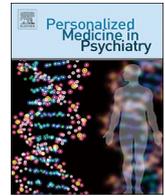


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Low-dose lithium impact in an addiction treatment setting

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ABSTRACT

Background: This study is to assess the effectiveness of low-dose lithium Carbonate (150 mg) augmentation or as a substitute for synthetic antidepressants and anti-anxiety medications in a residential addiction treatment center. The hypothesis being that adding or using low-dose lithium will improve treatment outcomes on multiple measurable levels.

Results: Marked effects in terms of patient medication usage, safety, and progress along with clinic functioning were recorded. Average opiate MAT dose was reduced by 50%, benzodiazepine usage reduced by 99%, atypical antipsychotics down by 70%, polypharmacy lowered by 79%, and smoking cessation participation increased by 300%. Within the clinic, average census increased by 10%, retention of patients improved by 25%, employment rate and readiness both doubled. Overall program completion improved by 20% while the completion rate of those who took low-dose lithium improved by almost 100%. There were no significant changes in standard lab measurements indicating safety of low-dose lithium usage.

Conclusion: The introduction of low-dose Lithium in an addiction treatment setting where trauma, untreated ADHD and medical conditions are common was useful in helping patients achieve and maintain progress in their lives. If further randomized studies confirm what we have seen, the implications could be paradigm shifting.

1. Background

“Lithium may well be an essential trace element. It is widely distributed, has been detected in sea-water and in many spring and river waters, in the ash of many plants, and in animal ash.”

(John Cade, 1949)

Lithium is a mineral that is both salt and metal resulting in its ability to conduct electricity. It's also the most effective psychiatric medication for reducing suicidal behavior [1,8]. Yet it remains at the bottom of the list of the twenty five most frequently prescribed psychiatric medications in the US [15]. Furthermore, despite the forged evidence that it is the best treatment for Bipolar Disorder [9], it's underutilized even for this ferocious condition. The bias against more frequent use may be from the need to monitor at high doses along with the false belief that synthetic medications are superior. But what if undetectably low doses could be both safe and hyper-effective for anxiety and mood symptoms? Not just as an adjunctive treatment [2] but as a first line option.

There is growing evidence that “subtherapeutic” doses of lithium are not subtherapeutic at all but rather foster constructive behavior [3,25], delay destructive behavior [10] and have neuroprotective

utility [11]. From ground water studies of associated lower rates of suicide, homicide, psychosis, and Alzheimer's disease [4,5,20,31] to large sample studies like the Texas LITMUS (that explicitly used low lithium doses) study [21] to anecdotal evidence from eminent psychiatrists [6,28], all of the above have been influential in pursuing the question: How low can we go to benefit from lithium while avoiding the side effects of higher doses?

This study is to assess the effectiveness of low-dose lithium carbonate (4.1 mmol/150 mg) enhancement in an addiction treatment center as a substitute for or supplement to synthetic antidepressants and anti-anxiety medications. The logic being that if standard dosing of lithium is so effective at reducing imminently suicidal behavior, then perhaps low-dose lithium could be useful in reducing the “slow-motion suicide” of addiction manifested in self-sabotage and self-harm. We also recommended this dose of lithium to attempt to improve alcohol and substance induced effects on mood and sleep. Its ability to deepen sleep, elevate mood and improve hopefulness could be useful for patients struggling with all the above.

The hypothesis then is that adding low-dose lithium for the appropriate patient would improve addiction treatment outcomes on multiple measurable levels.

Abbreviations: MAT, medication assisted treatment; DBT, dialectic behavioral therapy; PTSD, post traumatic stress disorder; ADHD, attention deficit hyperactivity disorder; BUN, blood urea nitrogen; LITMUS, lithium treatment in moderate use study; CRW, center for recovery and wellness; DSM, 5-diagnostic and statistical manual 5th version; MDD, major depressive disorder; GED, general equivalency diploma

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2. Methods

The Center for Recovery and Wellness (CRW) is a residential and outpatient healthcare center in the East Village of Manhattan where the author has been the Medical Director since March 2018. At CRW, the author introduced a “Triad Approach” to address three common antecedents of addiction; physical pain, emotional pain (trauma), and inattention (Attention Deficit Disorder). This approach included standard Medication Assisted Treatment (MAT) such as the tapered use of Buprenorphine-Naloxone [17] for opiate dependence and psychotherapeutic strategies by a multi-disciplinary team with expertise in Dialectic Behavioral Treatment (DBT), motivational interviewing, housing placement, educational and vocational assistance, all in a self-sustained holistic setting. The combination of services provided along with addressing the sources of addiction would theoretically lead to better outcomes.

What’s even more unique than this approach is the recommendation of low-dose lithium (4.1 mmol/150 mg) for said “emotional pain.” We used broad inclusion criteria. Nearly all our clients are diagnosed in according to the DSM-5 with a singular or polysubstance dependence. Greater than 75% are also diagnosed to have an underlying psychiatric condition such as Major Depression, Post Traumatic Stress Disorder, Attention Deficit Disorder, or a substance induced condition. Furthermore, the majority have been in multiple addiction treatment facilities indicating that the standard treatments were not effective enough. Any client with a history of trauma, addiction of any type, incarceration, and or recidivism could be treated with low-dose lithium. Any patient who was pregnant, had thyroid or kidney disease, or who refused to accept low-dose lithium despite their suitability was excluded.

Each patient was provided with a multidisciplinary assessment concluding with a discussion on how and if the Triad Approach applied to them. A treatment plan was formulated with consent focusing on improving overall health, undoing effects of addiction and improving his or her ability to move forward in his or her personal and professional goals. The potential risks and benefits of low-dose lithium was discussed with each patient. About 65% of patients consented to take low-dose lithium over the period being presented. On the matter of consent, all patients upon admission are informed of our methods and options for treatment on documentation which is signed by them.

Data was retrospectively analyzed in an observational analysis with respect to changes in medication utilization, patient safety, clinic functioning, and patient outcomes. Therefore, this study has not been registered in advance. Data also underwent a regression analysis to compare low-dose lithium recipient outcomes with those patients who did not receive it.

There were two major groups of comparison and one was subdivided:

Group 1 (n = 160) was the population of patients over eight months prior to the author’s arrival and instatement of the Triad System. This group could be considered a “pseudo-control” but because this was a retrospective, observational analysis, there was no formally designated control. This concept is similar to other observational studies where we compare the introduction of a mineral like fluoride or iodine into a population and then look at dental health or thyroid health before and after.

Group 2 (n = 175) is further subdivided into 2a (n = 62) and 2b (n = 113). Group 2a are the group of patients that benefitted from the Triad System but did not take low dose lithium while 2b did take low dose lithium and would theoretically have the best outcomes of all. Essentially, we are comparing 2b with both 2a and 1, each of which are “pseudo-controls.”

Furthermore, lab data of 90 patients that were prescribed low-dose lithium was collected to confirm safety. We are also presenting macro data of the clinic’s functioning from 8 months before and after the introduction of this approach to assess more than individual outcomes.

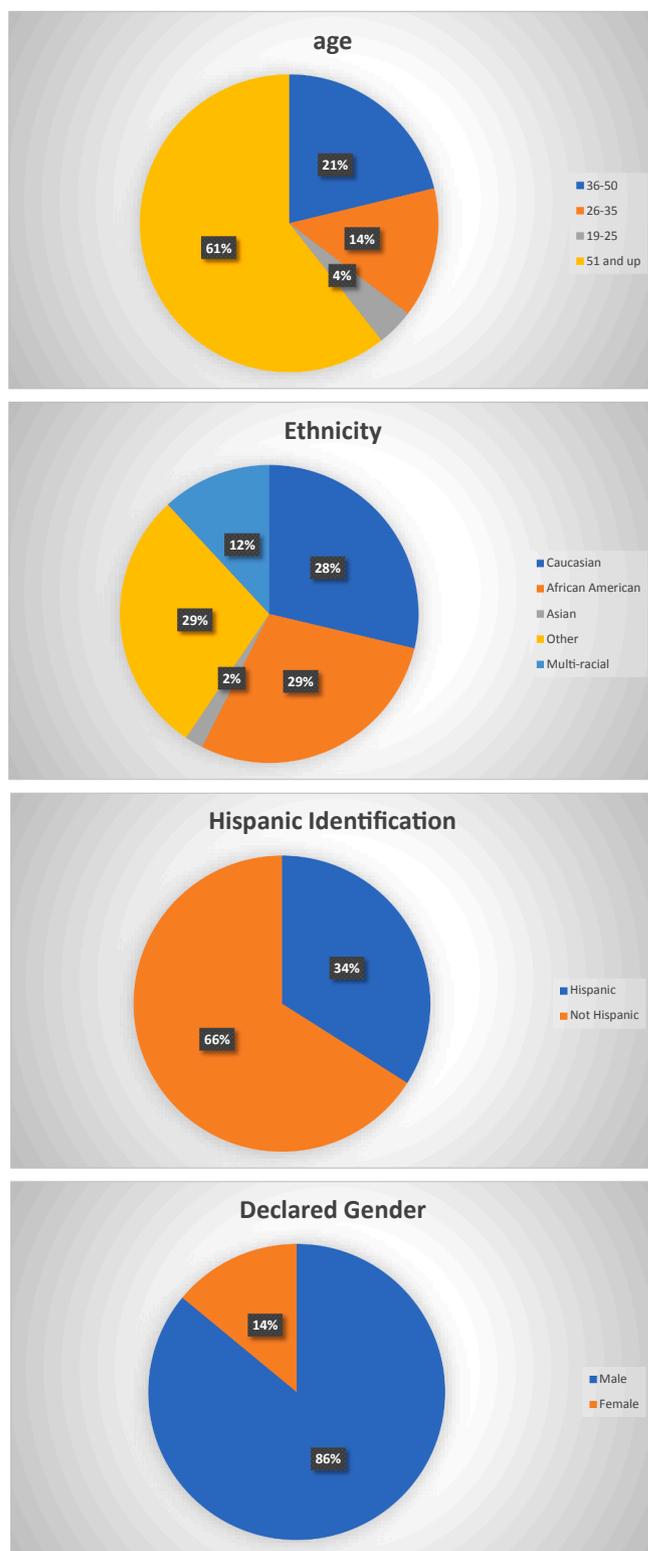


Fig. 1. Breakdown of age, ethnicity, and declared gender within the treatment population.

3. Demographics

The self-identifying collection of demographic data is reflected in the four pie charts below. Despite the location of CRW in a mainly Hispanic region of Manhattan, the data shows a diverse population with regards to ethnicity and age. We used data from 8 months prior to the

Table 1
Changes in individual medication management.

Metric Category	7/2017–3/2018 Before Low-dose Li N = 160 total patients at clinic	3/2018–11/2018 After introduction of Low-dose Li N = 175 total patients at clinic
Medication Assisted Treatment (MAT) dosing average of Buprenorphine-Naloxone	14.3 mg/day (68% of pts on MAT)	7.1 mg/day (60% of pts on MAT)
Benzodiazepine/Analog usage rate	52%	1%
Atypical Antipsychotic usage rate	42%	12%
Smoking Cessation participation	18%	56%
Polypharmacy Rate (A clinical definition of “polypharmacy” is 5 or more medications in a regimen)	61%	13%

Relative to the 8 months prior, there are marked improvements at the micro (individual) and macro (population) level.

introduction of the Triad Approach including low dose lithium, totaling 160 patients. This was compared to data 8 months after totaling 175 patients (Fig. 1).

4. Results

Table 1

On the micro level of individual patient care:

- Reduction in the dose of MAT required by over 50% (Buprenorphine-Naloxone usage average from 14.3 mg/day to 7.1 mg/day) and an acceleration in the ability for clients to taper MAT.

That the very use of Buprenorphine-Naloxone (MAT) is not widespread is evidence of inconsistency in addiction treatment. Akin to not treating pain in a patient from a myocardial infarction or physical trauma, it is important to include but also important to provide a path off from. Prior to supplementing with low-dose lithium, our average dose of Buprenorphine-Naloxone was 14 mg/day with some patients as high as 24 mg/day. The current guidelines indicate that above 16 mg/day may not be advisable as it is likely to worsen constipation, sedation, cognitive dulling and make it harder to taper off [17].

The application of the Triad Approach is the larger framework for how we address the current addiction crisis at CRW. With a significant amount of addiction stemming from untreated physical pain, emotional pain or the effects of inattention, addressing any or all the above is now a core principle at CRW. With patients, I've likened MAT to crutches and treating underlying conditions as strengthening the body, so crutches are eventually unnecessary. Pragmatically, this means that an opiate dependent patient with symptoms of residual emotional trauma and inattention (ADHD) would be provided a trial of low-dose lithium, low-dose stimulant, and conservative dose MAT which over time would be tapered. In addition, DBT in groups, individual therapy, vocational/educational assistance, improved diet, exercise options, and medical care improvements have all been part of the treatment provided at CRW. This holistic combination of the right pills and the right skills has left patients more ready for independence and less conditioned for dependence.

While most of the above interventions are labor intensive, they are also evidence based and hence not break-throughs in addiction treatment. All except for the use of low-dose lithium that again seems to have enhanced both pharmacologic and psychological treatments that existed prior at CRW.

- Elimination of continuous benzodiazepine usage

Upon the author's hiring as medical director, over half of inpatients had been using a benzodiazepine or analog (Zolpidem) for anxiety and insomnia management. With increasing evidence of their long-term toxic effects on sleep depth, overdose enhancement, reduced memory consolidation, rebound anxiety, depression induction, and dementia acceleration [16], we made it a point to explain to patients and staff the

importance of avoiding these medications. Exceptions would be made for necessary tapering or on a case by case basis. We theorize that this concerted effort towards “Zero Benzo” was enhanced by the use of low-dose lithium so that within three months and since, we nearly eliminated the need of these medications.

In my outpatient practice and as outlined in the Agarwal paper on the underreported “benzodiazepine crisis” [16], I have frequently been presented with cases where patients have been taking standing doses of benzodiazepines for months to years and others that take as-needed doses for just as long. As a result, not only is neurochemistry altered but a psychological component of this medication as a “rescue pill” is created. This duo of effects makes tapering challenging and treating the underlying core of their anxiety even more so. For such cases, I've seen consistent rates of voluntary and comfortable tapering by supplementing low-dose lithium and providing simultaneous education and supportive therapy.

- Reduction of 72% in atypical antipsychotic usage which were often provided as sedatives

Beyond polypharmacy, defined as “more drugs being prescribed than are clinically appropriate in the context of a patient's comorbidity”, we have also noted the effort to avoid using atypical antipsychotics unless multiple tiers of medication classes are provided a trial of. Furthermore, the reduction of using unnecessary atypical antipsychotics have helped patients in their metabolic profile goals. Of course, in cases where there is residual psychosis from substance abuse, such medications are indispensable to get patients back to high functioning status.

- An increase of 68% in smoking cessation participation, consisting of nicotine replacement therapy (varenicline or nicotine patches), and treatment of ADHD

Considering the importance of complete care, we would be doing patients a disservice if we did not address and encourage smoking cessation. Electronic cigarette usage was not utilized due to storage and fire safety concern, but they may be a viable, temporary weapon in reducing the myriad effects of standard smoking if regulated models are used. Also, by increasing screening for and treatment of underlying ADHD, we removed the need for extraneous stimulant use. Clinical assessment and the use of the Harvard ASRS scale were utilized in screening (ASRS v1.1) [27].

- Marked reduction of polypharmacy (see definition above) such as two antipsychotics or redundant antidepressant use

The use of two atypical antipsychotics is growing less common but the use of singular atypical antipsychotics as hypnotics and mood stabilizers is more common than before, even in children [18]. This has led to control of potential self-harm and agitation but with a significant side effect burden. Weight gain, sedation, cognitive dulling, and hypercholesterolemia are some examples. Moreover, the use of redundant

Table 2
Changes in lab values for patients that were taking/did take low-dose lithium.

Labs, n = 90	Average at commencement of Low-dose Li	Average 3 months post Low-dose Li
BUN 6–20 mg/dl	13n (normal limits) ± 3	16n ± 5
Creatinine 0.6–1.0 mg/dl	0.84n ± 0.16	0.89n ± 0.19
Serum Li Level 0.6–1.2 mmol/L	N/A	Undetectable (< 0.1)
TSH 0.45–4.5 Iu/ml	1.6n ± 0.5	0.9n ± 0.6
Free T4 0.82–1.77 ng/dl	0.97n ± 0.2	1n ± 0.3
WBC 3.4–10.8x 10E 3/ul	5.7n ± 2	8.2n ± 3

Absence of any negative changes in labs for kidney, WBC, or thyroid functioning as well as any associated changes in EKG, allergic reactions or a detectable Lithium level.

synthetic antidepressants (two different serotonin increasing medications) increases chances of sexual side effects, and medication interactions without proportional improvements in functioning.

With low-dose lithium supplementation, patients at CRW have a more tailored regimen. As a result, the above side effects were less seen and overall functioning was improved (Table 2).

The most important consideration is whether low-dose lithium carbonate of 150 mg/day is as safe as it is effective. With daily monitoring of self-reported side effects, labs and examinations reviewed prior to admission, and at regular intervals during, we can safely report that there were no discontinuations of low-dose Lithium due to the typical medical concerns of standard Lithium dosing (levels of 0.6 mmol/L to 1.2 mmol/L). There were discontinuations or refusals secondary to bias, stigma, or from online directed misinformation (n = 23). Consistent education in sessions, and recommendations to search and read vetted articles (see references) on “low-dose lithium” improved and prevented much of the reflexive fear. Our data also serves to help reassure the provider that at doses of 150 mg, the vigilance of monitoring labs is not equal to when higher doses are used. This may remove a barrier to a trial for both patient and provider.

Lithium levels were undetectable (< 0.1 mg/dl) in serum at 150 mg/day. At such a dose hair sampling would be most appropriate for accurate measurement but this was not cost effective at CRW. There may be significant relevance in measuring at this level for both medical and supplement standardization according to recent research in Moscow [12].

- Consistent reports of motivation, hope, dream recall, unbroken sleep, and unique success stories related to sobriety and progress. We have presented data but the people behind the numbers illustrate powerful stories, archetypes even.

An 18 y/o young man with a history of polysubstance dependence, violence, incarceration, victim of child abuse, and untreated ADHD completing the program on low-dose Li and stimulant with certification, employment and housing: “I feel like this really made a difference, I’m just...better.” Pt was discharged on 4 mg Buprinorphine/Naloxone every morning, Lithium Carbonate 150 mg once a day, and Dextroamphetamine 20 mg extended release every morning.

A 26 y/o man with a history of multiple failed rehab attempts for opiate dependence gains OSHA certification (occupational safety) and employment while on 4 mg MAT and low-dose Li. “I’m sleeping good, feeling good about myself, and the future.”

A 47 y/o male veteran with PTSD, MDD, alcohol dependence, multiple failed rehab attempts, and obesity worsened by olanzapine loses 10 Kg after we substitute low-dose Li for the olanzapine. He gains hope, control over self-destructive impulsivity, and is effusive in his appreciation.

A 31 y/o mother with a history of childhood sexual abuse, domestic violence, suicide attempts, psychiatric hospitalizations, failed rehab

attempts for opiate dependence takes low-dose Li for the first time. She sleeps deeper, dreams, finds both blame and forgiveness for her pain, motivation to be self-constructive, completes DBT and is discharged with employment as a receptionist and housing back with her family.

The stories are cinematic, expected by now after seeing the effects of low-dose Li but still surprising, and refute the belief that addiction treatment is a revolving door frustrating family, patient, provider, and system. It is sensible that the medication most effective for reducing suicide is also showing benefits in reducing the slow-motion suicide of addiction. As a result of this reduced regression, we are seeing improved traction in each patient’s unique progress, towards their authentic ascension.

On the macro level of clinic outcomes, changes were significant but with more variables and time, the effects may be less directly linked to the introduction of low-dose lithium. Still, data seen from our “dashboard” retrospectively from the 8 months prior compared to the 8 months after shows progress between group 1 and 2.

- Average census improved by nearly 10% from 86 to 95 in a center with the capacity for 100 inpatients

More average census means more patients are staying, more are coming in and fewer are leaving prematurely. The combination of the approach and content of treatment have been favorable to the bottom line of CRW and its patients.

- Retention percentage in the first month improved from 52% to 77%

This is more evidence that providing a clear mission of treating the underlying reasons for addiction has found acceptance over and over in our clients. Moreover, to be able to improve retention this dramatically implies that our enhanced care model is also being executed well.

- Maintenance or improvement in employment improved from 11% to 23%

This metric is a result of considering new, current and increased employment during the entirety of a patient’s length of stay. To have doubled it before and after March 2018 considering that all vocational/educational services were identical is a testament to the power of the “Triad” approach. It’s elementary that providing patients who have untreated ADHD with stimulants will enhance performance towards goals. From GED attainment to vocational certifications, college entrance, and improvement at the jobs they get. The addition of low-dose lithium may enhance achievement by preventing past inclinations of self-sabotage and igniting both innate value and the value gained from contribution.

- Vocational readiness within the first month improved from an average of 50% to 91%

This dramatic change is also related to our services combined with the a more progressive approach. Vocational readiness is measured using a combination of stability measurements such as participation, medical readiness and logistics.

- Overall completion percentage moved from 36% to 45% and to 59% for lithium recipients

Finally, an improvement in completion rate, while modest, is significant. Its lower margin relative to prior metrics is secondary to the many variables that affect it such as length of stay, and difficulty of the program itself. Still, as this approach becomes more ingrained within the culture of CRW, we expect a widening of this gap.

A deeper dive was conducted into the data to compare the outcomes when looking at the variable of low-dose lithium use. We found that

even when Triad Approach, patient outcomes improved over the prior approach but when patients also utilized Low-dose Lithium, their rate of completion nearly doubled. To confirm this effect, we would have to move to a blinded study using a robust sample. This leads us to limitations of the current analysis.

5. Discussion

5.1. Limitations

We can categorize the limitations of this study into bias, control, and blindness.

Experience and belief in the effectiveness of low-dose lithium would affect how a patient responds to it. Still, the consistency of response over eight months in this study and the degree of effect are unlikely to be exclusively from this factor. Bias comes from the Greek word for “oblique” and refers often to “going against the grain.” It is indeed against the grain to prescribe a dose of lithium that some think is useless, others dangerous. All in the mission of proving that the opposite is true.

As mentioned earlier, since this was a retrospective observational analysis and not a prospective double blind randomized controlled trial, we had no designated control group. However, there are “two pseudo-control” groups (1 and 2a). The first is the group of patients whose data was analyzed over 8 months prior to the author’s arrival as medical director. Comparing them to the group with improved treatment 8 months later could be considered a pseudo-control. The second group is the one that chose not to use low-dose lithium in their treatment plans. Nearly 35% of patients did not accept the low-dose lithium treatment and their outcomes were compared to the 65% (n = 113) that did in [Table 4](#). The data is significant in showing that prior to improved treatment strategies, completion rates were 36%. Afterwards, they improved overall and much more so for the low-dose lithium recipients.

Another potential limitation is how much the effect of a new medical director and his new program can be separated from the effect of low-dose lithium itself. In short, was it the author, the Triad System, or was it the lithium? The answer is likely all the above but in varying degrees with lithium being the most important variable. Placebo (derived from Latin for “to gift or please”) [\[26\]](#), is amplified by the presenter and the environment creating a ritual, much like how a wafer in Church becomes much more. Therefore a doctor’s bedside manner and credibility can increase the effect of medicine which in other hands would be potentially diminished. Still, [Table 4](#) is important in showing that while overall rates of program completion improved during the author’s medical leadership, the patients taking low-dose lithium had even higher rates than their non lithium prescribed peers. All patients were in the same therapeutic milieu with the same medical team but there was a much greater completion rate for those on low-dose lithium.

As for standardized measures of outcomes and any lack thereof, I believe we have innovated by measuring patient functioning in addition to their symptomatology. [Tables 1 and 3](#) relay improvements in pharmacological management and self-sustainability. This was in addition to standard monitoring of patients including urine tests, emergency room visits, and relapses.

The findings on outcomes for those patients on low-dose lithium would be even stronger if we conducted them in a randomized double blind study framework. We are indeed planning to conduct such study but the observational and regression analysis data are foundational for the tested hypothesis. Considering that there has been no previous research conducted on the consistent use of 150 mg Lithium Carbonate, it was logical to start where we did. Other public health improvements using periodic elements such as Iodine in table salt [\[29\]](#) or Fluoride in toothpaste [\[30\]](#) began as observational studies.

5.2. Interpretation

It is not surprising that the most effective treatment for suicidality has been useful in soothing the “slow-motion suicide” that addiction can be [\[23,24\]](#). More eye opening is the rate at which it has helped to enhance self-constructive behavior such as treatment adherence, participation in the labor force, and overall completion rate. Low-dose lithium’s safety and versatility have been most intriguing. One may consider it the Fluoride of mental health, which is a double-edged sword but still effective when wielded well. In fact, when Lithium is naturally present in groundwater, the rates of suicide, homicide, violent crime [\[22\]](#), Alzheimer’s [\[31\]](#) and even psychosis were found to be markedly lower. These findings have been replicated worldwide and there is a growing movement to study its potential at low and minute levels [\[12\]](#). In the United States, however, Lithium is ranked at #25 of the most prescribed psychiatric medications. It’s akin to not using your best player on the field. A benzodiazepine is #1 [\[15\]](#).

Still, the improved success of the patients at CRW is a result of more than the introduction of low-dose lithium. Our recognition of the importance of both MAT and treating common causes (the Triad Approach) of each patient’s addiction should be replicated whether or not low-dose lithium is included. For example, untreated ADHD has been proven to be associated with addiction, yet providers remain skittish about providing stimulants to an “addict” [\[19\]](#) which is potentially a form of discrimination. At CRW, I discuss treatment of ADHD with patients in a “pills and skills” manner. This means we encourage responsible medication use and lifestyle adjustments. The latter can be summed with the mnemonic OLDIES (Occupation/Organization, Love, Diet, Intoxication, Exercise, and Sleep). This is one example of how each point of the Triad is itself multifaceted. The therapeutic, nutritional, housing, vocational and educational services provided were all present prior but the efficiency of each has been accelerated in the past year.

The data and stories here only add to the legendary power of lithium. I have seen this since treating my first patient as an attending in 2007 and continue to even when providing doses at undetectable blood levels. Its ability to enlighten the dark logic of suicidality, to prevent self-harm post-trauma, and to work as an antidepressant faster, better, without sexual side effects or anesthetizing the human experience. Among many potential indications, I’ve used it to help people taper long term benzodiazepine usage resulting in deeper sleep, improved memory, increased REM and dream recall, and in cutting the psychological and physiologic chains of dependence. It’s this array of experience and encouragement from citations and psychiatrists that most inspired me to bring this paradigm shift to CRW.

Seventy years ago, the psychiatrist John Cade concluded his seminal paper by urging colleagues to consider the prescribing of lithium salts instead of a leucotomy, a standard and brutal surgery of the time [\[7\]](#). While we have evolved since then, continued progress is accelerated with the most proven mental health mineral. Amid an epidemic US mental health crisis [\[13,14\]](#) with suicide rates (CDC, 2019), mass violence rates (CDC, 2019), addiction rates higher than ever (CDC, 2019), we have an obligation to explore rather than ignore such a powerful element. If we can begin the healing on a micro level with each patient, the macro issues of greed and abuse that grow more pervasive will be easier to address.

6. Conclusion

It is likely that low-dose lithium is effective at assisting patients exit the cycle of addiction, especially when used with the Triad Approach of treating underlying causes.

7. Declarations

Ethics Approval and Consent

Table 3
Changes in functioning of CRW.

Macro Metric at CRW	Average during 8 months prior to Low-Dose Li 6/2017–3/2018	Average during 8 months after 3/2018–11/2018
Average Census	86/100	95/100
First Month Retention Rate	52%	77%
Employment Maintenance/Improvement (combination of employment rate and continued employment)	11%	23%
First Month Vocational Readiness (completion of 6 week readiness program)	50%	91%
Overall Completion Rate (average duration of 7 month stay after which treatment, housing, employment are secure)	36%	45%

Table 4
Regression Analysis of Lithium recipients relative to non-recipients.

Rate of program completion prior to Triad Approach (group 1)	36%
Overall rate of completion post Triad Approach (group 2a)	45%
Completion rate of low-dose lithium recipients post Triad Approach (group 2b)	59%

As mentioned in the manuscript, each patient has signed a written consent form for treatment and risks and benefits were discussed in person. The medication and lab data being used is not individually identifying but rather an average. Hence consent is not applicable in the traditional sense.

8. Availability of data

All data that would not compromise patient confidentiality has been attached for review.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmp.2020.100059>.

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