Cardio Comeback – Cardiovascular Rehabilitation in Prisons

Background

The leading cause of death among the 2.2 million incarcerated individuals in the US prison system is cardiovascular disease.[1] With health care concerns such as inadequate funding and staff shortages in healthcare providers and correctional authorities, inmates struggle to receive quality care.[1] Cardiovascular disease mortality is not only impacting incarcerated individuals at an inflated rate, it is also impacting recently released prisoners, with individuals who have been recently released from prison dying from cardiovascular disease at a higher rate than their peers.[1] Because health care isn't under the constitutional guarantee of discharge planning, these individuals are only left with their own knowledge to navigate the outside world.[1] Overall, there is a lack of investment in health care in the prison system, putting incarcerated individuals at a higher risk of poor physical and mental health outcomes, both of which can impact their risk of cardiovascular disease.[2] Although this is of concern across all prisons in the justice system, the most severely impacted by cardiovascular disease are placed in a Federal Medical Center, the primary location of Cardio Comeback (CC).[3] Furthermore, the CC program will be designed to rehabilitate inmates whose cardiovascular disease is affecting their quality of life and who require complex medical care. Secondary benefits of Cardio Comeback will include increased socialization, the promotion of healthy lifestyle choices and long-term education about its risk factors, symptoms and prevention.

The first part of CC's intervention strategy is based on a variety of physical interventions. It is widely accepted that exercise training is a fundamental part of cardiac

rehabilitation, as it can have a dramatic impact on cardiovascular risk factors, improve autonomic balance, prevent the development of atherosclerosis, and induce cardio protection against ischemia-reperfusion injury.[4,5] A meta-analysis concluded that dynamic exercise stimulated a significant overall reduction in resting and daytime ambulatory blood pressure (BP).[4] Hypertensive patients, the target population of CC, demonstrated the most evident reduction, with exercise reducing their resting BP by 6.9/4.9 mmHg.[4] Dynamic exercise was also effective at reducing triglyceride levels across all populations by 5.6%.[4] Dynamic activities that could be included are kettlebell swings, burpees, jumping jacks, jumping rope, squat jumps, shadow boxing, rowing, tai chai, and yoga.[4] Even when the case is as extreme as heart failure, exercise has been proven as a safe and effective strategy at reducing mortality.[4] Free-weight lifting, or resistive exercise, is more effective when the patients are already conditioned and need to improve endurance.[4] Free-weight lifting examples include a dumbbell bench press, bicep curls, deadlifts, rows, or goblet squats. For cardiac rehabilitation programs, each patients' specifics must be evaluated, including their needs, comorbidities and functional capacity.[4] This is the importance of CC's program. Utilizing the knowledge of the licensed medical staff, each patients' strengths and weaknesses could be analyzed to fit a specific intervention program. This physical, dynamic intervention aspect addresses predominantly the individual levels including heart health and physical fitness.

Another strength of the physical intervention strategy of CC is that it will be performed in groups, addressing more intrapersonal levels. Recent research performed outside of the scope of the inmate population has found that belonging to social groups, specifically subjectively important groups, enhance well-being, especially for individuals

dealing with injuries, illnesses, stressors or trauma.[6] As inmates are often dealing with a variety of the above, it does not come as a surprise that a fulfilling social life in prison, such as strong prisoner ties and membership in groups, satisfies the prisoners psychological needs and benefits their well-being.[6] CC offers inmates not only an opportunity to improve physically through dynamic exercise, but also a space to experience fulfillment through social interaction and a sense of belonging.

To evaluate the effectiveness of the physical intervention component of CC, outcome measures such as BP, the 6-minute walk test (6MWT), and the Timed Up and Go (TUG) can be used to evaluate cardiovascular health. Lowering BP to systolic levels of less than 130mmHg and providing BP lowering treatment, such as exercise, to individuals with a history of cardiovascular disease is strongly supported in the literature.[7] Using BP is a quick and feasible way to measure the progress of CC at each group visit. The 6MWT is a feasible, inexpensive and well-tolerated assessment of functional capacity for every day clinical practice. In adults with peripheral artery disease, the minimal clinically important difference for a moderate change was found to be 24 meters.[8] This would assess whether CC led to a meaningful improvement in the patient's health. Lastly, research shows that if participants are lacking other cardiovascular risk factors such as obesity, smoking or diabetes, a higher cardiovascular mortality rate was associated with a TUG greater than 10 seconds.[9]

The second part of the intervention strategy for CC is education, with close ties to the Health Belief Model (HBM). Education focusing on perceived susceptibility, perceived severity, perceived threat, perceived benefits of action, perceived barriers, cues to action, and self-efficacy would be used to address the benefits and importance

of the program.[10,11] Although self-efficacy is not directly aligned with the HBM alone, it is an important construct of the model.[11] Studies show that the HBM domains are beneficial for improving health related behavior and can be used in conjunction with other intervention to improve the health of a population.[10] Because inmates in the Federal Medical Centers most likely already have a severe form of cardiovascular disease, steps in the health belief model such as benefits of action, perceived barriers, cues to action and self-efficacy may be the most important HBM domains. Taking baseline surveys about the inmate's current knowledge, behavior and attitude toward cardiovascular disease can help CC coordinators understand what domains will be most important. Education could include prevention and rehabilitation strategies if inmates seem to be demonstrating difficulty with self-efficacy and are unable to understand a path forward to perform the health behavior. If they demonstrate limited knowledge surrounding mortality rates and how cardiovascular disease can impact their quality of life, education about susceptibility may be important. Improvements in these domains would address cardiovascular disease on an individual level.

An important component of the educational program through CC is the insurance of carryover once released from the justice system. As mentioned, there is a large gap in care when an inmate is discharged. Education surrounding medication and risk factor management, lifestyle changes, physical activity, symptom recognition, and the importance of follow up appointments taught in prison can help prepare and empower an inmate upon release. One way to ensure carryover is with the teach back method, a commonly used approach in health education programs across a variety of settings.[12] This method, where the patient teaches the instructor what they have learned, is related

to positive effects on patient satisfaction, patient perception, and most importantly, disease self-management and knowledge.[12] A second strategy that could be utilized is the peer-to-peer education method, a technique that would focus on intrapersonal relationships. Research shows that peer to peer support services in prison have a positive effect on the recipients and have been shown to achieve health and social goals not only within the prison environment, but also beyond.[13] Reasons for this could include the peer's ability to connect with other prisoners, the peers ability to interact with vulnerable populations that may be resistance to professional advice, and, less importantly, an effective utilization of prison resources in an already understaffed environment.[13]

Outcome measures for the education component of CC would be patient reported questionnaires on inmate health behavior, health beliefs and/or self-efficacy. There would also be an evaluation at the end of the course that asks about cardiovascular risk factors, symptoms, and prevention strategies to reinforce what was learned during the program. The Health Behavior Inventory-20 is a valid and reliable 20 item questionnaire designed specifically to investigate health behaviors.[14] It asks questions surrounding diet, use of health care resources, stress, preventative self-care, and substance use, all of which contribute to cardiovascular disease and hopefully will be improved through the educational resources provided.[14] The Cardiovascular Management Self-efficacy Scale is a self-reported measure that has proven excellent internal consistency, good test-retest reliability and good predictive validity.[15] This would allow CC to better understand how confident an inmate feels at managing their condition independently.

Program Goals:

The goal of this program will be to not only achieve a better physical health for inmates with cardiovascular disease but also educate to improve self-efficacy in managing the disease in prison and once released.

1. Participants in Cardio Comeback will improve their 6 MWT score by at least the MCID of 24 meters in 12 weeks to demonstrate moderate improvement in cardiac endurance by completing physical, dynamic exercises as part of the program.[8]
2. Participants in Cardio Comeback who are less than 80 years old will achieve a TUG score of less than 10 seconds in 12 weeks by participating in dynamic exercises, demonstrating safe and effective gait mobility.[16]
3. Participants in Cardio Comeback will score higher than a 9.7 on the Cardiovascular Management Self-Efficacy Scale by participating in education classes for 8 weeks, demonstrating an increased ability to self-manage their condition.[17]
4. Participants in Cardio Comeback will be able to identify 2 risk factors for cardiovascular disease and a strategy for addressing these factors long term in 12 weeks, demonstrating increased self-awareness and self-management of the condition.

Methods:

Personnel*:* Within Federal Medical Centers (FMC), there are approximately 6-7 physical therapists present every day. These therapists would be offered the opportunity to substitute a one-hour patient block to assist with the CC program. During the workday, physical therapists in the FMC would assist both the physical intervention and

education components of the program. Inmate medical care is funded through the local, state and federal governments, so there are not the same reimbursement concerns that would be true with Medicare and Medicaid. However, there should still be at least one physical therapist there for every three inmates, specifically in the physical active portion, to ensure safety of all inmates. These three inmates would then be on the physical therapists' schedule, and it would be the therapist's responsibility to ensure they are present for the program. If there is a particular concern that an inmate requires 1:1 care, it should be documented, and an additional physical therapist would be needed. For the education component of CC, only one physical therapist would be required as it would be more of a lecture-style class with engagement activities throughout. The therapist who teaches this class will be rotated each week. The therapists who typically are present for the physical activity portion, would then treat as normal, separate of the CC program.

Location: CC will take place initially at the Federal Medical Center in Butner, NC. It is a level 4 Medical Center, meaning inmates in this institution are severely impaired and may require daily nursing care.[3] Activities and exercise can take place in the yard when the weather is nice and in the therapy clinic when it is too cold or raining. The reason the yard would be incorporated into location is to increase sun exposure. Having an adequate amount of Vitamin D and UVR-induced nitric oxide in the body is a facilitator of favorable health outcomes, including decreased risk of death due to cardiovascular disease, lower prevalence of metabolic syndrome, and statin intolerance.[18] Research suggests that Vitamin D supplementation might not be an effective substitute for adequate sun exposure, and therefore to help in our progress toward reducing

cardiovascular disease in inmates, it is imperative that we also increase sun exposure.[18] The education component of CC will be help in one of the facilities recreational activity rooms. There are rooms in the FMC facility where inmates perform other tasks, such as fixing wheelchairs or stapling the newsletter for the week. Utilizing one of these rooms for an hour for educational purposes would be welcomed.

Enrollment: Inmates at the FMC that are currently receiving physical therapy for cardiovascular disease, or for another condition with a comorbidity of cardiovascular disease, will be asked if they wish to enroll in CC. Information about its components and benefits will be provided through both verbal explanation and a pamphlet, ensuring health literacy is a non-factor in understanding its content. The amount enrolled will be dependent on how many physical therapists are able to participate in the program. If a therapist takes paid time off or sick leave during one of the physical activity days, it is possible for another therapist to stand in their place to ensure inmates can maintain a consistent schedule. A maximum of 12 inmates will be able to enroll due to space limitations in the recreational rooms as well as a potential for lack of exercise equipment within the facility.

Inmates for enrollment will be selected based on severity of the condition and inmates who do not get enrolled in the initial program will have an opportunity to enroll at a later date. The inmate's medical team will be consulted and asked to make the decisions regarding severity of conditions. Inmates will be asked to participate in the program in the order at which severity has been decided. However, it is important to note that the program will be voluntary. In a study involving substance abuse, involuntarily admitted patients had significantly lower levels of motivation (39%) as

opposed to voluntarily admitted patients (59%).[19] Although the study found that the stage of readiness to change, associated with the Transtheoretical model, did not affect abstinence at follow-up, going into the program voluntarily may help boost morale in the early stages and promote more engagement and adherence throughout.[19]

Schedule: The program will be initiated February 4th, 2025, to allow for an appropriate and thorough screening of inmates currently receiving therapy for cardiovascular disease during January 2025. The Thursday prior to the program beginning, baseline assessments will be gathered. CC will run for a total of 12 weeks. On average, it takes 66 days for a new behavior to become automatic, but the range runs anywhere from 18 to 254 days.[20] Because the scope is so large, the 90-day timeline is an attempt to decrease this range, even if it is just slightly. The program discharge day will be 3 months from evaluation day and include a re-assessment of all physical and educational outcome measures. Below is a schedule of the first month of CC. Each month would be identical and consecutive as research shows having a routine is how you build health habits.[21] Physical therapists do not work on weekends, so there will be no scheduled therapy at this time. However, the inmates will be encouraged to decrease their amount of time sitting and provided home exercise programs to complete if motivated to do so. Thursday will be program re-evaluation day that occurs every 2 weeks.

MON	TUE	WED	THU	FRI	SAT	SUN
27	28	29	30 PROGRAM EVAL DAY	31	1	2
3 50 MINUTES - DYNAMIC EXERCISE	4 50 MINUTES - EDUCATION	5 50 MINUTES - DYNAMIC EXERCISE	6	7 50 MINUTES - DYNAMIC EXERCISE	8	9
10 50 MINUTES - DYNAMIC EXERCISE	11 50 MINUTES - EDUCATION	12 50 MINUTES - DYNAMIC EXERCISE	13 PROGRAM RE-EVAL DAY	14 50 MINUTES - DYNAMIC EXERCISE	15	16
17 50 MINUTES - DYNAMIC EXERCISE	18 50 MINUTES - EDUCATION	19 50 MINUTES - DYNAMIC EXERCISE	20	21 50 MINUTES - DYNAMIC EXERCISE	22	23
24 50 MINUTES - DYNAMIC EXERCISE	25 50 MINUTES - EDUCATION	26 50 MINUTES - DYNAMIC EXERCISE	27 PROGRAM RE-EVAL DAY	28 50 MINUTES - DYNAMIC EXERCISE	29	30
31 50 MINUTE - DYNAMIC EXERCISE	1	2	3	4	5	6

Intervention Specifics:

Dynamic Exercise: To see major health benefits, it is recommended to perform at least 150 minutes of moderate activity each week, with a dose-response relationship evident even beyond 150 minutes.[21] For this reason, on days that the inmates are not scheduled for CC, they will be encouraged to participate in a home exercise program. Each session will begin with a 5-minute active warm-up. This will include a lap around the "yard" and dynamic stretches including lunges, high knees, butt kicks, and arm swings. These can all be adapted based on inmate ability. The "lead" therapist for that day's CC intervention will oversee the dynamic activities. This can include a circuit style of activities or even a group-based sport activity for the entire 45 minutes. The format of each day should be everchanging and fresh regarding activities but maintain the structure and routine that will lead to healthy habits. This means that even as the activities change, the message of dynamic activity and cardiovascular health should remain the same. Dynamic activities could include adaptations and variations of:

- Kettlebell swings
- Jump squats
- Jumping jacks
- Mountain climbers
- Jumping rope
- Burpees
- Shadow boxing
- Rowing
- Tai Chai
- Yoga
- Stair climbing
- Sport activity
- Walk intervals
- Jog intervals
- Lunges
- Skaters
- Boxing squat

Education Block: Once a week a discussion surrounding a specific cardiovascular topic will occur. The 50-minute discussion will be filled with lecture as well as small group discussion about catalysts for lifestyle change. This could include building intrapersonal relationships between the inmates, so they hold each other accountable for healthy choices or personal motivation surrounding the Health Belief Model. Motivating inmates

to identify barriers, susceptibility, benefits, and cues to action may improve self-efficacy. Small groups will have a peer mentorship component using other inmates to encourage healthy habit adaptation.[13] Small groups will elect one member at the end of every class to share with the physical therapist what they have discussed and utilize the teach back method to promote carryover of material.[12] There will be 12 education classes, taught in the following order:

1. Overview of Cardiovascular Disease
2. Addressing the Health Belief Model
3. Importance of Physical Activity
4. Medication Management
5. Dietary Guidelines for Cardiovascular Health
6. Smoking and Cardiovascular Disease
7. Alcohol and Cardiovascular Disease
8. Heart Attack and Its Symptoms
9. Cardiovascular Disease and Stroke
10. Managing Stress
11. Sleep and Cardiovascular Health
12. Healthcare Gap Upon Release

These classes are designed to target both the Transtheoretical model and the Health Belief Model. The goal of CC would be for the inmates to accomplish the “action phase” of the transtheoretical model through both the physical classes and the education materials, so that once “graduated” they continue the maintenance phase. It is important to note that some inmates also may require going through the contemplation and preparation phase before fully committing to the action phase during this process. The Health Belief Model would encourage them to look within their own lives and, armed with the knowledge provided each week in class, better understand their barriers and risk factors, so they can be proactive in their lives following CC.

Program Evaluation:

The inmates will be re-evaluated every 2 weeks, on Thursday when the inmates have no other CC programming scheduled, for a total of 6 times. During the re-evaluation, the inmates will have their blood pressure taken and will perform both physical assessments, the 6 MWT and TUG. Questionnaires/surveys will only be performed at baseline and on the final day as these classes are only once a week and may require more time to see benefit. Physical assessment progress will be documented each week, but the overall change will be determined from baseline and final assessment scores. As evident in the program goals, meaningful, moderate change for the 6 MWT would be 24 meters. This would be the minimum change that is deemed successful for the CC program and anything greater than 24 meters would be celebrated.[8] For the TUG test, anything greater than 20 seconds for people less than 80 years old, would mean they require a gait aid and are unable to ambulate without one.[16] Anything greater than 30 seconds and they are deemed unable to go outside alone.[16] For the purpose of this program, the goal would be to have the participants walking "normally", indicating a value of less than 10 seconds. Therefore, if participants can do this by the end, it will indicate success. Although not a program goal, it is important to note that decreases in blood pressure will also be documented, as lowering BP to systolic levels of less than 130mmHg in individuals with a history of cardiovascular disease is strongly supported by the literature.[7]

The education component will be assessed at baseline and at the end of the program through the Cardiovascular Management Self-Efficacy Scale and the Health Behavior Inventory-20. The Cardiovascular Management Self-Efficacy Scale average

amongst patients with stable coronary heart disease was 9.7.[17] The goal for the program would be for our participants to be operating with more knowledge than the average person with their condition, with higher numbers being celebrated. Although the Health Behavior Inventory-20 does not have researched MCID's, MCD's or cut-off scores specific for cardiovascular disease, improvements in the outcome measure could still provide valuable information about the success of the program if they are grandeur. Another way we can determine success for our education component is the inmate's ability to use the Health Belief Model to evaluate their condition. Are they able to identify risk factors that make them more susceptible? Are they able to identify potential barriers that could arise in the future and create strategies to address these barriers? How confident do they feel in managing their condition? Susceptibility and self-efficacy can also be measured in the inmate's ability to address individual risk factors and strategies to combat them.

The program's effectiveness will be determined by the outcome measures discussed above. Because this is a free program for the inmates, cost effectiveness and efficiency will be determined as it relates to reimbursement of physical therapists. A check-in one month into the program to ensure physical therapists are reimbursed adequately and fair for their time will be imperative to the programs cost-effectiveness. Additional documentation or explanation may be required if it is not meeting reimbursement standards. The therapists will also have to ensure that the program is able to be completed in the allotted 1-hour time slot. Discussion surrounding how to make each session more efficient can be had if necessary. Process evaluations will be given twice a month in the first two months to staff and inmates to determine if the

program has been implemented appropriately. Process evaluations will answer whether the activities are taking place, how they are being conducted, and whether the appropriate resources have been allocated.[22] The program can be adapted if there are any concerns or consistent negative reports to better the implementation process. If unable to determine the nature of the problem, a formative evaluation will be given to better understand how CC can address it.[22] Feedback will be gathered from inmates at the end of each education class about its flaws, effectiveness and motivating qualities. These can be adapted for the next time the program is run to be more helpful if there is concern. Halfway through and at the end, feedback surveys will be provided to both staff and inmates. These will be different from the process evaluations as they will focus instead on the general feelings toward the program. What could be changed? What are the benefits? Do you feel like the program is beneficial? Because this is more subjective and less focused, changes may not be necessary unless patterns arise that point toward a larger problem. These feedback surveys would be more of a "catch-all" to ensure the program is operating smoothly.

Overall, the program's implementation, effectiveness, efficiency, cost effectiveness and attribution need to be evaluated.[22] Check-in's, subjective surveys and objective measures can all help to determine if the program is achieving the desired goals. It is important to do these throughout the program so that adjustments can be made in real time if necessary.

Conclusion:

CC is a program designed to facilitate healthy habits in inmates with cardiovascular disease. With 150 minutes of dynamic exercise and a 50-minute education class each week, the goal is not only to improve participants' health over the 12-week period but also to foster an environment that supports their progression through the stages of change. This will ultimately help them transition to a maintenance phase where they feel confident managing their condition independently. With the leading cause of death among the 2.2 million incarcerated individuals in the US prison system being cardiovascular disease, CC offers evidence-based interventions to address a large health disparity in this population. The skills learned in class and the habits developed through dynamic exercise will extend well beyond the 12-week program. The program enhances carryover by using the teach-back method to reinforce learning, strengthens intrapersonal relationships through peer mentoring, and fosters lasting health habits due to its duration, which helps solidify routine and behavior change. Current disparities in the health of inmate’s populations include a lack of funding and resources, so support for this program may not only make it more effective, but also be crucial for its success.

Resources

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