of surrogate outcomes in randomised clinical trials: Cohort study. *BMJ* 2010;341:c3653.
11. Martin JH, Fay MF. Surrogate end-points in clinical practice: Are we providing worse care? *Intern Med J* 2010;40:395–398.
12. Svensson S, Menkes DB, Lexchin J. Surrogate outcomes in clinical trials: A cautionary tale. *JAMA Intern Med* 2013;173:611–612.
13. Nikiforov YE, Seethala RR, Tallini G et al. Nomenclature revision for encapsulated follicular variant of papillary thyroid carcinoma: A paradigm shift to reduce overtreatment of indolent tumors. *JAMA Oncol* 2016;2:1023–1029.
14. Huybregts JG, Jacobs WC, Vleggeert-Lankamp CL. The optimal treatment of type II and III odontoid fractures in the elderly: A systematic review. *Eur Spine J* 2013;22:1–13.
15. Kherad M, Rosengren BE, Hasserijs R et al. Low clinical relevance of a prevalent vertebral fracture in elderly men—the MrOs Sweden study. *Spine J* 2015;15:281–289.
16. Jubert P, Lonjon G, de Loubresse CG. Complications of upper cervical spine trauma in elderly subjects. A systematic review of the literature. *Orthop Traumatol Surg Res* 2013;99(6 Suppl):S301–S312.
17. Saini P, Loke YK, Gamble C et al. Selective reporting bias of harm outcomes within studies: Findings from a cohort of systematic reviews. *BMJ* 2014;349:g6501.
18. Chan AW, Hróbjartsson A, Haahr MT et al. Empirical evidence for selective reporting of outcomes in randomized trials: Comparison of protocols to published articles. *JAMA* 2004;291:2457–2465.
19. Chan AW, Altman DG. Identifying outcome reporting bias in randomised trials on PubMed: Review of publications and survey of authors. *BMJ* 2005;330:753.
20. Welch HG, Schwartz L, Woloshin S. *Overdiagnosed: Making People Sick in the Pursuit of Health*. Boston: Beacon Press, 2011.
21. Moynihan R, Doust J, Henry D. Preventing overdiagnosis: How to stop harming the healthy. *BMJ* 2012;344:e3502.
22. Heath I. Overdiagnosis: When good intentions meet vested interests—an essay by Iona Heath. *BMJ* 2013;347:f6361.
23. Fatovich DM. The inverted U curve and emergency medicine: Overdiagnosis and the law of unintended consequences. *Emerg Med Australas* 2016;28:480–482.
24. Winters BS, Solarz M, Jacovides CL et al. Overdiagnosis of pulmonary embolism: Evaluation of a hypoxia algorithm designed to avoid this catastrophic problem. *Clin Orthop Relat Res* 2012;470:497–502.
25. Davies L, Welch HG. Current thyroid cancer trends in the United States. *JAMA Otolaryngol Head Neck Surg* 2014;140:317–322.
26. Hoffman JR, Cooper RJ. Overdiagnosis of disease: A modern epidemic. *Arch Intern Med* 2012;172:1123–1124.