



Pacific Northwest Medical Student Research Journal

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The editorial board would like to thank the reviewers who have volunteered their time and expertise to help make this issue possible.

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Lincoln City, OR - Submitted by Bobby Cannon

Creating New Opportunities for Medical Students & Trainees

On behalf of the Editorial Staff of the Pacific Northwest Medical Student Research Journal (PNWMSRJ), we thank you for taking the time to read our inaugural issue. We intend for this journal to become a thriving and highly sought-after publication for medical trainees in the Pacific Northwest. We have done everything in our power to ensure this journal has a lasting impact on medical education in the Pacific Northwest. With the hard work and enthusiasm of our authors and readers, this journal will become an integral part of the medical community at large.

In designing and creating a new student medical research journal, we spent a significant amount of time reflecting on the needs of the osteopathic students and trainees this journal will serve. There are already countless research journals, including four medical student specific journals located in the United States.¹ Of these four journals, however, all are located on the east coast and all are associated with allopathic medical

schools. Our goal was to create a medical research journal catering to trainees in the Pacific Northwest, and while not specifically an osteopathic journal, we wanted to ensure osteopathic students and trainees had a desirable and credible journal to publish and showcase their work.

A survey of over 800 first-year osteopathic medical students found that they viewed research as a valuable experience that was beneficial to their future careers.² According to the 2018 Charting Outcomes in the Match, graduating Osteopathic Seniors averaged 1.7 research experiences and 2.3 deliverables (abstracts, presentations, publications). That same year, US Allopathic Seniors reported an average of 3.2 research experiences and 5.7 deliverables.³ These data indicate that in the US medical education system, research is an essential component of the student and trainee experience. With recent developments such as the combined residency match, and USMLE moving towards

a pass/fail grading system, it is likely that research experience will become even more valuable in the future.

The publication process for medical students can be disheartening. As authors, most of us have received the dreaded rejection letter more than once. Faculty members at medical schools are often overworked and have a myriad of attention-demanding responsibilities to include mentoring students on research. This may lead to students who wish to publish having to navigate the often rigorous academic peer-review process on their own, with little feedback from overextended mentors. With the growing importance of research in applying to residency programs, students often do not have the luxury of time on their side to rewrite and revise their manuscripts for multiple submissions before residency applications are due.

A 2013 study found that studies published in biomedicine journals on average take 9-10 months from submission to publication.⁴ While there is no data officially published, the turnaround time for submission to publication estimates for student-run journals is substantially shorter with an average of 4-5 months.^{5,6} This abbreviated turnaround time benefits students who may only have a short window to work on their publication as they balance a heavy course load mixed with board preparation and extracurricular volunteer activities.

Medical student research journals also face their fair share of challenges. These journals are often viewed as “student-friendly” (i.e. a lax or no peer-review process) that publish subpar research. When this journal was initially pitched to faculty members at our own institution, several voiced their concern about the creation of a “pseudo-journal” that did not have a rigorous peer-review and publication process.

Our journal is committed to following the International Committee of Medical Journal Editors (ICMJE) Recommendations. There are currently only two student-run journals in the United States committed to following the ICMJE’s recommendations. We are proud to say that the PNWMSRJ is one of those two. Submitted articles will go through a peer-review process by clinicians or scientists who work in the Pacific Northwest. These reviewers consist of some of the brightest physicians, pharmacists, and PhD’s in the Pacific Northwest who are dedicated to advancing the medical education of students. To avoid conflicts of interest, faculty that serve as peer-reviewers will be unable to review submissions by students at their own or previous institutions. Furthermore, extensive measures have been put in place to keep the anonymity of the authors protected.

Upstart medical student research journals often dissolve after only a few years of publication. Reasons for this include, but are not limited to: a lack of enthusiasm on the student’s part, inadequate faculty support, and poor funding.¹ Given all these obstacles, one might question why a group of Osteopathic Medical Students from the Pacific Northwest would dare attempt to ‘launch their boat’ into the uncertain waters of academic medicine?

We acknowledge that while the odds may be stacked against us, we are ready to face these challenges head on. We believe that it is necessary for medical students to feel supported all along their journey into academic medicine. Future Student Editors will gain valuable experience with what it takes to run an academic journal as well as how the peer-review process works. Peer-reviewers have been selected from throughout the Pacific Northwest and are acknowledged for their valuable time and effort. Submitting to PNWMSRJ will not be an “easy” or “free pass” publication. Not all articles will be accepted. However, rather than giving a simple disheartening rejection letter, Student Editors will work with those seeking to publish (if we believe the research has value) to improve their manuscripts for resubmission when the appropriate edits have been made.

Viewership is key when publishing a medical journal. What value does your publication have if no one can find or read it? Our long-term goal is to become the second medical student journal to be MEDLINE® indexed in the United States. Short term, however, we plan to work with both the Osteopathic Physicians and Surgeons of Oregon (OPSO) as well as the Oregon Medical Association (OMA), to distribute our journal to its members across the state of Oregon. We plan in the near future to reach out to the Medical Associations of Alaska, California, Washington, Montana, Idaho, and Utah to have our journal distributed to their members as well.

The mission of the PNWMSRJ is threefold. First, we aim to provide an opportunity for students to develop their understanding of the research publication process and build critical analysis skills. Second, we provide students the ability to showcase their work by publishing their findings in a peer-reviewed journal. Finally, we aim to provide a platform for osteopathic medical students to continue to forge ahead and make an immediate impact in the research community. As the journal grows, the mission and goals of the journal will change as necessary to better suit the needs of the students and medical trainees it serves.

With your help and support, the PNWMSRJ will become a highly sought-after publication for medical students and trainees across the Pacific Northwest. This

journal's success depends on suggestions for further improvement from readers like you. We value each submission and will take the time to ensure its full and complete review. We strongly encourage students and trainees to further their education and contribute to the medical literature by participating in research. We hope that at the conclusion of your research, you will consider the Pacific Northwest Medical Student Research Journal as your top choice to showcase your research.

Signed,

Jacob Nelson
 Bobby Cannon
 Eric Rice
 Shannan Roddy
 Anthony Sainz
 Brady Winfield
 Alec Ziemann
 Heather Kopecky
 Cade Cloward
 Emily cloward
 Cameron Hadley

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Crater Lake, OR - Submitted by Steven Gay

A letter from the Editor

I would like to express my sincere gratitude to each reviewer, editor, advisor, and all other individuals who have donated countless hours to make this journal a reality. I would like to give a special thanks to our Advisory Board Chair, Dr. Glen Kisby, who has played a vital role in building the foundation of this journal. Without his expertise and guidance, this endeavor would not have been possible.

It is my sincere hope that PNWMSRJ will serve to increase visibility of the research efforts of medical students, and more importantly, provide a hands on learning experience for student researchers who would like to develop their understanding of the research publication process and enhance their critical analysis skills. We hope that our work increases inclusion and diversity within the research community.

Thank you for taking the time to read the inaugural issue of the Pacific Northwest Medical Student Research Journal!

Sincerely,

Jacob Nelson
Editor-in-Chief

Slice of Life

By Frederic Bahnson, MD, FACS

Uncertain Times

This column is meant to be a question and answer column - open to career, life, and education questions. For this first column... there were no readers yet, and no submitted questions. The topic was left to me, with one note from the Editor-In-Chief: “a piece on making decisions in the face of uncertainty (COVID-19) would be a timely read...”

Indeed.

We live in uncertain times. It feels like we should have extra support, extra time, and extra consideration for making big decisions and long term plans right now. Students and residents who are in their last years have some big decisions to make. It can feel like the resources to support these decisions aren't adequate right now. There aren't many career advice books out there with a chapter on starting your career during a worldwide pandemic and national economic shutdown.

So, what should we do? First, we should stop trying to treat this as different from decision-making at any other time. Don't get me wrong. There are new and important things to consider with education and career decisions right now. However, these things do not change the process for arriving at the best possible decision.

There are a couple of important pieces of background information here.

First: We always live in uncertain times. Coronavirus didn't create uncertainty. Coronavirus is confronting us with what forecasters, decision theorists, and planners call a high-impact low-probability (HILP) event. Although many have warned about a coming pandemic, nobody could have predicted it would happen this year in this way. But this type of event is not new.

Many of our grandparents or great grandparents lived through two world wars. The first of those overlapped with a worldwide pandemic (influenza) that killed between 17 million and 50 million people. There was a massive economic depression between the two world wars. Many people I know and work with made their major life decisions between nuclear attack drills throughout the Cold War. When my parents were college-age, 2.2 million men in the United States were drafted into the military during the time of their lives they otherwise would have been advancing their education or starting their careers. More recent impacts have come from tsunamis, nuclear power plant meltdowns, a couple of major economic crises, local devastation and worldwide medical supply interruptions by hurricanes. The list is long.

We don't have to debate what does or does not belong on this list. The coronavirus pandemic is unique in our lifetimes. But, it is not unprecedented for an entire generation to be making major life decisions during local or global upheaval. In fact, it may be more common to be making decisions during or in the immediate aftermath of world-changing events than in times not immediately affected by such events. So yeah, times are tough. But it turns out that's not new, or even all that unusual.

This is not meant to be a “suck it up, think of how hard your grandparents had it” treatise. The fact that the world is frequently in upheaval turns out to be quite reassuring... in context.

Second, also about context: It's important to realize that uncertainty in decision-making isn't limited to those starting out or at recognized transition points in their education or career. Important decisions happen throughout life. Using myself as an example - I've changed jobs within one major career, then completely changed careers. At my current job, I've taken on and

shed different roles over the past several years. Many of these decisions have significantly altered my life path - career development, family time, gain and loss of other options both at work and outside of it. The health system I work for was (and is) in the midst of a major reorganization when COVID-19 hit. I made some decisions just before the pandemic was recognized, and will make more over the next 18 months, that will alter my career in many ways. How those are playing out has been radically changed by coronavirus. My work, my spouse's job, the jobs of many close friends, the education and travel plans of my children - all have been upended. All need to be re-envisioned for a near future that remains uncertain but is clearly significantly different than any of us would have predicted even six months ago.

So, to summarize so far: (1) this isn't as unprecedented as it feels, and (2) you aren't alone.

Why is it good news that (1) and (2) are true? Because the process for making good decisions hasn't changed. We know more now about risk management, bias, what makes people happy and fulfilled, economic prosperity, research and career success, health and wellness than at any other time in history. And, because that knowledge has been gained and developed across a history full of high-impact low-probability events, the fact that we now have to make decisions in the midst of another such event doesn't invalidate the knowledge. Times like these are exactly what the best decision-making techniques have been honed for.

So for my first column, I offer you this:

1. Perspective is healthy. Our times are unique, but living in times of uncertainty is not.
2. None of us are alone right now. Sure, we're all one-of-a-kind, but we're a lot more like one another and those before us than we are different.
3. Having certainty would be reassuring, but it would be a false reassurance. One of the lessons of history is that, in important ways, the future does not resemble the past. The differences are often due to events (or our responses to them) that are unpredictable in any useful and time-specific sense.
4. And finally: any good advice on decision making from before the coronavirus pandemic is still good advice.

The nature of good decision-making is that it sets us up for the greatest chance of success. It also gives us realistic expectations of resilience (or even anti-fragility). In an uncertain world, the biggest decision making error available might be to try for (or pretend we have

achieved) certainty.

Instead of seeking a certainty that is either unattainable or illusory, put your energy into making decisions that have the best chance of good outcomes - despite the uncertainty we can't control. Align your decisions with what gives you the best outcomes in the domains that matter most - your own health, your impact on those around you and the world, your happiness and well-being.

Due to the nature of this journal, publication of this column will be infrequent. But questions and challenges around career, financial, life and goal planning are constant. With that in mind, I am launching a website at multifarion.com to ease and encourage engagement in these topics.

I am not a researcher of decision science. I am a practicing surgeon, a former engineer, a parent, and a mentor and coach to students, residents, and professionals - both in and outside of medicine. I am a long-time student of decision science. I integrate research from across this broad field into advice and methods for real-world use. This has made me a better physician and helped me grow outside of work as well. I want to share this knowledge and ongoing pursuit with you. I hope it helps you make the best educational, career and personal decisions you can. I hope it helps you reach a level of comfort with your decisions that you might not otherwise find - or at least helps you get there sooner and more easily.

Please send me your questions and comments at questions@multifarion.com. You can visit my website at multifarion.com to find more articles, and subscribe to get notified when new Q&A's or articles go up.

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Effect of Marijuana Legalization on Marijuana-Related Suspensions in a Rural Oregon High School

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Abstract: Purpose: We aim to determine if there has been an increase in marijuana-related suspensions (MRS) in an Oregon high school following marijuana legalization in 2015, and if students on an Individualized Education Plan (IEP) are more likely to be suspended for marijuana use compared to students who are not on an Individualized Education Plan (non-IEP). Methods: MRS data was collected retrospectively from a rural Oregon high school from 2012-2018. Student information was de-identified and separated into IEP and non-IEP populations. A 2-proportion z-test was used to compare the number of overall suspensions for pre vs. post-legalization. Results: In the 3 years prior to legalization there were 32 MRS, and 0.68% of students had a MRS. In the 3 years post-legalization, the number of MRS increased to 101, and 2.25% of students had a MRS ($p < 0.0001$). Prior to legalization, there were 5 IEP MRS (0.84% of IEP students) and 27 non-IEP MRS (0.65% of non-IEP students) ($p = 0.406$). Post-legalization there were 26 IEP MRS (3.8% of IEP students) and 75 non-IEP MRS (2.0% of non-IEP students) ($p = 0.0031$). Conclusion: In the population studied, there was an increase in the percentage of students suspended for marijuana related offenses following marijuana legalization in 2015. The IEP students were more likely to receive a MRS compared to non-IEP students after marijuana legalization in this rural Oregon High School. Relevance Statement: Our study found a significant increase in marijuana-related suspensions (MRS) in the general student population with students on an Individualized Education Plan being the most strongly affected following recreational marijuana legalization in Oregon. As marijuana legalization becomes increasingly common across the United States it is imperative to monitor the impacts on students and youth.

INTRODUCTION

Marijuana legalization is becoming increasingly prevalent across the United States. Currently, 33 states have legalized medical marijuana with 10 states and Washington, D.C. having legalized recreational marijuana for adults over the age of 21. Concurrent with this increasing legalization, an increasing number of Americans also favor some form of marijuana use.¹

In 2015, recreational marijuana was legalized in Oregon for adults over the age of 21. Research done in 2016 by the Oregon Health Authority through anonymous, school-based surveys of Oregon 8th and 11th grade students found that youth reported that marijuana was easier to obtain than cigarettes and about as easy to obtain as alcohol.² In addition, parental approval of marijuana usage by youth has steadily increased since legalization in Oregon.³ Research has demonstrated that as acceptance of marijuana usage increases, overall usage of marijuana increases accordingly.⁴ Despite this information, little research exists regarding the impact on youth usage rates in states where recreational marijuana has been legalized for adults 21 and over.

Our group quantified the number of students suspended for marijuana possession in an Oregon high school both pre-legalization and post-legalization. Our first objective was to determine if there had been an increase in marijuana-related suspensions (MRS) across the entire student body post-legalization. Our second objective was to determine if students on an Individualized Education Plan (IEP, indicating some form of learning disability) were more likely to have a MRS compared

to non-IEP students post-legalization. We pursued the second objective because youth with learning disabilities have been shown to be more susceptible to substance abuse.^{5,6} Compounding risk factors for substance abuse include academic trouble, loneliness, a desire to fit in and low self-esteem.⁷ Due to the increased availability of marijuana and the predilection of substance abuse for the IEP population, we hypothesized an increase in the number of MRS among all high school students post-legalization, and that IEP students would be more likely to receive a MRS compared to non-IEP students post-legalization.

METHODS

We examined de-identified records for 9,214 students from one Oregon high school for six consecutive school years from 2012 to 2018. Choosing this specific six-year span allowed us to compare data points from three years prior to the legalization of recreational marijuana and three years post-legalization. Suspension policies remained unchanged during the three years before and after legalization. A student was suspended only if they were caught with marijuana in their possession on school property. Students caught with marijuana a second time during the school year were expelled rather than suspended so repeat offenders were not included in our data.

We used a 2-proportion z-test to compare the following: 1) the percentage of overall MRS pre-legalization vs. post-legalization, and 2) the percentage of MRS pre-legalization and post-legalization for IEP students vs. non-IEP students.

The high school of interest had an average enrollment of 1,500 students per year, 200 of which on average qualified for an IEP. The methods used in this study were approved by the Western University of Health Sciences Institutional Review Board (P18/IRB/054).

RESULTS

In the three years following legalization of recreational marijuana (2015-2018), we found a significant increase in MRS among all students ($p < 0.0001$) (see Figure 1). Additionally, the increase in MRS was much greater among IEP students compared to non-IEP students post-legalization ($p = 0.0031$) (see Figure 2).

DISCUSSION

Previous studies have examined the effect of marijuana legalization on youth usage via self-reporting methods.² Our data is unique because we used objective data from the school district to eliminate reliance on self-reporting. Our study cannot determine if students were consuming more marijuana post-legalization, but it indicated that students were more likely to be in possession of marijuana on school grounds post-legalization. In comparing the number of MRS before and after legalization, it appears that youth are being impacted by marijuana legalization in ways that can be quantified.

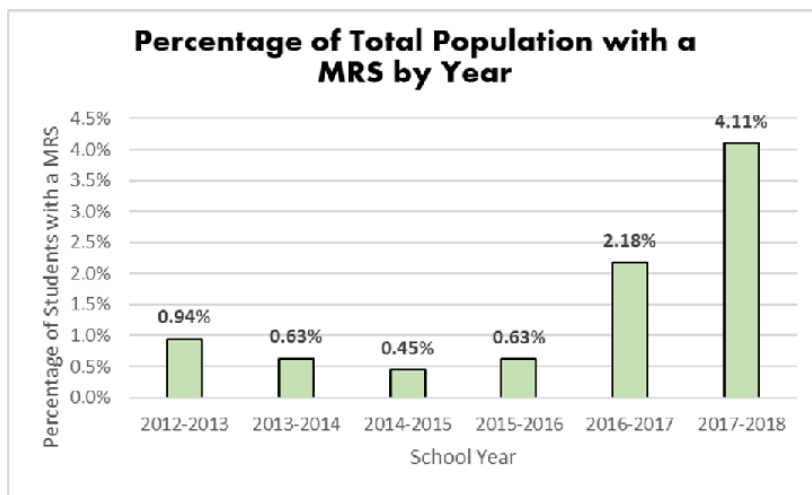


Figure 1: From September 2012 to June 2015 (i.e. pre-legalization), there were 32 MRS among all students (0.68% of total student population). From September 2015 to June 2018 (i.e. post-legalization), the number of MRS among all students increased to 101 (2.25% of total student population). Students at this Oregon high school were more likely to have a MRS following recreational legalization ($p < 0.0001$).

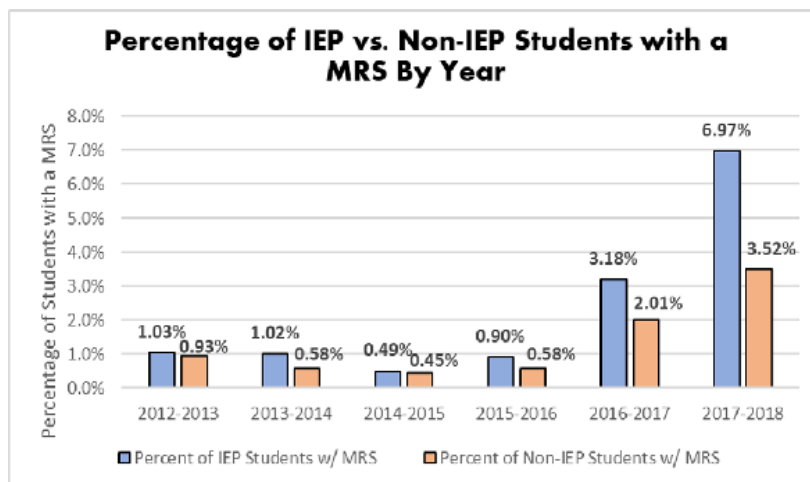


Figure 2: From September 2012 to June 2015, 0.83% of IEP students had a MRS compared to 0.65% of non-IEP students ($p = 0.406$). From September 2015 to June 2018, 3.8% of IEP students had a MRS compared to 2.0% of non-IEP students. Students on an IEP had a significantly higher rate of MRS compared to their non-IEP peers post-legalization ($p = 0.0031$).

Following the legalization of recreational marijuana in Oregon, students on an IEP were suspended at a significantly higher rate compared to non-IEP students. This appears to be consistent with previous research suggesting a link between individuals with learning disabilities and increased risk of substance use problems.⁵ More research is needed regarding the link between marijuana legalization and increased MRS for IEP students as prior to legalization, IEP students were not suspended at a significantly higher rate than their non-IEP peers.

At the time of this study the school district had not made any changes in policy to address recent marijuana legalization. This makes us feel confident that our post-legalization data was not inflated by policies encouraging increased “policing” of students by faculty or administration in response to marijuana legalization.

Increased “policing” of students is likely not the most efficacious response to marijuana legalization, but it is important to consider modernizing policies or implementing programs to minimize the unwanted effects of increased marijuana availability in states where it is legal. For example, drug education as a way of preventing suspension can benefit all youth but may be particularly beneficial to students with learning disabilities.

Marijuana has been shown to negatively impact adolescents’ learning and decision-making abilities and is associated with early school leaving.⁸ Emerging research has suggested that suspensions or expulsions from school can negatively impact academic performance of a student.⁹ Education is one of the strongest predictors of health: the more education a student can receive, the better their health is likely to be in the future.¹⁰ Comprehensive drug education for youth may deter drug use and improve health outcomes.^{11,12,13}

A pilot study in Washington state included two high schools and, as an alternative to out of school suspension for marijuana use, the students were required to complete an online in-school module designed to educate and stop illicit marijuana use.¹⁴ Over the course of the program, student knowledge about marijuana increased from 40% at the start to almost 90% when completed with 50% of students saying they would stop their current marijuana use.¹⁴ Programs such as these show the value of using education as a deterrent as opposed to focusing on punishment (suspension) after the offense. In the rural Oregon high school we studied, the risk of out of school suspensions did not seem to be a deterrent for students bringing marijuana onto school grounds as the numbers of MRS increased each year after legalization.

Previous studies relying on self-reported data in Colorado, Washington, and Oregon have indicated decreased youth marijuana usage immediately post-legalization.¹⁵ Our data was consistent with these findings as we did

not see a significant increase in MRS within the first year after legalization. However, when looking at data longitudinally across multiple years post-legalization, we discovered an increasing trend in MRS. Current literature may underestimate youth marijuana use and minimize the impact of marijuana legalization among youth.¹⁶ Working closely with school districts may help provide accurate and consistent estimates of underage marijuana use while minimizing reliance on self-reporting.

Our study was limited in that we were only able to gather data from one high school. We were also unable to obtain data regarding other causes for suspension (behavior, truancy, weapons, non-marijuana related drugs, etc.). Having this data in the future would help serve as an additional control to determine if all-cause suspensions have increased over this six-year period or if the increase is isolated to marijuana possession only. Future improvements will include surveying more high schools and collecting data related to all suspensions. Surveys to high school administrators will also be included with requests for data to determine what changes in administration have occurred over the six-year span as well as if any policy changes occurred during that time period.

CONCLUSION

We found a significant increase in the proportion of students with a MRS since marijuana legalization in this rural Oregon high school setting. IEP students were suspended at a significantly higher rate compared to their non-IEP peers post-legalization. These findings have significance for educators, parents, and providers who practice in states where recreational marijuana is legalized, as well as states considering legalizing recreational marijuana.

IRB Approval: The methods used in this study were approved by the Western University of Health Sciences Institutional Review Board (P18/IRB/054)

Conflict of Interest Declaration: All Authors have no conflicts of interest to disclose.

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A Retrospective Analysis on the Short-Term Effectiveness of the Complete Health Improvement Program at Samaritan Lebanon Community Hospital

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Abstract: Chronic diseases are estimated to cost the United States nearly 84% of its health care sector spending. The Complete Health Improvement Program was founded in 1988 in an effort to decrease the prevalence of chronic diseases, and consequently lower the cost of health care. The Complete Health Improvement Program was implemented at Samaritan Lebanon Community Hospital in Lebanon, Oregon, from January 2016 to December 2018, resulting in six courses and totaling 104 participants. Out of 104 participants, 81 participants obtained pre-course and post-course vital signs or laboratory blood work. Using the pre-course and post-course values, this study aims to analyze the short-term effectiveness of the Complete Health Improvement Program at Samaritan Lebanon Community Hospital. Results showed significant decreases in cholesterol (p-value <0.001), high-density lipoprotein (p-value <0.001), low-density lipoprotein (p-value <0.001), systolic blood pressure (p-value <0.001), diastolic blood pressure (p-value <0.001), weight (p-value <0.001), and fasting glucose (p-value <0.004). Additionally, non-significant decreases in triglycerides (p-value <0.3) and very-low-density lipoprotein (p-value <0.4) were observed. Overall, the Complete Health Improvement Program, which revolves around a plant-based diet along with an emphasis and education on personal lifestyle choices to overall health, shows a positive short-term reduction in risk factors that contribute to chronic diseases within the Samaritan Health Services and the population it serves.

INTRODUCTION

Towards the end of the 20th century, the focus of healthcare shifted from acute treatments and infectious diseases to chronic diseases such as hypertension, diabetes, and cardiovascular disease. These chronic conditions became more prevalent, while many acute illnesses became curable with advancements in medical research. In 2009, it was estimated that 145 million people lived with at least one chronic condition, and spending associated with managing those conditions accounted for 84% of health care spending.¹ With the rising cost of health care and the overwhelming financial burden that chronic diseases have on the national budget, it is crucial to implement programs to lower its prevalence.

The Complete Health Improvement Program (CHIP) was founded by Dr. Hans Diehl in 1988 to combat the rising prevalence of chronic diseases, many of which contain underlying components that are related to lifestyle choices, such as diet and exercise. It has been shown that numerous chronic diseases are responsive to lifestyle modifications.² The CHIP aims to implement those changes with emphasis on a plant-based diet, nutritional education, and importance of personal lifestyle choices.

The CHIP at the Samaritan Lebanon Community Hospital (SLCH) in Linn County of Oregon started in January 2016. One full CHIP course consists of 18 bi-weekly classes over a span of nine-weeks. Each class

focuses on different components of plant-based diets and other lifestyle determinants of health like exercise, stress reduction, sleep, relationships, etc., that can be incorporated into patients' lives.

Six CHIP courses have been started at SLCH where 104 participants enrolled with the most recent class ending in December 2018. Every community has unique needs and resources, making it necessary to personalize certain aspects of the generalized CHIP curriculum. This study attempts to understand whether the participation and completion of the CHIP course benefitted the community through a thorough analysis of laboratory values and vital sign measurements.

To evaluate the short-term effectiveness of the CHIP curriculum for Linn County, an analysis of the participants' lipid panel, fasting glucose, and vital signs was performed with the following question in mind – 'Does completion of the CHIP course lead to improvement in the laboratory values and vital signs?'

Given the structure of this course, and the results of previous research on CHIP, it is expected that all values would show positive short-term health benefit of the program upon completion of the CHIP.^{3,4,5,6}

METHODS

All participants were asked to make a laboratory appointment within the week prior to the start of the course up until the second class. Once individuals were

able to attend 12 or more of the 18 classes, participants were categorized as “completed” for the CHIP course and asked to schedule a post-course laboratory appointment. The post-course values were taken anytime during the last week of classes until three days after the last class. The flexibility of these timeframes was made to accommodate participants’ schedules. Vital signs collected include systolic and diastolic blood pressures and weight. Laboratory work included triglycerides (TG), total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and very-low-density lipoprotein (VLDL), and fasting glucose.

All subjects met the following inclusion criteria: (1) enrolled and attended at least 12 of 18 classes of the CHIP course at SLCH between January 2016 to December 2018; (2) obtained a pre-course and post-course set of vital signs or a pre-course and post-course set of laboratory blood work, or both. Subjects were excluded from the study based on the following exclusion criteria: (1) enrolled but did not complete the CHIP course; (2) failed to obtain a pre-course and post-course set of vital signs and a pre-course and post-course set of laboratory bloodwork. Of the participants included in the study, participants were excluded from specific categories of analysis due to the following: (1) non-fasting or ambiguous fasting status made them ineligible for TG and fasting glucose calculations; (2) non-numerical laboratory or vital sign values; (3) missing a pre-course or post-course value. Twenty-three participants were excluded in certain categories. Table 1 presents those categories and the explanation for their exclusion.

Categories	Number of Participants with Data ¹	Pre	Post	P-value ²
		Average (SD) Min, Max	Average (SD) Min, Max	
Triglycerides ³	62	141 (71.2) 30, 370	141 (93.2) 17, 595	0.3
Cholesterol	80	197 (46.4) 100, 379	182 (43.7) 71, 301	<0.001
HDL	80	54.5 (14.3) 32, 95	49.7 (13.2) 30, 98	<0.001
LDL	79	114 (38.9) 33, 274	105 (36.4) 15, 216	0.001
VLDL	78	28.5 (14.6) 6, 79	27.6 (14.4) 3, 70	0.4
BP Systolic	80	138 (14.7) 108, 175	130 (12.8) 107, 160	<0.001
BP Diastolic	80	81.8 (7.6) 61, 100	77.1 (7.6) 56, 90	<0.001
Weight (lbs)	80	218 (61.2) 116, 534	206 (49.2) 112, 354	<0.001
Fasting Glucose ³	60	107 (24.2) 45, 192	103 (16.1) 83, 161	0.02

Table 1. Explanations of special circumstance of exclusion for certain categories for Participants 1 through 23.

A retrospective chart review was performed on participants based on the inclusion and exclusion criteria.

Of the 104 participants enrolled, 86 completed the CHIP course and 81 were included in this dataset for analysis. Blood pressure, weight, fasting glucose, and lipid panel data were compared from before to after the CHIP course using paired t-tests for normally distributed variables, and Wilcoxon signed-rank tests for non-normally distributed variables. Participants who were missing pre or post data for a given variable were excluded from that analysis. All analyses were performed in R version 3.6.1.

RESULTS

Based on the data of pre-course and post-course measurements of participants enrolled in the CHIP at SLCH, there were statistically significant reductions in TG, cholesterol, HDL, LDL, BP systolic, BP Diastolic, and weight. There was also a reduction of average cholesterol values from 197 to 182 (p-value <0.001), average HDL values from 54.5 to 49.7 (p-value <0.001), average LDL values from 114 to 105 (p-value 0.001), average BP systolic values from 138 to 130 (p-value <0.001), average BP diastolic values from 81.8 to 77.1 (p-value <0.001), and average weight from 218lbs to 206lbs (p-value <0.001).

There were statistically non-significant reductions in TG, VLDL, and fasting glucose. TG was noted from 141 to 141 (p-value 0.3), VLDL from 28.5 to 27.6 (p-value 0.4), and fasting glucose from 107 to 103 (p-value 0.02).

A detailed table of the average pre-course values, average post-course values, participant number, and p-values can be seen in Table 2.

DISCUSSION

Overall, each category showed a decrease in average value at the end of the CHIP compared to average values at the start of the course. Two of those categories, TG and VLDL, had a non-significant decrease over the nine-week period. The overall decrease in lipid panel categories, blood pressure, and weight, show support for the positive effects of short-term effectiveness in improving one’s health with the implementation of a plant-based diet.

Interestingly, the dataset shows a decrease in HDL stores in the 80 participants in this study after the CHIP course. HDL has long been associated as “good cholesterol” due to its ability to carry cholesterol from the periphery of the body back to the liver.

Participant Number	Excluded In	Reason(s)
1-18	Fasting glucose	No indication of non-fasting versus fasting
19	Fasting glucose, VLDL, and LDL	Non-fasting post-course glucose measurement; invalid VLDL value due to TG value of 595; non-exact LDL value
20	Fasting glucose	Non-fasting post-course glucose measurement
21	Fasting glucose	Non-fasting pre-course glucose measurement
22	TG, cholesterol, HDL, LDL, VLDL	No pre-course lipid panel
23	BP systolic, BP diastolic, weight	No pre-course vital signs

Table 2. Statistical analysis results for each category with the number of participants, pre-course average value, post-course average value, and p-value.

¹ Participants had to have both pre and post data available to be included in the analysis.

² P-values for cholesterol, LDL, BP Systolic, and BP Diastolic were from paired t-test with equal variance, p-values for TG, HDL, VLDL, weight, and fasting glucose were from Wilcoxon signed rank tests due to a non-normal distribution.

³ Participants who were not clearly designated as “fasting” for their glucose measure were excluded.

Levels of HDL has been reported to have an inverse relationship with the incidence of coronary heart disease (CHD). Notably, while low HDL is not a cause for CHD, it has been identified as an independent predictor of risk for CHD.^{7,8} The results of this study indicate significant short-term reduction in HDL stores in participants, which may raise concerns for potential secondary risk in developing CHD. However, studies that report low HDL being an independent predictor of CHD have also tied low HDL to unhealthy lifestyles in individuals with high TG, cholesterol, LDL, VLDL, and other comorbidities that contribute greatly to poor cardiovascular function.⁹ To complicate matters, a cohort study of 3590 men and women from the Framingham Heart Study showed cardiovascular disease (CVD) risk associated with low HDL, but more so in individuals accompanied by LDL \geq 100mg/dL and/or TG \geq 100mg/dL. The study further found that low HDL in isolation is a considerably less predictive of CVD risk when there is high TG, high LDL, or both.¹⁰ Hence, it is difficult to interpret the findings of low-HDL levels in individuals without looking broader at their overall lipid panel, which in this study shows significant reduction in categories that are often more greatly associated with cardiovascular compromise.

Notably, the significant decreases in cholesterol, LDL, VLDL, BP systolic, BP diastolic, weight, and fasting glucose after completion of the CHIP is indicative of

better overall health of the participants within nine weeks. A complicating factor in this analysis resides in the differences in the timeline of the recording of the individuals’ vital signs and laboratory work. The flexibility of timeframes could have potentially generated a maximum of a 10-day difference between the earliest participant and the latest participant. When evaluating the short-term effectiveness of the CHIP, a 10-day difference may have a significant effect in the outcomes of their laboratory and vital sign values.

Overall, some of the biggest limitations in this study remains to be the bias of the sample population and sample size. While the sample size is adequate ($n = 81$), there was a portion of participants that were not accounted for in the fasting glucose and TG calculations due to aforementioned circumstances, which lessens the power of those categories. Individuals were often encouraged by their primary care providers to join the course due to their pre-existing health diagnoses. In addition, individuals who enrolled may be actively attempting to change their lifestyles and be more motivated than the average individual. Individual motivation continues to factor into other aspects of this study, such as those who were willing to come back to get their labs drawn and vital signs taken and those who did not complete the course were not accounted for.

In this study, participants in the course was limited to individuals with financial stability. The cost of the program is \$650 where only current Samaritan Choice and Intercommunity Health Network insurance plans will cover the CHIP course. Individuals who were able to afford the program may have been more motivated than the average person to change their lifestyles.

One of the most challenging components in evaluating the effectiveness of the CHIP course is accounting for the degree of changes that individuals make in their diet and lifestyle using the education they received during the course. One individual may start a plant-based diet immediately after the first class compared to another individual starting midway through the course. Other participants may slowly incorporate more plant-based meals into their diet and variations of participant diets are infinite. It is not a requirement for participants of the program to be on a strict plant-based diet throughout the nine-weeks with routine exercise scheduled. As a result, there is a possibility that some individuals never changed their diet or changed it to incorporate more unhealthy habits. However, the portion of individuals that made negative changes in their lifestyle is likely in the minority, due to the aforementioned discussion in sample bias.

CONCLUSION

The CHIP curriculum centers around incorporating a plant-based diet with proper patient education to prevent chronic diseases. Studies have shown that a plant-based diet reduces risk of atherosclerosis, coronary artery disease, and other cardio-metabolic diseases due to the absence or lowering intake of animal fat and carbohydrates.^{11,12} A plant-based diet alone cannot adequately change the behavior of patient;¹³ instead, what CHIP does well is the educational component that promotes nutrition that allows patients to understand the harms and benefits of their food choices in their health. Other components that could be adjusted at SLCH's CHIP include: (1) incorporation of participants' support system; (2) dietitian follow-ups with patients six months and a year after completion of the program; (3) use of exercise rooms at SLCH to incorporate exercise routine to the curriculum; (4) post-course surveys for participant feedback regarding the course.

The data from two years of CHIP at SLCH showed positive short-term effects of decreasing cholesterol, HDL, LDL, BP systolic, BP diastolic, weight, and fasting glucose. These results validate the already established findings of plant-based diet in the reduction of health risks. It also highlights the importance of patient education when implementing changes in patients' lifestyle. The CHIP intervention, which revolves around a plant-based diet along with an emphasis and education on personal lifestyle choices to overall health, shows a positive short-term reduction in risk factors that contribute to chronic diseases within the Samaritan Health Services and the Linn County population.

Further research should explore the long-term effects of the CHIP in reducing health risks with suggestions laid out for the SLCH program.

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The Socioeconomic and Health Impacts of Community Gardens

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Abstract: Studies of community gardens (CGs) have consistently demonstrated benefits through nutrition, mental health, income, and sense of companionship amongst community members. However, the use and distribution of CGs in low vs high income communities were found to not always be the same. In this study, we examined the distribution of community gardens (CGs) in disadvantaged communities and evaluated how socioeconomic status affects utilization of CGs. A review of the literature revealed 20 papers regarding CGs with consideration of income and social status with only six of these papers presenting self-reported income levels of its participants, while the remaining studies generalized the income levels of the individual gardeners. When utilization trends were studied between high- and low-income gardeners, it was found that higher-income gardeners identified their primary incentives for gardening were socialization, personal education and greater control of the quality and safety of their food, but lower-income gardeners cited food security and financial limitations as their priority in gardening. Additionally, low socioeconomic status neighborhoods that develop thriving CGs often find that the CG elevates neighborhood pride and perception, consequently creating a process of gentrification that drives away many low-income families that the CGs are meant to help. Finally, we summarize the recommendations of the authors for promoting CG access to low socioeconomic communities through policy, future research, and collaborative community efforts to minimize these disparities.

INTRODUCTION

Community gardens (CGs) are green spaces developed and maintained by a surrounding community as a hub for collaborative gardening. Models range from individually maintained plots to communal efforts where multiple gardeners tend the same crops.¹ There is increasing recognition of the benefits these urban green spaces can provide to gardeners and to the neighboring community.²⁻⁴ For example, CGs provide personal development, community cohesion, improved health, access to fresh foods, supplemental income, and environmental stability amongst many other benefits.⁵ A CG can improve community health by increasing availability and consumption of fresh produce.³ Other studies showed increased consumption of fresh fruits and vegetables were associated with lower intake of sugary drinks, sweets, and dairy products.⁶ Additionally, studies have shown that CGs also promote social and mental health by creating social connections and collaboration. This environment creates a sanctuary of safety, acceptance, and a greater sense of purpose for individuals.⁷ Low income limitations can force families towards unhealthy lifestyles, such as fast-food consumption, social isolation, chronic stress, and limited exercise. However, CGs can offset food costs or provide extra income from produce sale, thus combating food insecurities that consequently result in a series of unhealthy habits.⁸ CGs can also provide safe spaces, fresh produce, and a physically active and socially engaging pastime. However, limited resources such as transportation, time, and finances can make CGs inaccessible and unaffordable for some residents.^{9,10}

This paper assesses the distribution of CGs in low-income versus high-income communities and highlights the factors that influence the locations and accessibility of these gardens. Considering the prevalence of literature that proposes CGs enhance the surrounding community's social bonds, neighborhood pride, food security, and healthy food intake, our goal was to determine if this purported potential is realistic for the low-income communities that might benefit the most from CGs.

METHODS

The Science Direct database was searched for peer-reviewed articles that focused on CGs. The keywords used were "community garden" with "income." Results were narrowed to peer reviewed articles in English. A preliminary review of the resulting papers was conducted to exclude results that were literature review articles, opinion articles, or not research studies. The reference lists of selected articles and any review papers were reviewed for additional articles not returned in the initial search for possible inclusion.

We included peer-reviewed, English articles with original research on one or more urban CGs that were organically developed by a surrounding community. CGs had to be a primary focus of the article, and that income level was investigated as a variable for inclusion. We eliminated papers that did not primarily investigate CGs, did not evaluate income or socioeconomic metrics, and cases where the CGs was specifically created for research. CGs from rural areas, or underdeveloped

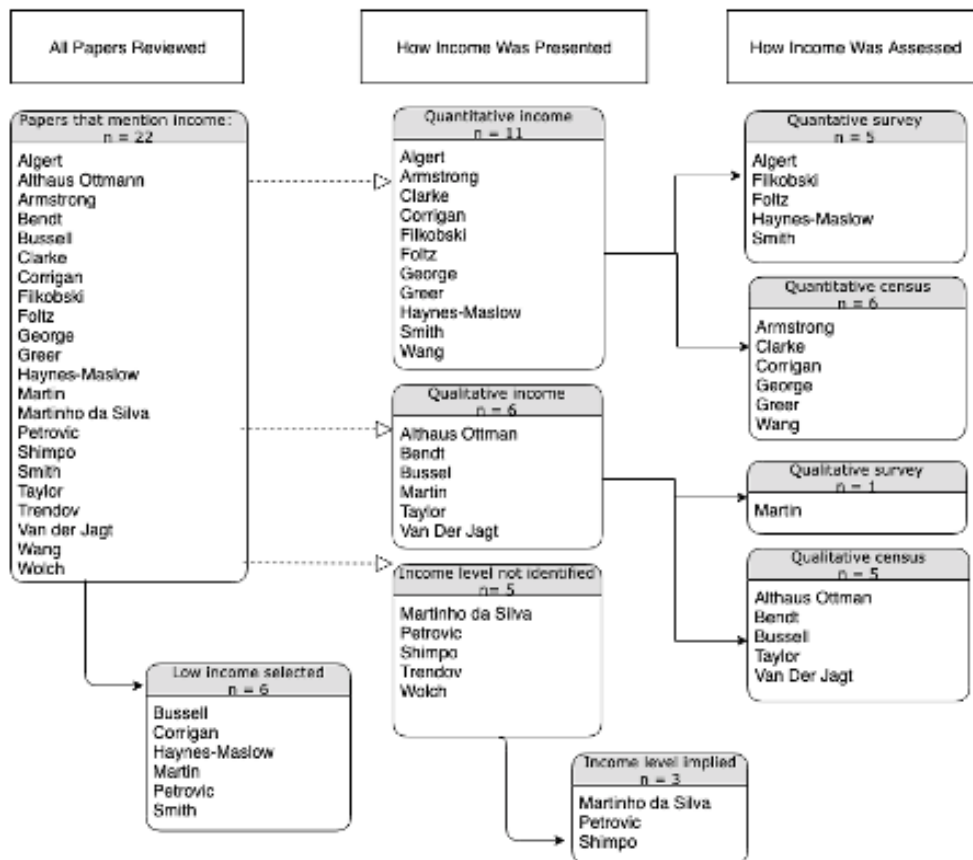


Figure 1: shows how the papers that met review criteria were further categorized based on income and how this information was attained.

and emerging countries were excluded; only a couple papers existed for these criteria, so we could not make generalizations between urban areas or developed and Western countries, respectively.

Included papers were sorted by whether income level was quantitatively or qualitatively described. Papers that explicitly described gardener income were further divided by how this information was attained (i.e. gardeners completed surveys, vs. inferred from the average income of neighborhood residents). See Figure 1.

RESULTS

The initial search resulted in 103 articles. Preliminary review narrowed this down to 32. Full article review resulted in 22 articles for inclusion.

MEASURING INCOME

Our initial search resulted in 22 relevant articles. We found that 6 articles intentionally selected low income or minority-predominant CGs as a focus of the paper. Income was identified explicitly (either as a quantitative or qualitative metric) in $n = 17$ articles and was not explicitly given in $n = 5$ articles. Of these five, we found that in three articles the income levels of gardening participants

were presumed from other metrics (i.e. unemployed vs highly educated). There were $n = 6$ papers that directly surveyed gardeners to ascertain income level, and $n = 11$ papers that used census data of the surrounding neighborhood as a proxy for determining income levels of the CG participants. The most reliable metric for assessing participant income was by survey; census data erred towards overgeneralization. Some papers presented income in low (below poverty), middle- and high-income categories, foregoing a 'lower-middle class' category which shares many of the challenges that low-income communities encounter.

Studies presenting quantitative income gathered through surveys were compared. Articles that intentionally selected low-income groups were excluded from this consideration, leaving three articles that showed a relatively equal number of higher and lower income participants. Algeri reported CG participants in San Jose, CA had a below average monthly income of \$4,900.11 Filkobski reports 34.5% of gardeners having below average income, and 29.3% above average.¹² Foltz reports 26.5% as lowest-income gardeners, with highest-income participants accounting for an equivalent 26.9%.¹³ However, as only three articles fit this criteria we were unable to make generalizations about the greater

distribution of CG users.

Utilization Trends

Women of higher social class identified environmental concerns and a desire for quality produce as their primary motivation for gardening, while lower income women identified food security, limited income, and a desire for nutritious food. Both demographics agreed that personal development, pride in producing produce, and socializing were important motivators.¹⁴ Furthermore, Bussell and Armstrong both describe only a small percentage (12.5% and 10%, respectively) of CG participants that sold crops to supplement income. However, Bussell also identified a group of CGs operated by a non-profit refugee support organization that reported 84% of participants who sold crops for profit.^{5,15}

Martinho da Silva identified a predominance of low income and unemployed applicants for CG plots. Unemployed applicants and the low-income group ranked food security as their primary reason for applying, with the unemployed group additionally ranking “access to organic farming” and “environmental concerns” as a low priority. Conversely, “highly-educated” applicants reported education, environment, and food safety as top priorities, with food security at the bottom.¹⁶

DISCUSSION

Differences in Utilization between Low Income and High-Income Communities

Low income communities were more likely to state the primary reason for gardening was to sell produce or use crops for food, reducing the financial burden of groceries.^{5,17} Van Holstein reiterates that higher income levels are inversely related to gardening for food and income supplementation, but parallels a desire to garden for leisure and personal gratification.¹⁸ CGs in Los Angeles, CA showed a positive correlation between income and plot sizes. Also, biodiversity of species grown in a plot increased with income; this was especially notable with ornamental plants, suggesting more disposable income for gardening.¹⁹

Higher income communities prioritized the social aspect of the gardens, such as formation of social bonds with other gardeners and community involvement. Personal development, personal accomplishment, and exercise were also prioritized. In general, CGs in higher income neighborhoods represent a recreational activity rather than a necessity, as these residents have more time and resources for gardening.⁴ Although lower income communities also appreciated camaraderie and personal development, this was viewed as a secondary benefit.¹⁵

Low-Income Accessibility

Case studies of CGs in low-income communities were overrepresented in the literature. Specifically, several papers investigated CGs in low-income neighborhoods and third world countries, or over-sampled low income communities to ensure representation of these demographics in the study; thus, forgoing representation of the true distribution of CGs in urban areas.^{15,20} As a result, we could not accurately gauge the proportion of low-income CG participants to middle- and higher-income counterparts at this time. It also remains difficult to determine if socioeconomically disadvantaged populations are capable of making use of CGs despite the location of urban CGs in low-income neighborhoods and food deserts. 8 of 26 studies used location as a proxy for assessing income level. However, when considering factors such as limited resources and gentrification trends, as discussed below, we determined that living near a CG does not necessarily confer an equivalent level of access to gardening. Lower-income residents must overcome many barriers to gardening including limited time, social capital, knowledge, finances, as well as safety and transportation concerns.^{10,21} In addition, fees, that cannot be afforded, may be charged for access, discouraging low-income residents from participating in the use of CGs.²² Overall, financial barriers to entry, compounded with limited gardening knowledge, can make gardening a risky investment of time and money, especially for the new or inexperienced low-income gardeners.

Further compounding the obstacles between low-income residents and CGs is gentrification: a progressive displacement of a historic, low income residents. Gentrification has been correlated with increasing number of CGs in multiple studies, and increased urban green space accelerates the gentrification rate.^{1,23,24} Low-income neighborhoods were four times more likely to see improvements, such as reduced littering and increased neighborhood pride. However, these outwardly positive findings could also represent progressive gentrification. As property values increase, CGs in privately owned lots may find that their land has been reclaimed for development. Protective policies are rarely upheld, putting the gardens at risk of abrupt closure.²⁵ Often, a CG is viewed as a “...temporary practice on a temporarily-available land” and are at risk of requisition.²¹ Given the marginal profits of selling CG produce, supplemental income from CG crops is unlikely to offset rising land values.⁵ So while many cities may attempt to foster CGs in low income communities, they may be unintentionally displacing the same populations that they are trying to support.²⁶

Gentrification should be acknowledged, but efforts

should made to include residents in civil planning to avoid uprooting such individuals from their homes.²⁷ For instance, green space development should be coupled with affordable housing initiatives, with green space investment equally distributed across an urban community to improve maintenance of and proximity and transportation to the CGs.¹⁵ Though the majority of urban gardeners walk to their plots, those who do require transportation will only need to travel a short distance to the garden.²⁸ In summary, if CGs are to fulfill their potential benefits of food stability, supplemental income, and personal and social development, low-income accessibility must be expanded.²⁴

Insights for Further Investigation

Currently, the scope of literature focuses disproportionately on low income communities yet cannot determine if these populations have equitable access to CGs compared to their more affluent counterparts. In other words, we cannot say whether or not the community physically surrounding a community garden is in fact the people who are utilizing the community garden. It may be beneficial for future research to compare the socioeconomic traits of garden participants to the population of the community the garden is meant to serve. Further, most studies examine urban locales in the US or other western and developed countries. We recommend that further research addresses these gaps in the literature.

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Understanding Community Perceptions of Health Care in Sweet Home, Oregon: A Qualitative Study

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Abstract: Introduction: When compared to surrounding communities, the rural town of Sweet Home, Oregon has high rates of unmet health care needs. Concerns outlined in previous studies include primary care capacity ratio, mental health care, dental health care, and preventable hospitalizations. ⁴ While quantitative measures are often used to measure unmet health care need, the goal of this qualitative study was to use participatory research methods to better understand needs through focus groups with community members. **Methods:** This study consisted of a series of four focus groups with the goal of eliciting community member perception of health care strengths and barriers. The study included twenty participants who were long-term Sweet Home residents over the age of 18. **Results:** Participants reported community strengths of high levels of engagement and a strong desire to improve health outcomes. Participants reported frustration with high primary care provider turnover and lack of after-hours health care. While there was no singular conclusion about the greatest health concerns in the community, participants cited concerns about transportation, poor nutrition, drug and alcohol use, homelessness, mental health issues and an aging population. **Conclusion:** By engaging in participatory research, this study allowed for a deeper understanding of community concerns and provided possible solutions to improve health care access and delivery. Understanding community perceptions of health needs may be useful to guide future health care initiatives in this community.

INTRODUCTION

Americans living in rural communities of the United States receive disproportionately worse health care than those living in urban settings.¹ Residents of rural areas tend to have higher smoking and obesity rates, lower amounts of physical activity and less access to medical insurance.² Consequently, rural areas report higher mortality rates and overall less healthy individuals, as compared to urban cities.³

The Oregon Office of Rural Health published the Areas of Unmet Health Care Need Report (AUHCN) in 2017 that evaluated unmet health care needs in Oregon's 130 primary care service areas.⁴ Each area receives a score from 0 to 90, with 90 being the best and 0 being the worst score. When compared to its surrounding areas, the community of Sweet Home, Oregon, was ranked as having higher than average amount of unmet need, specifically in the areas of primary care capacity ratio, mental health care, dental health care, and preventable hospitalizations. The mean score for Oregon was 41.1, with Sweet Home scoring 34.4 Sweet Home also scored below the mean for its geographic area, rural (without frontier), which had a mean score of 37.9. With an estimated population of 9,9775 and its location 15 miles from the closest community hospital, Sweet Home is an ideal representative of rural Oregon populations. Like many American communities, the 1980s brought a significant population and industrial decline to the region. Due to increased competition, logging regulations, and economic fluctuations of the time, Sweet Home experienced closures of its sawmills

and logging operations that greatly impacted the community's identity.⁶

After identifying Sweet Home as an area with high unmet health care need, researchers wanted to better understand the community's health care resources, weaknesses and strengths. Participatory community research is a model that can be useful to help understand both structural and personal barriers that patients encounter while utilizing health care resources. One such model, Community Health Improvement Partnership (CHIP) suggests that including community members' feedback when determining unmet health care needs can benefit the overall health of the community.⁷ Researchers determined that focus groups would be an effective strategy to better understand community perspectives and provide insight into the high level of unmet health care need in Sweet Home.

MATERIALS AND METHODS

Study Design

The research team began by collaborating with a local community leader in Sweet Home to create focus groups. With the help of the community leader, participants within the community were selected based on long-term residency in Sweet Home. Participants represented both elected officials and community members. None of the participants were directly involved in health care delivery. Four focus groups were conducted. The first focus group consisted of seven elected officials. The remaining three focus groups consisted of participants who represented

health care utilizers. A total of 20 participants were included in this study. Focus groups were conducted at the Sweet Home School District office on April 19th, May 3rd, May 9th and May 23rd 2018. Each group was facilitated by two medical student researchers and a third researcher who recorded participants' nonverbal cues. Nonverbal cues were used to better understand emotions and reactions to questions. Afterwards, each focus group was recorded and transcribed verbatim. Transcriptions are available upon request to the author.

Inclusion and exclusion criteria

In order to participate in the study, individuals confirmed they spoke English, were over the age of 18 and currently lived in the Sweet Home area.

Focus Group Guidelines

The focus groups took place at the Sweet Home School District offices. Before beginning the focus group interview, one facilitator verbally explained the goals of the focus group and read the verbal consent dialogue. The facilitators allowed time for questions before proceeding. After this, participants conversed freely, with guidance from the facilitators. The facilitators used the following questions to guide the group:

1. What local health resources are you aware of?
2. What do you think is the biggest health concern for Sweet Home residents?
3. What additional resources do you think would be most beneficial to improve the health of Sweet Home residents?

RESULTS

Study Demographic

A total of 20 participants were included in this study. The ages of participants ranged from 42 to 74 years old. Six participants identified as female and 14 identified as male. Seven participants reported that they were college graduates, nine reported that they had attended "some college", three reported "other," and one declined to report their education level.

Focus Group Discussions

In this study, three overarching questions were proposed and discussed among participants. The focus group recordings were reviewed and transcribed after the meetings. From these transcriptions, researchers identified overarching themes that were discussed in more than one focus group to be included in the results. Reviewing the four focus groups, the overarching themes were fairly congruent. An effort was made to preserve

dissenting and outlying opinions as well. Using these themes, researchers summarized or quoted participants' commentary.

Question 1: What resources exist for Sweet Home residents?

When describing resources that exist in the community, a common theme was that the community itself is a vital resource and "when the community decides that something is going to happen...it happens." In addition, participants noted that the annual Community Health Fair is an important resource that provides essential medical, dental, and health care services for hundreds of attendees. Participants also reported that the Sweet Home Family Medicine (SHFM) clinic plays a crucial role in community health but is the only primary health care option available and does not fully meet community needs due to limited hours of operation, rotating primary care physicians and difficulty obtaining an appointment. Participants reported resources that include the Boys and Girls Club, Head Start, Sweet Home Emergency Ministry Food Bank, Meals on Wheels and church groups that are available to serve community needs.

Question 2: What do you think is the biggest health concern for Sweet Home residents?

Transportation to care facilities

Many participants brought up the difficulty of physically getting to the care facilities in Sweet Home. Specifically, participants noted that many Sweet Home residents do not have reliable transportation options.

Poor Nutrition

Multiple participants identified poor nutrition as a source of chronic disease. Several participants believed that a large percentage of the population under the age of 18 receives meals through the free and reduced lunch program. Members of the elected officials focus group verified this report.

Drug and Alcohol usage

Drug and alcohol use and addiction were brought up in each of the focus groups. One participant noted that "I don't think it's worse than any other small town", but others identified it as a larger problem. One participant reported having trouble finding employees for entry level jobs due to their inability to pass a drug test. Multiple participants identified that there are few treatment options in the area for people struggling with addiction.

Homelessness

Homelessness was identified by several participants as a community concern. They reported that there are not

many resources available to the homeless population in Sweet Home. One participant reported that there were several families who were no longer able to afford rent and were forced to live out of their cars. Another participant stated that many students in the high school were homeless.

Mental Health

Participants were aware of people suffering from issues including depression, anxiety, addiction and PTSD. Several participants believed that the lack of mental health resources contributed to a substance abuse problem.

Aging population

Several participants pointed out that Sweet Home has an increasing retired population and a declining population of middle-aged people in the workforce. Participants largely agreed that the average age of a resident in Sweet Home is increasing and that this population shift requires unique services.

Question 3: What additional resources do you think would be most beneficial to improve the health of Sweet Home residents?

Increased Primary Care Providers/Urgent Care resources

Participants unanimously reported a desire to have more primary care providers (PCPs) in the area and less turnover of existing physicians. While some people noted no difficulty in retaining a PCP, one participant highlighted that in eight years, he has had four different PCPs. In all the focus groups, participants mentioned the community's desire to build a new urgent care or expand the current urgent care to include weekend hours. Participants stated that they believed if more providers were available to work in Sweet Home, the community would be able to fundraise money to buy land and build the facility.

Frustration with Existing Resources

A relatively small, but outspoken, group of participants expressed frustration with Samaritan Health Services (SHS). One participant told us that they have attempted to talk to SHS about the lack of hours and services but has not seen any action, "we've had these talks with Samaritan and we haven't gotten anywhere with that" further stating that "it's the perception that because we are Sweet Home, out here on the end, not quite as important."

Preventative/Community Health events

Participants emphasized the need for preventative programs, both at schools and in the community. One participant noted, "...that might be the model we jump to... a healthy community program." Many people

believed that the health fair is an effective opportunity to reach community members who rarely leave their homes and that "there was at least one instance where when screening [at the health fair] saved somebody's life."

Mentorship

Participants consistently addressed the need for mentorship for teenagers and children in the community. Many participants expressed the desire for medical students to serve as mentors for children in their community by speaking to children about career goals and healthy living. One participant noted, "There are kids here just looking for heroes."

DISCUSSION

This study attempts to further understand community perceptions of health in Sweet Home through the use of focus groups. When starting this study, researchers had an understanding of areas of unmet health care need in Sweet Home, based on quantitative data, which included primary care capacity ratio, mental health care, dental health care, and preventable hospitalizations. Researchers found that participant's experiences supported these statistical findings but also illuminated unique challenges and strengths. It was apparent that lack of health care resources available to the residents has resulted in a fraught relationship between residents and the local health care organization. The limited care options available to residents had created a perception that the organization was not taking an active role in investing more medical opportunities in the town. While there was no singular conclusion about the greatest health concerns in the community, participants cited concerns about transportation, poor nutrition, drug and alcohol use, homelessness, mental health issues and an aging population. For the most part, there was congruency between the focus group that included elected officials and the ones that represented community members. There was some disagreement on the extent of the issue that substance abuse presents, which could be an area of future study. Participants recognized that many of these concerns could be addressed through increased preventative health strategies. Importantly, participants consistently reiterated the strength of their community to overcome challenges and to band together to create opportunities.

While this study is specific to the rural community of Sweet Home, this participatory research is an example of the value of coming directly to community members to assess their wants and needs prior to the implementation of projects. In this case, many community concerns were in line with prior reports on health care needs, but several had not been mentioned in prior literature about Sweet

Home. For example, the AUHCN did not identify travel time to PCP as a concern, but residents consistently brought this up as a barrier to health care access. This study demonstrates not only specific, actionable items for improvement in unmet health care needs but also serves as an example of the importance of narrative, qualitative studies in addition to quantitative research.

Limitations

As with all qualitative studies, our findings can only be generalized to a certain extent. Other limitations of this study include the small sample size (20 participants) and a skewed age range (all participants were over the age of 42). There was also a sex ratio favoring males (about 2:1). Another limitation is that we had a lead person dictate whom in the community to involve in the focus groups. While this gave us a source within the community and built trust between researchers and participants, it may have contributed to selection bias. If this study were continued, researchers would seek a larger sample and more randomized group.

CONCLUSION

The barriers to ensuring that community health needs are met are complex and cannot be described by any single factor. As detailed in this research, Sweet Home participants asserted community strengths, including a strong sense of community pride and motivation to improve health outcomes. They also delineated challenges, such as the need for increased providers, and concerns over preventative care gaps. This study highlighted the importance of utilizing community voices to guide implementation of projects. This qualitative research can be compared to quantitative studies to determine areas of health care need and find solutions that benefit the community.

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Telehealth Applications on Continuity of Care, Quality of Care, and Patient Satisfaction in the United States

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Abstract: Background: In healthcare delivery, continuity of care is an important cornerstone in determining the quality of care provided to patients since it affects health outcomes, compliance to medication and recommendations, and provider trust. Telehealth will continue to play a role in the nation's healthcare landscape as consumers increasingly value convenience of time, location, and the need to meet virtually in the context of a global COVID-19 pandemic. Purpose: This review highlights the effects of telehealth on patient satisfaction and healthcare quality while considering the implications on longitudinal, informational, and interpersonal continuities of care.

Methods: A review was conducted utilizing peer-reviewed journal articles from databases such as PubMed, CINAHL, and Web of Science. Both quantitative and qualitative studies were included in analysis.

Results: Telehealth increased continuity when administered by in-network providers who have a relationship with the patient. While medical guideline adherence and prescribing behaviors varied amongst physicians who used telehealth applications, patient satisfaction remained high if telehealth was administered through their healthcare home. Conclusion: Telehealth can serve populations experiencing barriers to medical care, particularly for regions with physician shortages and in populations with limited access to in-person visits. In order to best serve patients, telehealth must meet criteria for safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity.

INTRODUCTION

Telehealth refers to a variety of technologies and methods of delivering health care and education via a virtual interface, including but not limited to video calls, mobile health, remote patient monitoring, etc. Telehealth can be asynchronous (no face-to-face interaction) or synchronous (virtual/remote face-to-face interaction). It can also be offered as an independent application where the patient sees a different healthcare provider each time (no long term relationship) or as a service through their healthcare home where they routinely receive care through an established primary care provider. Telehealth is expected to become a more ubiquitous feature in primary care as the number of virtual doctor visits grew 20% from 1 million in 2015 to 1.2 million in 2016.¹ Moreover, around 72% of hospitals and 52% of physician groups offer telehealth options.¹ Concerns for telehealth include lack of personal relationships with providers, data insecurity for private health information, and non-coverage from insurance plans. On the other hand, top reasons in favor of telehealth are as follows: convenience, potential cost savings, ease of prescription refills, and more frequent communication with their provider. The specific aim of this review is to analyze the impact of telehealth on continuity of care (CoC), quality of care measures, and patient satisfaction.

METHODS AND MATERIALS

This review will be inclusive of both qualitative and

quantitative peer reviewed studies as pertaining to telehealth. Journal articles will be retrieved from the following databases: PubMed, CINAHL, and Web of Science.

RESULTS

Telehealth has several different modalities, with services available from independent apps or integrated within larger healthcare systems. When Telehealth is used as an independent source of care, it contributes to a fragmented healthcare system and negatively impacts patients' continuity with their PCPs. However, most research in the current literature looks at telehealth programs integrated within clinics and hospitals and show opposite results. Holyk et al. (2017) conducted a survey on continuity of care (CoC) with 210 patients at Carrier Sekani Family Services (CSFS), a primary care model that combines on-site services with telehealth. Supplementing in-person physician visits with telehealth improved CoC, especially for patients with geographic barriers to accessibility. Participants were surveyed on their perceptions of medical trust, satisfaction, usability, effectiveness, and convenience after using telehealth. Overall, telehealth services (videoconferencing) enriched longitudinal continuity, with 77% of respondents reported being able to see their doctor more regularly and 82% indicating greater ability to attend appointments due to less need for travel. Patients who considered CSFS their healthcare home were more likely to give higher scores for usability, convenience of services, and sustained use.² In general, telehealth's aptitude to lower barriers for

care improved CoC. Telehealth need not always require advanced technology, systems, or software. Telephone visits have proven to be effective at maintaining CoC as well. Scheduled telephone visits at the Veterans Health Administration (VHA) medical homes allowed nurses to check up on patients continuously. Providers cited higher awareness of patients' health status and had a higher propensity of involving patients in the medical decision-making process. Because telephone visits enabled scheduling flexibility and did not require transportation, it reduced the likelihood of missed visits; thereby, increasing longitudinal continuity.³

Healthcare institutions may adopt telehealth platforms with the intention of collecting information on patients to inform treatment. Informational continuity is of interest among researchers who seek to understand how telehealth affects care coordination and management for patients with chronic conditions. The Health Buddy Program[®], a popular telehealth tool examined by numerous studies on a variety of target populations, has been linked to improved health outcome indicators among the elderly with congestive heart failure and diabetes.⁴ Vital signs and daily questionnaire answers are collected from patients via the Health Buddy[®] device and transmitted to case managers who review the data. One advantage is that disabled patients do not have to leave their homes to provide this information. Case managers can then contact those at high risk of deterioration for further medical intervention. Identifying patients' level of risk at an earlier stage not only improves coordination of care, it helps to maintain significant cost-savings (to be further discussed in a later section).⁴ Other clinician-supported telehealth tools and kiosks can relay up-to-date patient information, facilitating risk management, timely referrals, and coordinated care.⁵

There is a fear that telehealth—especially asynchronous modalities that do not require seeing or even listening to a provider—will ultimately lead to tradeoffs with interpersonal continuity, characterized by detached relationships and lack of empathy. However, Holyk (2017) found that medical trust, a fundamental component of interpersonal continuity, was not compromised when using telehealth in lieu of in-person visits at primary care centers, where the difference in mean scores for trust between telehealth and in-person appointments were non-significant at 2. Additionally, focus groups reported that routine telephone calls from Veterans Health Administration medical homes met both patients' and physicians' expectations for interpersonal continuity.³ Telehealth fortified patient-provider relationships by easing patients' accessibility for urgent and routine needs. Although patients were initially wary that phone calls would feel impersonal, they found that frequent

contact (longitudinal continuity) actually made them more comfortable with established providers. The convenience of "healthcare at home" has resulted in more positive perceptions of healthcare and even higher praise towards providers from telehealth users. Amongst older patients, the relationship and knowledge of the provider was deemed more essential than immediate access. Telehealth employed for chronic disease management allowed providers to identify and encourage at-risk populations to make lifestyle changes. Diabetic patients who had the opportunity to use telehealth for chronic disease management cited that technology helped them develop closer relationships with providers. Nurses also felt that they were able to build trust and provide patient-centered, culturally appropriate, and linguistically sensitive care through telehealth.⁶

Consistent consultation and health monitoring via telehealth helps hospitals prevent admission and readmission, contributing to significant financial savings for both individuals and systems. Hospitals suffer economically from high rates of uncompensated care when chronic illness goes untreated or unmanaged. To address this, Mercy Health Center in Texas implemented a Telemedicine Diabetes Disease Management Program featuring Health Hero iCare portals and Health Buddy[®] devices. Videoconferencing visits, combined with at-home glucose and blood pressure monitoring devices, can be particularly useful for patients with conditions that require constant monitoring. These devices provide an effective and efficient means of delivering care to patients while presenting opportunities for collaboration between physician and patients. Patients in the program had cost-savings of \$747 per patient, 32% reduction in inpatient admissions ($p < 0.07$), 34% reduction in emergency room visits ($p < 0.06$), and 49% reduction in outpatient visits ($p < 0.001$). Compared to controls, mortality rates were 2.5 points lower for those in the intervention group beginning the second year of program implementation.⁴ These results are likely due to enhanced self-management and nurses' ability to pinpoint high-risk patients for timely intervention.⁸ Holyk (2017), a study with 210 enrolled participants, showed reduced emergency department visits among 63% of patients and lower transportation out-of-pocket spending for 69% of patients.²

Telehealth can incorporate eReferrals, an electronic referral system amongst clinicians. eReferrals cut wait times for patients while simultaneously improving communication and partnerships among PCPs and specialists.⁹ Specialized physicians quoted lower rates of inappropriate medical and surgical referrals with electronic methods (2.6% medical and 2.1% surgical) as opposed to paper methods (6.4% medical and 9.8%

surgical). Avoidable follow-ups also occurred less when using electronic referrals processes (27.5% medical and 13.5% surgical) over paper-based methods (32.4% medical and 44.7% surgical). These differences were significant at $p < 0.01$.¹⁰

Schoenfeld et al. (2015) set out to measure variations in quality measures across eight virtual visit companies among patients who presented one of six common illnesses: ankle pain, streptococcal pharyngitis, viral pharyngitis, acute rhinosinusitis, low back pain, and recurrent urinary tract infections. Five hundred commercial virtual visits were completed in the study period from May 2013 to July 2014. Completed histories and physical examinations occurred in 69.6% of visits (95% CI: 67.7-71.6%), correct diagnoses in 76.5% (95% CI: 72.9-79.9%), and guideline adherent management decisions in 54.3% (95% CI: 50.2-58.3%). Less than 33% disclosed clinician's credentials or allowed patients to choose and only 32% discussed side effects of prescribed medications. There were significant differences in diagnosis variations and guideline adherence for the six illnesses of interest, depending on the company. However, mode of communication (i.e. video, telephone, or webchat) did not alter adherence rates.¹¹ Prescribing behaviors also differed. Mehrotra et al. (2013) reported that physicians engaging in eVisits were more likely to prescribe antibiotics for sinusitis and urinary tract infections, using a conservative treatment approach to compensate for the lack of in-person examinations. While eVisits can lower health care spending due to lower reimbursement rates, higher volume of antibiotic prescriptions and misdiagnoses undercut cost-saving advantages.¹² While there should be continued research on this topic, quality of care seems to be vastly different between integrated and independent telehealth applications.

Telehealth has been touted as a solution to issues of accessibility due to physician shortages in Midwestern regions of the U.S. Therefore, interventions have been especially of interest among vulnerable populations—such as the elderly, veterans, and rural residents—and show promising results. Jue et al. (2017) set out to examine how technology can broaden access to care for complex cases. The study invited 296 veteran patients in Florida to participate in video chats with surgical oncologists, leading to an 80.7% reduction in travel distance. This translated to savings of \$155,627.20 in total Medicare reimbursements during the length of the study. Patients unanimously agreed that they were still able to enjoy the benefits of face-to-face visits, appropriate counseling, and discussion of treatment options' risks and benefits. While 86% of the patients believed telehealth improved accessibility and gave high

patient satisfaction scores (averaging 4.5 on a scale of 5), it was difficult to assess surgical outcomes since the study did not collect necessary data on comorbidities and hospital volume that would invariably complicate the relationship.⁷

Patient satisfaction either considerably improved or did not change after telehealth usage. In settings that offered telehealth, Gustke et al. (2000) concluded a 98.2% satisfaction rate among 495 participants who received interactive virtual clinical consultations after adjusting for patient age, gender, race, income, education, and insurance. Previous studies on telehealth patient satisfaction averaged around 92.8% (ranging from 77-100%), indicating that results were consistent with previous findings.¹³ When CVS Health assessed patient satisfaction regarding diagnostic images, usability, provider capacity, quality of care, and convenience for a telehealth pilot program in their Minute Clinics, 34% of 1,734 patients expressed preferences for telehealth and 57% reported telehealth "just as good as a traditional visit".⁵ Convenience and absence of wait times were among the main motivators for using telehealth. Individuals with no medical insurance were 21% times more likely to prefer telehealth visits over traditional ones.⁵ In traditional primary care settings, patients gave significantly higher ratings for satisfaction ($p = 0.01$), effectiveness ($p < 0.001$), convenience ($p < 0.001$), and usability ($p = 0.01$) if they considered the clinic their healthcare home.² Telehealth strengthens communication, adherence, and patient-provider relationships when integrated with in-person medical offices. Personalizing telehealth services to meet the needs and expectations of patient population enables high satisfaction among users.

DISCUSSION

Telehealth has shown remarkable progress in advancing health outcomes and CoC. Still, there are policy and practice considerations necessary for increasing telehealth uptake. The literature was overwhelmingly in favor of integrating telehealth programs in hospitals and primary care centers. There are factors to consider when doing so. First, telehealth interventions should meet the dimensions of healthcare quality: safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity. It must be recognized that telehealth's return on investments is a long-term matter—reducing waste in equipment, supplies, ideas, and energy. Second, important characteristics of an in-person visit should be adopted and incorporated into telehealth for it to be successful. Crucial information such as medical records, medical images, and medication lists should be available prior to implementation. Rather than relying on physicians to collect this information during consultations,

preparation in advance will improve efficiency. Third, telehealth is best operationalized within an organization when implementation decisions are initiated from and supported by frontline workers, such as nurses and physicians. Fourth, organizations should develop user-friendly mechanisms to deliver telehealth that is convenient for both providers and patients. For example, telehealth should be accessible via mobile devices, but extra care is required to ensure that medical information is kept confidential. Patients may feel reluctant to disclose private health information if they do not feel like they are in a safe environment, especially since fundamental elements of the in-person encounter that facilitate data collection are removed. Therefore, telehealth should be respectful and responsive to individuals' needs so that it is patient-centered. Fifth, it is important to note that not all in-person interaction can or should be replaced with virtual ones; thus, organizations must be strategic about the areas in which they want to offer telehealth. Lastly, telehealth should be equitable and deliver care for those who need it most. When delivered through a physician-led healthcare, telehealth improves communication and coordination between providers for patients with special needs. Telehealth is not a one-size-fits-all solution and must be tailored to fit its intended audience.

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Anti-MDA5 Dermatomyositis with Rapidly Progressive Refractory Skin Lesions

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Abstract: Introduction & Objective: Anti-MDA5 positive dermatomyositis does not contain the same typical skin findings and progressive muscle weakness as classical dermatomyositis and can be difficult to diagnose and treat. The objective of this paper is to highlight the rapidly progressive onset of necrotic skin lesions in a patient with cutaneous disease refractory to initial treatments. Case Presentation: 49 yo Vietnamese male presented with clinically non-specific skin rash and isolated urine protoporphyrins leading to initial diagnosis of porphyria cutanea tarda. After lack of response to prednisone with worsening and transforming skin rash and proximal muscle weakness, a further workup was initiated and ultimately revealed anti-MDA5 positive dermatomyositis with refractory skin disease and without rapidly progressive interstitial lung disease. The patient has remained stable on a combination of IVIG, rituximab, wound care, and Bactrim prophylaxis. Conclusion: The quick diagnosis and aggressive treatment of anti-MDA5 positive dermatomyositis is necessary to treat painful and rapidly progressive skin ulcerations. A multidisciplinary approach involving rheumatology, dermatology, pulmonology, pathology, radiology, and infectious disease is paramount to the successful treatment and improved quality of life for these patients.

INTRODUCTION

Dermatomyositis is a multisystem, idiopathic, inflammatory myopathy. The incidence is approximately 8 cases/million population/year with a bimodal age distribution with both juvenile and adult phenotypes.¹ Anti-melanoma differentiation-associated gene 5 (MDA5) dermatomyositis, first identified in 2005,² is a subtype of dermatomyositis presenting with clinically distinct skin and mucous membrane findings. MDA5 is a pattern recognition receptor capable of detecting double and single-stranded RNA, namely in viruses. Activation of MDA5 causes downstream transcription of type I interferons. The clinical presentation of anti-MDA5 dermatomyositis differs from that of typical cutaneous dermatomyositis and the diagnosis is often overlooked. This is important because patients with this disease process have a significant risk for developing rapid interstitial lung disease (ILD) and a delay in diagnosis can be devastating.^{3,4}

Cutaneous manifestations of classic dermatomyositis include heliotrope rash and Gottron's papules with malar erythema, photo-distributed poikiloderma, violaceous erythema, periungual and cuticular changes, and alopecia.⁵ In contrast, anti-MDA5 dermatomyositis tends to present with distinct mucocutaneous findings. Large cutaneous ulcers develop in 82% of cases and usually appear as deep ulcerations with necrotic centers and a hyperkeratotic crust. Generally, these ulcers develop overlying the usually very recognizable Gottron's papules and on the elbows and knees. Additionally, palmar papules and gum pain are frequently noted.³ A study conducted at Stanford

University agrees with previous studies showing that in patients with anti-MDA5 dermatomyositis, skin disease predominates with absent or very mild muscle disease. Additionally, this cutaneous necrosis is very challenging to treat and leads to significant quality of life impairment (even more so than psoriasis and atopic dermatitis).^{6,7} While the exact pathophysiology of cutaneous disease in dermatomyositis is still unknown, it is thought that there is an increase in cutaneous vasculopathy compared to the muscular vasculopathy of classic dermatomyositis. This is possibly related to the overexpression of MDA5 in individuals with this phenotype, as the MDA5 leads to release of type I interferons which have vasculopathic effects of their own.⁷

CASE PRESENTATION

A 49-year-old Vietnamese male with a medical history complicated by alpha thalassemia, alcoholism (sober since June 2018), and chronic hepatitis B presented 5 days post left carpal tunnel release procedure with a presumed left septic wrist and bacteremia. During hospitalization, the patient developed a diffuse violaceous rash of the bilateral hands, arms, and upper chest. Lab studies revealed elevated urine porphyrins leading to a diagnosis of porphyria cutanea tarda and treatment with a course of high dose prednisone. One week post discharge for bacteremia, the patient returned with concerns of hypotension, proximal muscle weakness, and worsening skin rash on the bilateral dorsal hands. Lab workup revealed normal CK levels but aldolase elevated to 11.8 U/L and ferritin levels of 2700 ng/mL. Physical description of the worsening skin rash showed pink thin papules to plaques on the PIP and MCPs

of bilateral hands and ill-defined erythematous scaly thin plaques on the extensor arms, upper chest, and upper back. A skin biopsy revealed vacuolar dermatitis with plasma cells which the pathologist commented may be consistent with dermatomyositis but is not suggestive of porphyria cutanea tarda. A muscle biopsy of the R deltoid performed at this hospitalization revealed degenerating/regenerating myofibers, a sparse macrophage infiltrate, and no increase in lymphocytic inflammation. The pathologist commented that the only features supporting a diagnosis of dermatomyositis included some slight perifascicular atrophy but were rather non-specific. The autoantibody assay returned positive for anti-MDA5 antibodies supporting the diagnosis of dermatomyositis presenting with worsening skin rash and minor proximal muscle weakness. Chest CT revealed scattered bilateral ground glass opacities and the patient was started on 60 mg prednisone and mycophenolate mofetil 1000mg bid.

Three weeks after starting prednisone and mycophenolate mofetil, the patient again presented to the emergency department for worsening skin rash and confusion. Labs showed worsening transaminitis, thrombocytopenia, and chest CT with bilateral ground glass opacities. The patient was admitted, the mycophenolate mofetil was discontinued due to concerns of liver toxicity and worsening symptoms, and the patient was started on IV solumedrol 500 mg daily for 3 days and IVIG 2 gm/kg given over 3 days. At this time, the patient was also switched to rituximab 1000mg. The previously pink, papular rash now appeared as punched out ulcerations with overlying eschars on the bilateral elbows, posterior shoulders, bilateral dorsal feet, right 5th MCP, right index MCP and bilateral pinna (Figure 1). The eschars on the right shoulder and right elbow were removed with sharp dissection but the others were too adherent. He was started on collagenase and recommended weekly wound care visits and 10 mg daily prednisone on discharge.



Figure 1: Skin lesions with overlying eschars of the R elbow, R 2nd MCP, and R 5th MCP

Follow up two months after starting rituximab 1000mg infusions, 10 mg daily prednisone, 3 times weekly IVIG, as well as careful wound care showed slowly improving

skin lesions (Figure 2) without development of new lesions, stable ILD as noted by repeat CT scan, and improved clinical complaints of muscle weakness. The patient was treated twice for pseudomonas pneumonia but recovered well. Clinically, the patient reported improved skin lesions and no breathing concerns. Collaboration between rheumatology and dermatology agreed on continuation of the rituximab 1000mg 2 doses every 6 months, IVIG as the ulcers continue to improve, 5 mg prednisone daily, and Bactrim 3 times weekly for bacterial prophylaxis. The patient is doing well.



Figure 2: Healing skin ulcers after debridement and 2 rituximab infusions

DISCUSSION

Anti-MDA5 dermatomyositis can pose a diagnostic challenge on initial presentation. Interestingly, it seems that in this patient the trigger for the clinical development of dermatomyositis was the septic wrist. There was a 7 week delay in reaching the diagnosis of anti-MDA5 dermatomyositis as the elevated urine porphyrins were the only real diagnostic clue for the somewhat non-specific initial skin rash. The rash began as diffuse and violaceous, transformed into pink and papular, then finally turned to deep ulcerations. It wasn't until the patient began developing rapidly worsening skin lesions prompting biopsy and proximal muscle weakness that the definitive diagnosis was reached. This patient is fortunate that he has been spared from the rapidly progressive ILD that often comes with this subtype of disease. The estimated prevalence of ILD in Asian populations with anti-MDA5 dermatomyositis is 92%-100%.³ He has, however, struggled with recurrent pulmonary infections.

Aggressive treatment for this patient's anti-MDA5 dermatomyositis was warranted especially given his very high ferritin values which carries a strong association with disease activity in these patients. According to Kurtzman et al, elevated serum ferritin levels (≥ 500 ng/mL) suggests decreased survival and the strength of this association increases with increasing ferritin levels (≥ 1600 ng/mL).³ The decision to begin treatment with mycophenolate mofetil in this patient is consistent with

the first line steroid-sparing agent used successfully in other case studies, however this patient did not respond favorably and was switched to rituximab plus IVIG with beneficial result and skin improvement. This treatment combination of rituximab plus IVIG is consistent with new research demonstrating favorable outcomes in patients with refractory autoimmune processes, especially those presenting cutaneously.⁸

The multidisciplinary team of rheumatologists, dermatologists, pathologists, radiologists, infectious disease specialists, and pulmonologists who evaluated this patient ultimately reached the correct diagnosis and a suitable treatment plan relatively quickly. Had this patient had to wait longer for aggressive treatment, it is likely given his high disease markers, quickly progressive skin findings, and his propensity for sepsis that morbidity would have been greatly increased.

LEARNING POINTS

1) Anti-MDA5 dermatomyositis can be difficult to diagnose given the lack of myopathy and the different mucocutaneous presentation compared to classical dermatomyositis

2) Early recognition of the associated skin lesions is important given the high morbidity from rapidly progressive ILD. Ferritin and aldolase are useful disease markers.

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Case Report of Spinal Gout in a 68-Year-old Female

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Abstract: Background: Gout is a common arthritic joint disease that predominantly presents in the first metatarsophalangeal joint. It is caused by the deposition of monosodium urate crystals in the joint causing pain, inflammation, and swelling. The clinical manifestations of acute gout include severe joint pain, edema, and erythema. Case Presentation: A 68-year-old Caucasian female presented with lower back pain with associated myalgias, malaise, and intermittent dyspnea. On exam, she was febrile with decreased breath sounds and 1+ bilateral lower extremity edema. The patient was diagnosed with spinal gout and began prednisone therapy. Conclusion: The analysis of our case report suggests that physicians should consider the diagnosis of spinal gout in patients with nonspecific back pain and a history of chronic gout. Although it is rare for gout to disseminate into the spine, it is important to remember that gout is caused by an increased level of urate in the bloodstream and may deposit anywhere in the human body.

INTRODUCTION

Gout is the most common type of inflammatory arthritis. The prevalence of gout in the United States among adults was recently found to be 3.9%.¹ It is caused by the deposition of monosodium urate crystals in a joint causing pain, inflammation, and swelling. Gout is more common in males with a particular predominance in Caucasian males.¹

The clinical manifestations of acute gout include severe joint pain, edema, and erythema. The onset of pain is generally within 24 hours and often resolves within 7-14 days.² Chronic manifestations include nodules, prolonged inflammation, joint damage, and arthritis. Acute on chronic attacks are common, even in patients receiving gout prophylaxis.³

We present the case of a patient with a history of gout with severe back pain without any other joint pain. During the course of treatment, an acute gouty flare appeared. A course of colchicine and steroids resolved the acute gouty flare as well as the associated back pain. To the best of our knowledge, there are no other similar cases in the medical literature.

CASE PRESENTATION

We present the case of a 68-year-old Caucasian female, with a past medical history of congestive heart failure, chronic kidney disease, and gout who presented with uncontrolled, acute on chronic back pain. The pain was described as spasm-like and rated as an 8 out of 10 in severity. Associated symptoms included one episode of urinary incontinence, feelings of malaise, myalgias, and intermittent dyspnea. The patient denied dysuria, hematuria, cough, and chest pain. The patient reported

a history of back pain and a past medical history of sciatica.

Examination revealed an easily arousable, morbidly obese female. Vitals were a blood pressure of 103/55 mmHg, heart rate of 69 bpm, respiratory rate of 18, oxygen saturation of 97% on room air, and a temperature of 38.4 degrees Celsius. Auscultation of the heart revealed an irregularly irregular rhythm and a 3/6 systolic murmur. The pulmonary exam revealed unlabored breathing with diminished breath sounds in the lung bases bilaterally. Extremity examination revealed 1+ bilateral lower extremity edema. The rest of the examination was unremarkable.

Laboratory testing revealed a white cell count of 19.7 x 10⁹ /l (4-11 x 10⁹ /l). Serum sodium was 133 mEq/L (136-145 mEq/L), serum chloride 92 mEq/L (95-105 mEq/L), and serum bicarbonate 32 mEq/L (22-28 mEq/L). Serum urea nitrogen 72 mg/dL (7-18 mg/dL) and serum creatinine 1.53 mg/dL (0.6-1.2 mg/dL). Serum aspartate aminotransferase 46 U/L (8-40 U/L). Urinalysis revealed blood, leukocyte esterase, and 3+ monosodium urate. Procalcitonin was 1.5 ng/mL (0.10-0.49 ng/mL). Due to the elevated levels of procalcitonin, along with abnormal urine study, a concern of sepsis was considered, and infectious disease was consulted.

A computed tomography (CT) scan of the lumbar spine region was performed (fig 1). The scan showed enhancement in the L4-5 region related to inflammation but was non-specific. A magnetic resonance imaging (MRI) exam of the lumbar spine was performed as well (fig 2). MRI of the lumbar spine revealed epidural enhancement with early phlegmon in the area of spinal segments L4-S1. There was a loss of disc height in the L2-L5 regions and mild disc bulging at the vertebral level

of L2-S1 with spinal stenosis and possible L5 nerve root impingement. An L5 bone biopsy, with cartilaginous tissue, was subsequently performed which revealed nonspecific reactive changes without any signs of inflammation or crystal deposition. A working diagnosis of discitis or osteomyelitis with epidural abscess was considered and the patient was administered empiric intravenous antibiotics with coverage of suspected pathogens.

The following day, the patient reported new-onset left wrist pain. Physical examination revealed left wrist inflammation and dactylitis of the right index finger. Needle aspiration of the wrist was performed demonstrating 3+ monosodium urate crystals. The patient was started on colchicine and prednisone medication therapy to improve gout-related symptoms in fingers and wrists. The following week, the patient demonstrated significantly decreased inflammation in the wrists and fingers as well as overall decreased back pain. A plan was made to slowly taper the prednisone and then start allopurinol to prevent the recurrence of gout. At the time of hospital discharge, the patient reported no back pain and was comfortable returning to her place of residence.

DISCUSSION

The initial presentation of our patient was uncontrolled, chronic back pain, and fever with a recent urinary tract infection (UTI) which led to the primary suspicion of a back infection with a possible ascending and metastatic infection to the spine. With the concern of systemic inflammatory response syndrome (SIRS) due to non-specific symptoms with prior UTI, procalcitonin levels were checked. Procalcitonin was elevated to 1.5ng/ml and the complete blood count (CBC) showed leukocytosis. The patient's urinalysis was positive for leukocyte esterase, blood, and 3+ monosodium urate. Due to the patient's history of gout, but no current common joint symptoms and renal failure, the 3+ monosodium urate level on urinalysis was not considered a clinically significant finding at the time. The patient was treated with intravenous antibiotics due to suspected infection and oxycodone for pain control. Despite the administration of pain medication, the back pain remained uncontrolled. The patient had an acute gout flare the following day in the wrist and finger and was treated for that flare-up. Treatment rapidly improved the wrist and finger pain, as well as dramatic and quick improvement of her back pain. Although there was no diagnostic study showing uric acid crystals in the spine, the bone biopsy with cartilaginous tissue has limited use when diagnosing crystal associated arthritis (CAA). Looking at 65 synovial tissue biopsies from 1988 to 2015 with clinical suspicion of CAA, only 20% of

the biopsies proved a positive result.⁴ Due to the patient presentation, CT and MRI tests showing enhancements, no signs of septic cause, and improvement with gout treatment, a clinical diagnosis of acute gouty discitis was made.

Epidemiological studies have shown that the incidence of gout is rising in the United States.⁵ As the more cases increase, it is essential for physicians to recognize the abnormal presentations of gout. In 2015, 131 cases of reported spinal gout were reviewed, with 75% of patients having a history of gout and 59% with a current gout tophus within another joint. Diagnosis of spinal gout occurred with 75 of the patients requiring surgery for diagnosis and another 32 with bone biopsy or needle aspiration.⁶ In a retrospective study involving five cases of spinal gout between 2014 and 2017, only one of the patients avoided surgery in favor of conservative management and bone biopsy. A history of gout as well as an elevated uric acid level were associated with spinal gout in 4 of 5 patients.⁷

The analysis of our case report suggests that physicians should consider the diagnosis of spinal gout in patients with non-specific back pain and a history of chronic gout. Although it is rare for gout to disseminate into the spine it is important to remember that gout is caused by an increased level of urate in the bloodstream. Due to this fact, uric acid crystals can collect in virtually any part of the human body requiring blood supply. We also suggest that treatment with medications may be possible before surgery to decrease morbidities among patients. Further research should be completed in this area to provide improved diagnosis and treatment methods of spinal gout.

LEARNING POINTS

- 1) Spinal gout should be considered as a differential diagnosis in the workup of back pain in patients with a history of gout.
- 2) Although gout classically presents in peripheral joints in the fingers and toes, remember that gout may disseminate and collect in various locations in the human body.

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FIGURES



Figure 1. CT of the lumbar spine with enhancement of the L5-S1 disc space showing inflammation in the area

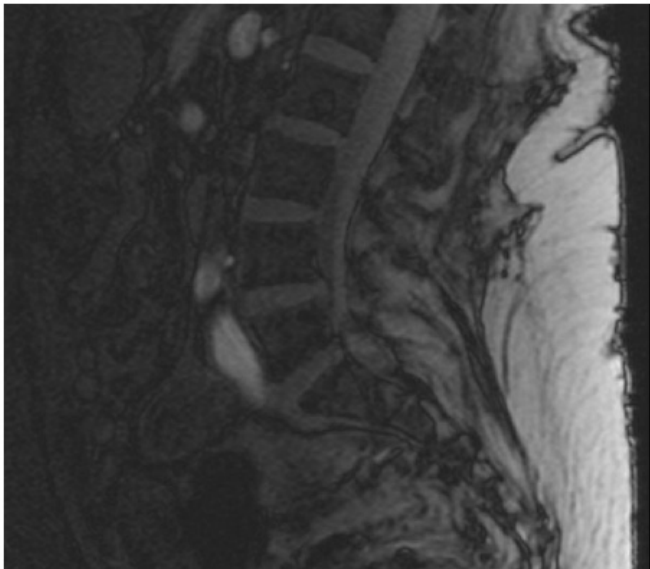


Figure 2. T-2 weighted MRI of the lumbar spine with enhancement in the L4-S1 region indicating early phlegmon.

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Past Studies, Cellular Mechanisms, and Implications of Low Molecular Protein Tyrosine Phosphatase as a Novel Therapeutic Target for Inhibition in the Treatment of Type 2 Diabetes Mellitus: A Review of Literature

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Abstract: Type 2 diabetes mellitus has grown to become one of the most important global health challenges, resulting in increased efforts to treat patients with lifestyle changes and pharmacotherapy. Protein tyrosine phosphatases are a promising therapeutic target to treat type 2 diabetes mellitus, considering their role in dephosphorylating insulin receptors. Protein tyrosine phosphatase 1B is a class 1 protein tyrosine phosphatase which has been the main target for inhibition in recent decades; however, inhibitors designed thus far have yet to achieve optimal specificity and bioavailability. Thus, novel therapeutic targets—such as low molecular protein tyrosine phosphatase—are being considered in the treatment for type 2 diabetes mellitus. Low molecular protein tyrosine phosphatase is suggested as a negative regulator of insulin receptor signaling which is functionally distinct from other protein tyrosine phosphatases. It has been shown that low molecular protein tyrosine phosphatase knockout-mice with high-fat diet-induced diabetes had significantly improved glucose tolerance compared to wild-type mice. Furthermore, an orally bioavailable small-molecule inhibitor of low molecular protein tyrosine phosphatase was able to effectively reverse obesity-induced diabetes. These findings suggest low molecular protein tyrosine phosphatase inhibitors could be a tangible therapeutic in improving insulin sensitivity and glycemic control. Despite encouraging results, further research should be performed to study potential side-effects of low molecular protein tyrosine phosphatase inhibition. With continued optimization, low molecular protein tyrosine phosphatase could prove to be a viable oral drug for type 2 diabetic patients.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) has become one of the most important global health challenges, as it has been predicted that approximately 591.9 million people will be living with this disease by the year 2035.¹ Despite the effectiveness of suggested lifestyle changes and pharmacotherapy, the rising incidence of T2DM cases and associating co-morbidities—particularly in the adolescent population—necessitate a search for novel treatment options.²

Recently, there has been growing interest in targeting protein tyrosine phosphatases (PTP) in the treatment of T2DM. Under normal physiological conditions, the binding of insulin to its corresponding insulin receptor (IR) on the plasma membrane stimulates autophosphorylation, which signals a cascade to promote biological effects of insulin such as glucose uptake. This process is negatively regulated by PTPs, which dephosphorylate substrate IR tyrosine residues to attenuate insulin signaling pathways.³ PTP expression levels are amplified in insulin-resistant obese patients and thus serve as a target for inhibition to increase insulin sensitivity.⁴

Many studies have focused on targeting class 1 protein tyrosine phosphatase 1B (PTP1B) for inhibition in the treatment of diabetes, to varying degrees of success.⁵

Low molecular weight protein tyrosine phosphatases (LMPTPs) are class 2 PTPs involved in multiple signaling pathways, yet their role in insulin resistance and potential as a therapeutic target remain understudied. The objective of this review is to assess the viability of LMPTP inhibitors in treating T2DM; this will be achieved by evaluating outcomes of existing PTP inhibitors in T2DM treatment, reviewing mechanisms of LMPTP activity in the IR pathway, and finally considering the implications of LMPTP as a novel therapeutic target.

PTP1B INHIBITORS HAVE YET TO ACHIEVE OPTIMAL SPECIFICITY AND ORAL BIOAVAILABILITY.

The action of PTPs is important in both the transmission and attenuation of insulin signaling via dephosphorylating IR. For this reason, PTPs have been considered a target for inhibition in the treatment of T2DM. PTP1B has been of specific interest in recent decades because its gene expression is increased in subjects with T2DM, which largely contributes to insulin resistance.⁶ However, it has been demonstrated that mice with genetically knocked out PTP1B exhibit increased insulin sensitivity and resistance to weight gain on a high-fat diet.⁷

Early inhibitors were based on vanadium compounds, which are competitive inhibitors of PTP1B. It has been postulated that vanadium anions bind cysteine side

chains in active sites of PTP1B, acting as antagonists to prevent binding of substrate IR phosphate groups.⁸ However, the catalytic site of PTP1B is well conserved amongst all PTPs⁹; thus, competitive inhibitors display limited specificity to PTP1B and could potentially act on several other phosphatases and kinases.

Because of this limitation, PTP1B has been experimented on using a variety of chemical entities exhibiting distinct mechanisms of inhibition. A study conducted by Erbe et al. demonstrated eriprotafib inhibits PTP1B via non-classical kinetics and improves glycemic control via multiple mechanisms.¹⁰ This molecule was subsequently used in a phase 2 clinical trial for the treatment of T2DM; however, the trial was terminated due to insufficient efficacy, unwanted side-effects, and toxicity concerns. Inhibitors of allosteric sites on PTP1B were also explored as a therapeutic target because of greater specificity, fewer side effects, and lower toxicity.¹¹ Trodusquemine and Claramine are highly selective allosteric inhibitors of PTP1B which have demonstrated positive results in T2DM treatment and have subsequently entered clinical trials.^{12, 13}

PTP1B is recognized as an established therapeutic target for inhibition as treatment for T2DM. Unfortunately, it is evident that new PTP1B inhibitors are constantly being designed and renewed because optimal specificity and oral bioavailability have yet to be achieved. Problems with specificity could arise from the highly-conserved nature of the catalytic site in PTPs, whereas issues with bioavailability could stem from difficulty in inhibitors crossing cellular membranes. Although similar limitations may apply to inhibitors designed against LMPTP, it is possible that minute differences in structural and functional properties of the regulatory protein could allow for a successful inhibitor design. Therefore, novel therapeutic targets—such as LMPTP—should be considered.

LMPTP IS A NEGATIVE REGULATOR OF IR SIGNALING THAT IS FUNCTIONALLY DISTINCT FROM OTHER PTPS

In considering LMPTP as a therapeutic target, it is important to first understand the mechanistic pathways initiated once insulin binds IR. Downstream effectors of IR include IRS-1 and IRS-2, which when phosphorylated, further activate phosphatidylinositol 3-kinase (PI3-K) and Akt. Amongst many pathways, the IR-IRS-1/2-PI3-K-Akt signaling cascade is responsible for two important cellular activities: increasing the utilization of glucose in glycogenesis, and increasing the transportation of GLUT4 from the cytoplasm to the plasma membrane for glucose uptake in adipocytes, hepatocytes, and skeletal muscle.¹⁴ Therefore, an increase in cellular insulin sensitivity could

lead to increased glucose uptake and usage by cells, thus improving hyperglycemia in the context of T2DM.

Multiple lines of evidence suggest LMPTP as an *in vivo* negative regulator of insulin signaling pathways, through modulating IR phosphorylation and activation. The physiological role of LMPTP in insulin signaling was first established by Chiarugi et al.; in this study, a dominant negative form of LMPTP was overexpressed in NIH3T3-IR cells to demonstrate that LMPTP directly interacts with IR upon insulin stimulation.¹⁵ Furthermore, in a study conducted by Pandey et al., researchers suppressed expression levels of LMPTPs *in vivo* via LMPTP-specific antisense oligonucleotides.¹⁶ Knockdown of LMPTP expression levels resulted in increased tyrosine phosphorylation of IR, and a subsequent increase in glucose tolerance.

LMPTP has also been demonstrated to exhibit distinct phosphocysteine hydrolysis mechanisms from PTP1B in the active site, despite the conserved nature amongst PTPs.¹⁷ Therefore, alternate mechanisms of inhibition could be designed to allow for greater molecular specificity against LMPTP. Considering LMPTP is suggested as a negative regulator of IR that is functionally distinct from other PTPs, this provides a rationale for its inhibition in the possible treatment of T2DM. Furthermore, the preservation of IR function from decreased LMPTP expression levels suggests LMPTP inhibitors may not only be useful in treating type 2 diabetic patients, but also in preventing T2DM in pre-diabetic patients who are developing insulin resistance.

IMPLICATIONS OF LMPTP AS A NOVEL THERAPEUTIC TARGET

Inhibiting LMPTPs may be an attractive option to treat T2DM, given their critical relationship in regulating IR and novelty as a therapeutic target. In a study conducted by Stanford et al., the role of LMPTP in the context of insulin resistance was characterized, and potential as a therapeutic target for T2DM was evaluated for the first time *in vivo*.¹⁷ It was demonstrated that LMPTP knockout (KO) mice with high-fat diet-induced diabetes had significantly improved glucose tolerance in comparison to wild-type (WT) mice. Further investigation illustrated that LMPTP activity promotes obesity-associated diabetes specifically in the liver. The researchers also developed a small-molecule inhibitor with a novel uncompetitive binding mechanism specific to LMPTP. This orally bioavailable inhibitor was effectively able to reverse obesity-induced diabetes, characterized by an increase in liver phosphorylation which led to improved insulin sensitivity and glucose tolerance.¹⁷

Because LMPTP is involved in the regulation of a diverse

number of pathways, successful LMPTP inhibition could have applications in other prominent diseases such as cancer and cardiomyopathy. A study conducted by Chiarugi et al. showed LMPTP is a positive regulator of tumor onset and growth of NIH3T3 fibroblasts, through dephosphorylating ephrin receptor.¹⁵ Therefore, inhibiting LMPTP activity could offset metastasis through maintaining phosphorylation of ephrin receptor. LMPTP expression has also been shown to be increased in end-stage heart failure, thus playing a critical role in cardiac function. In a study conducted by Wade et al., LMPTP KO mice were resistant to pressure overload hypertrophy and heart failure via increased IR phosphorylation, as well as increased protein kinase A and ephrin receptor expression.¹⁸ Considering T2DM is heavily associated with vascular disease, it is possible a successful LMPTP inhibitor could not only improve glycemic control in T2DM patients but also alleviate co-morbid microvascular complications such as diabetes-induced cardiomyopathy.

Evidently, LMPTP inhibitors have wide applicability; however, it is important to consider that LMPTP acts on many phosphotyrosine-containing cellular proteins throughout the body. For this reason, LMPTP inhibitors could impair normal physiological processes occurring in different tissues, manifesting in unwanted side-effects. Therefore, in designing LMPTP inhibitors for therapeutic treatment, a focus must be placed on localizing inhibitor function to impacted tissues. Despite this, the positive findings from using a novel uncompetitive LMPTP inhibitor in the Stanford et al. study are encouraging for the future of T2DM treatment.¹⁷

CONCLUSION

Protein tyrosine phosphatases are considered attractive therapeutic targets in the treatment of T2DM. PTP1B has been the main target for inhibition in recent decades due to a demonstrated increase in PTP1B expression levels and associated decrease in insulin sensitivity in T2DM patients. Therefore, PTP1B inhibitors could potentially increase insulin sensitivity and glucose tolerance. However, inhibitors designed thus far have yet to successfully achieve optimal specificity and bioavailability. Thus, novel therapeutic targets—such as LMPTP—are being considered in the treatment for T2DM.

Previous studies have shown LMPTP to attenuate insulin pathways such as the IR-IRS-1/2-PI3-K-Akt signaling cascade (responsible for glycogen synthesis and glucose uptake) through dephosphorylating IR. In turn, knockdown of LMPTP has been shown to increase IR phosphorylation, and improve glycemic control. Furthermore, because of distinct hydrolysis mechanisms

in the active site of LMPTP from other PTPs, greater drug specificity can be achieved. Therefore, these findings provide a rationale for targeting LMPTP for inhibition. Stanford et al. were the first researchers to design an orally bioavailable uncompetitive inhibitor against LMPTP, for the treatment of T2DM.¹⁷ Study findings suggest obesity-induced diabetes was effectively reversed by LMPTP inhibition in hepatocytes, which resulted in increased IR phosphorylation, thus improving insulin sensitivity and glycemic control. Moreover, previous studies have demonstrated LMPTP inhibitors could have further application in the treatment of cancerous growth and diabetes-induced cardiomyopathy.

Despite encouraging results generated by the Stanford et al. study, additional factors must be considered before implementation of LMPTP inhibitors into clinical trials.¹⁷ For example, IR expression has been shown to be decreased in insulin-resistant tissues involved in energy homeostasis, creating the possibility that LMPTP inhibitors may not sufficiently increase insulin sensitivity in diabetic patients.¹⁹ Further investigation is thus warranted in using LMPTP inhibitors in conjunction with insulin-sensitizing drugs such as Rosiglitazone, known to partially restore IR expression levels. Dosage is another parameter that must be optimized in LMPTP inhibitors. Too low a dose may not have an effect, whereas too large a dose could be detrimental. With the incidence of T2DM steadily increasing despite the effectiveness of current lifestyle and pharmacological interventions, LMPTP inhibitors could have immense implications in the healthcare field. As is covered in this review, LMPTP has demonstrated great potential as a novel therapeutic target; with continued optimization, LMPTP inhibitors could prove to be a viable oral drug for type 2 diabetic patients.

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Surfing's Unique Health Benefits

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Abstract: Many “extreme sports,” such as skateboarding, snowboarding, and wakeboarding, are known for different mental and physical health benefits. The objective of this review article is to summarize the distinctive health benefits provided by the extreme sport of surfing. Peer-reviewed journals regarding surfing’s health benefits were reviewed in terms of physical benefits, mental benefits, the impact surfing can have on individuals with disabilities, and the effects of outdoor vs. indoor exercise. The results showed increased cardiovascular and muscular fitness related to surfing, improvement in the mental-wellbeing of “at risk” young adults and veterans suffering from Post-Traumatic Stress Disorder (PTSD), significant health benefits for individuals with disabilities, and more positive mood from outdoor vs. indoor exercise. While these positive outcomes are promising, studies focusing on the health effects of surfing are limited, and the methodologies lack rigor. Thus, more studies utilizing sophisticated research designs could greatly expand our understanding of the ways surfing can enhance health and wellbeing in a wide range of individuals.

INTRODUCTION

Surfing is a unique sport that centers on the ocean and the elements (examples: wind and tide) that produce waves. Its allure is international in scope, as shown in a 2012 study that estimated 35 million surfers worldwide. The distribution showed 13.5 million surfers in the United States, 6.5 million in Oceania, 6 million in Asia, 4.5 million in Europe, and 4.5 million in Africa, with a gender gap (81% male vs. 19% female); 60% of surfers were over the age of 24.¹ In the United States, a 2011 survey showed the profile of the average surfer was a 34-year-old male, with a college education or above, and earned at least \$75,000 per year. The average surfer had 16 years of surfing experience, and had surfed 108 times per year.² Extreme sports have been recognized for numerous psychological health benefits, and forming a connection with nature. A 2019 qualitative study that gained insight into the lives of 8 extreme sport athletes analyzed themes of early childhood experiences, challenges of the outdoors, and varying emotions and reactions with nature. Commonalities between the athletes showed how extreme sports, while risky, provided the psychological benefits of increasing positive emotions, resilience, and life-coping skills, as well as a pro-environmental benefit of connecting with nature.³ Surfing has been categorized as an extreme sport internationally, however little data exists as to its specific health benefit. Although research surrounding the subject is limited and ever evolving, this article summarizes the current findings in the English literature. We also will summarize the strengths and weaknesses of this extreme sport.

MATERIALS AND METHODS

A literature search regarding surfing and its health benefits was conducted, providing a limited number of articles in peer-reviewed journals and websites. The databases used were Google for “surfer demographics,” PubMed, and Google Scholar. The years searched included 2010-2020, except for the search “surfing risks,” which included the years 2000-2020. Searched items included: “surfing,” “surfing benefits,” “outdoor exercise benefits,” “outdoor indoor exercise,” “surfing mental health,” and “surfing risks.” The reference lists from the searched articles were also screened for relevant information. No exclusion or inclusion criteria were put in place. The articles revealed themes related to surfing’s physical and mental benefits, impact on individuals with disabilities, and, more generally, the effects of outdoor vs. indoor exercise. A total of 145 journals were identified through this search, and after screening for duplicates and reliability, 15 journals were included in this article (Figure 1). This approach helped us gain information not only regarding surfing, but also related to the broad category of outdoor sports. The literature search provided articles from 2005 to 2020.

RESULTS

Physical Benefits of Surfing

The physical demands of surfing are specific to the sport, however to date, only limited methods of directly comparing and measuring these aspects have been utilized. Authors Farley, Abbiss, and Sheppard⁴ noted physical data points during professional surf competitions. They measured male surfer’s heart rates, and utilized time-motion analysis, video recording, and

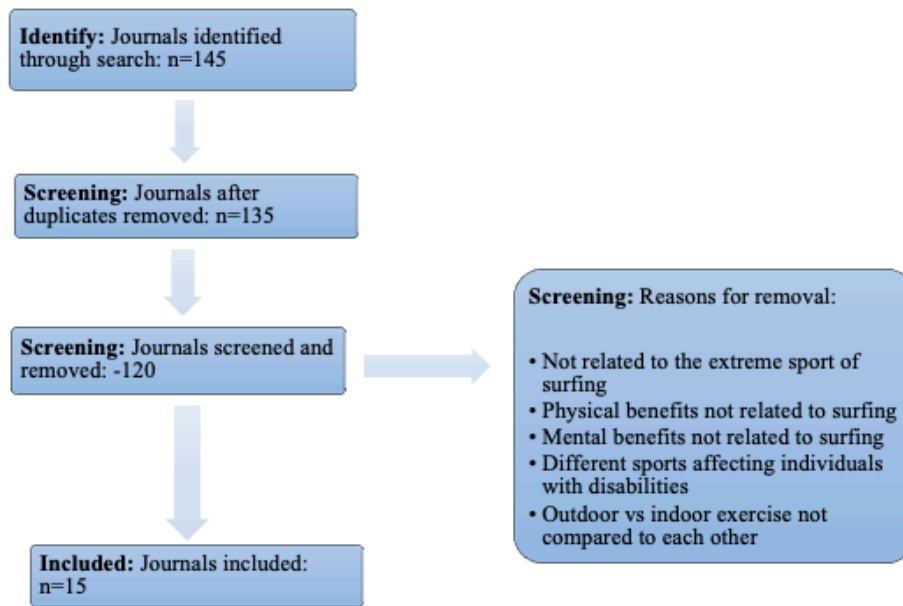


Figure 1. Schematic of literature search and journals included in this review article.

Global Positioning Satellites (GPS), to focus on distinct aspects of surfing, such as paddling, resting, wave riding, breath holding, and recovery of the surfboard. Outcomes were influenced by the environmental and wave conditions that necessitated surfers to have high cardiorespiratory fitness, high muscular endurance, and increase in strength and anaerobic power, especially in the upper torso. Given the scant research data regarding the physical benefits of surfing, better measurements utilizing relevant performance analyses from other sports could provide a more detailed understanding of surfing's dynamics.⁴

Mental Health Benefits of Surfing

Authors Hignett, White, Pahl, Jenkin, and Le Froy⁵ provided insight into surfing and its ability to provide mental health improvements in children/young adults (between the ages of 12-16 years old) at risk of missing school or likely to be excluded from mainstream schooling. After a 12-week surfing program, there was self-reported increase in satisfaction in terms of self-evaluated physical appearance, more positive attitudes towards school and friendships, and greater environmental awareness. Furthermore, teachers gave

these students more positive evaluations. Similarly, authors Caddick, Smith, and Phoenix⁶ found improved mental health outcomes related to surfing for veterans with PTSD. More specifically, employing dialogical narrative analysis with combat veterans belonging to a UK-based surfing charity, surfing was found to create a sense of respite from PTSD, and, as stated by the authors, "A full release from suffering due to surfing." Analogous findings were shown in another prospective study of veterans with PTSD who were transitioning to civilian life. The authors evaluated attendance rates and retention in the program that included 5 surf sessions over 5 weeks. 14 veterans were enrolled, 11 completed the study, and 10 attended more than 3 sessions. Participants reported clinically meaningful improvements in PTSD severity and depressive symptoms.⁷

Surfing's Benefits in Individuals with Disabilities

A study performed in Portugal utilizing individuals with disabilities demonstrated that adapted surfing (customized to the needs of individuals with disabilities) promoted inclusivity and disability awareness in the general population. The authors assessed four factors: empowerment, social interaction and integration,

physical rehabilitation, and disability awareness-raising, and analyzed the effects adapted surfing had on physical, mental, and social rehabilitation, and promoting inclusivity. Four major conditions were also identified, aquatic environment, environment-individual interaction, individual-coach/therapist interaction, and group interaction, which added value for adapted surfers. Findings demonstrated enhancement of self-esteem, increase in time spent exercising, greater teamwork and social inclusion, and an increase sense of protection toward the environment.⁸ In children with disabilities such as autism, Down syndrome, global developmental delays, and cerebral palsy, surfing effectively improved physical fitness. One group of authors evaluated seventy-one children who were divided into two groups, an eight-week surfing therapy group and an unstructured pool playgroup, and compared various physical fitness measures. Significant improvements to varying physiological measures were shown, including core strength, upper body strength, flexibility and cardiorespiratory endurance, body fat percentage and fat free mass, and bone mineral density.⁹ In another small study, researchers analyzed 10 children with grade 1 or 2 disabilities who did not exercise regularly, and compared physiological improvements before and after aquatic exercise. They found significant differences in lean body weight, muscular strength and endurance, cardiovascular endurance, flexibility, as well as differences in triglyceride and immunoglobulin G, demonstrating physical and immunological improvements to health.¹⁰

Benefits of Outdoor vs. Indoor Exercise

One systematic review of the effects of outdoor vs. indoor exercising performed in 2011, examined eleven trials. Eligible controlled trials (randomized and non-randomized) must have compared the effects of outdoor exercise to indoor ones and reported one additional physical or mental benefit in either adults or children. Findings demonstrated that exercising in natural environments was associated with increased feelings of revitalization and positive engagements, more energy, and a decrease in tension, confusion, anger, and depression. Additionally, in the outdoor sample, there was greater enjoyment and satisfaction, and intent to repeat the activity again. While promising, the results were essentially based on self-reported measures of mental wellbeing.¹¹ A more recent 2019 systematic review comparing the effects of exercise, in the presence of nature, on physical and mental wellbeing found that outdoor exercises may favorably influence affective valence and enjoyment, but it did not affect emotion, perceived exertion, exercise intensity, or biological markers. This review also screened for articles that must have compared the effects of outdoor vs indoor exercise

and demonstrated one additional physical or mental benefit, which included comparative or crossover design trials. Overall, there was limited evidence that outdoor exercise showed greater benefits compared to exercise without exposure to nature.¹² In the former systematic review, eleven trials were compared and totaled to 833 adults, while the latter's reviewed twenty-eight trials.^{11,12} The contradictory findings demonstrate a need for large, well-designed, long-term trials in populations who would benefit the most.¹¹ Authors Walter et al. are conducting an ongoing study that compares outdoor activities (such as hiking) to water activities (such as surfing) in active duty service members with major depressive disorder (MDD).¹³ While the results of the study are yet to be published, the strength of this article is in the methods utilized to conduct the study, such as the use of randomized controls to evaluate the differences in these natural settings, isolating the effect water has on the participants' outcomes, and maximizing generalizability. The data employed a variety of modalities having complementary strengths and limitations. The 3-month follow-up, which to date is the longest for any surf therapy, is yet to be published. The results likely will provide a wide range of outcomes, potentially augmenting much of the previous research on the immediate and long-term effects of both hike and surf therapy.¹³

DISCUSSION

Surfing is a unique extreme sport practiced internationally, which has shown to provide physical and mental benefits, and enhances a connection with the environment. The authors reviewed the related publications in the English literature and relevant websites, and have summarized the above-mentioned benefits. Although there are limitations on the availability and methodologies in studying surfing's benefits, the initial investigations showed surfing does help in unique ways. However, no discussion would be complete without highlighting some of the risk factors associated with surfing. Both benefits and risk factors are discussed below.

Benefits associated with surfing

Surfing demands distinct muscles and cardiovascular requirements strictly related to its practice. Mentally, those "at risk" for lack of schooling as well as veterans with PTSD and possibly MDD mentally benefited after experiencing surfing. In individuals with disabilities, surfing was a useful method of improving mental and physical wellbeing. On a broader scope, one of surfing's characteristics, occurring outdoors, appears to be an added reason for increased positive mood and enjoyment as compared to indoor exercise. An ongoing study, in veterans suffering from MDD, aims to answer

some of the limitations of the research by investigating the benefits of outdoor activities vs. water activities such as surfing. This has been discussed in detail in the section highlighting outdoor vs. indoor exercise benefits.

Risks associated with surfing

Though the benefits of surfing outweigh the risks, one should acknowledge them. Authors Zoltan, Taylor, and Achar, and Tseng and Jiang discuss the following risks, which include trauma, marine hazards, and environmental hazards.^{15,16} Sprains, strains, lacerations, and fractures are the most common type of trauma, usually resulting from the rider's own surfboard. Marine hazards include jellyfish stings, stingrays, coral reefs, and occasional shark attacks. Environmental hazards include auditory exostoses, tympanic membrane rupture, otitis externa, and increase incidents of skin cancer risk from sun exposure.¹⁴ An additional environmental hazard includes gastrointestinal illness risks from fecal bacteria contaminated coastal waters, in urbanized areas. Furthermore, surfers were at greater risk compared to swimmers of ingesting larger amounts of water.¹⁵

The authors note that despite limited risk factors associated with surfing, there is overwhelming recent evidence of the physical and mental health benefits, especially in disadvantage populations such as young people at risk of exclusion from mainstream schooling, veterans suffering from PTSD and MDD, and individuals with both physical and mental disabilities. It is important to note that the major limitation of this review article is the limited publications in the English literature. In addition, most of the studies did not have control groups, or a long-term follow up. Given that extreme sports such as surfing could provide physical activity interventions in the disadvantaged populations, additional research is required to substantiate these benefits.

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A Literature Review of Manual Medicine for the Conservative Management of Plantar Fasciitis

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Abstract: A narrative literature review was conducted to ascertain the efficacy of manual manipulation for the treatment of plantar fasciitis (PF). PF is a common painful condition of the plantar foot. The current literature on the pathophysiology of PF is veering from inflammatory towards degenerative, making it an apt target for manual medicine. Osteopathic manipulative techniques (OMT) offer safe yet effective treatment methods to halt or delay the deformation to the plantar fascia thereby preventing its degradation. Our goals with this literature review are to provide a review of the existing Osteopathic manipulative techniques to treat Plantar Fasciitis and to encourage further data driven research for the use of OMT for Plantar Fasciitis.

INTRODUCTION

Plantar fasciitis (PF) is a prevalent condition treated among podiatrists, osteopathic and allopathic physicians, chiropractors, and physical therapists. It often presents as heel pain and 10 percent of individuals in the United States will experience PF at some point in their life.¹ There are as many as 1 million cases diagnosed with plantar fasciitis yearly.² The incidence rate of PF increases with an increase in age, the most common age to experience plantar fasciitis is when the individual is 40-60 years old.³ Despite this high incidence rate, treatment for PF varies among these providers considerably. This variation in treatment makes the diagnosis and management of PF challenging for the patients as well as providers. Symptoms usually diminish within one year, but if they persist and non-invasive methods such as splints, orthotics, rest, shock wave therapy, and injections are not effective surgery is generally considered. The use of manual medicine techniques independently or in conjunction with current techniques could help prolong non-invasive management of PF and yield better outcomes.

Manual manipulation is one of the oldest treatments and has been used globally within various professions including, osteopathic physicians, podiatrists, chiropractors, physical therapists, and massage therapists. Although there is a plethora of information and evidence around the effectiveness of manual manipulation each field has unique names for the same treatment. The use of several different names creates distinctions between each field scattering the studies conducted and thereby blocking off the interpretation of their results from other fields' providers. We have

compared the efficacy of manual treatments, such as counterstrain, myofascial release, and HVLA within the osteopathic, podiatric, chiropractic, and physical therapy fields. Compiling the results of studies and grouping them under shared terminology may aid in furthering the understanding of the procedures, efficacy, and best use of manual medicine. The potentially significant benefits of manual medicine are associated with minimal risks for the patient, and thus make it a logical solution to be incorporated into the care of physicians and therapists.

METHODS

The main electronic databases used for this literature review was PubMed and Google Scholar. The keywords utilized for the search were: "OMM for plantar fasciitis", "conservative treatments for plantar fasciitis", "osteopathic treatment for plantar fasciitis", "counterstrain for plantar fasciitis", "osteopathic approach to plantar fasciitis", "myofascial release and plantar fasciitis", "conservative treatment for plantar fasciitis", "MFR for plantar fasciitis", "HVLA for plantar fasciitis", "Anterior talar dysfunction and plantar fasciitis", "muscle energy for plantar fasciitis", "electric shock wave therapy", "strain-counterstrain for plantar fasciitis", "plantar fascial stretching", and "corticosteroid injection for plantar fasciitis".

We screened the articles through the title, abstract, summary, and date published. We found several scientific studies which were designed as randomized clinical trials looking specifically at the effects of OMM on patient outcomes with plantar fasciitis. Other studies compared OMM to static stretching and conventional

physical therapy exercise. We included articles discussing possible standard treatment protocols for treating plantar fasciitis. Certain articles we reviewed had animal studies included within it.

Counterstrain

Counterstrain is an osteopathic manipulative medicine technique in which the practitioner diagnoses the patient's somatic dysfunction through identifying non-radiating tender points and passively positions the patient to decrease the tenderness of the point.⁴ By passively positioning the tissue to approximate the bony attachments of muscle the practitioner is taking advantage of natural neuromuscular reflex arcs to relax tissues.³ When the tissue is able to relax in the position of injury or strain the reflex arcs are attenuated and the pain signals from the region are reduced. Deformation to tissue may initiate an inflammatory cascade releasing substance P. Prostaglandins may heighten and prolong this inflammatory response which result in the promotion of nociceptive activity resulting in increased sensitivity to touch. The goal of counterstrain technique is to normalize neurophysiologic functioning and correct a somatic dysfunction.⁴ The specific counterstrain points

for plantar fasciitis are at insertion of the plantar fascia—at the calcaneus, as well as in the belly of the quadratus plantae muscle.³

The Flexion Calcaneus (FCA), also referred to as the quadratus plantae, is a tender point located on the plantar surface of the foot at the anterior end of the calcaneus, near the origin of the plantar fascia. This point can become tender after the onset of dysfunction and can be treated by counterstrain. The FCA tender point is likely related to dysfunction of the quadratus plantae. Patients with this tender point often present with symptoms of plantar fasciitis or even plantar fasciitis itself.⁴

The efficacy of counterstrain specifically in relation to plantar fasciitis was tested in a randomized control trial by Wynee et. al. which concluded counterstrain OMM improves clinical outcomes for patients with plantar fasciitis compared to those who did not receive any OMM. The researchers found that the therapeutic effects came from mechanical improvements rather than electrical changes in reflex response of calf muscles. Additionally the researchers conducted a pretreatment and posttreatment symptom severity survey in which they found a significant relief in symptoms that was most



Figure 1. Tender point location (above) and treatment position (bottom). Images reproduced with permission from WesternU OMM/NMM department.

pronounced immediately following treatment and lasted for 48 hours.⁵ Another study conducted by Pawar et al. determined that strain-counterstrain, synonymous to counterstrain, is effective in patients affected by plantar fasciitis and yielded improved ankle dorsiflexion range. In regards to pain the research subjects had a significant difference between pre and post intervention after 5 days of counterstrain therapy ($p < 0.0001$).⁶

MFR

Myofascial release (MFR) is an Osteopathic Manipulative treatment in which the physician identifies the spastic, resistant or tight myofascial tissue in an affected region of the body and precedes to engage that area by applying gentle sustained pressure. By doing so will allow the patient to restore motion.⁴ MFR can be done either directly or indirectly. Direct MFR involves directly engaging the restrictive myofascial barrier and applying constant force until there is a release of the tensed tissue. Indirect MFR involves moving the dysfunctional tissues in the direction of ease until increased movement is sensed.⁴

The efficacy of MFR in management of plantar fasciitis was examined in a randomized controlled trial. This study measured outcomes using the foot functional index. Sixty-six patients diagnosed with plantar fasciitis were randomized and put into the control group (sham ultrasound therapy) and experimental group (MFR). This study concluded that MFR was more effective than the sham ultrasound therapy for the treatment and management of plantar fasciitis.⁷ The study also broadly concluded that a large number of people can benefit from MFR that are suffering from plantar fasciitis.⁷ Another study set out to examine the differences within OMM techniques (MET vs MFR) and patient outcomes. The patient outcomes were measured using visual analog scale (VAS), foot and ankle ability measure (FAAM), and foot functional index (FFI). There were a total of 30 patients divided into two groups. One group received Muscle Energy Technique and the other group received MFR. They found no significant differences between the two groups and concluded that both MET and MFR were effective in reducing pain and improving lower limb function.⁸

HVLA

High Velocity Low Amplitude (HVLA) is an OMM technique in which the practitioner applies a direct rapid force over a short distance to joints which exhibit signs of a treatable somatic dysfunction. One of the oldest uses of manual medicine and a frequently used techniques amongst osteopathic physicians, chiropractors, and

physiotherapists has been the manipulation of the spine, pelvis, and peripheral joints.⁴ In the lower extremities these methods can correct misalignment and malrotation of bones. Misalignment, especially in the foot, ankle, and leg can disrupt normal tensions in tendons and ligaments.³ Addressing any misalignment of bones may help decrease foot pain, as the bones of the foot represent key areas of focus in foot pain, in particular plantar fasciitis, because of their ligamentous and muscular attachments within the arches.³ Misalignments can occur at the talus bone, specifically if it is flexed in can cause restriction in dorsiflexion of the talus and this ankle as a whole.⁴ Another joint dysfunction of the ankle involves the tarsal bone. Displacement of the tarsal bone can cause eversion of navicular bone, inversion of cuboid bone, dorsal arching of cuneiform bones. These corresponding changes lead to the resistance of plantar arching which may be involved in the development of symptoms in plantar fasciitis. Talus and Talar HVLA are two HVLA techniques that can be used to address possible plantar fasciitis dysfunction.

In a study conducted by Dimou et al. chiropractic adjustments of foot and ankle subluxations with archwear compared to shock absorbing orthotics custom designed by a podiatrist. The chiropractic adjustments occurred twice weekly for four weeks and once at the one month follow-up. The custom orthotics included a range of subtalar, midtarsal and neutral casts and they were worn for eight weeks. On day 15 there was a significant difference in pain ratings between the interventions, favoring chiropractic adjustments with stretching over orthotics, however both groups saw significant improvements in pain rating, first step pain, heel pain during leisure, and algometer measurements. Furthermore, there were no adverse events reported in either group.⁹ The results from this study highlight the possibility that conducting manual manipulation of the joints affected independently or in conjunction with orthotic therapy may yield more long term and efficacious results than orthotic therapy alone. One such chiropractic treatment that can be used is the activator treatment on calcaneal subluxations which have proven to successfully manage symptoms in patients with plantar fasciitis and heel spurs.¹⁰ The activator treatment is in theory a high velocity low amplitude (HVLA) thrust delivered to a bone, but rather than the chiropractor using their hands the provider uses an instrument called the activator which delivers the thrust.

Moreover, HVLA may be useful in the event that a patient has new or recurring pain after surgery to relieve plantar fasciitis. A case report of fifteen patients found that patients who had unmanageable foot pain after plantar fascia release surgery, plantar fasciotomy, benefited

from joint mobilization and manipulation. The study also concluded that joint mobilization and/or high velocity, low amplitude manipulation are safe conservation procedures to use in the treatment of patients with lateral column foot pain in status post fasciotomy.¹¹

CONCLUSION

Our review of the current literature surrounding manual manipulation and the treatment of plantar fasciitis has highlighted the need for a broader understanding of the treatments used and the order in which they are employed. Osteopathic manipulative medicine has proven to be an effective conservative treatment. This review has compiled the various literature currently available on manual manipulation and its use in treating plantar fasciitis. The aim of this review is to provide a concise resource for providers to curate their own protocols from. A considerable amount of research has been done on the effectiveness of osteopathic and other manipulative medicine, which points to the potential vital role it may have in delaying or preventing the need for surgery in many patients, as well as, provide immediate relief of symptoms. This review highlights the need to develop a standard protocol to treat and manage plantar fasciitis, in which the naming of techniques manual manipulation should be standardized. Such standardization would allow data among osteopathic, chiropractic, podiatric, and therapists alike to be shared and interpreted with greater ease.

Future research should target the efficacy rates of the various manual medicine techniques in comparison to traditional methods employed today. Although this process may be cumbersome it is vital to understanding the specifics of how long and how frequently treatments must be performed to be effective long term. With a greater pool of data it will be easier to compare the long term effects of the various treatment methods employed to treat plantar fasciitis.

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