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CLINICAL EVIDENCE

American Chiropractic Association's Participation in Choosing Wisely:

Close inspection shows no evidence to support its anti-imaging points 1 and 2.

Paul A. Oakley and Deed E. Harrison

Abstract: Recently, the American Chiropractic Association (ACA) joined the Choosing Wisely initiative which encourages participating societies to identify 5-10 tests, treatments or procedures that are perceived as commonly overutilized within their healthcare discipline. The goal is to educate patients and doctors of specific practices to question and limit their use. The ACA created their list of five strategies by an internal committee that was then approved by the ACA board of governors. The first two strategies include avoiding X-rays: Point 1 is to not X-ray a patient presenting with acute low back pain within 6-weeks of onset; Point 2 is to not perform repeat imaging to monitor patients' progress. It has recently been illustrated how this initiative has backfired causing insurance companies to use the ACA's list as profession guidelines per se, to limit financial reimbursements to chiropractors. It has also been pointed out that these two points are not evidence-based, the chiropractic and spine rehabilitation literature is profuse with high-quality and evolving evidence supporting how radiography is intimately connected to procedural approaches and patient outcomes. Herein we assess the validity of the ACA's Choosing Wisely Points 1 and 2 by inspecting the supporting references and statements. It is concluded that the supporting citations do not support the endorsement of the ACA's two points to refrain from X-ray use. Further the supporting statements are fraught with arguments from the medical perspective; that is, the practice of general medicine. Many factions within chiropractic utilize X-rays beyond 'red flag' screening and much more substantially than MDs, and these practice approaches are evidence-based, ethical and patient-centered. We recommend the ACA retracts Points 1 and 2 condemning radiography use as it is antithetical to scientific reality and to the practice of contemporary chiropractic approaches.

Indexing Terms: American Chiropractic Association, Radiography, Chiropractic

Introduction

On August 15, 2017, the American Chiropractic Association (ACA) released a statement that they had joined the '*Choosing Wisely*' program. (1) This program is spearheaded by the American Board of Internal Medicine (ABIM) which encourages heath care specialties to select 5-10 practices considered over-utilized and the program serves as an avenue to discourage practitioners from using these procedures in daily practice. (2) The ACA chose 5 procedures/treatments that they internally deemed as 'over-utilized' within current chiropractic practice. (1) It is important to note that concerns have been raised that this list was arbitrarily made from an undisclosed ACA committee who did not seek external collaboration or feedback from the profession at large or other important stakeholders including their members,

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other chiropractic state associations, chiropractic technique organizations, etc. (3) Within the list, Points 1 and 2 are statements condemning of the use of X-ray imaging for assessing patients with low back pain (LBP) of less than 6-weeks duration (Point 1) and to avoid the use of X-rays for assessing a patient's progress to treatment (Point 2). (1) Figure 1 lists the first 2 points with their supporting statements.

Figure 1: American Chiropractic Association's Choosing Wisely statements 1 and 2 with the corresponding descriptions

1. ***Avoid routine spinal imaging in the absence of clear clinical indicators for patients with acute low back pain of less than six (6) weeks duration.***

Multidisciplinary evidence-based guidelines recommend against the routine use of spinal imaging for patients with acute low back pain of less than six weeks duration in the absence of clear clinical indicators. Such indicators include, but are not limited to, history of cancer, fracture or suspected fracture based on clinical history, progressive neurologic symptoms, and infection. Doctors of chiropractic must also consider conditions that potentially preclude a dynamic thrust to the spine, which include but are not limited to, osteopenia, osteoporosis, axial spondyloarthritis and tumors. Unnecessary imaging incurs monetary cost, exposes the patient to ionizing radiation, and can result in labeling patients with conditions that are not clinically meaningful, creating a false sense of vulnerability and disability. Indeed, several studies have shown that the routine use of radiographs in the care of low back pain may result in worse outcomes than without their use.

2. ***Do not perform repeat imaging to monitor patients' progress.***

With few exceptions (e.g., the long-term management of idiopathic scoliosis) radiographic findings should not be used as outcome measures for low-back pain. There is currently no data available to support a relationship between changes in alignment or other structural characteristics and patient improvement. This practice increases costs, exposes patients unnecessarily to ionizing radiation and may distract from more meaningful outcomes. Furthermore, there is no known correlation between performing routine or repeat imaging studies to monitor a patient's condition and improved clinical outcomes or meaningful changes in patient management. Repeat imaging is appropriate only if strong clinical indications exist, such as a major change in diagnosis, documented worsening of symptoms or significant progression of disease. Failure to respond to treatment is not an indication for repeat imaging.

In a recent paper, Oakley and Harrison have at length, demonstrated that the endorsement of these 2 points by the ACA are not scientifically-based for the practice of contemporary chiropractic. (3) In fact, these 2 points are counter to much high-quality evidence (i.e. RCTs) that shows that both routine initial imaging and imaging used for monitoring spinopelvic changes in patients being treated with modern spine rehabilitation methods are indeed warranted by those chiropractors who practice such methods. (e.g. 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28) We have also demonstrated that the ACA's participation in the Choosing Wisely program has resulted in far-reaching and cascading consequences. These include stifling of conflicting data, the potential stifling of X-ray-guided, patient-specific spine rehabilitation programs (proven to improve health outcomes), and '*tragically, the ACA's adoption of the Choosing Wisely initiative led to some insurance companies including Blue Cross Blue Shield*

(BCBS) to routinely assign non-reimbursement for types of X-ray imaging claims as part of its "chiropractic services policy."' (3, p.7)

It is alarming when the ACA, which has no legal authority over practice policy anywhere, can self-select an arbitrary list of practices to condemn and ends up having such a harmful influence on insurance coverage for practicing chiropractors. It was also pointed out that there seems to be a glaring conflict of interest as Goertz, the CEO and founder of *SpineIQ*, has determined her agency deems that the practice of *not* taking X-rays is a positive '*performance measure*,' and that this has been approved by Centres for Medicare and Medicaid Services (CMS). (3) The original ACA Choosing Wisely list indicated on page 3 that '*Choosing Wisely recommendations 1 and 2 are performance measures approved by Centres for Medicare and Medicaid Services (CMS) for the 2017 Spine IQ Qualified Clinical Data Registry for Conservative Spine Care.*' For unknown reasons, this statement at the top of page 3 has been removed upon an update to the ACA's Choosing Wisely 3-page statement on June 11, 2019.

The non-transparency, seemingly overt conflict of interest over Goertz's Spine IQ '*performance measures*,' and the complete surprise to the profession upon its release renders the ACA's participation in the Choosing Wisely suspect. Herein we assess the validity of the ACA's Choosing Wisely Points 1 and 2 by inspecting the supporting citations and explanatory statements.

Examination of the 6 references in support of Point 1

Point 1 of the ACA's Choosing Wisely list states: '*Avoid routine spinal imaging in the absence of clear clinical indicators for patients with acute low back pain of less than six (6) weeks duration.*' There are 6 citations listed to support this statement: Chou et al. 2009, (29) Bussieres et al. 2008, (30) Kendrick et al. 2001, (31) Vining et al. 2014, (32) ACR Appropriateness Criteria for LBP 2016, (33) and Brinjikji et al. 2015 (34).

The 2009 Chou et al. paper (29) is a systematic review and meta-analysis on randomized controlled trials (RCTs) that compared immediate lumbar imaging versus no imaging in the treatment of LBP by 'usual care.' Since the paper is published by 3 MDs and one PhD from John Hopkins University School of Medicine, 'usual care' equates to the pharmacologic management of back pain. It is noted the study included only 6 papers, two being MRI/CT scan trials (Modic et al. (35, 36;) Gilbert et al. (37, 38)).

The remaining 4 papers that did include plain film radiography included primarily weak studies that were limited in follow-up duration, had small sample sizes, had mixed patient populations (i.e. acute and chronic LBP), or that actually showed support for routine imaging of LBP patients. The 2005 Djais et al. study (39) was a small trial with only a 3-week follow-up that simply demonstrated that patients considered to require LB X-rays (by MDs) improved less than those patients not considered to require X-rays upon initial assessment; thus, indicating they were more severe from the outset.

The 2000/2002 Kerry et al. study (40, 41) identified patients receiving X-rays of their low backs had better psychological well-being and less depression scores at 1-year follow-up. The 2001 Kendrick et al. study (31, 42) determined that the patients who received radiography were in fact more satisfied with the care they had received; patients allocated to a 'preference group' (where the decision to receive lumbar radiography is made by them) achieved clinically significant improved outcomes compared to those randomized to a non-radiography or a radiography group.

The 1987 Deyo et al. study (43) investigated the withholding of initial lumbar X-rays to patients by resident physicians at a walk-in clinic at a public hospital. They concluded no differences in patient outcomes and that it resulted in a 'substantial savings' to the 'education' group (not X-rayed). It is noted that the savings was $56 and they did not account for the costs

associated with the time it took to adequately educate the patients in the non-radiography arm. It is also noted that one-third of the education group, for various reasons, did receive X-rays by the 3-month follow-up. The authors state their trial is "clearly too small to establish the safety of withholding roentgenograms." (43, p.144)

The 11-year old Chou et al. paper (29) continues to be referenced by anti-X-ray advocates, who herald it as a definitive source of evidence for delayed imaging in the management of LBP. (1) Despite being a meta-analysis, the evidence presented is limited, and not strongly in favour of not imaging. Most importantly, this paper is for the allopathic medical management of LBP whom only require X-ray to rule out red flags; thus, this paper does not support the stance to not image patients with ALBP of less than 6-weeks duration presenting to the chiropractor.

The second reference in support of Point 1 is the Bussieres et al. (2008) X-ray guidelines (30, 44) that are known to be essentially recycled medical practice 'red flag only' guidelines (i.e. for the practice of general medicine). (45, 46, 47) Now dated, Bussieres et al. state '*Radiographs not initially indicated for non specific acute, subacute, or persistent back and neck pain (no red flags).*' (30, p.58) And if the guidelines were not already an obviously re-tooled medical management guideline, they admit the entire guideline was modelled after the UK Royal College of Radiologists '*Referral guidelines for imaging.*' (48) Bussieres et al. even state that one of the purposes of the 'chiropractic-specific' guidelines is for use in the hospital emergency room! The Bussieres guidelines also state '*Conventional radiography does not appear to be clinically useful as a screening test as evidenced by the low prevalence of serious spinal pathologies such as cancer and infection, and the poor sensitivity, predictive values, and likelihood ratios for many musculoskeletal conditions.*[112-121]' (44, p.641) It is noted that of the 10 references (49, 50, 51, 52, 53, 54, 55, 56, 57, 58) used to support the latter statement (their references 112-121), 9 of 10 are medical citations; (49, 50, 51, 52, 53, 54, 55, 56, 57) that is, guidelines for the practice of general or specialty medicine – not chiropractic. This remains the recurrent theme from those who condemn the routine use of radiography in chiropractic practice.

The third article listed in support of Point 1 is the oft-cited Kendrick study (31, 42) which we have discussed. This study does not support the ACA's Point 1.

The fourth reference to support Point 1, was the Vining et al. study (2014); (32) we point out that Goertz was a co-author and is very well knowledgeable about the details of this manuscript and how it does not support the ACA's Point 1. The purpose of this study was to determine the incidence of various lumbopelvic abnormalities in a chronic LBP population. They concluded that the incidence rates for lumbar disc herniation, spondylosis, spondylolisthesis, and sacral slope were similar to other reports in the literature and increased with age. There was no control or non-pain group for comparison. They stated: '*Each of the findings studied represent physiological states that may not only influence imaging decisions and diagnosis, but also clinical treatment and management, especially for manual therapy providers.*' (32) First, this seems to support X-ray use, but more importantly, we are at a complete loss of how this paper, on a population of chronic LBP patients, supports the position to not image patients presenting with acute LBP? This study certainly does not support the ACA's Point 1.

The fifth citation listed is the American College of Radiologists (ACR) Appropriateness Criteria for LBP (2016). (33) This guideline was created by a team of radiologists (16 of 18 authors being MDs). These guidelines are to assist medical radiologists in choosing the appropriate imaging for differing clinical scenarios of LBP and/or radiculopathy including for patients presenting with red flags raising suspicion for serious underlying conditions, such as cauda equina syndrome, malignancy, fracture, and infection. This is an obvious medical management LBP guideline and does not support the ACA's Point 1 for the practice of contemporary chiropractic approaches.

The sixth and final reference cited to support Point 1 is the 2015 systematic review by Brinjikji et al. (34) This review evaluated the frequency of degenerative spine conditions in asymptomatic subjects. Importantly, 32 of 33 included studies used magnetic resonance imaging (MRI) and not plain radiography. Thus, we question how this review could be used to support not taking a lumbopelvic X-ray on a patient presenting to a chiropractor.

It is important to note that if the point of the ACA committee was to demonstrate that degenerative findings are a common occurrence and that these are not clinically important, then it is important to discuss the meta-analysis published by the same authors, in the same year, in the same journal (Brinjikli et al. 2015b) (59). They detailed 14 studies covering 1,193 asymptomatic subjects matched to 1,904 symptomatic subjects, up to 50 years of age. They state '*MR imaging evidence of disc bulge, degeneration, extrusion, protrusion, Modic 1 changes, and spondylolysis is more prevalent in adults 50 years of age or younger with back pain compared with asymptomatic individuals.*' (59) Thus, the same authors confirmed that (MR) imaging enables the practitioner to discern between normal and abnormal subjects based on the presence of degenerative findings. This study also does not support the ACA's Point 1.

The references cited by Goertz's ACA committee are almost exclusively references from the practice of medicine and offer no valid support for their anti-imaging stance; they certainly do not support Point 1, to not X-ray chiropractic patients presenting with acute LBP within the first 6-weeks of onset.

Examination of the description in support of Point 1

As seen in Figure 1, the ACA provided a statement of explanation in support of Point 1: To not obtain imaging for patients with acute LBP during the 6-weeks after onset in the absence of red flags. We now inspect the validity of this statement.

The statement reads:

> *'Multidisciplinary evidence-based guidelines recommend against the routine use of spinal imaging for patients with acute low back pain of less than six weeks duration in the absence of clear clinical indicators. Such indicators include, but are not limited to, history of cancer, fracture or suspected fracture based on clinical history, progressive neurologic symptoms, and infection.*'

We agree 'red flags' are classic well-taught clinical indicators that warrant special consideration including definitive imaging including specialty views and/or referral for advanced imaging or medical consultation. We also note that the strict adherence to 'red flag only' practice is not appropriate for chiropractors as the clinical presentation of more serious pathology seems to be higher than the commonly reiterated occurrences in general medicine. (46, 60) For instance, it is commonly stated that the incidence of malignancy and fracture in general medicine is less than 1% (61) and 1-4%, (62) respectively. The best available evidence suggests these numbers to be equivalent to up to 3.1% for malignancy and 6.6% for fracture incidence in chiropractic practice. (60)

As we have noted previously, (46, 47, 63) because the incidence of cancer is increasing, (64) the likelihood of diagnosing malignancy is also increasing for chiropractors, and this raises obvious medico-legal concerns. (46, 47, 63) Alarmingly, the dependency on red flag questions to guide imaging can lead to serious misdiagnoses as Premkumar et al. found that 64% of patients presenting with spinal malignancy reported no associated red flags. (65) They state: '*While a positive response to a red flag question may indicate the presence of serious disease, a negative response to 1 or 2 red flag questions does not meaningfully decrease the likelihood of a red flag diagnosis. Clinicians should use caution when utilizing red flag questions as screening tools.*' (65)

It may be surprising to many that although 'red flags' are a part of most all current guidelines for low back pain, many red flags have poor or untested diagnostic accuracy. (61, 62, 65, 66, 67, 68, 69) In assessing 13 red flags for malignancy contained in LBP guidelines only two had clear empirical evidence of acceptably high diagnostic accuracy; Verhagen et al. state '*the origin of many red flags was unclear or was sourced from case reports.*' (68) In assessing 53 red flags for fracture or malignancy in LBP guidelines, only a small subset were found to have evidence for usefulness. (66) Importantly, and frustrating for clinicians, across guidelines there are large discrepancies; that is, different guidelines endorse different red flags and are incongruent. (67, 68, 69) This further adds confusion surrounding red flag validity and their usefulness in daily practice.

It is important to note that even in the practice of general medicine, the delaying of X-rays in the management of patients presenting with LBP is a debated issue. Esslemont (70) argues that guidelines are largely '*academic*' and that in clinical practice the adherence to *'ideal guidelines*' recommending delayed imaging in the early treatment of LBP patients is difficult because even a small incidence of significant pathology is significant to those patients, a 'normal' X-ray is useful from the point of view of diagnosis, patient satisfaction is very important, as often if X-rays are not taken to satisfy the patient they go elsewhere to get them, and in the end, '*balancing a patient's fears of serious illness and the doctor's fears of being sued… taking an X-ray is the likely outcome*.' Further, a patient who is in pain has this compounded by their worries about its causes as Esslemont states '*People equate cancer with pain and pain with cancer. And to wait six weeks with such a doubt would be callous.*' (70)

Chiropractors offer a very unique form of health care involving the delivery of dynamic thrusts into the spine, other body joints and tissues that naturally warrant more comprehensive patient assessment including spinal X-rays. (46, 47, 60, 63, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80) There have been many studies assessing the incidence of clinical 'indicators,' including congenital or developmental anomalies, pathologies and relative or absolute contraindications to manual spinal manipulation (Table 1). (60, 76, 77, 78, 79)

Table 1. Incidence of anomalies, pathologies and postural changes that could alter treatment, and relative and absolute contraindications to provide chiropractic treatment.

			Age		Cohort/	Postural	Congenital	Contraindications		Serious	Anomalies/
Author	Region	n	Avg (SD)	Sex	Setting	Changes	Anomalies	Relative	Absolute	Pathology	Pathologies
Jenkins	Cervical	2814	n/r	n/r	Macquarie University		28.5%				
	Thoracic	695	n/r	n/r	Chiro Clinic		0.7%				
	Lumbar	1052	n/r	n/r			18.3%				
Young	Lumbar	262	>/<50	mix	Chiro Radiologist	94%				44%	
Pryor	Cervical	413	n/r	n/r	Chiro College						91%
	Thoracic	403	n/r	n/r	Clinic						70%
	Lumbar	402	n/r	n/r							79%
Beck	Full spine	847	33 (12)	mix	New Zealand Chiro College Clinic		68.1%		6%	0.6-6.6%	
Bull	Full spine	1698	36	n/r	Macquarie University Chiro Clinic			33%	14%		66%

As shown, anomalies and pathologies that could alter chiropractic intervention strategies are very common. Also shown is that contraindications to spinal manipulation are relatively common and importantly, would alter chiropractic patient management. For example, Hazel Jenkins, who

has recently published a so-called chiropractic review on X-ray use (81) that has been substantially criticized for lacking important data and being overtly medically biased, (46) has herself stated in 2010 (with other colleagues) that '*In the cervical spine there is a 23.4% chance of finding an anomaly that contraindicates SMT of the neck completely or until further investigations are performed.*' (81 p.73) Regarding the low back, Jenkins et al. found an 18.3% chance of finding a congenital anomaly. Giles supported the Jenkins paper by stating '*The authors are to be congratulated for "thinking outside the box" rather than accepting guidelines without question*.' (80)

The controversies regarding red flags combined with the unique treatments that chiropractors perform (dynamic thrusts into the spine and related tissues) lead to obvious implications that warrant a more comprehensive patient examination including X-ray analysis beyond simple 'red flag' pathology screening. (46, 47, 60, 63, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80) If initial radiographic screening has a high chance of altering patient treatment than it is both scientifically and ethically warranted.

> *'Doctors of chiropractic must also consider conditions that potentially preclude a dynamic thrust to the spine, which include but are not limited to, osteopenia, osteoporosis, axial spondyloarthritis and tumors.'*

This is an obvious statement, again however, the ACA is only suggesting screening for serious pathology or 'red flag only' X-ray use. As we have just discussed, this is not scientifically justified for the practice of contemporary chiropractic that would alter treatment when discovering certain conditions that preclude a dynamic thrust including relative and absolute contraindications, bone anomalies, spinal deformities and postural alterations not limited to scoliosis. (46, 47, 60, 63, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80) As chiropractic clinicians are well aware, most all of these possible findings are only discovered with use of X-ray assessment.

More advanced understanding of spinopelvic biomechanical parameters and their unique interrelations, are only properly assessed via full-spine radiography, as the International Spine Study Group (ISSG) states: '*accurate assessment of ASD [adult spinal deformity] requires a thorough radiographic evaluation of both the spine and pelvis, including concomitant assessment of the cervical, thoracic, and lumbar spine, as well as the femoral heads and pelvis*.' (82) Advocates for refraining from routine X-ray use including the ACA and others continue to ignore and dismiss the substantial and critically important emergence of spinopelvic biomechanics showing the relationship between posture, spinal curves, sagittal balance and diverse health outcomes including pain, function, disability and health-related quality of life. (83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102)

It is unacceptable for chiropractic organizations, such as the ACA (1) and WFC research council, (103) to disregard a plethora of spine biomechanics evidence that is counter to their ideology. Global spine subluxation patterns or adult spinal deformity (ASD) is now known to be a significant health threat to those affected. In fact, two international spine research organizations (European Spine Study Group - ESSG; International Spine Study Group - ISSG) have both independently verified that ASD is associated with serious health consequences. (104, 105) Pellise and the ESSG determined that those having scoliosis greater than 20°, thoracic kyphosis greater than 60°, anterior sagittal balance greater than 50mm, or a pelvic tilt greater than 25° had significantly poorer SF-36 health-related quality of life scores than patients suffering from the common conditions of self-reported arthritis, chronic lung disease, diabetes, or congestive heart failure. (104) They stated '*The impact of ASD on HRQL warrants the same research and health policy attention as other important chronic diseases.*' (104)

It is important to mention that the current understanding of spinal biomechanics is so evolved that spine surgeons have deformity thresholds as goals of care; that is, there are radiographically-guided biomechanical measurements known to be associated with superior long-term patient outcomes. (82, 88, 89, 90, 92, 106, 107, 108, 109, 110, 111, 112, 113) Ironically, this published information is not isolated for use by spine surgeons, it applies to anyone treating spinal disorders! As we have stated in our critique of the Jenkins et al. review of radiography use for chiropractors, '*It is utterly shocking to us that Jenkins et al. (or any other chiropractic affiliation such as the ACA) would have the chiropractic profession believe this voluminous information doesn't exist.*' (46 p.145)

> *'Unnecessary imaging incurs monetary cost, exposes the patient to ionizing radiation, and can result in labelling patients with conditions that are not clinically meaningful, creating a false sense of vulnerability and disability.'*

Regarding the latter statement obviously X-rays do incur costs. It is pointed out however, that plain radiography is among the cheapest of the imaging modalities. Chiropractic is also known to be very cost-effective, and even more cost-effective compared to physiotherapy for ALBP patients, (114) thus the addition of a small cost for initial X-rays would be marginal. More importantly, the use of X-rays in an initial assessment proves cost-effective as it curtails the need for further, more advanced and costly imaging. (115) Jenkins et al. (81) makes the argument against initial X-ray use as often other imaging methods (i.e. MR or CT) is superior for diagnostic precision. (116) However, when MR or other advanced imaging are used over plain X-ray, it adds tremendous healthcare costs. Additionally, use of MR over X-ray leads to more costly surgeries. (117) In actuality, immediate plain X-ray imaging reduces the use of more advanced and costly imaging, and reduces very costly, unnecessary surgeries. (117) Thus, use of routine X-ray does add a small initial cost, but is not costly but actually is cost-effective. The monetary costs of initial X-rays are also a small fraction of the total cost for chiropractic treatment, regardless of chiropractic technique and ancillary therapies used. Thus, the 'cost argument' is a moot point when considering overall cost-effectiveness of patient management by chiropractors who utilize routine initial X-rays versus alternate patient triage scenarios.

Regarding patient radiation exposures, yes this is true. Today, however, there is clear understanding that the amount of radiation given to a patient from an X-ray, or even several X-rays over several years are not harmful. (118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128) Thus, no cancer would ever be expected to result from a few X-rays. Any guidelines including the ACA's Choosing Wisely strategies alluding to dangerous patient radiation exposures as rationale to avoid imaging is not an evidence-based argument. This is an antiquated notion that has been repeated by those affiliated with the ACA, (1) the WFC research council (103) and others in the chiropractic literature (81, 129) that needs to stop. We and many others have provided lengthy discussions as to the scientific merits of why X-rays are harmless to the patient, (118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128) but this information continues to be dismissed by those who repeatedly cite the authoritative regulatory and advisory bodies (ICRP, NAS BEIR, etc.) that are being heavily scrutinized for clutching on to outdated and scientifically defunct Linear No-Threshold (LNT) scientific theory. (130, 131, 132, 133, 134, 135) The latest consensus from the higher quality literature does not support cancer causation from low-dose X-rays. (136) LNT ideology is not valid for risk assessment pertaining to low-dose radiation as from spinal X-rays; it is a 'failed fiction.' (137)

Regarding the concept of '*labelling patients*,' that would lead to an illness behavior is also a statement that is reiterated stemming, again, from the general medicine paradigm. (39) The medical management of LBP is mainly pharmacological, and just as imaging does not typically alter the medical management, imaging does tend to reveal radiographic characteristics not

necessary previously known (e.g. elements of osteoarthritis). It is argued that the patient may become psychologically affected by simply learning of 'incidental findings' (IF's) – clinically insignificant findings, traditionally considered in most cases to be irrelevant. First, we would argue that incidental findings are more important in chiropractic (e.g. bone anomalies, etc.) and we agree with Coumans et al. who state: '*The management of incidental findings varies among practitioners and commonly depends more on practice style than on data or guidelines*.' (138)

Second, we argue that a resulting sense of vulnerability/disability is highly doubtful as it has been shown in repeated studies (including ones cited by the ACA) that patients receiving immediate spinal X-rays, even if the diagnostic utility is low (in medicine), are more satisfied with their care and have better outcomes. (31, 37, 38, 40, 41, 42, 139) Third, the understanding of IF's from any imaging should be explained to the patient by the doctor – this would prevent any untoward psychological development of adverse behaviors from misunderstood radiographic findings.

It is surprising the '*labelling of patients*' argument is made as just as the argument is made that doctors should educate patients about the unencessity of X-rays (for the medical management of their back pain i.e. Deyo et al. (43)) the doctor should be easily able to reassure the patient about IF's if they are indeed irrelevent. It has been stated '*Asking a physician not to be interested in or comment on extra or unforeseen findings during an examination is unconscionable*.' (140) Thus, the ideology that IF's should not be presented to a patient is nonsensical as the interpretation should be provided by the doctor that would not allow a patient's ignorant worry about an IF go on to fester into some sort of '*false sense of vulnerability or disability*' (i.e. illness behavior).

> *Indeed, several studies have shown that the routine use of radiographs in the care of low back pain may result in worse outcomes than without their use.*

This is a weak and repeated statement by anti-imaging advocates. (1, 81, 103) The Kendrick study (26, 37) is often used to support this statement, however, as discussed herein and in our response to the WFC research council who made the same claims, (141) the patients in this trial who received immediate imaging were more satisfied with the care they had received at the long-term (9-month) follow-up. Further, even in the practice of general medicine (where imaging rarely alters LBP management), there are trials demonstrating that early imaged patients have better outcomes such as the discussed Kerry et al. study (35, 36) and others. (32, 33, 139) Further, early imaging is associated with increased clinician confidence in diagnosis. (32, 33) Thus, the reiterated statement of early imaging causing 'worse outcomes' is not the consensus of the literature, it is a cherry-picked notion, and is often from misinterpreted general medicine practice trials.

Examination of the 7 references in support of Point 2

The ACA's Point 2 states '*Do not perform repeat imaging to monitor patients' progress*.' Regarding Point 2, the ACA lists 7 references. Five of the 7 references are repeated from references listed to support Point 1 (Brinjikli et al. 2015, (34) Chou et al. 2009, (29) Kendrick et al. 2001, (31, 42) Bussieres et al. 2008, (30) and ACR Appropriateness Criteria for LBP 2016 (33). Importantly, none of these citations evaluate the validity of using repeated spinal imaging to monitor a patient's progress from chiropractic treatments and do not provide any support for the ACA's Point 2.

The two remaining studies cited in support of ACA's Point 2 are from the same research group from Keio University, Tokyo, Japan (Matsumoto et al., (142) and Okada et al. (143)). The 2013 Matsumoto et al. study (142) claims to be the first to simultaneously compare MR detected degenerative changes in the lumbar and cervical spines of asymptomatic volunteers. They found 79% of subjects had evidence of 'tandem' degenerative findings. They suggested '*the physiological*

ageing process involves the whole spine, and where disc degeneration is found in one part of the spine, other parts of the spine should be examined.' (142) The 2011 Okada et al. study (143) was claimed to be the first study to investigate age related degenerative changes in the cervical spine in patients with lumbar disc herniation compared to healthy volunteers. They determined that degenerative changes increased with ageing, and that the rate of degenerative changes in the cervical spine in both the healthy (88.5%) and lumbar disc herniation subjects (98%) were high, although statistically higher in the patient group. They concluded that '*disc degeneration appears to be a systemic phenomenon.*' (143)

Although interesting MR studies, (142, 143) neither provide support for ACA's Point 2. Regarding the former Matsumoto et al. study, (142) it highlights that if degenerative findings are present upon initial MR imaging, then whole spine MR screening would be warranted. We wonder how this MR study relates to repeated X-ray imaging for monitoring patient progress from chiropractic treatments? Regarding the latter Okada et al. study, (143) again, we wonder how the high incidence of tandem degenerative findings in the cervical and lumbar spinal areas, and how tandem degeneration in both areas in symptomatic lumbar disc disease patients showing slightly higher degeneration rates has anything to do with repeated imaging to chiropractic patients by plain X-ray. It should be noted that Okada and Matsumoto and colleagues, performed a 10-year MR follow-up study on asymptomatic subjects that showed that with escalating degenerative changes, various simultaneous cervicogenic symptoms evolved, they state: '*Progression of degeneration of cervical spine on MRI was frequently observed during 10-year period, with development of symptoms in 34% of subjects.*' (144) These studies, taken together seem to warrant routine imaging to screen for degenerative findings (84% in asymptomatics (142)), whole-spine screening as it is typically systemic (88.5-98% (143)), and is associated with progressive cervicogenic symptoms. (144)

None of the 7 studies cited support the ACA's Point 2, to refrain from repeat imaging in treating patients under chiropractic care.

Examination of the description in support of Point 2

> *'With few exceptions (e.g., the long-term management of idiopathic scoliosis) radiographic findings should not be used as outcome measures for low-back pain. There is currently no data available to support a relationship between changes in alignment or other structural characteristics and patient improvement.'*

This statement is false.

This statement has been perpetuated by those condemning X-ray use in chiropractic by among others, Haas et al., (145) Bussieres et al., (30, 44) Jenkins et al., (81) Young et al., (146) Cote et al., (129) Kawchuk, Goertz, Taylor, Peterson, and the WFC research Council, (103) and currently by Goertz and the ACA. (1) The research pyramid illustrates how even a single case report is more credible evidence than 'expert opinion.' It is ironic that an organization that pushes so heavily for 'red flag only' X-ray practices, that may have weak or no diagnostic accuracy (often being based on a single study or case report), (61, 62, 65, 66, 67, 68, 69) continues to deny the existence of data in the highest form of scientific evidence, randomized controlled trials, showing spine changes correlating with patient outcomes. (4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28) The fact that health outcomes relate to spinopelvic parameters is irrefutable; it is preposterous to state there is no relation.

Using Chiropractic Biophysics technique (CBP) as an example, this technique has multiple high-quality RCTs that have been published in premier rehabilitation and chiropractic journals, (5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18) and have been presented at the major chiropractic scientific meetings including the Association of Chiropractic Colleges/Research Agenda

Conference as well as the World Federation of Chiropractic congress of which Goertz is affiliated. (141) The reiteration of statements suggesting there is no relation of spine changes to patient outcomes is an embarrassment to the chiropractic profession. Spine rehabilitation and other medical specialties, particularly the spine surgical literature has produced countless high-quality studies substantiating the association between patient outcomes and spine structural alignment. (82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113) We reiterate '*The concept that spine and postural displacements of a patient impacts their health and wellbeing is a well framed evidence-based practice in the spine literature.*' (46)

Within the practice of chiropractic and spinal rehabilitation there is ample high-quality evidence for the routine and repeated use of X-rays for treating patients with anterior head translation (forward head posture), cervical hypolordosis/kyphosis, lumbar hypolordosis, thoracic hyperkyphosis and scoliosis. (4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28) Further, as opposed to 'currently no data available,' there is also an abundance of lower level evidence supporting routine and repeated X-ray use to monitor spine/posture changes corresponding to health improvements for many other specific spinal conditions including anterior sagittal balance, (147, 148) flat back syndrome (lumbar kyphosis), (149) lateral head translation posture, (150, 151, 152) lateral thoracic translation posture (pseudo-scoliosis), (153, 154) lumbar disc herniation, (155, 156) lumbar hyperlordosis, (157) spondylolisthesis, (158, 159) straight back syndrome, (160, 161) and thoracolumbar junctional kyphosis. (162) Even a single case report is more substantive evidence than a wrong opinion.

> *'This practice increases costs, exposes patients unnecessarily to ionizing radiation and may distract from more meaningful outcomes.'*

As discussed, X-ray costs are minimal and risks to ionizing radiation exposures from X-rays are non-existent. How to state that repeated imaging may '*distract from more meaningful outcomes*' is an attempt to raise an issue that is irrelevant to their Point 2 statement. All chiropractors are well-trained in taking history, performing patient examinations etc., thus, a repeat X-ray, if taken by a chiropractor who is qualified to determine if one is warranted, knows this is but one aspect of a patient re-examination. Other assessment procedures often include collecting pain, disability and quality of life data, assessing physiological performance measures including range of motion, posture, strength tests and other functional capacity testing, etc.

> *'Furthermore, there is no known correlation between performing routine or repeat imaging studies to monitor a patient's condition and improved clinical outcomes or meaningful changes in patient management.'*

Again, this statement is utterly false. As we have summarized recently, (119, 121, 164) several well design RCTs have demonstrated patients randomized to a multimodal treatment arm that includes spinal traction that structurally changes the spine towards more ideal alignment have superior long-term outcomes as compared to patients who get randomized to the same treatment regimen less the spinal traction. (5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18) Ironically, many of these trials have been presented at the WFC conference, one winning an award, (11) of which Goertz is affiliated. This statement, therefore is not likely made from complete ignorance, but from overt negligence to acknowledge the voluminous literature contrary to their agenda.

One more item needing mentioning is that in certain chiropractic rehabilitation circles, chiropractors who practice evidence-based, spine-altering methods do, in fact need to change their treatment according to a change in the patient's spino-pelvic biomechanical parameters resulting from the corrective measures. (163, 164) Changes in patient management includes altering specific rehabilitation approaches with spine alignment improvements, or ceasing

particular rehabilitative methods once a patient's spine and posture approaches the normal/ideal alignment.

> *'Repeat imaging is appropriate only if strong clinical indications exist, such as a major change in diagnosis, documented worsening of symptoms or significant progression of disease. Failure to respond to treatment is not an indication for repeat imaging.'*

For the former statement, we agree, this is common sense. What is missing of course, is an exception for evidence-based treatment approaches that do alter spine and postural alignment, and would warrant a repeat image to assess patient response to spinal rehabilitation. This is again important as spine alignment changes could alter patient management; we have discussed this and provided ample scientific evidence. For the latter statement, this cannot be true according to the ACA's own position of avoiding initial patient X-rays. If fact, the whole argument that the ACA presents is to only X-ray after an initial trial of treatment, and then specifically because the patient fails to respond to treatment, X-rays would then be warranted (i.e. delayed initial X-rays).

Again, however, for the chiropractor who practices spine-altering methods the '*failure to respond to treatment*' could also be an indication that either, more treatment and time is needed or the treatment is not having the intended effect. Since clinical practice is not as simple as academic guidelines accept, (70) often repeat imaging for this very reason is warranted, for example, in taking stress views or correction potential views, etc. Chiropractors trained in specialty techniques that alter spine alignment are well knowledgeable in clinical encounters that run counter to this ACA recommendation.

Conclusion

There is no valid scientific evidence cited by the ACA to support their official statement of participation in Choosing Wisely regarding Point 1, to not initially X-ray patients presenting with ALBP and also regarding Point 2, to not use repeated X-rays to assess response to treatment.

Alternatively, there is sufficient and a growing body of literature showing evidence to the contrary; that is, to use X-ray for both initial assessment, including patients presenting with ALBP within the first 6-weeks, and to assess patient response to treatment when chiropractors utilize current evidence-based spinal rehabilitation practices.

The ACA's Points 1 and 2 only serve to perpetuate a false narrative that is not scientifically valid for certain types of evidence-based chiropractic and manual medicine procedures. Many factions within chiropractic utilize X-rays beyond 'red flag' screening and much more substantially than MDs, and these practice approaches are evidence-based, ethical and patient-centered.

We recommend the ACA retracts Points 1 and 2 condemning radiography use as it is antithetical to scientific reality and to the practice of contemporary chiropractic approaches.

Paul A. Oakley
DC , MSc
Private Practice
Newmarket, Ontario
docoakley.icc@gmail.com

Deed E. Harrison
DC
CBP NonProfit Inc.
Eagle, ID, USA

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