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Compliance with evidence-based radiographic imaging guidelines by chiropractic interns at a chiropractic training program

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ABSTRACT

Objective: Evidence-based radiographic guidelines are used to justify the need for radiographs and prevent their overuse. This study aimed to assess whether 4th-year chiropractic interns at the International Medical University plan to use x-ray imaging in their future private practice in line with the principles taught throughout their chiropractic program and the evidence-based imaging guidelines.

Methods: A survey questionnaire was distributed to 74 final year chiropractic interns, with 62 completed responses. The questionnaire consisted of 8 case scenarios representing potential chiropractic patients. The interns were asked to decide whether to x-ray the patient or not, and which x-ray views to request if they chose to x-ray the patient.

Results: Results were compared with the gold standard using percentage agreement. The findings revealed that the chiropractic students adhered to the gold standard answers for 6 out of 8 cases. However, they did not perform well in selecting the correct x-ray views for the 3 cases where radiography was indicated by the gold standard.

Conclusion: Results suggest that while the interns have a good understanding of when radiography is necessary, they may need additional training in selecting the appropriate x-ray views for each case.

Key Indexing Terms: Chiropractic; Education; Radiography; X-rays; Guideline Adherence

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INTRODUCTION

Radiology, which celebrated its 125th anniversary in 2020, has significantly transformed medical diagnosis across all health science disciplines.[1] Just 15 years after Wilhelm Conrad Roentgen's groundbreaking discovery of x-ray, the Palmer School of Chiropractic incorporated plain film radiography, a prevalent imaging technique, into its curriculum.[2] Since then, chiropractors have often used radiography in conjunction with chiropractic examination and physical examination to determine the presence (or absence) of pathology, congenital spinal anomalies, to assess vertebral alignment and tailor appropriate treatment plans for patients.[3] However, the potential harm of radiation exposure has sparked a debate over the indications for radiographic imaging in chiropractic practice.[4]

Chiropractic students at the International Medical University (IMU) undergo 4 years of rigorous academic and clinical training, which includes comprehensive radiographic interpretation training for common pathologies encountered in chiropractic practice. During their 4th-year internship, students are required to complete at least 60 radiographic studies, including 30 x-rays of patients under their active treatment. According to a study conducted in Klang Valley, Malaysia, it was found that there is a significant demand for chiropractic services, emphasizing the need for high levels of competency in taking and reading radiographic studies.[5]

While there is a consensus among chiropractors on the use of radiographic imaging in the presence of red flags or to rule out pathology, some practitioners advocate for routine spinal x-rays for spinal biomechanics analysis, guiding treatment, and monitoring patient progress.[6] Interestingly, there are chiropractic guidelines that do not limit x-ray indications to red flags conditions. The International Chiropractors Association Best Practice Guidelines and Practice Chiropractors' Committee on Radiology Protocol supports the routine use of x-rays, primarily for biomechanical reasoning, without excluding red flags indications.[3]

However, current radiographic imaging guidelines discourage imaging in most patients under 65 with musculoskeletal complaints during the initial 4–6 weeks of care, unless they present with red flags conditions.[7] These guidelines are based on the best evidence available from scientific research, and it

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is recommended that all practitioners adhere to them.[7] Despite the emergence of alternate imaging guidelines that support the use of imaging for biomechanical analysis, radiographic guidelines with a more restrictive red flags basis are still considered the best practice in the evidence-based published literature.[7]

Evidence-based radiographic guidelines assist chiropractors in determining the necessity of an x-ray for a patient. Inappropriate imaging can lead to potential harms such as overdiagnosis, increased radiation exposure, unnecessary costs, and missed diagnosis.[8] However, a recent Australian survey revealed that only half of the chiropractors were aware of the current radiographic guidelines for low back pain.[9]

Adherence to radiographic imaging guidelines is a hallmark of an evidence-based health care provider.[10] It is crucial for chiropractors to accurately identify valid clinical concerns that will directly affect treatment so that appropriate imaging can be ordered without delay, which could otherwise worsen the prognosis of the condition.[4] Conversely, chiropractors must be aware of the risks of ionizing radiation to patients to avoid unnecessary imaging referrals.[4]

One of the most common issues in musculoskeletal pain care is the overuse of imaging.[9] The frequency of clinicians obtaining imaging for musculoskeletal complaints varies substantially.[11] Several survey-type studies aim to determine primary care physicians' adherence to imaging guidelines.[11]

To address this, implementing guideline education within chiropractic teaching institutes and to chiropractors within the profession through workshops and seminars are among the cost-effective methods to increase awareness and adherence to evidence-based radiography guidelines.[12] Ammendolia et al.[13] proposed an education intervention strategy as a means of implementing evidence-based guidelines for imaging, which may be most effective in increasing guideline compliance among chiropractic communities.

The adherence of chiropractic interns to evidence-based radiographic imaging guidelines is crucial for accurate diagnosis and to prevent unnecessary exposure of patients to ionizing radiation.[13] This study aims to provide insight into the awareness of the evidence-based radiographic imaging guidelines and their adherence to them in referring outpatients for radiographic evaluation.

The objective of this study is to evaluate the competency of chiropractic interns in (1) identifying the need for an x-ray for their patients, (2) determining the relevant x-ray series as taught at IMU and described in recent literature, and (3) avoiding unnecessary radiographs that could expose patients to avoidable harms.

METHODS

This study employed a cross-sectional, descriptive research design to investigate the adherence of 4th-year chiropractic interns at the IMU to evidence-based imaging guidelines. The research design was chosen for its effectiveness in providing a snapshot of the population at a specific point in time, making it suitable for assessing the current state of adherence to these guidelines among the interns.

The study sample was chosen from Semester 7 (cohorts CH119) and Semester 8 (CH219) in 2022, amounting to a total of 70 chiropractic interns. These cohorts were selected as they represent the most recent interns who have undergone the full 4-year academic and clinical training program at IMU, thus providing the most up-to-date reflection of the training provided by the institution. The study was conducted with strict adherence to ethical guidelines to ensure the protection of human rights. Participation in the study was entirely voluntary, and interns were informed that they could withdraw at any time without any repercussions. All personal information collected during the study was kept confidential and used solely for the purposes of this study. The study was approved by the IMU Joint-Committee on Research and Ethics (ID BCh I-2022-10).

Data collection was conducted through the distribution of a physical survey questionnaire. This questionnaire was adapted from the study by Butt et al,[14] titled "Use of radiographic imaging protocols by Canadian Memorial Chiropractic College interns. In the original Canadian Memorial Chiropractic College (CMCC) study, a questionnaire consisting of 10 case scenarios representing potential chiropractic patients was developed.[14] These scenarios were curated to represent a spectrum of cases where radiographs might be essential, unnecessary, or subjectively warranted.[14] The content and face validity of these cases were evaluated by a Diplomate of the American Chiropractic Board of Radiology before administration.[14]

We adapted the survey, retaining the core elements of the questionnaire by Butt et al[14] while reducing the number of scenarios to 8 and making necessary modifications to align with the context of IMU's chiropractic program. The questionnaire consisted of 8 case scenarios that represent potential real-life situations encountered by chiropractic practitioners. These scenarios were designed to cover a wide range of patient presentations, thus providing a comprehensive assessment of the interns' decision-making process regarding the use of radiographic imaging. Interns were given a week to complete and return the questionnaire. This timeframe was chosen to provide the interns with ample time to consider their responses carefully, thus ensuring the accuracy of the data collected.

Data analysis was performed using Microsoft Excel (Microsoft Corp). The responses from the survey questionnaire were compared with the gold standard, which represents the ideal adherence to evidence-based imaging guidelines. This comparison was quantified using percent agreement for each of the 8 cases. Percent agreement was chosen as the measure of adherence as it provides a straightforward and easily interpretable measure of the degree to which the interns' decisions align with the evidence-based guidelines.

RESULTS

The study aimed to evaluate the adherence of IMU chiropractic interns to evidence-based radiographic imaging guidelines. A total of 74 questionnaires were distributed to IMU chiropractic interns at 2 locations: Setiawalk and Bukit Jalil Chiropractic Centers. Of these, 62 were returned completed, reflecting an 84% response rate. The respondents were final-year chiropractic students, comprising 26 females and 36 males, all of whom were participating in their internship program at the student clinic.

The evaluation of 8 different clinical cases revealed significant variability in the agreement between the respondents' decisions and the gold standard, as shown in Table 1. The analysis of the data revealed a disparity in opinion among the IMU chiropractic interns for most cases, with the exception of

Table 1 - Summary of Respondents Compared With the Gold Standard

	Yes	No	Gold standard	Percentage agreement to gold standard
Case 1: A 34-y-old female presents to your practice with a complaint of neck and all over body stiffness. She tells you that she has recently been diagnosed with rheumatoid arthritis and was wondering if chiropractic can help her maintain as much joint mobility as possible. Over the last few months, she has noticed that her morning stiffness has increased from 1 h to 2 h and she is worried that she is going to freeze up completely.	51	11	Yes	82.26%
Case 2: A 40-y-old man presents to your office with a right knee complaint. He tells you that he fell 3 d earlier on a slippery floor at the grocery store. Upon observation, you notice some bruising and slight swelling around his right knee. Physical examination reveals tenderness over the patellar tendon and a 10% decrease in knee flexion. He reports that he walked to a nearby pharmacy to buy an ice pack. Although he says his knee has been getting better, his wife thought he should come in and see you for treatment.	34	28	No	45.16%
Case 3: A 30-y-old mother of 2 presents to you with low back pain. She describes the pain as dull and achy in nature. The pain began insidiously about a week ago and although Tylenol has helped to relieve her pain, she explains that she is afraid of some of the side effects of NSAIDs after reading a recent newspaper article and was wondering if chiropractic could help her. Physical examination reveals a positive lumbar Kemps on the right and pain on lumbar extension and lateral bending.	16	46	No	74.19%
Case 4: A 55-y-old woman presents to you with an insidious onset of neck and low back pain. She explains that the back pain has been bothering her on and off for the past 10 y but has now gotten so bad that it is interfering with her work. The pain is well localized with no referral or associated radicular symptoms. While going through her systems review, you determine that the patient underwent menopause 10 y ago for which she received no hormone replacement therapy.	37	25	Yes	59.68%
Case 5: A 45-y-old smoker presents to your clinic after he fell while stepping off the sidewalk yesterday. He reports pain and tenderness in the 5th toe of his left foot. Upon observation you notice no signs of edema or swelling. The patient is able to weight bear.	21	41	No	66.13%
Case 6: A mother brings her 14-y-old daughter into your office and explains that her daughter has a scoliosis. The mother explains that their previous chiropractor x-rayed her daughter every 3 mo for the past 2 y to monitor the curve. The mother explains that the curve is an 18-degree right-sided thoracic curve. She goes on to tell you that for the past 7 mo, the scoliosis has not progressed any further. You learn that the patient has a 20-y-old sister with a stable 16-degree thoracic curve. The mother is concerned about too much radiation. She brings you her daughter's most recent x-rays and asks for your opinion.	37	25	No	40.32%
Case 7: A 40-y-old female presents to your office after being involved in a fender-bender. She reports that she felt okay after the accident but woke up a day later with a stiff and achy feeling in her neck and between her shoulder blades. She has no neurological symptoms, but you detect tenderness in her trapezius and levator scapulae muscles.	30	32	No	51.61%
Case 8: A 15-y-old boy presents to your clinic on a particularly cold and icy day holding his right arm into his body in pain. He tells you that he was goofing around with his friends outside and ended up falling on the ground. He explains that he tried to break his fall with his right arm. The palm of his hand is scraped and bleeding. He doesn't think he broke anything but his hand and wrist sure hurt a lot.	55	7	Yes	88.71%

Cases 1, 3, and 8. Out of the 8 cases, only 6 aligned with the gold standard answer, and 4 of these had a very narrow margin of agreement (less than 10%).

The interns demonstrated a lack of adherence to the evidence-based radiographic guidelines in the 3 cases where radiographs were indicated according to the gold standard (Cases 1, 4, and 8). A common trend among the IMU chiropractic interns was the propensity to order additional views. Among the 3 cases, only Case 8 exhibited a pattern where nearly half of the interns ordered the complete set of x-ray views in line with the gold standard answer. For the remaining 2 cases, fewer than 5% of interns managed to order the correct set of views without any unnecessary extras.

DISCUSSION

The study revealed that adherence to evidence-based radiographic guidelines among final-year chiropractic interns should be high due to the similar education they receive in the chiropractic program. However, the practice of techniques other than the diversified technique and a lack of awareness or uncertainty about current radiographic guidelines were identified as potential barriers to adherence.[13,15]

Historically, chiropractors have used radiographs as a tool to screen for anomalies, spinal alignment, and biomechanical changes.[16,17] Although this method of x-ray use is no longer supported by evidence-based literature guidelines, it is still utilized by some chiropractic technique systems such as the Gonstead system and Chiropractic BioPhysics.[12,13] The lack of awareness of current radiographic guidelines is another reason why chiropractors do not adhere to evidence-based guidelines. The study found that when chiropractors are aware of the guidelines, the chances of adhering to the guidelines are 1.72 to 2.35 times greater than if they are unaware of the guidelines.[18]

The study also presented several cases to illustrate the application of these guidelines in practice. The cases highlighted the importance of radiographic imaging in certain situations, such as in the diagnosis of rheumatoid arthritis and osteoporosis, and the potential dangers of unnecessary imaging, such as in the case of mechanical low back pain without any red flags and minor trauma without significant findings.[2,3,12,19]

The results of the study showed varying levels of agreement with the gold standard among the respondents. The highest level of agreement was observed in Case 1 (YES case), where 82.26% of the respondents chose to x-ray the patient. The lowest level of agreement was observed in Case 2 (NO case), where only 45.16% of the respondents chose not to x-ray the patient.[20] These results highlight the need for improved education and awareness about current radiographic guidelines among chiropractic interns.

In a deeper analysis of the case scenarios presented to the interns, certain patterns and trends emerged that warrant attention. Specifically, while some cases saw a high degree of alignment with the gold standard, others revealed areas of uncertainty or divergence among the interns. For instance, while Case 1 saw 82.26% agreement with the gold standard, Case 2 had a notably lower agreement rate of just 45.16%. This disparity suggests that certain clinical presentations or scenarios might be more challenging for the interns to navigate, potentially due to ambiguities in the presented information or gaps in their training. Moreover, a recurring trend was the interns' inclination to order additional x-ray views, even when not aligned with the gold standard. This propensity indicates a potential over-reliance on radiographs or a lack of confidence in selecting the most pertinent views. Such insights into the specific types of errors and areas of disagreement are invaluable, as they can guide targeted educational interventions and curriculum refinements to better prepare future chiropractic interns.

The study also compared the performance of IMU chiropractic interns with that of CMCC chiropractic interns. The results showed that CMCC chiropractic interns had a higher level of agreement with the gold standard in all cases, with a 100% agreement in 1 case. In contrast, the highest level of agreement among IMU chiropractic interns was only 88.7%.[21] This suggests that CMCC chiropractic interns may have a better understanding of and adherence to current radiographic guidelines.

In the broader context of health care, advancements in radiographic imaging have led to the development of intelligent systems that can identify conditions such as pneumonia from chest x-rays. While these advancements currently focus on medical conditions outside of the typical chiropractic scope, they highlight the evolving role of radiographic imaging in health care. As these technologies continue to advance, it is conceivable that similar systems could be developed for conditions more commonly encountered in chiropractic practice. This underscores the importance of chiropractic interns being well-versed in current radiographic guidelines and prepared for future developments in this field.[11,22]

This study focused on the adherence of final-year chiropractic students to radiographic guidelines in the student clinic. However, no studies in Malaysia have been published pertaining to the comparison of the adherence of radiographic guidelines among chiropractic graduates. Therefore, further studies could be carried out in private clinics to investigate the adherence of radiographic guidelines of chiropractors with more working experience in the field. This would provide a more comprehensive understanding of the adherence to radiographic guidelines in the chiropractic profession in Malaysia.

In light of our findings, we strongly recommend that educational institutions, particularly those offering chiropractic programs, consider revisiting their curricula and instructional methodologies. Our study underscores the importance of evidence-based decision-making among students, especially in the realm of radiographic guidelines. By integrating our insights into the curriculum, institutions can foster a more robust understanding and application of these guidelines. Furthermore, institutions should actively seek feedback from students and faculty to identify potential areas of improvement. Such proactive measures will not only enhance the quality of education but also ensure that future chiropractic practitioners are well-equipped with the knowledge and skills necessary for optimal patient care.

Limitations

The study has several limitations. First, the use of questionnaires with case scenarios, while mimicking real-life chiropractic patients, can only provide brief information about the case. This may not fully represent an actual clinical situation where full information from the patient's history or physical examination can only be obtained in an actual clinical setting. This might have impacted the intern's decision of the x-ray referral in each case. Second, the interns surveyed may not have been truthful when answering the survey questions. They might have treated the questionnaire as a test and only provided academically desirable answers. Additionally, another

limitation is that only interns at one educational program were sampled. This may not reflect chiropractic teaching more broadly across different institutions or regions. Finally, the sample size is a limitation to this study. Out of 74 questionnaires, only 62 (83.78%) responded, which may not be representative of all chiropractic interns.

CONCLUSION

The study aimed to assess the adherence of final-year chiropractic interns at our university to evidence-based radiographic guidelines. The findings revealed that while the interns generally adhered to the guidelines in determining the necessity of radiographs, they were less successful in selecting the appropriate x-ray views when radiography was indicated. This suggests that while the interns have a solid understanding of when radiography is necessary, they may require additional training in selecting the appropriate x-ray views for each case.

The study also uncovered a disparity in the interns' decisions, which could be attributed to the practice of techniques other than the diversified technique, or a lack of awareness or uncertainty about current radiographic guidelines. This suggests that there may be a need for further education and training in these areas to ensure that all chiropractic interns are fully aware of and adhere to the current guidelines.

In conclusion, the study underscores the importance of adherence to evidence-based radiographic guidelines in chiropractic practice. While the IMU chiropractic interns generally adhered to these guidelines, there are areas, such as the selection of x-ray views, where further training and education may be beneficial. Future studies could investigate the adherence of radiographic guidelines among chiropractors with more working experience in the field, providing a more comprehensive understanding of the adherence to these guidelines in the chiropractic profession in Malaysia. This study serves as a steppingstone towards improving the quality of chiropractic education and practice, ultimately leading to better patient care and outcomes.

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