

May 2025

Volume 78

Number 5

2025 SDSMA Annual Leadership Conference

AI IN MEDICINE

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South Dakota Medicine
(ISSN 0038-3317)

Published 12 times per year with one special issue by the South Dakota State Medical Association.

The SDSMA thanks the University of South Dakota Sanford School of Medicine for its financial contributions toward the production of South Dakota Medicine.

Subscription price: \$50 per year domestic
\$65 per year foreign, \$8.95 for single copy

Periodicals postage paid at Sioux Falls, South Dakota and additional mailing offices.

Postmaster: Send address changes to
South Dakota Medicine
2600 W. 49th Street, Suite 100
Sioux Falls, SD 57105

SDSMA Home Page: www.sdsma.org

AMA Home Page: www.ama-assn.org

Printer:
Walsworth
P.O. Box 370
Fulton, Missouri 65251-0370



INVESTING WISELY FOR THE MARATHON

ROSS POLKING, CFP®, AIF®, MBA, Senior Business Development Advisor

Investing can often feel like a high-stakes game. We've all heard the stories about someone who got in early on a hot stock or nailed the perfect cryptocurrency trade. It's easy to look at those stories and feel like success is just a matter of luck or being in the right place at the right time. But just like in sports, chasing investment returns without a solid strategy and discipline can lead to disappointment, sometimes even failure.

Imagine that you're a marathon runner lining up to cover 26.2 miles as fast as possible. In the beginning, it's tempting to sprint ahead when you see other competitors charging forward. But you could burn out too quickly and not have enough gas left to finish the race.

I learned this the hard way. My first marathon was in Minneapolis, back in the early 2000's. My only strategy was to carb load the night before, with a plate of pancakes at Perkins. Other than that, I figured I would pace off the front-runners. Why not? After all, they must have known what they were doing. So, if I wanted success, chasing them made sense. I quickly realized my mistake and almost had to be carried to the car after crossing the finish line.

The same basic principle applies to investing. You might see some stocks or assets with

dramatic short-term returns. The temptation to jump in and participate is overwhelming. Everyone else is doing it, right? But just because something looks like a sure bet in the moment doesn't mean that it aligns with your long-term success. FOMO is real. However, just like in a marathon, committing yourself to a solid, pre-planned strategy will help ensure you successfully cross the finish line.

Fortunately, I learned my lesson after that first race and adapted my approach. Ultimately, this landed me at the Boston Marathon a decade later. If what other investors are doing is not part of your plan, then have the discipline to tune out the noise and stick to your strategy. Chasing short-term returns might feel rewarding in the moment, but it's often a sprint that leaves you exhausted, with nothing to show for your effort.

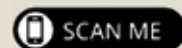
A disciplined, long-term approach to investing may lead to greater returns. Our team here at Foster Group is incredible at keeping clients focused on the plan and long-term goals. There is no chasing, but rather building and trusting the process. And most importantly, you won't need to be carried to the car afterward.

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Someplace between Def Leppard and Sza

Jason Kemnitz, EdD

Not too long ago, as I was cleaning up after supper, the Amazon Echo device that lives on our kitchen counter was providing music via the Spotify app. As DJ X (IYKYK) was providing a steady stream of cleaning motivation regaling me with the likes of Def Leppard, The Outfield, Van Morrison, Nirvana, Metallica and various showtunes my wife strolled in and as if I listened to anything remotely new or just “old” music? In that moment I did indeed wonder, ‘have I become that guy? The classic rock guy?’ I was very relieved when X slid the music to Sza, Noah Kahn, Giveon, and Lil Tjay, because that meant I was at least semi current thanks to the influence of my sophomore in high school son and our various road trips where he runs the music. This cross generational collaboration has saved me from being “old.” I am sure many have experienced this generational blend as well, and as educators we see it on a regular basis.

A quick PubMed search reveals no less than 1,000 articles dedicated to the topic of learning generations. In addition, there are a fair number of articles discussing the fact that there is no such thing as learning generations. While I don’t embrace the idea that we need to teach every generation differently based on the era they fit into, I do think that each group of students has its own proclivities that help and hinder learning. I also believe that there are basic ideas that we can help students master no matter where they fall in age and seniority. The following four tips are a good start.

Time management is important. This is a lesson we can all use. This one simple statement is the basis to many struggles in Pillar Two(M3) for our medical students. This is the first time that students do not have a regimented schedule beyond clinic and study for shelves and STEP 2. Prior to this, throughout most of their educational life students are provided with a schedule to follow. In this new, more lifelike, phase of their education those hard deadlines are not always articulated in advance. The school sets benchmarks for specific items students need to complete but the overall deadline of STEP 2 is set in stone. An effortless way to help your students deal with time management is to ask them how they are doing on their benchmarks and if they have a plan for STEP 2. In addition, let them know how you deal with time management issues, as it’s often easier to learn from someone else by adapting differing ideas to help, rather than having to forge all new ideas.

Incorporate literacy development into your teaching. The American Literacy Association estimated that reading “anything for pleasure” fell to an all-time low of 10 minutes a day as relayed by the annual Time Use Survey. This gives further credence to the idea that students finding articles on their own to supplement their education is declining. As an educator you can help to combat this by working with your clerkship directors to curate a series of articles that you think may be important for all students to read when working with your specialty. Better yet, incorporate questions and ideas from this reading into your teaching. This incorporation with help integration and recall of specific knowledge later.

Teach information management. While learners may be well versed in finding and even retrieving knowledge, they often struggle with discerning the veracity of the information they access. The CRAAP method (see my last editorial) is a terrific way to help with this discernment. In addition, the explanation of why you use the resources you use is helpful in developing solid long-term information accessing and use behaviors.

Embrace your differences. One of the best things about teaching is that you can learn at the same time. If you remain open to the idea that there are multiple ways to learn and engage in a conversation with your learner about how they learn, you may surprise yourself and find a way to supplement how you learn. Don’t worry about looking foolish or not completely understanding how to do something (what’s reddit, or a substack for that matter) just ask, young learners are almost always willing to teach as well. Heck, if you’ve made it this far after reading the first paragraph you are well on your way!

Two quick items of importance:

1. The Office of Faculty Affairs has restarted the Faculty Matters! newsletter. If you are Interested, you can check it out here: <https://bit.ly/4bQMqim>
2. Congratulations and Welcome to Carolyn Gilbertson, MD, FAAFP who recently accepted the position of Associate Dean of the Sioux Falls Campus!

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Keep on Keeping On

Jen Tinguely, MD, MPH
President, South Dakota State Medical Association

We've all had that patient who pulls out their (full page long) list of concerns when you ask them, "What brings you to the clinic today?" You smile politely, accept the fact that your schedule will go off the rails for the rest of the shift, and do the best you can for that patient. I've felt a bit like that throughout my tenure as your SDSMA President this past year. And I wish I could write this last editorial as president with a sense of accomplishment and relief but, instead, am writing with a sense of regret for what didn't go well this past year and fear for what the future holds for the state of medicine, the health of our patients and the health of our country.

I regret that our membership numbers within my district fell this past year. We've even lost a couple of our District board members which stings even more. While I know the reasons for this are multifactorial, I have heard from many members (and non-members) who are upset with the AMA for what they perceive to be a lack of fight against the appointment of Department of Health and Human Services Secretary, Robert F. Kennedy, Jr. This is understandable as, I too, was desperately hoping that my professionally aligned societies (AMA, AAFP, APHA) would rise to the occasion and speak out against what seems to be a very risky choice to lead the country's top health agency.

I also regret that, at a state level, we lost a decade-long battle to fight back against scope creep in the practice of medicine. During this legislative session, the physician assistants successfully obtained independent practice, joining nurse practitioners across the state who also have independent practice. This was a battle that had been fought so hard for so many years, and it pains me to know that the issue was lost on my watch.

But this is where I must recalibrate and remember that, while the issue was lost, things could have been much worse. The initial bill that was brought forth by the PAs would have allowed them to obtain independent status after only 2,080 hours of supervised collaboration with a physician OR another physician assistant. Physicians could have been completely removed from the supervisory hours requirement.

So, with a lot of hard work by our lobbyists and members, we were able to secure an amendment to the bill that sets the practice hours to 6,000 hours and those hours must occur under the supervision of a physician.

There were several other bills this past legislative session that we were able to defeat and knowing this gives me hope that not all is lost within our organization and reminds me of the importance of our voice. A bill that would have allowed South Dakota cities to stop adding fluoride to their public water supplies passed out of committee but was ultimately defeated on the Senate floor. Another bill would have required blood donation collectors to ask donors if they had ever been vaccinated against COVID-19. Medical providers would then have to ask recipients of blood products if they wanted blood that had the vaccine in it or if they wanted "non-vaccinated" blood. Bills like this sound crazy but this one only lost by one vote in committee! And if that bill sounds crazy, there was another bill that was proposed that would have repealed statutes requiring the use of seat belts in South Dakota! This bill was also defeated but is a reminder of the importance of showing up, making the testimony and reaching out to our legislators who vote on things like this.

So, while I feel regret over the losses this past year, I also have to think about the importance that societies like ours play in pushing back against some of the unbelievable things that are happening at both the state and national level. I think about the anti-vaccine sentiment that has been growing for years and will certainly be allowed to flourish under the new DHHS Secretary. Already this spring, there have been two pediatric deaths in the U.S. due to measles. The number of cases is growing every day, and we should not be surprised when we see our first case in South Dakota. We have areas of the state that do not meet the threshold for herd immunity for measles, so we better be ready. And this means we will have to band together with all medical providers, no matter the credential, because the health of our country is on the line and we still have a voice.



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Physical Therapist Assessed Initial Lower Back Pain: A Retrospective Cohort Study

Brandon I. Peterson, DPT; Micheal J. Vasek, MBA; and Thomas Tiahr, PhD

Abstract

Treatment of patients with low back pain (LBP) amenable to improvement through physical therapy usually follows one of two pathways. The first is primary-care provider and nursing evaluation, often with imaging, pain medication, and a frequently delayed physical therapy referral. The second is a multi-disciplinary approach of embedding a physical therapist to assist with evaluations and active physical therapy treatment as early as possible. The present study compares the results of the first instance of LBP for the traditional pathway to the early physical therapy pathway for patients of the U.S. Department of Veterans Affairs hospital in Sioux Falls, South Dakota. The research comprised a retrospective review of electronic records of patients presenting the first onset of LBP evaluated in primary care. The patients on the first pathway had nursing and primary care providers assess patients during the initial visit and later referred them to outpatient physical therapy. Patients on the second pathway had a physical therapist on the primary care team. The results of this study show that second-pathway patients required fewer images, specialists, sessions, and pain medications; they had fewer no-shows at follow-up appointments.

Introduction

Low back pain (LBP) prevalence is well documented and results in one of every 17 primary care visits.^{1,2} As of 2020, there were estimated to be 619 million LBP cases worldwide, comprising almost eight percent of all years lived with disability and the greatest contributor to worldwide disability. The total is projected to increase to more than 800 million cases by 2050.³ Annual 2020-2021 LBP disbursements from the New Zealand Accident Compensation Corporation were \$506 million in a nation of just over five million people.⁴ Of the 154 conditions included in a 2020 study of U.S. healthcare costs, the 2016 estimate of \$134.5 billion for LBP and neck pain spending was the greatest.⁵ Opportunities to reduce costs and improve outcomes are attractive, possible, and necessary. The research conducted demonstrates that cost reduction, greater patient satisfaction, and faster positive results are achievable.

Methods

The research design was a retrospective cohort study with two subsets of male and female Veterans 18 years of age and older, who were enrolled for healthcare, and received care at the Sioux Falls VA Healthcare System. The first cohort's subjects were diagnosed with their first onset of LBP, low back sprain or strain, sciatica, degenerative disc

disease, spondylosis, and LBP with radiculopathy ICD-9 codes 724.2, 847.2, 724.3, 722.52, 722.51, or 724.4. The first diagnostic team included primary care providers, specifically medical doctors, physician assistants, and nurse practitioners. The timeframe for this study included Veterans diagnosed from January 1, 2013, to December 31, 2015, and formed the control group. The second cohort's subjects included Veterans who presented with first onset of LBP, low back sprain or strain, sciatica, degenerative disc disease, spondylosis, and LBP with radiculopathy ICD-10 codes M54.9, M54.15, M54.16, M54.17, M51.36, M54.3. The transformation from ICD-9 to ICD-10 coding was a national healthcare change that occurred between 2015 and 2016. The second diagnostic team included at least one physical therapist, and the timeframe spanned October 5, 2016, to October 5, 2018. Patients in both groups were excluded if they lived more than forty miles from the Sioux Falls VA Hospital to ensure that travel difficulties did not affect the results.

The veterans were retrospectively identified, separated, and assessed by the following model: the first cohort comprised patients whose initial assessment was completed by a primary-care provider and later triaged to physical therapy; the second cohort was assessed in primary care by a physical therapist

who was embedded in Primary Care as part of the primary care team. The study's location was Sioux Falls, South Dakota, and the clinical setting from which the treatment records were drawn was the Department of Veterans Affairs Hospital.

The assumed values for the mean difference of the two independent groups were an effect size of 0.9, a significance level of 0.05, and a power of 0.95, which determined sample sizes of 28 for each group. The assumed values for Fisher's exact test parameters were a difference in proportions of 0.2, a significance level of 0.05, and a power of 0.75, resulting in sample sizes of 37 for each group. However, because the exclusion counts were unknown a priori, 60 was chosen as a prudent oversampling count for each group. Hence, the retrospective record review analyzed 60 control and 60 treatment records. All patient records were selected using a multi-step process. First, a database analyst retrieved each qualifying record that met the study's coding criteria from the Veterans Health Information Systems and Technology

Architecture database. Second, each record was anonymized and assigned a pseudorandom number produced by the Microsoft Excel generator function. Third, two groups of records were placed in descending order using those random values. Fourth, the first sixty random records from each group went through a chart review to ensure that they met the inclusion criteria, including the distance criterion. Fifth, each record was reviewed by a database analyst and a physical therapist. Any record that either had a red flag presentation to Primary Care or was not the first onset of LBP was removed from consideration.⁶ See Table 1.

Finally, the remaining 39 and 49 qualifying records had all presented to Primary Care for the first time with mechanical low back pain complaints. There were no missing values. The pathway for care was then analyzed. All subjects were checked by a database analyst, reviewed by a physical therapy team member, and transferred directly to spreadsheet files. See Table 2. The variables we used to determine the outcomes were Days until Physical Therapy, Days from Physical

Table 1. Lower-back pain red-flag conditions.

Condition	Imaging type
Severe or progressive neurological impairments such as abnormal reflex responses, bowel or bladder dysfunction, muscle weakness	MRI
Fever with back pain	MRI or CT
Extreme spinal tenderness of patients with osteoporosis or cancer	X-ray or MRI
Significant trauma	X-ray or CT
Cancer patient	MRI
Unexplained weight loss	MRI
Immunosuppression	MRI
Intravenous drug use	MRI
Recent invasive spinal procedure	MRI
Suspected infection (e.g., osteomyelitis)	MRI

CT, computed tomography; MRI, magnetic resonance imaging; X-ray, high-energy, short-wavelength radiograph.

Table 2. Patient events.

Event	No physical therapist in primary care	Physical therapist in primary care
Records reviewed	60	60
Eligibility criteria met	39/60	49/60
X-rays before physical therapist examination	23/39	15/49
MRIs before physical therapist examination	11/39	1/49
Specialist evaluation before physical therapy	8/39	1/49
Pain medication prescribed before physical therapist examination	16/39	7/49
Patients who stopped attending physical therapy prior to discharge	16/39	8/49
Patients triaged to primary-care provider, radiology, or chiropractor	0/39	15/49
Discharged due to symptom resolution	23/39	25/49

MRI, magnetic resonance imaging; X-ray, high-energy, short-wavelength radiograph

Therapy to Last Visit, Total Visits, Specialist Seen Before Physical Therapist, Medical Images Taken, Pain Medication Prescribed, No-show Patients, and Discharge Completed.

Results

The mean differences between the cohorts demonstrate statistically significantly superior results for the physical therapist group in days-to-physical-therapy and total visits, with the latter cut by nearly half. The duration of physical therapy was also better for the physical therapist group but not statistically significant. See Table 3.

All proportions indicate the physical therapist cohort had either lower-cost treatment or better health outcomes when compared to the control group. However, Discharge Completed was not statistically significant. See Table 4.

Discussion

The present study examines the timeliness of physical therapy and the outcomes of first-time LBP presentations. The

comparison is based on a retrospective review of electronic medical records from the Sioux Falls Veterans Affairs Health Care System. It found that embedding a physical therapist into the primary care team produced superior results compared to a delayed approach to physical therapy.

Despite widespread agreement on the best practices to treat LBP, primary-care or general practitioners (physicians, physician assistants, nurse practitioners) often pursue ineffective approaches, including unwarranted images and opioid prescriptions delaying active care for LBP.⁷ In New Zealand, general practitioners and physical therapists customarily perform the initial assessment for LBP.⁸ Still, general practitioners often do not adhere to clinical practice guidelines, producing suboptimal results and incurring unnecessary costs.⁹ Two surveys showed evidence suggesting that 52% and 53% of physical therapists in New Zealand follow acute LBP guidelines.^{10,11} Yet even when New Zealand physical therapists deviate from guidelines, those deviations

Table 3. Age and event mean differences.

Variable	No physical therapist in primary care group, <i>n</i> = 39	Physical therapist in primary care group, <i>n</i> = 49	Difference between arithmetic means	
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	<i>p</i> -value
Age	53.26 $\pm$ 2.63	56.20 $\pm$ 2.32	2.94 $\pm$ 3.51	0.403
Days until physical therapy	23.97 $\pm$ 2.59	1.96 $\pm$ 0.44	22.02 $\pm$ 2.63	< 0.001*
Days from physical therapy to last visit	41.59 $\pm$ 8.51	25.73 $\pm$ 6.95	15.86 $\pm$ 11.0	0.153
Total visits	6.92 $\pm$ 0.84	3.57 $\pm$ 0.34	3.35 $\pm$ 0.90	< 0.001*

*Statistically significant at *p* < 0.05; SD, standard deviation

Table 4. Tests for equality of event proportions.

Variable	No Physical therapist in primary care, <i>n</i> = 39	Physical therapist in primary care, <i>n</i> = 49	Two-sample test for equality of proportions	
	Proportion	Proportion	Difference	<i>p</i> -value
Specialist seen before physical therapist	0.21	0.02	0.19	< 0.01*
Medical images taken	0.80	0.33	0.47	< 0.001*
Pain medication prescribed	0.41	0.14	0.27	< 0.01*
No-show patients	0.41	0.16	0.25	< 0.01*
Discharge completed	0.56	0.51	0.05	0.61

*Statistically significant at *p* < 0.05; SD, standard deviation

still appear to reduce pain and improve function.¹²

A US cohort study of almost 1.2 million first-time LBP patients discovered that just 1.2% received surgery but incurred 29.3% of total annual LBP costs. Of the non-surgically treated patients, 32.3% had images taken in the first 30 days of presentation, and 35.3% received imaging without physical therapy.¹³ The consensus guidelines recommend medical imaging only for patients with red-flag conditions such as history of cancer, unexplained weight loss, night pain, night sweats, fevers, and acute trauma due to a fall.¹⁴ Early magnetic resonance imaging is associated with increased length of disability for patients with acute LBP without red flags.¹⁵ For 90-95% of LBP patients with no indication of underlying spinal pathology, imaging may be harmful and prolong recovery. Radiation exposure from X-rays and computed tomography is one form of harm, but a clinician may prescribe needless treatment from image observations that mislead the observer. For example, degenerative and bulging discs appear in up to 96% of images of asymptomatic patients, leading to unnecessary specialist referrals and possibly surgery.¹⁶ Imaging increases costs, healthcare utilization, and absences from work for most LBP patients.^{17,18}

Opioids may provide short-term relief, but their long-term effect is unlikely to be clinically important within dosages prescribed by guidelines.¹⁹ Furthermore, opioids were no more effective than placebos for LBP, and even chronic LBP patients did not experience pain relief clinically distinguishable from a placebo.^{20,21} Evidence indicates that opioids do not reduce the time to return to work and may constrain the effectiveness of other treatments.²²

LBP guidelines endorse physical exercise and early non-pharmacological treatment to decrease the use of healthcare resources.^{23,24} Early physical therapy reduced chiropractic, emergency department, and orthopedic visits, as well as epidural steroids and medical imaging.²⁵

Physical therapist-initiated patient referrals have successfully diagnosed various conditions and pathologies.²⁶ In military settings, using a physical therapist instead of primary-care providers to assess patients with musculoskeletal pain demonstrated that a physical therapy perspective was effective.²⁷ Having physical therapists with clinical privileges improved the clinical decision-making process.²⁸

Conclusion

Embedding a physical therapist into primary care to perform

an initial assessment produces greater effectiveness for patient treatment for those who present with an initial onset of lower back pain. The physical therapist-first approach improved patient compliance with follow-up appointments; it decreased specialist referrals and saved downstream costs; it required fewer imaging tests, medications prescribed, and follow-up physical therapy visits. Physical therapist assessment for first-time lower-back pain patients leads to early physical therapy, resulting in fewer medical images, specialists, sessions, and pain medications, improved patient outcomes, and reduced costs.

REFERENCES

1. Licciardone, JC. The epidemiology and medical management of low back pain during ambulatory medical care visits in the United States. *Osteopathic Medicine and Primary Care*. 2008;2(1):1-17.
2. Spijker-Huiges A, Groenhouf F, Winters J, van Wijhe M, Groenier K, van der Meer K. Radiating low back pain in general practice: incidence, prevalence, diagnosis, and long-term clinical course of illness. *Scandinavian Journal of Primary Health Care*. 2015;33(1):27-32.
3. Ferreira ML, de Luca K, Haile LM, Steinmetz JD, Culbreth GT, Cross M, Kopec JA. Global, regional, and national burden of low back pain, 1990–2020, its attributable risk factors, and projections to 2050: a systematic analysis of the global burden of disease study 2021. *The Lancet Rheumatology*. 2023;5(6), e316-29.
4. Chapple CM, McKenna C, Hill J, Ellis R, Reid D, Mani R, et al. Physical therapists' perceptions of implementing STarT Back in New Zealand: a thematic analysis of focus group data. *New Zealand Journal of Physiotherapy*. 2022;50(3).
5. Dieleman JL, Cao J, Chapin A, Chen C, Li Z, Liu A, et al. US health care spending by payer and health condition, 1996–2016. *JAMA*. 2020;323(9):863-84.
6. Jenkins HJ, Downie AS, Maher CG, Moloney NA, Magnussen JS, Hancock MJ. Imaging for low back pain: is clinical use consistent with guidelines? A systematic review and meta-analysis. *The Spine Journal*. 2018 Dec 1;18(12):2266-77.
7. Foster NE, Anema JR, Cherkwin D, Chou R, Cohen SP, Gross DP, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. *The Lancet*. 2018;391(10137):2368-83.
8. Baxter GD, Chapple C, Ellis R, Hill J, Liu L, Mani R, et al. Six things you need to know about low back pain. *Journal of Primary Health Care*. 2020;12(3):195-8.
9. Wilson R, Prymachenko Y, Abbott JH, Dean S, Stanley J, Garrett S, et al. A guideline-implementation intervention to improve the management of low back pain in primary care: a difference-in-differences analysis. *Applied Health Economics and Health Policy*. 2023;21(2):253-62.
10. Hendrick P, Mani R, Bishop A, Milosavljevic S, Schneiders AG. Therapist knowledge, adherence and use of low back pain guidelines to inform clinical decisions—a national survey of manipulative and sports physical therapists in New Zealand. *Manual Therapy*. 2013;18(2):36-42.
11. Hill J, Bedford J, Houston D, Reid DA, Baxter GD, Ellis R. Exploring physical therapists' use of clinical practice guidelines, screening, and stratification tools for people with low back pain in New Zealand. *New Zealand Journal of Physiotherapy*. 2020;48(2):59-69.
12. Tumilty S, Adhia DB, Rhodes R, Mani R. Physical therapists' treatment techniques in New Zealand for management of acute nonspecific low back pain and its relationships with treatment outcomes: a pilot study. *Physical Therapy Reviews*. 2017;22(1-2):95-100.
13. Kim LH, Vail D, Azad TD, Bentley JP, Zhang Y, Ho AL, et al. Expenditures and health care utilization among adults with newly diagnosed low back and lower extremity pain. *JAMA Network Open*. 2019;2(5):e193676.
14. Verhagen AP, Downie A, Popal N, Maher C, Koes BW. Red flags presented in current low back pain guidelines: a review. *European Spine Journal*. 2016;25:2788-802.
15. Shraim BA, Shraim MA, Ibrahim AR, Elgamal ME, Al-Omari B, Shraim M. The association between early MRI and length of disability in acute lower back pain: a systematic review and narrative synthesis. *BMC Musculoskeletal Disorders*. 2021;22:1-12.
16. Hall AM, Aubrey-Brassler K, Thorne B, Maher CG. Do not routinely offer imaging for uncomplicated low back pain. *BMJ*. 2021;372.
17. Fritz JM, Brennan GP, Hunter SJ. Physical therapy or advanced imaging as first management strategy following a new consultation for low back pain in primary care: associations with future health care utilization and charges. *Health Services Research*. 2015;50(6):1927-40.

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Core Muscle Recruitment during Horseback Riding: A Pilot Study

Jacob J. Miller, MD, FAAFP; and Aarabhi Gurumoorthy, MPH

Abstract

Introduction: Horseback riding is a common activity performed worldwide. Although core muscle strengthening is frequently promoted as beneficial for horseback riding, little is known about muscle activation during riding gaits. We examined activation of four core muscles (erector spinae, gluteus maximus, gluteus minimus, and rectus abdominis) during horseback riding compared with ground exercises.

Methods: Nine active members (seven females and two males) of the South Dakota State University Rodeo Club volunteered for the study. Target muscle contraction was measured by surface electromyography (sEMG) using the Delsys Trigno Wireless Biofeedback system. Subjects performed a series of ground exercises to establish a maximal voluntary contraction, followed by horseback riding in a walk, trot, and lope (canter). Muscle activation during the various riding gaits was then compared with maximal voluntary contraction and expressed as a percentage.

Results: All core muscles examined were active during horseback riding, with rectus abdominis showing the greatest activity. There was a positive correlation between percent maximal voluntary contraction and riding gait speed in all core muscles.

Conclusion: Core musculature is utilized during horseback riding, and activation increases with riding gait speed. This study informs protocols for riding rehabilitation and deepens understanding of riding benefits for athletic training and hippotherapy.

Introduction

Horseback riding is an activity performed worldwide. Over thirty million Americans engage in horseback riding annually for work, competition, or pleasure.¹ It has also been utilized for rehabilitation or treatment of physical and mental ailments. Studies on horseback riding (also called hippotherapy) benefits are numerous, including increased core strength and balance, decreased anxiety and depression, and improved social interaction.²⁻⁵

Riding instructors promote strong core musculature for proper posture, communication with the horse, and riding success.⁶ Hampson and Randle showed augmenting core strength can improve rider and horse performance; however, few studies examine rider biomechanics or muscle activation during horseback riding, making it difficult to provide evidence-based training or rehabilitation recommendations.⁷

Surface electromyography (sEMG) is an established tool in sport and exercise science that non-invasively measures muscular contractions.^{8,9} To date, use of sEMG during

horseback riding has been limited; to our knowledge, only one study performed by Encheff examined muscle recruitment of horse jumpers.¹⁰ In our study, we examined activation of four core muscles (erector spinae, gluteus maximus, gluteus minimus, and rectus abdominis) using sEMG during horseback riding at different gaits compared to ground exercises.

Methods

We recruited nine (7 females and 2 males) active members of the South Dakota State University rodeo team to participate in the study. Participants were between the ages of 18 and 30 years and not currently pregnant. Participants were student-athletes competing in rodeo events at an intercollegiate level. Each rode in the Western style, using a saddle with a high cantle, horn, and wide stirrups, and using subtle leg and foot cues to guide horse movement. Written, informed consent was obtained.

Testing took place at the participants' practice arena. Participants were fitted with sEMG Individual Muscle



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Units (IMUs) from the Delsys Trigno Wireless Biofeedback system (Delsys Incorporated, Natick, MA) according to manufacturer's directions. Skin over target muscles was shaved, if necessary, and cleansed with an alcohol swab prior to placement. IMUs were placed bilaterally on the erector spinae, gluteus medius, gluteus maximus, and rectus abdominis according to previously published guidance.^{9,11-13} If unclear signals were obtained, the IMU was repositioned 1 cm proximal or distal to the original site, guided by muscle belly thickness.

To ensure correct IMU placement and obtain a Maximal Voluntary Contraction (MVC) value, participants performed a series of exercises activating target muscles. Delsys EMGWorks v4.8.0 EMG Acquisition software (2010-2021, Delsys, Inc.) measured muscular contractions. Research assistants provided just enough contraction resistance to not overcome the contraction. To measure erector spinae, participants lay prone with hands behind the head and the lower body stabilized. They then raised the torso and held this position while research assistants pressed the posterior shoulders. For gluteus medius, participants performed side-lying hip abduction while research assistants pressed downward against the lateral ankle. Gluteus maximus MVCs were obtained by having participants lie prone with the tested knee bent 90 degrees and the hip extended; research assistants applied downward pressure over the posterior distal thigh. Rectus abdominis was tested by having participants lie supine with hands behind the head and the knees and hips extended and stabilized. They then flexed their abdominal muscles to elevate the scapulae from the ground as research assistants pressed on the sternum or anterior shoulders.

After MVCs were measured, and while still wearing the IMUs, participants mounted their horses and performed a circular riding pattern 50 feet in diameter in the following manner: right walk, left walk, right trot, left trot, right lope (canter in English riding), and left lope. Data from

three revolutions in each direction was analyzed. Muscular contraction measurements were transmitted to a laptop. The transmission receiver was activated after participants completed one pattern revolution to avoid interference from initiating horse movements.

Analysis was performed by Delsys EMGWorks Analysis version 4.7.3.0 (1998-2019 Delsys, Inc., Natick, MA). Root mean squared (RMS) calculations were completed on raw EMG data with the highest RMS peak used as the MVC. Riding gait data for each muscle was also analyzed using RMS and then subjected to an Amplitude Analysis calculation, normalized to the MVC RMS of the corresponding muscle. Both a peak percentage of MVC (MVC max) and average percentage of the MVC (MVC ave) were calculated. The MVC max was located visually or using the QuickView tool if two peaks were close in value. Ten contraction cycles on either side of the peak were included in MVC ave analysis. If contraction cycles were not apparent, ten seconds of data on either side of the peak were analyzed, for a total of twenty cycles or twenty seconds of data included in MVC ave calculation. Further analysis was performed by Sanford Research Design and Biostatistics Core and evaluated average and maximal muscle contraction and differences in contraction between gait and direction using SAS software, Version 9.4 of the SAS System for Windows 7 (PROC GLM) (2002-2012 SAS Institute Inc., Cary, NC). The study was approved by Sanford Health IRB.

Results

Due to the small number of participants, statistical significance could not be ascertained, and only trends are reported. Muscle activation was observed in every gait. In general, MVC ave was greater on the right side for erector spinae, gluteus maximus, and rectus abdominis. This contrasted with gluteus medius activation, which showed greater left-sided MVC ave in all gaits except right lope (Table 1).

Table 1. MVC ave and standard deviation for gaits by muscle group.

Gait	Muscle group							
	Erector spinae		Gluteus maximus		Gluteus medius		Rectus abdominis	
	Right	Left	Right	Left	Right	Left	Right	Left
Right walk	11.2 (10.5)	7.05 (2.39)	5.14 (3.37)	4.01 (2.31)	5.04 (1.94)	7.37 (3.08)	8.76 (9.35)	7.19 (4.27)
Left walk	14.9 (18.0)	6.28 (2.94)	5.27 (3.15)	3.81 (1.98)	5.97 (2.94)	7.25 (2.99)	8.73 (7.98)	8.57 (6.29)
Right trot	17.7 (8.85)	13.5 (4.17)	12.4 (8.03)	11.3 (6.65)	11.5 (8.15)	13.2 (5.38)	21.8 (20.3)	16.3 (12.9)
Left trot	16.3 (7.72)	14.0 (4.92)	10.7 (7.46)	9.66 (4.67)	9.41 (5.86)	10.9 (4.99)	20.4 (17.9)	14.6 (10.8)
Right lope	21.4 (11.6)	13.8 (4.77)	15.5 (11.1)	16.8 (15.9)	18.4 (19.4)	13.7 (6.27)	27.0 (24.7)	20.3 (15.6)
Left lope	17.6 (10.1)	15.8 (6)	15.8 (12.6)	10.6 (5.32)	13.1 (7.94)	20.9 (18.7)	33.7 (37.2)	24.6 (23.7)

Table 2. MVC max and standard deviation for gaits by muscle group.

Gaits	Muscle							
	Erector spinae		Gluteus maximus		Gluteus medius		Rectus abdominis	
	Right	Left	Right	Left	Right	Left	Right	Left
Right walk	28.16 (12.85)	22.69 (10.40)	18.06 (19.60)	12.54 (10.71)	14.64 (7.50)	20.50 (8.13)	28.20 (33.93)	28.93 (24.75)
Left walk	28.86 (12.01)	21.73 (11.60)	15.01 (11.16)	12.17 (8.83)	19.34 (8.90)	22.86 (5.90)	30.16 (26.42)	30.69 (22.91)
Right trot	48.81 (26.39)	37.21 (12.76)	45.52 (43.10)	30.70 (17.07)	41.96 (38.03)	55.37 (60.77)	92.63 (102.72)	54.88 (45)
Left trot	49.59 (28.43)	38.68 (14.45)	35.04 (27.13)	29.72 (13.45)	43.15 (40.57)	29.95 (10.48)	71.84 (61.60)	50.05 (41.70)
Right lope	61.06 (33.56)	40.89 (14.52)	61.31 (46.05)	63.55 (58.67)	94.99 (121.91)	56.74 (41.57)	108.67 (97.46)	89.39 (79.84)
Left lope	56.70 (21.59)	46.27 (19.91)	49.20 (39.36)	43.30 (24.64)	48.42 (37.79)	111.12 (177.04)	109.78 (130.73)	76.48 (68.23)

Similar results were observed for MVC max data. Right-sided MVC max was generally greater for erector spinae, gluteus maximus, and rectus abdominis at all gaits. Left-sided gluteus medius MVC max was greater in all gaits except left trot and right lope (Table 2). A positive correlation was observed between MVC ave and increasing gait speeds across all muscle groups (Figures 1 and 2).

Discussion

Horse riding biomechanics are not well-defined, and describing core muscle activation may enlarge understanding of hippotherapy benefits. Youdas, Baartman, and Gahlon et

al. describe a sEMG muscle activation classification system dividing MVC values into very high (>60%), high (41%-60%), moderate (21%-40%), and low (0%-20%) groups.¹³ Much of the activation observed in our study is low-level, particularly at slower gaits. However, during the faster gaits, MVC ave reached at least a moderate degree, and some MVC max values exceeded 100%. Rectus abdominis and erector spinae MVC ave values are similar to those in the aforementioned study, which measured muscle activation in push-up positions. Our results also compare favorably to measurements obtained during hip, trunk, and thigh rehabilitation exercises; however, other exercises may produce

Figure 1. Left walk, trot, and lope MVC ave.

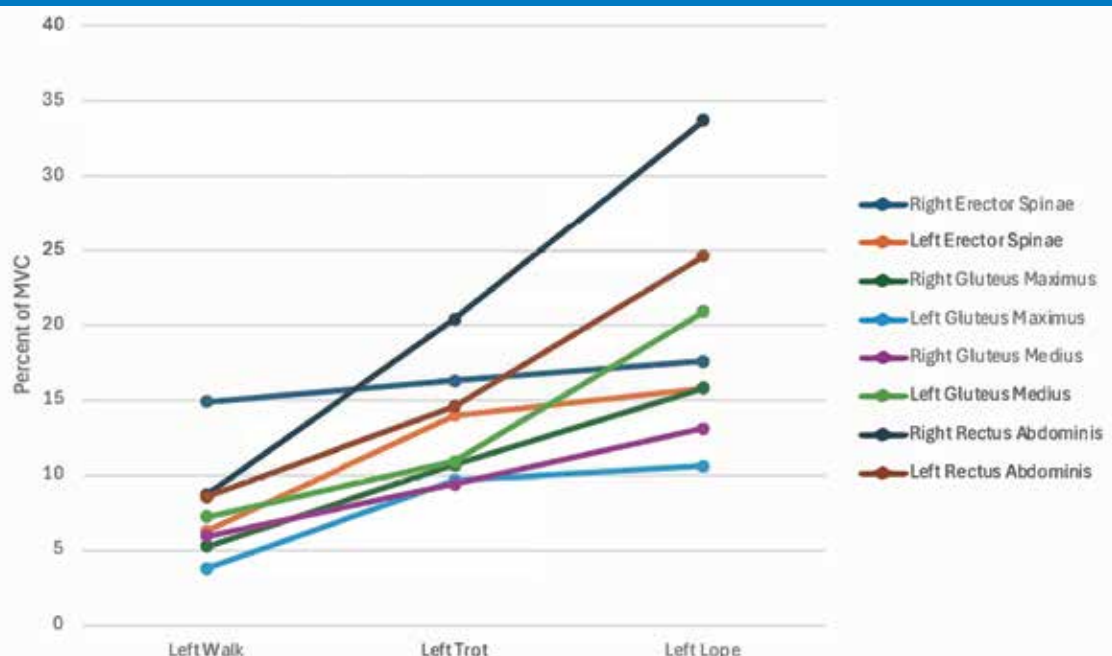
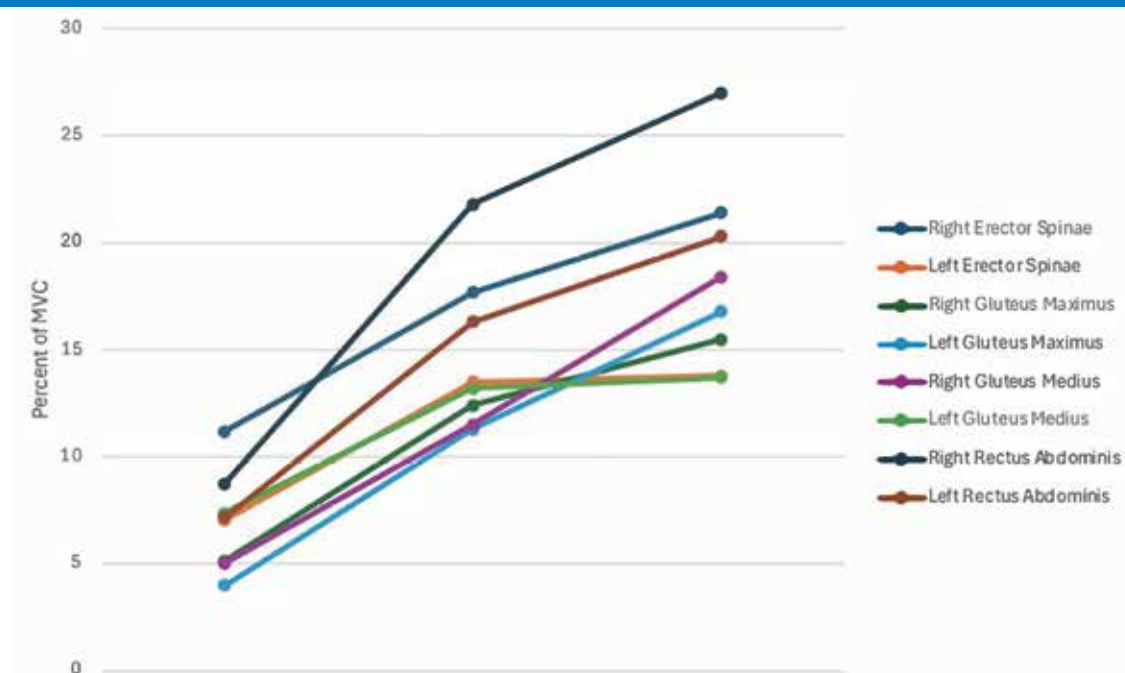


Figure 2. Right walk, trot, and lope MVC ave.



greater mean MVCs for gluteus medius and maximus.¹⁴⁻¹⁶

Core muscle activation in horseback riding bears promise for cross-training and rehabilitation. Previous studies report improvements in external oblique thickness and hamstring, rectus abdominis, and quadriceps strength with simulated and natural horseback riding.^{3,17,18} Balance, functional reach test, timed up-and-go scores, and cardiovascular fitness have also been reported to be positively impacted.¹⁹⁻²² Westerling noted superior maximal aerobic capacity in elite riders compared to experienced riders.²³ Horseback riding may also improve non-specific chronic low back pain by enhancing gluteus medius strength.¹² Athletes may enhance core strength and stability by employing this modality.²⁴

Three muscle groups showed greater right-sided activation during riding, while gluteus medius showed greater left-sided activation. This is possibly due to acquired imbalances in horseback riders; Alexander et al. and Hobbs et al. found most riders had functional asymmetry, negatively impacting performance and potentially contributing to low back pain.^{25,26} Muscle activation may also be influenced by hand positioning; future studies should note whether a rider grips reins with the non-dominant hand (as is often done in rodeo) or uses a two-hand reining approach. Prior kinesiology studies define the gluteus medius as a pelvic stabilizer, serving as a counterforce to other core muscles.²⁷ Interpretation of

the relationship between increased muscle activation and strength should proceed cautiously. Exercises targeting a muscle increase its activation, but weaker muscles manifest increased activation compared to stronger, contralateral counterparts.²⁸

Some MVC max readings exceeded 100%, consistent with previous studies and attributed to muscle activation during rapid, explosive movement.²⁹ However, exceptionally high amplitude peaks may be linked to sEMG artifact caused by the following:

- 1) IMU contact against horse, saddle, or clothing
- 2) Increased participant adipose tissue
- 3) Incomplete IMU skin adhesion
- 4) Aberrant horse motion, such as a stumble or “spook”
- 5) Scar tissue underlying the IMU
- 6) Suboptimal technological environment at the arena.

In this pilot study, minimal demographic data was collected. Generalizability may be limited given differences in body mass index, age, and gender, as well as lack of statistical significance between variables. Most participants were female from a single horseback riding population. Future studies should strive to ascertain the impact of demographic and environmental factors on sEMG measurements.

While lacking statistical significance, core muscle activation during Western horseback riding is positively correlated to gait speed, and activation progresses to a moderate degree in rectus abdominis and gluteus medius during the fastest riding gaits. This supports the importance of core muscle strengthening in riding training and rehabilitation programs. It also demonstrates the potential utility of horseback riding as a core strengthening therapeutic and training tool. Future studies should clarify the role of hand position and acquired riding posture imbalances in core muscle recruitment during horseback riding.

REFERENCES

1. American Academy of Pediatrics. Horseback riding: care of the young athlete patient education handouts. 2011.
2. Aranda-Garcia S, Iricibar A, Planas A, et al. Comparative effects of horse exercise versus traditional exercise programs on gait, muscle strength, and body balance in healthy older adults. *J Aging Phys Act.* 2015;23:78-89.
3. Baek I, Kim BJ. The effects of horse riding simulation training on stroke patients' balance ability and abdominal muscle thickness changes. *J Phys Ther Sci.* 2014;26:1293-96.
4. Janura M, Svoboda Z, Cabell L, et al. Effect of repeated therapeutic horse riding sessions on the trunk movement of the rider. *Neuro Endocrinol Lett.* 2015;36(5):481-89.
5. Oh H, Lee M, Jang J, et al. Time-effects of horse simulator exercise on psychophysiological responses in men with chronic low back pain. *Isokinet Exerc Sci.* 2014;22:153-63.
6. Fit Rider, Happy Horse. *Practical Horseman.* 2016:69.
7. Hampson A, Randle H. The influence of an 8-week rider core fitness program on the equine back at sitting trot. *Int J Perform Anal Sport.* 2015;15(3):1145-59.
8. Rainoldi A, Melchiorri G, Caruso I. A method for positioning electrodes during surface emg recordings in lower limb muscles. *J Neurosci Methods.* 2004;134:37-43.
9. du Rose A, Breen Alex, and Breen Alan. Relationships between muscle electrical activity and the control of inter-vertebral motion during a forward bending task. *J Electromyogr Kinesiol.* 2018;43:48-54.
10. Encheff J. Comparison of muscular activity of the trunk and lower extremity muscles during normal ambulation versus horseback riding. *Pediatr Phys Ther. Abstracts for the 2006 Combined Sections Meeting.* 2006:89-90.
11. Connelly CM, Moran MF, Grimes JK. Comparative analysis of hip muscle activation during close-chain rehabilitation exercises in runners. *Int J Sports Phys Ther.* 2020;15(2):229-37.
12. Pruthviraj R, Lalrinkimi B, Archana P, Shyamprasad SB. Electromyographic analysis of gluteus medius activity in people with non-specific chronic low back pain compared to healthy controls. *Indian J Physiother Occup Ther.* 2021;15(3):90-6.
13. Youdas JW, Baartman HE, Gahlon BJ, et al: Recruitment of shoulder prime movers and torso stabilizers during push-up exercises using a suspension training system. *J Sport Rehabil.* 2020;29: 993-1000.
14. Ekstrom RA, Donatelli RA, and Carp KC. Electromyographic analysis of core trunk, hip, and thigh muscles during 9 rehabilitation exercises. *J Orthop Sports Phys Ther.* 2007;37(12):754-62.
15. Luk J, Kwok F, Ho I, Wong D. Acute responses of core muscle activity during bridge exercises on the floor versus the suspension system. *Int J Environ Res Public Health.* 2021;18(11):5908.
16. Distefano LJ, Blackburn JT, Marshall SW, and Padua DA. Gluteal muscle activation during common therapeutic exercises. *J Orthop Sports Phys Ther.* 2009;39(7):532-40.
17. Alfredson H, Hedberg G, Bergstrom E, et al. High thigh muscle strength but not bone mass in young horseback-riding females. *Calcif Tissue Int.* 1998;62:497-501.
18. Shinomiya Y, Osawa T, Hosaka Y, et al. Development and physical training evaluation of horseback riding therapeutic equipment. *Int Conf Adv Intell Mechatron.* 2003:1239-43.
19. de Araujo TB, de Oliveira RJ, Martins WR, et al. Effects of hippotherapy on mobility, strength, and balance in the elderly. *Arch Gerontol Geriatr.* 2013;56:478-481.
20. Kim S, HwangBo G. The effects of horse-riding simulator exercise on balance in elderly with knee osteoarthritis. *J Phys Ther Sci.* 2017;29(3):387-89.
21. Kim S, Yuk GC, Gak H. Effects of the horse riding simulator and ball exercises on balance of the elderly. *J Phys Ther Sci.* 2013;25:1425-28.
22. Park J, Lee S, Lee J, et al. The effects of horseback riding simulator exercise on postural balance of chronic stroke patients. *J Phys Ther Sci.* 2013;25:1169-72.

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Volar Locking Plates in a Non-Academic Setting: Complications of Distal Radius Fracture Fixation in 300 Cases

Kyler A. Hardie, MS IV; Troy D. Hollinsworth, MS IV; Michaela J. Derby, MS III; Paul F. Thanel, MD; Colton C. Husby, MS II; Hillary A. Becker, MD; Matthew C. Anderson, MD; Li Cao, PhD; and Robert E. Van Demark Jr., MD

Abstract

Background: The volar locking plate is an increasingly common method to treat distal radius fractures. This study aimed to assess whether complication rates following volar locking plate fixation for distal radius fractures for patients in a rural, non-academic setting are comparable to post-operative complication rates reported at larger academic centers.

Methods: A retrospective review of all patients who received volar locking plate fixation for distal radius fractures from January 2017 to February 2022 via the electronic medical record was performed at a single institution. A total of 300 patients were included in the study. Demographics, medical history, injury data, surgeon specialty and surgery data were collected along with any type of complications from surgery.

Results: Overall, 79 complications were identified representing 26% of patients, with the most frequent being hardware removal due to discomfort (n=21, 7.0%) and stiffness (n=21, 7.0%), followed by median nerve neuropathy (n=15, 5.0%), and tendonitis/tenosynovitis (n=10, 3.3%). The mean age for all patients was 57 years, 81% of which were female. No significant difference was observed between complications and patient demographics, medical history, injury or surgery data. There was no significant difference in complications between hand fellowship trained surgeons (87% of cases, 23% complication rate) and non-hand orthopedic surgeons (13% of cases, 27% complication rate).

Conclusion: The complication rate following volar locking plate fixation for distal radius fractures in our rural, non-academic setting (26%) is comparable to post-operative complication rates reported at larger academic centers (11-30%).

Introduction

Distal radius fractures (DRF) are among the most common orthopedic injuries.^{1,2} Accounting for over 25% of all fractures in the pediatric population and 18% of all fractures in the elderly population, the management of distal radius fractures has a massive impact on healthcare as a whole.^{1,3} Additionally, recent epidemiologic studies report an overall increase in the incidence of these injuries due to the ever-growing elderly population.^{1,3} Distal radius fractures follow a classic bimodal age distribution, with highest rates under the age of 18 and over the age of 65.² The most common mechanism of injury is the classic fall-on-outstretched-hand (FOOSH), which correlates naturally with the populations that most represent these injuries.

Despite the commonality of distal radius fractures, the

management of these injuries has continued to evolve over the past few decades.^{4,6} Complex anatomy, fracture pattern variance, and surgeon preference all play important roles in management.^{4,5,7} In general, however, minimally displaced fractures can be managed nonoperatively with cast-immobilization, while displaced and highly comminuted fractures are managed with open reduction and internal fixation (ORIF). In particular, the volar locking plate (VLP) has grown in popularity since its institution by Orbay and Fernandez in the early 2000s.⁸⁻¹⁰ Per the recent WRIST trial in 2020, patients who undergo ORIF with a VLP have faster recovery than those who receive external fixation ± pin fixation (EFP). However, at 12 months, neither patients with ORIF nor EFP had significantly better outcomes.

With the VLP becoming a more common method of

treatment for distal radius fractures, studies reporting it's outcomes and complication rates have followed naturally.^{11,12} DeGeorge et al. reviewed the outcomes of 636 patients who received volar plate fixation for distal radius fractures over a 15-year period at an academic center.¹³ Their primary aim was to report the type and incidence of complications, while secondarily identifying which patient factors impacted these complications.¹³ Their overall major and minor complication rates were 13.8% and 17.5%, respectively, with "hardware prominence requiring removal" and "transient paresthesias" making up the majority of these complications.¹³ Despite slight variance in complication definitions, these results have been consistent with subsequent studies by Andersen et al. and Nwosu et al.^{14,15} One question that continues to be discussed, however, is whether complications are associated with surgeon experience or the setting in which they practice.

Andersen et al. reported that the "surgeon's level of experience" had no significant difference on complication rate after volar plate fixation.¹⁴ Although defining the "surgeon's experience" is quite relative, they pointed out an important variable that could help explain the variance in complication rates between centers. That is, more severe fractures may be triaged to a hand specialist, while more simple fractures may be treated by a non-hand fellowship trained surgeon.¹⁴ This trend could also be present when considering academic and non-academic hand surgery departments, which is a key factor for our study. The primary aim for this study is to report the post-operative complication rates following VLP fixation for DRFs in a rural, non-academic setting. The secondary aim is to identify whether patient risk factors, fracture type, or orthopedic surgeon specialty (hand surgeon versus non-hand surgeons) is associated with a significant impact on patient outcomes.

Methods

Institutional review board approval was obtained, followed by a data query from the electronic medical record. Current Procedural Terminology (American Medical Association, Chicago, Ill.) codes 25607, 25608, and 25609 were used to identify the unique patients who received open treatment of distal radius fractures from January 2017 to February 2022 at our single institution. All orthopedic surgeons were included in the data query, including both hand surgeons (completed a hand surgery fellowship) and non-hand orthopedic surgeons.

Patients were included for analysis if they were at least 18 years of age at the time of surgery, had a qualifying injury, received volar locking plate fixation, and completed 6 weeks of regular follow up. Patients were excluded if they had a prior injury

or surgery on the ipsilateral wrist, concomitant dorsal plate fixation, or if they did not have injury radiographs available for review. Patient chart review was completed on the most recent patients in the data query until 300 met the above criteria. Data was obtained by manual retrospective chart review for data not able to be obtained from the data query. Patient data was stored in REDCap (Version 13.4.13). Data was categorized into demographics/history, injury/surgery, and complications for simplicity in future analysis.

Patient demographic/history data included: age, sex, active tobacco use, diabetes mellitus, osteoporosis, rheumatoid arthritis, other autoimmune disease or immunodeficiency, immunosuppressive medication use, presence of chronic glucocorticoid use, or bisphosphonate use. Injury/surgery data included: date of injury, date of surgery, CPT code, mechanism of injury, fracture type (open/closed), AO/OTA fracture classification, surgeon specialty, volar plate device vendor, date of 1st follow up visit, date of discontinued immobilization, type of hand therapy, and date of radiographic union. For patients who did not have radiographic evidence of union (per radiologist or surgeon reading), no date was collected.

Complications of interest included: hardware removal, malunion, nonunion, any tendon rupture, complex regional pain syndrome (CRPS), ulnar neuropathy, superficial infection, deep infection, palmar cutaneous branch of the median nerve (PCBMN) neuropathy, carpal instability, median neuropathy, missed injury, heterotopic ossification, stiffness, and tendonitis/tenosynovitis. No distinction between major/minor complications were made. Date of diagnosis (or date of hardware removal surgery) for each complication was recorded.

Descriptive statistics were conveyed using the mean, median, and interquartile range for continuous variables. Categorical variables were presented as frequencies and percentages. The logistic regression test was utilized to identify associations between demographic variables and risk factors with the complications in the patient sample. Surgeon training and complications were analyzed using a Chi-squared analysis. All the analysis was done by SPSS Version 29. A *p* value less than 0.05 was considered statistically significant.

Results

The initial electronic medical record data query yielded 573 distal radius fractures (CPT codes 25607, 25608, 25609). After reviewing 326 records (Jan 2019 – Feb 2022), the most recent 300 cases were identified and included for analysis.

Demographics/History

The mean age for all patients was 57 years, 81% of which were female. Forty-four (15%) of patients reported active tobacco use (Table 1). For past medical history, 45 (15%) had osteoporosis, 26 (8.7%) had diabetes mellitus, 5 (1.7%) had rheumatoid arthritis, and 17 (5.7%) had another autoimmune disease or an immunodeficiency. There were 10 (3.3%) patients taking immunosuppressant medications or chronic glucocorticoids and 14 (4.7%) taking bisphosphonates at the time of surgery.

For the analysis of the above demographics and history, complications had no significant association with any of these factors (Table 1).

Injury/Surgery

For all patients, the median days from injury to surgery was 5.0 days and the median days from surgery to 1st post-op follow up visit was 13 days (Table 2). The median days to discontinue immobilization after surgery was 35 days, and the median days from surgery to radiographic union for patients who had imaging was 55 days (n=183). The most frequent mechanisms of injury were fall-on-outstretched-hand (FOOSH) (n=241, 80%) and motor vehicle accidents (n=24, 8.0%). Only 12 (4.0%) cases were open fractures, and 157 (52%) cases had an ipsilateral ulnar or carpal bone fracture. The most frequent vendor for the volar locking plate was DePuy Synthes at 163 (54%), followed by Zimmer Biomet at 88 (29%). When categorized by the AO/OTA fracture classification system, 28% were Type A (n=84), 7.0% were

Type B (n=21), and 65% were Type C (n=195). The AO/OTA fracture classification system is outlined in Table 3.

For the analysis of the above injury and surgery data, complications had no significant association with any of these factors (Table 2).

Complications

Of the 300 cases included in the analysis, there were 79 complications identified, representing 26% of patients (Table 3). The most frequent complication types were hardware removal due to discomfort (n=21, 7.0%), stiffness (n=21, 7.0%), median nerve neuropathy (n=15, 5.0%), and tendonitis/tenosynovitis (n=10, 3.3%) (Figure 1). No factor was identified in this analysis that significantly increased risk of complications.

Hand Fellowship vs. Other Specialist

Cases were separated by those performed by a hand fellowship trained surgeon and those who were not. There were 260 (87%) performed by hand fellowship trained surgeons, and 40 (13%) performed by non-hand surgeons (Table 4). When comparing the rates of complications between the two groups, there was no significant difference found. There were 9 complications (23% of all surgeries) in the non-hand surgeon group and 70 complications (27% of all surgeries) in the hand surgeon group (Figure 1).

Discussion

Our overall complication rate was 26% out of the 300 cases analyzed in this study. This rate is comparable to other

Table 1. Patient demographics and history and complications analysis.

Patient demographics		Complications analysis of demographic variables		
Variable	N = 300 ¹	OR ²	95% CI ²	p-value
Age at time of surgery	60, 57, (47,67)	1	0.98, 1.02	0.7
Sex				
Female	244 (81%)	Ref		
Male	56 (19%)	1.38	0.65, 2.82	0.4
Comorbidities				
Active tobacco use	44 (15%)	0.81	0.32, 1.83	0.6
Osteoporosis	45 (15%)	1.05	0.40, 2.53	>0.9
Type 2 diabetes mellitus	26 (8.7%)	1.29	0.44, 3.33	0.6
Rheumatoid arthritis	5 (1.7%)	1.92	0.08, 22.1	0.6
Other autoimmune diseases or immunodeficiency	17 (5.7%)	2.15	0.60, 7.08	0.2
Active immunosuppressive medication or glucocorticoids	10 (3.3%)	0.24	0.01, 1.89	0.2
Active bisphosphonates	14 (4.7%)	0.63	0.19, 2.07	0.4
¹ Median, Mean (IQR); n (%)		² OR = Odds ratio, CI = Confidence interval		

Table 2. Patient injury/surgery risk factors and complications analysis.

Injury/surgery risk factors		Complications analysis of risk factors		
Variable	N = 300 ¹	OR ¹	95% CI ¹	p-value
Days from injury to surgery	5.0, 6.22, (2.0,8.0)	0.98	0.92, 1.03	0.5
Days from surgery to 1 st postop follow up visit	13, 15.5, (12, 14)	1.01	1.00, 1.04	0.2
Days from surgery to discontinue immobilization	35, 40.46, (27, 45)	1	0.99, 1.01	>0.9
Days from surgery to radiographic union (n=183)	55, 72.79, (43,76)	1.003	0.99, 1.01	0.2
CPT code				
25607	100 (33%)	Ref		
25608	49 (16%)	1.375	0.73, 2.59	0.326
25609	151 (50%)	0.89	0.36, 2.22	0.8
Mechanism of injury				
FOOSH	241 (80%)	Ref		
MVA	24 (8.0%)	3.15	1.11, 8.63	0.026
Other	19 (6.3%)	0.52	0.14, 2.05	0.4
Sports accident	16 (5.3%)	1.14	0.25, 3.97	0.8
Fracture type				
Open	12 (4.0%)	2.95	0.69, 11.3	0.12
Closed	288 (96%)	2.03	0.59, 7.0	0.26
AO fracture classification				
Type A	84 (28%)	Ref		
Type B	21 (7.0%)	0.32	0.04, 1.49	0.2
Type C	195 (65%)	0.8	0.32, 1.97	0.6
Ipsilateral ulnar or carpal fracture	157 (52%)	0.91	0.48, 1.73	0.8
Surgeon type				
Non-hand surgeon	40 (13%)	Ref		
Hand surgeon	260 (87%)	1.64	0.62, 4.76	0.3
Volar plate device company				
DePuy Synthes	163 (54%)	Ref		
Other	49 (16%)	1.19	0.52, 2.62	0.7
Zimmer Biomet	88 (29%)	0.49	0.20, 1.10	0.092
Type of hand therapy				
Home therapy	195 (65%)	0.95	0.25,3.53	0.9
Outpatient PT	87 (29%)	1.56	0.41,5.96	0.52
Unknown/other	18 (6.0%)			
¹ Median, Mean (IQR); n (%)		¹ OR = Odds ratio, CI = Confidence interval		

Table 3. AO/OTA fracture classification system of distal radius fractures.

	23-A1	23-A2	23-A3
Extra articular distal radius fracture	Ulna fractured, radius intact	Simple or impacted metaphyseal radius fracture	Comminuted metaphyseal radius fracture
Partial articular fracture of distal radius	Radius, sagittal	Radius, coronal, dorsal rim	Radius, coronal, volar rim
Complete articular fracture of distal radius	Articular simple, metaphyseal simple	Articular simple, metaphyseal multifragmentary	Articular multifragmentary

Figure 1. Complication rates of distal radius fractures after volar plate fixation. A bar graph comparing the different rates of complications between non-hand surgeons (blue bars) and hand surgeons (orange bars) is shown.

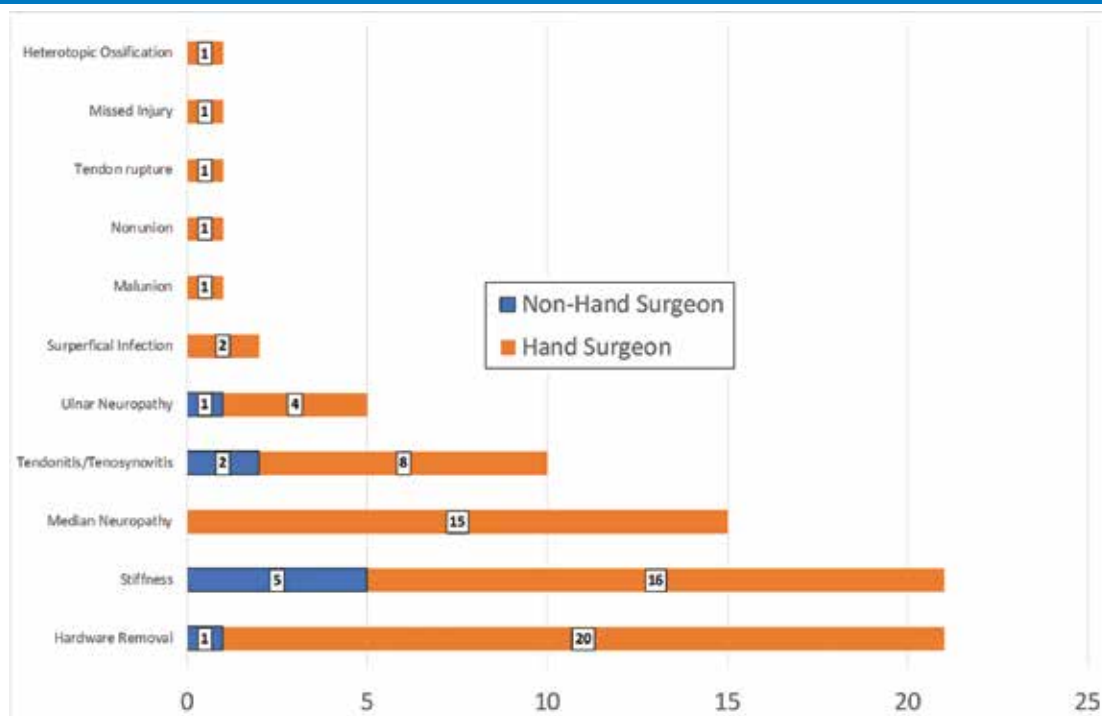


Table 4. Complication rates for all patients.

	N = 300 [†]
Total complications	79 (26%)
Complication type	
Hardware removal	21 (7.0%)
Stiffness	21 (7.0%)
Median neuropathy	15 (5.0%)
Tendonitis/tenosynovitis	10 (3.3%)
Ulnar neuropathy	5 (1.7%)
Superficial infection	2 (0.7%)
Malunion	1 (0.3%)
Nonunion	1 (0.3%)
Tendon rupture	1 (0.3%)
Missed Injury	1 (0.3%)
Heterotopic ossification HO	1 (0.3%)
Complex regional pain syndrome CRPS	0 (0%)
Deep infection	0 (0%)
Palmar cutaneous branch of the median nerve PCBMN	0 (0%)
Carpal instability	0 (0%)
	[†] n (%)

Table 5. Complications rates and comparison by surgeon's experience using Fisher's exact test.

	Non-hand surgeon	Hand surgeon	Total	p-value [†]
Hardware removal	1 (2.5%)	20 (7.7%)	21 (7.0%)	0.3
Malunion	0 (0%)	1 (0.4%)	1 (0.3%)	>0.9
Nonunion	0 (0%)	1 (0.4%)	1 (0.3%)	>0.9
Tendon rupture	0 (0%)	1 (0.4%)	1 (0.3%)	>0.9
Ulnar neuropathy	1 (2.5%)	4 (1.5%)	5 (1.7%)	0.5
Superficial infection	0 (0%)	2 (0.8%)	2 (0.7%)	>0.9
Median neuropathy	0 (0%)	15 (5.8%)	15 (5.0)	0.2
Missed injury	0 (0%)	1 (0.4%)	1 (0.3%)	>0.9
Heterotopic ossification	0 (0%)	1 (0.4%)	1 (0.3%)	>0.9
Stiffness	5 (13%)	16 (6.2%)	21 (7.0%)	0.2
Tendonitis/tenosynovitis	2 (5.0%)	8 (3.1%)	10 (3.3%)	0.6
Total	40	260	300	[†] Fisher's exact test

recent, similarly designed studies that also reported overall complication rates of VLP fixation in DRF, which range as low as 11% (Andersen et al.) and 13.2% (Pidgeon et al.) to as high as 30.8% (Nwosu et al.) and 27.9% (DeGeorge et al.).¹⁴ ¹⁶ When analyzing these studies in comparison to our own, the definition of complications, inclusion/exclusion criteria and follow up time periods among each study do involve some degree of variance. However, when solely comparing overall complication rates, our results fall within the range of these other well-organized, larger studies. As such, the authors believe more confidence can be given to our results in terms of overall complication rate. Although we did not find any significant association between complication rate and any patient or surgical risk factor, our study sample again appeared to be comparable to the referenced studies in this article. For example, DeGeorge et al. reported their high proportion of AO/OTA 23-C/intraarticular fracture pattern to be at 67%, which was near our sample at 65% (Table 2).¹³ This phenomenon in our setting can be explained similarly. Given our rural tertiary care center, our catchment area includes a large rural population and hundreds of highway/interstate miles. This leads to a high rate of osteoporotic fractures in combination with high-velocity trauma due to motor vehicle accidents.

In our study, we specifically compared the complications in association to hand-surgeons and non-hand surgeons. The rates were found to be similar between the non-hand surgeons (n=9, 23%) and the hand surgeons (n=70, 27%) (Figure 1). In comparison, Andersen et al. reported “non-specialists” had a complication rate of 19% (n=33/352), “less experienced specialists” had a rate of 14% (n=25/180), and

“experienced specialists” had a rate of 11% (n=8/71).¹⁴

When considering the rates of various types of complications seen with VLP in distal radius fractures, our results are again similar to other studies. For our patient sample, hardware removal due to discomfort was the most frequent indication for removal, accounting for 7% (n=21). Likewise, Pigeon et al. prospectively identified 39 complications following distal radius fracture management with volar plate fixation alone over a 12-year period.¹⁶ Their most frequent complication was “hardware complication requiring removal” occurring at a rate of 7% (n=18). Similar results have been reported by other studies, as well.^{13–15,17} Holc et al. found that volar locking plate removal after distal radius fractures was the most common during the first year after surgery and remained notable until the third year, after which the rate of hardware removal stabilized.¹⁷ As such, surgeons must be aware of these relatively high rates of potential complications when discussing the risks and benefits of surgery.⁶ Recent work has been done in the area of patient-reported outcomes after volar locking plate fixation, which should equally be considered in surgeon-patient discussions.^{18–20}

There are multiple limitations associated with this study. First, the retrospective study design limits data to that which could be extracted from the patient chart. Patient reported outcomes and functional outcomes also could not be considered with this study design. Additionally, surgeon post-operative management preferences between hand surgeons and non-hand surgeons could not be controlled for. Also, due to the rural setting of our institution, many patients who lived hours away may have sought care closer

to home after the initial 6 week follow up was completed. Finally, radiographic union data were likely skewed because radiographs were not obtained for all patients at designated time points, and were typically obtained if healing problems were suspected.

Conclusion

Patients with distal radius fractures have a real risk of functional impairment and complications, even with optimal care. Our study highlights the similar rates of complications for VLP fixation in distal radius fractures in our rural, non-academic sample of patients when compared to the post-

operative complication rates reported at larger academic centers. By anticipating the common complications of volar locking plate fixation as reported by our study, surgeons can better identify them as they care for patients. Additionally, when comparing hand surgeons to non-hand surgeons in terms of complication rates, our results should instill confidence to surgeons and patients alike that traveling to a large academic center for distal radius fracture repair may be unnecessary. Future studies could potentially evaluate patient reported outcomes associated with obtaining care closer to home.

REFERENCES

1. Nellans KW, Kowalski E, Chung KC. The epidemiology of distal radius fractures. *Hand Clin.* 2012;28(2):113-25.
2. Karl JW, Olson PR, Rosenwasser MP. The epidemiology of upper extremity fractures in the United States, 2009. *J Orthop Trauma.* 2015;29(8):e242-4.
3. Shauver MJ, Yin H, Banerjee M, Chung KC. Current and future national costs to medicare for the treatment of distal radius fracture in the elderly. *J Hand Surg.* 2011;36(8):1282-7.
4. Vannabouathong C, Hussain N, Guerra-Farfan E, Bhandari M. Interventions for distal radius fractures: A network meta-analysis of randomized trials. *J Am Acad Orthop Surg.*
5. Huettnerman HE, Shauver MJ, Malay S, Chung TT, Chung KC. Variation in the treatment of distal radius fractures in the United States: 2010-2015. *Plast Reconstr Surg.* 2019;143(1):159-67.
6. Chung KC, Kim HM, Malay S, Shauver MJ. The wrist and radius injury surgical trial (WRIST): 12-month outcomes from a multicenter international randomized clinical trial. *Plast Reconstr Surg.* 2020;145(6):1054e-66e.
7. Abbaszadegan H, Jonsson U. External fixation or plaster cast for severely displaced Colles' fractures? Prospective 1-year study of 46 patients. *Acta Orthop Scand.* 1990;61(6):528-30.
8. Orbay JL. The treatment of unstable distal radius fractures with volar fixation. *Hand Surg Int J Devoted Hand Up Limb Surg Relat Res J Asia-Pac Fed Soc Surg Hand.* 2000;5(2):103-12.
9. Orbay JL, Fernandez DL. Volar fixation for dorsally displaced fractures of the distal radius: a preliminary report. *J Hand Surg.* 2002;27(2):205-15.
10. Kandemir U, Matityahu A, Desai R, Puttitz C. Does a volar locking plate provide equivalent stability as a dorsal nonlocking plate in a dorsally comminuted distal radius fracture? A biomechanical study. *J Orthop Trauma.* 2008;22(9):605-10.
11. Grant DW, Chung KC. A critical assessment of the most cited papers on distal radius fractures. *Hand Clin.* 2021;37(2):189-96.
12. McKay SD, MacDermid JC, Roth JH, Richards RS. Assessment of complications of distal radius fractures and development of a complication checklist. *J Hand Surg.* 2001;26(5):916-22.
13. DeGeorge BR, Brogan DM, Becker HA, Shin AY. Incidence of complications following volar locking plate fixation of distal radius fractures: An analysis of 647 Cases. *Plast Reconstr Surg.* 2020;145(4):969-76.
14. Andersen MF, Landgren M, Schmidt LB, Hassani G. Complications associated with anterior plate fixation of distal radial fractures: A retrospective study of 599 patients. *J Hand Surg Eur Vol.* 2022;47(8):825-30.
15. Nwosu C, Rodriguez K, Zeng S, Klifto KM, Klifto CS, Ruch DS. Complications following volar locking plate fixation of distal radius fractures in adults: A systematic review of randomized control trials. *J Hand Surg.* 2023;48(9):861-74.
16. Pidgeon TS, Casey P, Baumgartner RE, Ferlauto H, Ruch DS. Complications of volar locked plating of distal radius fractures: A prospective investigation of modern techniques. *Hand N Y N.* 2020;15(5):698.
17. Holc F, Bronenberg Victorica P, Avanzi R, Huespe IA, De Carli P, Boretto JG. Risk of volar locking plate removal after distal radius fractures: Time-to-event analysis. *J Hand Surg.* 2023;48(10):1011-7.
18. Jayaram M, Wood SM, Kane RL, Yang LY, Chung KC. Association of open reduction and internal fixation with volar locking plate for distal radius fractures with patient-reported outcomes in older adults. *JAMA Netw Open.* 2023;6(6):e2318715.
19. Nagura N, Naito K, Sugiyama Y, et al. Evaluation of patient-reported and clinician-reported outcomes of volar locking plate fixation for distal radius fractures. *J Hand Surg Asian-Pac Vol.* 2020;25(3):359-63.
20. Lawson A, Naylor J, Mittal R, Kale M, Xuan W, Harris IA. Does radiographic alignment correlate with patient-reported functional outcomes and posttreatment complications in older patients treated for wrist fractures? *J Hand Surg.* 2023;48(6):533-43.

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Pictured: Andrew Huang Pacheco, MD, Pediatric Gastroenterologist

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Assessing Medical Students' Perception of the Role of Artificial Intelligence in Healthcare

Oluwafunke Oluwatosin Ogunremi, MS III; Alexandra Job, MS III; Ethan Noble, MS III; Joseph Reynen, MS III; Andrew Holmes, MD; and Valeriy Kozmenko, MD

Abstract

Artificial intelligence (AI) holds the potential to unlock numerous advancements and positive changes in healthcare. However, concerns such as bias, privacy, and accountability are being considered alongside the potential benefits. A 28-question survey was distributed to medical students at the University of South Dakota Sanford School of Medicine (USD SSOM) to assess their perceptions of AI in healthcare. Responses were measured using a 5-point Likert scale and analyzed through regression analysis and ANOVA tests. Overall, medical students found AI's integration into healthcare to be neutral, with no significant difference in the overall view of AI between the four medical school cohorts. Aspects of this study, notably views on diagnostic radiology, highlight a dual perception of AI in healthcare: recognition of the potential to enhance diagnostic accuracy alongside concerns about possible job displacement. While medical students currently maintain a neutral stance toward AI in healthcare, there exists a foundational optimism that could be nurtured through education and practical experience. Emphasizing the importance and irreplaceable nature of human labor in the workforce may aid in easing the skepticism of those wary of integrating AI into healthcare.

Introduction

Artificial intelligence (AI) holds the potential to drive numerous advancements and transformative changes in healthcare. The application of AI in clinical settings could revolutionize diagnostic recognition, treatment selection, and the automation of administrative tasks, ultimately saving time, reducing costs, and minimizing human error.¹ In particular, AI has shown promise in areas such as medical imaging, where machine learning algorithms can assist in interpreting radiological images with a level of accuracy comparable to that of human experts.² Additionally, AI-powered decision support systems can analyze vast amounts of patient data to identify optimal treatment plans, providing clinicians with evidence-based recommendations that improve patient outcomes.³ By automating routine administrative tasks, AI could also alleviate clinician burnout, allowing healthcare professionals to focus on direct patient care.⁴

Despite the promising advantages, concerns about AI replacing healthcare professionals have been widely discussed. However, human connection remains the cornerstone of quality patient care, and AI should be viewed not as a replacement for clinicians, but as a tool to enhance the patient-provider relationship. For instance, AI

can save clinicians time by streamlining documentation, analyzing clinical data, and providing quick access to up-to-date, evidence-based guidelines, thereby increasing the amount of time clinicians can spend with their patients.⁵ Moreover, while AI algorithms excel in processing large datasets, not all patients fit neatly into predetermined models or algorithms, emphasizing the continued need for human oversight. Healthcare providers will remain essential in making individualized decisions and addressing the nuances of patient care that AI cannot fully replicate.

Nevertheless, it is crucial to consider AI's potential risks alongside its benefits. AI algorithms rely heavily on data, which is often collected by humans, making these systems vulnerable to biases present in the data or research methodology.⁶ Biases in AI can result in health disparities, especially when training datasets are not sufficiently diverse or representative of different populations.⁷ Additionally, issues surrounding data privacy, security, and accountability in AI-driven decision-making must be addressed to ensure that AI is used ethically and responsibly in healthcare settings.⁸ Furthermore, regulatory frameworks will need to be established to oversee the integration of AI technologies into clinical practice and to ensure their safety and efficacy.



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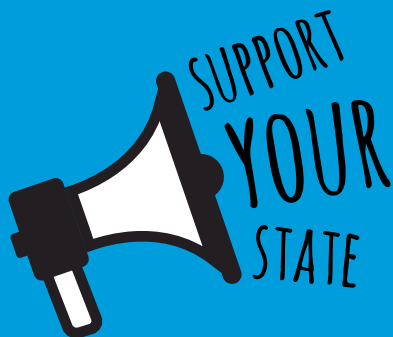
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Prior health science student surveys on AI have shown an overall positive attitude toward AI in addition to concerns regarding ethics education in AI.⁹ This project aims to explore the perspectives of medical students at the University of South Dakota Sanford School of Medicine (USD SSOM) on the role of AI in healthcare, focusing on their attitudes toward AI's potential to enhance clinical practice, as well as their concerns regarding its integration into the healthcare system.

Methods

To assess medical students' understanding of the current and potential future roles of AI in healthcare, a 28-item IRB approved survey was administered via the Qualtrics platform to medical students' school issued email accounts at USD SSOM. The students were assessed according to medical cohort, the class in which they currently hold an enrollment. The survey consisted of both previously validated questions from the literature and original questions designed for this study. It aimed to evaluate students' perceptions of the potential benefits and drawbacks of AI integration into the healthcare system. In addition to collecting participants' demographic data, the survey collected data on the ability of AI to affect general practitioners, specialists, burnout, workflow, and patient-provider relationships. Participants were asked to rank medical specialties based on their perceived potential to benefit from AI, as well as respond to statements using a 5-point Likert scale. The survey was distributed to 279 medical students at USD SSOM and remained open for a period of four months so that subsequent email reminders could be issued (Table 1). Data collected from the survey was downloaded to Microsoft Excel, and was analyzed using regression analysis and ANOVA tests, as appropriate.

Results

A total of 98 responses were generated on Qualtrics, and 84 participants in the study fully completed the survey. The summative score of the survey items graded using the Likert scale was used as a metric for the overall view of AI in medicine. A higher score correlates to a more positive opinion, while a lower score correlates to a more negative opinion. No significant difference in the overall view of AI was found between medical school cohorts ($p = 0.793$). There was no correlation between the number of hours of social media use per day by students and their overall view of AI use ($p = 0.854$). When divided based on which specialty the students planned on pursuing, there was no significant difference in the overall view of AI between groups ($p = 0.895$).

There was a statistically significant moderate positive correlation between the response to "AI will strengthen the physician-patient relationship" and the overall view of AI ($r = 0.525$, $p < 0.001$). There was a statistically significant moderate positive correlation between the response to "AI will help troubleshoot and catch missed diagnoses" and the overall view of AI ($r = 0.648$, $p < 0.001$). There was a statistically significant moderate positive correlation between the response to "AI will build physician confidence" and the overall view of AI ($r = 0.543$, $p < 0.001$). Participants were asked to rank which specialties they thought were most likely to benefit from AI (Figure 1), and which specialties were most likely to be replaced by AI (Figure 2). The highest number of students responded that diagnostic radiology would be most likely to benefit from AI ($n = 49$), followed by pathology ($n = 7$). The highest number of students responded that diagnostic radiology was most likely to be replaced by AI ($n = 59$), followed by pathology ($n = 10$).

Table 1. Response by medical school cohort. Depicts the survey response rate both within and among the medical student cohorts. The total survey score for each of the cohorts is shown within the table as well, and no significant difference was found between the groups ($p = 0.79$).

Medical school cohort	Number of years completed in medical school	Number of students in the cohort	Number of students who completed the survey	Response rate per cohort	Average total score on survey
Class of 2027	0	72	24	33.3%	54.33
Class of 2026	1	72	21	29.2%	56.14
Class of 2025	2	66	12	18.2%	54.58
Class of 2024	3	63	27	42.3%	54.85
Total	N/A	279	84	30.1%	54.98

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Figure 1. Specialty most likely to benefit from AI. Depicts which specialty each medical student responded with "1" to the question: Rank the specialties based on which ones you think will benefit the most from AI. (1 = most benefit, 11 = least benefit).

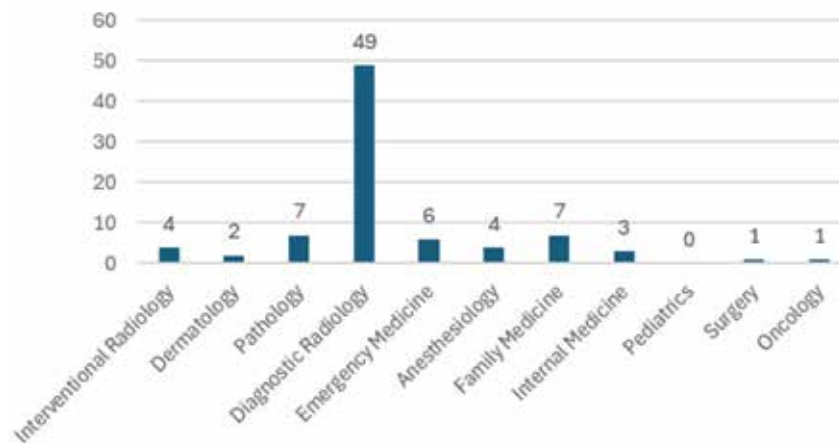
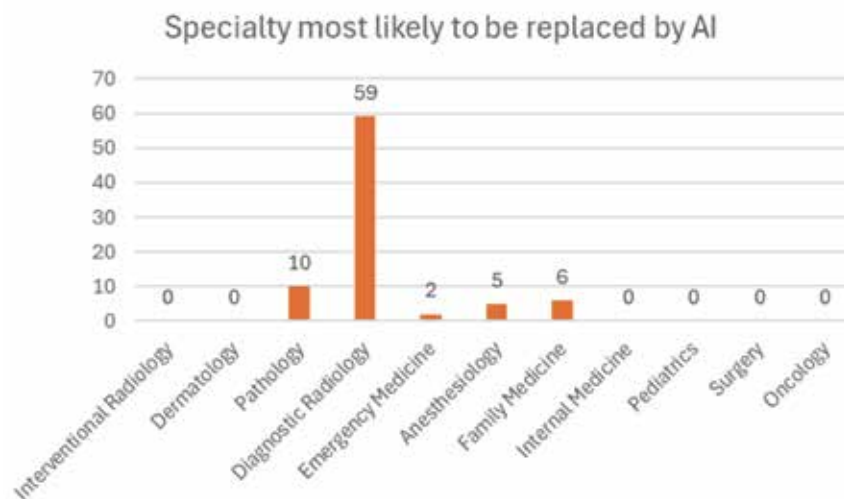


Figure 2. Specialty that is most likely to be replaced by AI. Depicts which specialty each medical student responded with "1" to the question: Rank the specialties based on which ones you think are most at risk of being replaced by AI? (1 = most likely to be replaced, 11 = least likely to be replaced).



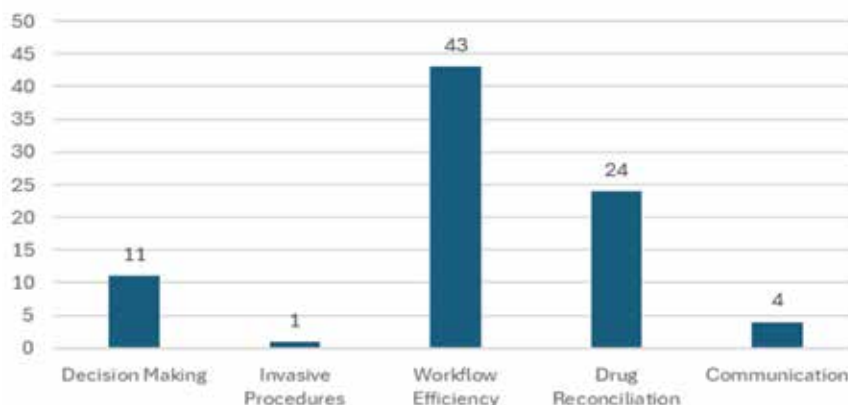
The participants were asked to give their impression of how AI use would affect physician burnout, with response options such as no effect on burnout, somewhat of an increase or decrease of burnout, or a significant increase or decrease in burnout. When grouped based on response, there was no significant difference in the overall view of AI between groups ($p = 0.415$). Participants were also asked to rank various areas of healthcare (communication, invasive procedures, decision making, drug reconciliation, and workflow efficiency) in order of which they thought would benefit most from AI (Figure 3). 43 students believed that workflow efficiency would benefit most, 24 believed drug reconciliation would benefit most, 11 believed decision making would benefit most, 4 believed communication would benefit most, and 1 believed invasive

procedures would benefit most.

Discussion

This study aimed to assess the perspectives of current medical students at USD SSOM regarding the integration of AI in healthcare, revealing a generally neutral view across the surveyed cohorts. While no significant differences were found among the various medical school cohorts or based on specialty interests, the data indicated moderate positive correlations between beliefs about AI and overall attitudes toward its implementation. Specifically, students who believed that AI could strengthen the physician-patient relationship or assist in diagnosing missed conditions were more likely to hold favorable views of AI in healthcare.

Figure 3. Area of healthcare most likely to benefit from AI. Depicts which specialty each medical student responded with "1" to the question: Rank the following areas of healthcare based on which ones you think that AI will impact most positively. (1 = most positive impact, 5 = least positive impact).



Diagnostic radiology emerged as the specialty that students felt would benefit most from AI, while simultaneously being perceived as the most at risk of replacement by it. This dual perception underscores the recognition of AI's potential to enhance diagnostic accuracy in radiology, alongside concerns regarding the potential displacement of radiologists. Furthermore, students identified workflow efficiency as the area within medicine most likely to benefit from AI, followed by drug reconciliation and decision-making processes. This prioritization suggests that students primarily view AI as a tool for streamlining administrative tasks and supporting clinical decision-making rather than as a substitute for human oversight.

Although the sample size was adequate, the data were collected from a single institution, which may limit the generalizability of the findings. Additionally, the neutral overall perspective could mask underlying concerns that might be uncovered through more extensive survey instruments or open discussions, such as interviews or focus groups. Future research should consider broader geographic sampling and delve deeper into students' attitudes, potentially revealing complexities that quantitative measures alone may not capture.

The results indicate a need for practical trials to examine AI's impact in real-world clinical settings, both inpatient and outpatient, to gain insights into the tangible effects of AI on clinician workflow, patient outcomes, and burnout levels.

Addressing these aspects is essential for understanding how AI integration might influence clinician well-being and the dynamics of patient care.

While medical students currently maintain a neutral stance toward AI in healthcare, there exists a foundational optimism that can be nurtured through education and practical experience. By emphasizing AI's supportive role, medical training programs can cultivate a future generation of clinicians who are both technologically proficient and deeply committed to preserving the essential human element of patient care.

Conclusion

Overall, medical students expressed a neutral perspective regarding the integration of AI into the healthcare industry, with no significant differences observed in their views across the four medical school cohorts. The implementation of AI technology presents both undeniable advantages and challenges. Among the benefits are enhancements in diagnostic recognition, treatment selection, automation of administrative tasks, reductions in human error, and overall time and cost savings.¹³ However, potential drawbacks include the introduction of biases in research and data collection, as well as concerns related to ethics, accountability, and privacy. Emphasizing the critical and irreplaceable role of human labor in the workforce may help alleviate skepticism among those apprehensive about integrating AI into healthcare.

REFERENCES

1. Alowais SA, Alghamdi SS, Alsuebany N, Alqahtani T, Alshaya AI, Almohareb SN, Aldairem A, et al. Revolutionizing healthcare: the role of artificial intelligence in clinical practice. BMC Med Educ. 2023 Sep 22;23(1):689.
2. Najjar R. Redefining radiology: a review of artificial intelligence integration in medical imaging. Diagnostics (Basel). 2023 Aug 25;13(17):2760.
3. Elhaddad M, Hamam S. AI-Driven clinical decision support systems: an ongoing pursuit of potential. Cureus. 2024 Apr 6;16(4):e57728.
4. Pavuluri S, Sangal R, Sather J, Taylor RA. Balancing act: the complex role of artificial intelligence in addressing burnout and healthcare workforce dynamics. BMJ Health Care Inform. 2024 Aug 24;31(1):e101120.
5. Wehkamp K, Krawczak M, Schreiber S. The quality and utility of artificial intelligence in patient care. Dtsch Arztebl Int. 2023 Jul 10;120(27-28):463-9.
6. Rajpurkar P, Chen E, Banerjee O, Topol EJ. AI in health and medicine. Nat Med. 2022 Jan;28(1):31-8.
7. Norori N, Hu Q, Aellen FM, Faraci FD, Tzovara A. Addressing bias in big data and AI for health care: a call for open science. Patterns. 2021 Oct 8;2(10):100347.
8. Wubineh BZ, Deriba FG, Woldeyohannis MM. Exploring the opportunities and challenges of implementing artificial intelligence in healthcare: a systematic literature review. Urol Oncol. 2024 Mar;42(3):48-56.
9. Amiri H, Peiravi S, Rezazadeh Shojae SS, Rouhparvarzamin M, Nateghi MN, Etemadi MH, ShojaeiBaghini M, et al. Medical, dental, and nursing students' attitudes and knowledge towards artificial intelligence: a systematic review and meta-analysis. BMC Med Educ. 2024 Apr 15;24(1):412.
10. Fosch-Villaronga E, Drukarch H, Khanna P, Verhoef T, Custers B. Accounting for diversity in AI for medicine. Computer Law & Security Review. 2022;47:105735.
11. Shiang T, Garwood E, Debenedectis CM. Artificial intelligence-based decision support system (AI-DSS) implementation in radiology residency: introducing residents to AI in the clinical setting. Clinical Imaging. 2022;92:32-7.
12. Alghamdi SA, Alashban Y. Knowledge, attitudes and practices towards artificial intelligence (AI) among radiologists in Saudi Arabia. Journal of Radiation Research and Applied Sciences. 2023;16(2):100569.
13. Al-Medfa MK, Al-Ansari AM, Darwish AH, Qreeballa TA, Jahrami H. Physicians' attitudes and knowledge toward artificial intelligence in medicine: benefits and drawbacks. Heliyon. 2023;9(4).
14. Martin C, DeStefano K, Haran H, Zink S, Dai J, Ahmed D, et al. The ethical considerations including inclusion and biases, data protection, and proper implementation among AI in radiology and potential implications. Intelligence-Based Medicine. 2022;6:100073.

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Dual Antiplatelet Therapy: A Concise Review of Evidence for the Practicing Clinician

Mustafa Shehzad, MD; Dawood Shehzad, MD; Logan Johnke, MD; Dawlat Khan, MD; Hammad Shabir Chaudhry, MD; and Sanjana Manimaran, MD

Abstract

This review article examines the importance of dual antiplatelet therapy (DAPT) in managing thrombotic events related to cardiovascular atherosclerotic disease. DAPT typically includes aspirin and a P2Y₁₂ inhibitor and is used to mitigate complications from cardiovascular atherosclerotic disease. The article details the pharmacological profiles of common antiplatelet agents. Evidence from randomized controlled trials informs DAPT's application in various clinical contexts, demonstrating clear benefits in chronic coronary syndrome and acute coronary syndrome. However, its role in primary prevention is unproven. The review highlights the need for individualized treatment strategies, particularly concerning the duration of therapy following procedures like percutaneous coronary intervention, coronary artery bypass grafting and post transcatheter aortic valve implantation. Considering the ubiquitousness of these medications clinicians should be aware of the underlying induction, and evidence surrounding their use. Ongoing research is essential to refine antiplatelet strategies, ultimately improving patient outcomes while minimizing adverse effects. This review highlights the importance of individualized assessments in optimizing DAPT for various cardiovascular conditions.

Introduction

Under normal physiological conditions, platelets are necessary for normal hemostasis. In certain situations, platelet adhesion, activation, and aggregation play a crucial part in the pathophysiology of thrombotic events. Dual antiplatelet therapy (DAPT) combines two antiplatelet drugs, typically aspirin and a P2Y₁₂ inhibitor, to prevent and treat complications from cardiovascular atherosclerotic disease.

Currently, oral and intravenous antiplatelet agents are available. Their indications, optimal duration, specific drug combinations, and potential bleeding risks are the areas of active research and ongoing investigation. The past two decades have seen multiple randomized controlled trials that have informed our practice, and risk scores have been developed to assess patients' thrombotic versus bleeding risk.

In this review, we will aim to summarize common antiplatelet agents currently available in the United States, their use in clinical practice, the evidence behind their use, and areas where we lack convincing evidence-based data.

Summary of Antiplatelet Agents in Current Practice

Since the 19th century, aspirin has been a cornerstone of antiplatelet therapy. While it remains the most cost-effective

option, its limited ability to prevent platelet activation has led to newer generations of antiplatelet drugs to complement aspirin. Recent decades have seen the introduction of medications such as indobufen, commonly used in East Asia, and various P2Y₁₂ inhibitors, phosphodiesterase inhibitors, and protease-activated receptor-1 (PAR-1) antagonists.

Aspirin

Aspirin is an oral agent that exerts its antiplatelet effect through the irreversible inhibition of cyclooxygenase (COX) 1 and 2, enzymes necessary to produce thromboxane A₂, which prevents platelet aggregation.¹ Low-dose aspirin (75 mg to 325 mg) can induce complete or near-complete inhibition of COX-1. This dosing range has been evaluated in numerous trials and meta-analyses. Aspirin's antithrombotic effect is similar across 75-1300 mg/day doses. By contrast, the risk of bleeding began to increase with doses above 325 mg/day.²

Indobufen

Although not approved in the United States, indobufen is commonly used throughout Asia and Europe as a reversible antiplatelet. Like aspirin, its antiplatelet activity is achieved through COX inhibition, although, unlike aspirin, its effect is reversible.³ It has many similar benefits to aspirin when used in patients at risk of CVD.³ We will not discuss

Indobufen further, as it is not used in the United States.

P2Y₁₂ Receptor Inhibitors

Clopidogrel, ticagrelor, and prasugrel are the most prescribed P2Y₁₂ inhibitors for oral formulations. They work by inhibiting P2Y₁₂ receptors on the surface of platelets, which interferes with the biochemical processes that lead to platelet aggregation.⁴

Phosphodiesterase (PDE) Inhibitors

PDE inhibitors work by preventing the conversion of cAMP and cGMP into AMP and GMP, respectively. This inhibition dampens cytoskeletal rearrangement and platelet secretion while inducing a vasodilatory response.⁵ Although they are rarely used as standalone antiplatelet agents, dipyridamole and cilostazol have been evaluated for this purpose with mixed results. Cilostazol, while primarily used to alleviate symptoms of claudication, may also help reduce the risk of ischemic stroke.⁶

PAR-1 Antagonists

Vorapaxar functions as a protease-activated receptor (PAR-1) antagonist, inducing an antiplatelet effect by blocking thrombin-induced platelet activation. Despite its approval for use in the U.S., its clinical use remains limited.⁷

Role of Dual Antiplatelet Therapy in Primary Prevention for Atherosclerotic Cardiovascular Disease (ASCVD)

There is currently no evidence for the use of DAPT in the primary prevention of cardiovascular disease (CVD). Recommendations do exist for low-dose aspirin; however, they vary from guideline to guideline. The 2019 ACC/AHA guidelines recommend that low-dose aspirin (75-100 mg daily) may be considered among adults 40-70 at higher risk of CVD (10% or greater 10-year CVD risk) but not at increased risk of bleeding.⁸ The European guidelines do not recommend aspirin for ASCVD prevention.⁹ A large meta-analysis looking at different doses of antiplatelet therapy found that aspirin appears to be equally effective for preventing vascular events at doses between 75 to 325 mg daily. Aspirin in doses from 75-325 mg daily produces similar benefits on CVD events to doses over 1300 mg but with far fewer side effects.¹⁰ There is no evidence adding a second antiplatelet agent offers any further reduction in adverse cardiovascular events.

Dual Antiplatelet Therapy in Chronic Coronary Syndrome

Chronic coronary syndrome (CCS), previously known as stable ischemic heart disease, is defined as confirmed obstructive CAD without recent (<1 year) ACS or PCI.¹¹ Most patients can be given this diagnosis based on a

classic history of angina pectoris in the presence of either risk factors or other evidence of known atherosclerotic cardiovascular disease. The 2023 AHA/ACC guidelines for the management of patients with CCD assign a class 2B recommendation for DAPT.¹¹ The effectiveness of aspirin (75-100 mg) for secondary prevention in ASCVD is clear and a Class 1A recommendation. The CHARISMA trial randomized patients with CCS (n = 15,603) and multiple risk factors for major adverse cardiovascular events to either clopidogrel and aspirin versus aspirin alone. The study did not reveal any substantial advantages of extended DAPT in reducing the incidence of stroke, MI, or cardiovascular fatalities (RR 0.93; 95% CI 0.83-1.05; P=0.22).¹² Further, the study indicated potential disadvantages in patients with several risk factors, such as moderate bleeding (RR 1.62; 95% CI 1.27-2.08; P<0.001) NNH= 125).¹²

Dual Antiplatelet Therapy in Acute Coronary Syndrome (ACS)

Platelet inhibition has been critical in acute and long-term acute coronary syndrome (ACS) management. Aspirin has been shown to halve the risk of recurrent events in patients presenting with acute myocardial infarction.^{13,14} A loading dose of 162-325 mg of uncoated aspirin should be given to any patient with ACS as soon as possible, irrespective of treatment strategy.¹⁴ Based on the initial ISIS-2 trial in 1988, in patients with STEMI, aspirin use reduced vascular mortality at five weeks, with aspirin having an NNT of 42 compared to placebo.¹⁵ After the loading dose, guidelines recommend continuing aspirin 75-81mg daily unless contraindications develop.¹⁴

All patients receiving fibrinolysis should receive a P2Y₁₂ receptor blocker immediately upon presentation. Though guidelines favor the use of ticagrelor/prasugrel, many contraindications exist hence, clopidogrel is usually chose.¹⁴ Some of these contraindications include increased bleeding risk in the elderly population, increased side effects such as dyspnea that is associated with ticagrelor. Cost and adherence are also important factors as clopidogrel is often cheaper and dosed once a day, compared to ticagrelor which is more expensive and dosed twice a day which makes real-life adherence more difficult to maintain. Post fibrinolysis, DAPT is continued for one year.¹⁴

Guidelines recommend starting a P2Y₁₂ receptor blocker as early as possible after the diagnosis is established for patients undergoing primary PCI. However, there is no strong evidence supporting an early benefit. Primary PCI reperfusion occurs in many patients before these medications reach their maximum antiplatelet effect. There



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Table 1. Pharmacological profile of common antiplatelet agents.

Medication	Properties	Mechanism of Action	Usual dosage range	Half-Life	Duration of Action
Aspirin	Salicylate, Antiplatelet, analgesic, antipyretic	COX-1/2 Inhibitor, irreversible	75–325 mg/day	~15-20 minutes	Platelet inhibition persists through lifespan of platelet, usually ~10 days
Indobufen	Antiplatelet	COX-1 Inhibitor, reversible	200–300 mg/day	7 hours	Data not well established
Clopidogrel	Thienopyridine, Antiplatelet	P2Y ₁₂ receptor inhibitors	75-225 mg/day	6 hours	5 days
Prasugrel	Thienopyridine, Antiplatelet	P2Y ₁₂ receptor inhibitors	10 mg/day	7 hours	5 – 9 days
Ticagrelor	Nucleoside (adenosine) analogue, Antiplatelet	P2Y ₁₂ receptor inhibitors	90 mg/twice daily	7– 9 hours	2.5 – 3 days
Dipyridamole	Antiplatelet, vasodilator	Phosphodiesterase inhibitors	200–400 mg/day	10 –12 hours	18 – 24 hours
Cilostazol	Antiplatelet, vasodilator	Phosphodiesterase inhibitors	100 mg/twice daily	11 – 13 hours	Data not well established
Vorapaxar	Antiplatelet	Protease-activated receptor-1 antagonists	2.08 mg/day	3 – 4 days	Up to 4 weeks

is also significant variability among patients in the time it takes to achieve a meaningful reduction in platelet effect, making it hard to assess early benefits after a recent acute event.^{15,16} The ATLANTIC trial provides weak evidence for the early (prehospital) ticagrelor use. It reduced early stent thrombosis but found no differences in ST resolution or clinical outcomes.¹⁷

For patients where PCI is planned, the decision for DAPT is usually made in conjunction with cardiology, especially since administering a P2Y₁₂ receptor blocker could delay CABG until the drug washes out (~7 days). For patients receiving bare metal stents, DAPT should be continued for at least 1 month (preferably 1 year).¹⁴ The recommended duration for those with drug-eluting stent implantation is at least (3 months for sirolimus eluting stents and 6 months for paclitaxel-eluting stents).¹⁴ This is continued up to 12 months in patients who are not at high risk for bleeding based on the ACC/AHA guidelines. Shorter DAPT durations may be safe in specific circumstances such as patients' receiving ticagrelor monotherapy following three months of DAPT or in patients considered to be a high-bleeding risk. (TWILIGHT, STOPDAPT-2, ONYX ONE).¹⁷⁻¹⁹ Ultimately, the decision to shorten DAPT therapy in the post-PCI setting should be guided by each patient's individual risk for bleeding events and a patient-physician discussion over the risks and benefits of shortening DAPT therapy as current data on shortened

DAPT length following PCI is still evolving and an active area of research.

Continuation of clopidogrel for longer may be reasonable (Class IIb by AHA/ACC guidelines) in patients who have tolerated a minimum course of DAPT without a bleeding complication and who are not a high bleeding risk. This is an area of active research, and several trials are looking into strategies to best identify patients who will benefit from reduced duration of DAPT. There is no data to continue DAPT beyond 36 months post-ACS.

Dual Antiplatelet Therapy Following PCI in ACS, in patients with Atrial Fibrillation

Several guidelines outline the duration of antiplatelet therapy for atrial fibrillation (AF) patients after PCI. The 2018 ESC guidelines recommend considering triple therapy (aspirin, clopidogrel, and an oral anticoagulant) for one month, regardless of the stent used.²⁰ This can be extended to six months for patients at higher ischemic risk, as the benefits may outweigh bleeding risks. If the bleeding risk is high, a combination of clopidogrel and an oral anticoagulant is advised during the first month post-PCI. After 12 months, antiplatelet therapy should typically be discontinued, continuing only the oral anticoagulant as needed.

The 2021 AHA/ACC/SCAI guidelines recommend that AF patients stop aspirin no later than four weeks post-PCI and

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continue with a P2Y12 inhibitor and a non-vitamin K oral anticoagulant to minimize bleeding risk.²¹ Risk assessment tools like the CHA2DS2-VASc and HAS-BLED scores help identify AF patients at greater risk for adverse events after PCI and inform decisions on antiplatelet therapy duration.

Role of Dual Antiplatelets Post-Coronary Artery Bypass Graft (CABG)

2021 ACC/AHA/SCAI guidelines recommend aspirin (100-325 mg daily) should be started within 6 hours and continued lifelong to prevent graft occlusion and further adverse cardiovascular events.²¹ The use of DAPT has been studied in this population, and it has come to differing conclusions. Studies evaluating (Aspirin 100 mg daily and clopidogrel 75 mg daily) have found improved graft patency at 3 months.²² The CASCADE trial found no difference between aspirin 162 mg daily and clopidogrel 75 mg daily in 113 patients at one year, with no difference in major bleeding events.²³ Two recent randomized control trials (DACAB, POPular CABG) have evaluated the addition of ticagrelor to aspirin.^{24,25} DACAB found superior graft patency rates at one year, whereas POPular CABG could not find any difference in the same timeframe.^{24,25} In light of this conflicting evidence, the guidelines do not recommend adding a second antiplatelet agent to reduce the risk of graft stenosis. Shorter duration DAPT, based on the pathophysiology of graft failure, may be a promising strategy that requires testing in adequately powered randomized trials.

Role of Dual Antiplatelets Post-TAVI

There are multiple studies assessing antiplatelet therapy post-transcatheter aortic valve implantation (TAVI). For patients post-TAVI without a concurrent indication for therapeutic anticoagulation and no concurrent indication for DAPT, aspirin 75-100mg daily is recommended for life. The risk of ischemic events is similar with single antiplatelet therapy and DAPT, but single antiplatelet therapy (SAPT) is associated with lower bleeding risk (hazard ratio [HR] 0.59, 95% CI 0.46-0.77).^{26,27}

It is reasonable to consider DAPT in the initial three to six months, depending upon valve type, followed by lifelong SAPT, which was used in the pivotal TAVI trials. If a concurrent indication for DAPT exists, the duration of DAPT is dictated by the concurrent indication, after which SAPT is recommended by both the ACC/AHA and ESC guidelines.

Role of Antiplatelets in Non-Cardioembolic Ischemic Stroke and TIAs

The role of DAPT therapy in non-cardioembolic ischemic stroke and transient ischemic attacks remains under research.

Starting combination therapy with aspirin and clopidogrel within 24 hours of symptom onset has been linked to a reduced incidence of recurrent stroke at 90 days, though it increases hemorrhage risk.²⁸ The CHANCE trial indicated that DAPT for 21 days effectively reduces recurrent stroke and major vascular events, outweighing bleeding risks.²⁹ However, these results were not replicated in the later POINT trial.³⁰ No established guidelines exist for DAPT use in this context, and each patient's risks should be assessed before starting treatment.

Antiplatelets in Peripheral Artery Disease (PAD)

Current literature does not support the use of DAPT in patients with PAD without recent peripheral stent or intervention. Even in patients who have received peripheral stents for PAD, the data is not entirely clear, with some studies suggesting that up to two months of DAPT following intervention may be beneficial. Unfortunately, a lack of studies looking at DAPT in PAD has resulted in data from coronary trials being extrapolated for use in PAD, and antiplatelet regimens are often dependent on individual institutions or providers.

Conclusions

Dual antiplatelet therapy is essential in managing thrombotic events in cardiovascular diseases. While aspirin remains the cornerstone of antiplatelet therapy, newer agents are tailored to balance efficacy and bleeding risks. The use of DAPT varies by clinical indication, such as secondary prevention in chronic CAD, post-PCI, CABG, and more. However, DAPT has been proven ineffective in a variety of situations such as primary prevention of CAD, highlighting the need for individualized patient assessment. Future research is needed to optimize antiplatelet therapy regimens.

REFERENCES

1. Vane JR, Botting RM. The mechanism of action of aspirin. *Thromb Res.* 2003;110(5-6):255-8.
 2. Antithrombotic Trialists' Collaboration. Collaborative meta-analysis of randomised trials of antiplatelet therapy for prevention of death, myocardial infarction, and stroke in high risk patients. *BMJ.* 2002;324(7329):71-86.
 3. Liu J, Sun P, Qi X. Reversible and non-competitive inhibition of cyclooxygenase by indobufen for efficient antiplatelet action and relief of gastrointestinal irritation. *Pharmaceutics.* 2023;15(8):2135.
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Sanjana Manimaran, MD, Internal Medicine Residency Program, University of South Dakota Sanford School of Medicine.

Eight ways
to

GET INVOLVED in the SDSMA RIGHT NOW!

- ***Become a member***
- **Join an SDSMA committee**
- Participate in the **Doctor of the Day Program**
- Attend the **Annual Conference**
- Follow SDSMA on **Twitter, Facebook & Instagram**
- **Submit an article** to *South Dakota Medicine*
- **Submit a policy issue** at a membership open forum
- **Meet with your state legislators** to discuss the most pressing issues in medicine

For more information, contact SDSMA staff

membership@SDSMA.org

www.sdsma.org

605-336-1965

Member News

Visit www.sdsma.org for the latest news and information.

Sen. Mike Rounds to Speak at SDSMA PAC Lunch During Leadership Conference



We're excited to have U.S. Senator Mike Rounds as our SDSMA PAC Lunch speaker at 12:00 on May 30 in conjunction with the SDSMA 2025 Annual Leadership Conference at the Hilton Garden Inn Downtown Sioux Falls. Senator Rounds serves as co-chair of the U.S. Senate Artificial Intelligence Caucus. Register to attend the lunch (\$40) to take full advantage of all the great opportunities taking place during the 2025 SDSMA Annual Leadership Conference!



South Dakota State Medical Association Political Action Committee

Sign Up for the 2025 SDSMA Annual Leadership Conference



Get ready for the 2025 SDSMA Annual Leadership Conference on Friday, May 30 at the Hilton Garden Inn Downtown Sioux Falls. Join us for a day of learning and engagement as we talk about AI's transformative role in healthcare! The conference is a benefit of your SDSMA membership – there is no registration fee for members (ticket purchase required for some events and meals). Registration, details and the schedule for the day can be found at sdsma.org.

Medical Student Poster Session Highlights Medical Students' Work

Be sure to join us for the Medical Student Poster Session from 1:45-2:30 pm on May 30 during the 2025 SDSMA Annual Leadership Conference in Sioux Falls. Following the poster session, Olivia Heinecke, the #1 Abstract winner, will present her work. Be sure to attend – the medical student poster session is an opportunity that helps University of South Dakota Sanford School of Medicine students improve their CVs and their competitiveness for medical residencies.

Submit a Policy Issue & Participate in the Member Open Forum

Do you have a policy issue you'd like to bring to the SDSMA's attention? Make plans to address the SDSMA Policy Council during the SDSMA Annual Leadership Conference on May 30 in Sioux Falls. Policy issue submission forms and more information are available at sdsma.org. Submissions are being accepted until May 16. The open forum will be held at the Hilton Garden Inn Downtown Sioux Falls during the conference.

Membership Mixer is Networking Opportunity

Join us for the Membership Mixer from 6:00-7:00 pm during the SDSMA Annual Leadership Conference on May 30 in Sioux Falls at the Hilton Garden Inn Downtown. Enjoy an opportunity to meet SDSMA leaders and network with your peers. Meet other physicians in the state to expand your professional network. This year during the mixer, we'll also be celebrating the upcoming retirement of SDSMA CEO Barb Smith, who will be retiring later this year. The event is sure to be an all-around great time! Spouses/guest are welcome to attend. The mixer is free of charge. Tickets are required for the Awards Banquet and Scholarship Recognition following the mixer. See a schedule of the day's events at sdsma.org.



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Join us For Awards Banquet, Scholarship Recognition & Presidential Inauguration on May 30

Enjoy a fun-filled celebration on Friday, May 30 at the Hilton Garden Inn Downtown Sioux Falls! Start the evening with the mixer at 6:00 pm and continue the celebration with the Awards Banquet, Scholarship Recognition & Presidential Inauguration, where Keith Hansen, MD will be sworn in as SDSMA president, awards will be bestowed upon fellow colleagues,

outgoing and incoming officers will be celebrated and welcomed, and medical student scholarship recipients will be recognized. The mixer is free to attend; dinner tickets (\$75) must be purchased in advance. To register and see the schedule of the entire day's events, please visit sdsma.org.

**Don't forget to send in your favorite scenic photo for
South Dakota Medicine
front cover consideration. Send photos to ereiss@sdsma.org.**

Follow us on Social Media!

Stay up to date with the latest from the South Dakota State Medical Association. We are on Facebook, Twitter, and Instagram! Follow and connect with us.



Help Shape the Future of Medicine in South Dakota

The South Dakota State Medical Association Foundation, the philanthropic arm of the South Dakota State Medical Association, is a tax-exempt 501(C)(3) non-profit corporation, was established to assist and support medical research, medical teaching and medical education at the Sanford School of Medicine.

On average, medical students graduate with \$130,000 in

debt. Contributions to the South Dakota State Medical Association Foundation provide financial assistance to students at the Sanford School of Medicine and are all designated for scholarships, grants and low-interest loans for students.

Any amount can be donated at any time throughout the year. If you have questions or want more information, please call 605.336.1965.

Send Your Contributions Today To:

South Dakota State Medical Association Foundation

2600 W 49th St Ste 100, Sioux Falls, SD 57105

Or contribute online at www.sdsma.org



SOUTH \$ DAKOTA
State Medical Association Foundation

Shaping the Future of Medicine in South Dakota



South Dakota medicine

South Dakota Medicine, the monthly peer-reviewed medical journal published by the South Dakota State Medical Association, is read by physicians, residents, medical students, hospital and clinic administrators, and other health care leaders. SDSMA members receive the journal through a mailed subscription as a member benefit and have access to full issues at sdsma.org.

With a 100-year history as the state's leading provider of medical information, *South Dakota Medicine*'s original research, educational articles and association news combine to offer you a comprehensive information support system that can help with the decisions you make every day. Additionally, the journal is indexed in PubMed and has unmatched reach and unsurpassed readership within its field, making it unique in meeting the needs of all physicians in state – from retired doctors and primary care physicians to specialists, medical students and residents. Articles published by students and residents in a PubMed-indexed journal strengthen residency and fellowship applications.

Submit a Manuscript

Are you interested in having your work published? *South Dakota Medicine* editors review many manuscripts each year, and we encourage article submissions. Please confirm that your manuscript meets the guidelines at www.sdsma.org/SDMed before submitting for review.

Support the Journal

South Dakota Medicine brings important medical information to South Dakota's physicians, and advertising in the journal generates revenue that helps support the SDSMA's ability to publish this high-quality, peer-reviewed journal. Help support *South Dakota Medicine* by advertising your practice while gaining excellent exposure – find more information at www.sdsma.org.





SOUTH DAKOTA
BOARD OF MEDICAL & OSTEOPATHIC EXAMINERS



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- Provides Safe Haven, supports, and promotes confidential monitoring of its healthcare providers

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Board News is a monthly feature sponsored by the South Dakota Board of Medical and Osteopathic Examiners. For more information, contact the Board at SDBMOE@state.sd.us or write to SDBMOE, 101 N. Main Avenue, Suite 301, Sioux Falls, SD 57104.



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