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RESEARCH ARTICLE

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High Medical Risk and Low Criminogenic Risk: What is the Price?

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ABSTRACT

When exposed to confinement, aging incarcerated individuals are exposed to risk factors (e.g., dietary limitations, exposure to violent behavior, stressful conditions) that accelerate the progress of chronic illnesses, and cognitive and physical disabilities [1]. This rapid progression subsequently produces a high health and medical need for these aging incarcerated individuals which poses maximum financial and ethical concerns. However, research has also shown that this aging population is less likely to recidivate, which produces a minimal threat to public safety [2]. As these medical and health impacts continue to be associated with the aging incarcerated population, further understanding of this population, who are significantly costly but less criminogenically risky, must be considered.

A quasi-experimental design was utilized to evaluate the medical and mental health impacts of the aging incarcerated population through an aging and non-aging cohort (N = 17,833) from a mid-sized correctional department. Findings revealed significant differences in health care encounters (e.g., dental, medical, nursing, mental health), health care claims and costs, and health service codes by custody level and criminogenic risk level suggesting that aging incarcerated individuals with low criminogenic risk in low custody are more likely to initiate dental, medical, and nursing encounters a well as health claims and costs, than their younger and riskier counterpart. Studies like this one are beneficial as they provide consideration to policy changes focusing on the geriatric population, attention to the aging population's physical and mental health, and investigate innovative approaches for dealing with health and mental health issues of the aging inmates.

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Introduction

While the rates of the prison population have decreased throughout the US, harsher laws and guidelines have produced lengthier and stricter prison sentences, frequently with limited or no possibility of parole or community supervision [3]. Subsequently, correctional departments have become home to the increasing age category of individuals - the aging (i.e., 55 years or older) [1]. With the increased aging prison population comes an increase of mental, physical, and social health and care issues (including but not limited in their diet, preventative and primary care, and exercise); the aging incarcerated population are exposed to risky lifestyles and insufficient health care, which leads to more rapid progression of chronic illnesses, and cognitive and physical disabilities, than their younger incarcerated counterpart [4]. This accelerated and rapid progression becomes more evident in a prison-setting which is also more likely to house individuals with poor social economic background with sub-average health care, associated with unhealthy and risky lifestyles previously and during confinement [5]. Even more, due to their insufficient mental, physical, and social health care, the aging incarcerated population suffers from disproportionally greater rates of overall physical and mental health problems than non-incarcerated aging populations [3,4].

When exposed to confinement, incarcerated individuals are more likely to be subjected to risk factors (e.g., dietary limitations, exposure to violent behavior, stressful conditions) [6]. Unlike the non-aging incarcerated population, the aging population accrue expensive and extensive medical needs, and correctional departments are challenged with the multifaceted and costly consequences of the new sentencing laws and guidelines and are tasked to provide essential support and care [1,6,7]. Aging incarcerated individuals, on average, suffer from more chronic conditions than their non-incarcerated age-matched counterparts [3,4]. While these chronic conditions (e.g., cardiovascular disease, diabetes, chronic liver and kidney disease and esophageal disorders) are similar to the aging non-incarcerated population, the aging incarcerated population suffer from remarkably more incidence in confinement [6]. Also, the aging incarcerated individuals are more susceptible to severe infections (e.g., pneumonia, acute myocardial infarction, influenza) in a correctional setting [8]. Additionally, prisons can also present new health and medical issues and

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needs, impairments and declines, geriatric syndromes, and mental and psychological health concerns, which can affect overall safety [4,6]. Furthermore, aging individuals suffered from a number of mental and psychological health concerns such as depression and anxiety disorders; for example, up to 27% of aging individuals have shown to suffer from some form of mental or psychological issues [6]. Lastly, while not all aging incarcerated individuals suffer from a severe mental or psychological health issue, most suffer from trauma and stress associated to imprisonment [3,6].

Outside of typical medical and health concerns, there are also a number of medical and health care issues that aging individuals specifically suffer from. These aging medical and health care issues, also known as geriatric syndromes (e.g., cognitive decline and impairment, functional deficiencies, and hearing and vision loss), are typically associated with their increased age [7]. While geriatric syndromes are typical in aging non-incarcerated populations, due to their confinement status, aging incarcerated individuals are commonly more at risk for geriatric syndromes, which places them in even at more jeopardy for adversity while incarcerated [9]. Aging individuals, regardless of incarceration status, suffer from cognitive decline and impairment; such cognitive decline and impairment in aging populations includes a range of neurologic and mental issues such as dementia [3]. Dementia is not a specific disease, but instead is considered an overarching condition of numerous impaired brain and cognitive functions [3,6]. Individuals who suffer from functional deficiencies have issues in completing daily living activities (e.g., eating, walking, bathing); these functional deficiencies prevent the ability for true autonomy and self-governess. For aging incarcerated individuals, functional deficiencies are associated to high medical care expenses, continued functional deterioration, and death [8]. Individuals who suffer from either hearing or visual impairments, or both, can significantly decrease social involvement and increase social segregation, decrease autonomy and increase dependence, and physical and mental decline [1,6,7]; for example, aging incarcerated individuals who are hearing impaired might not hear correctional staffs' commands and be infracted for insubordination while aging incarcerated individuals who are visually impaired might be more prone to tripping and falling - both examples impacting an aging incarcerated individual's safety.

The aging incarcerated populations add a significant medical and health burden which equates to considerable expenses [9]. Recent research has shown that the aging incarcerated individual costs up to three times more than their younger counterpart [5]. These considerable expenses come from medical and health care expenditures such as prescription medications, specialized nursing care, diagnostic tests, and hospitalizations [6]. Outside of true medical and health care expenses, other costs are also associated to these costs including travel (e.g., to and from hospitals, emergency rooms) and custody/ security (e.g., 1 to 1 supervision, physical support) [4]. Additionally, due to the medical state, correctional departments are also challenged with housing aging incarcerated individuals. For example, aging incarcerated individuals who cannot be autonomous require around-the-clock, one to one long-term supervision; in some instances, the aging individuals are continuously housed in general population regardless of their health and medical needs while others are able to be placed in housing units specialized for an elderly population, the infirmary, or other non-general population locations.

Despite the aging prison population increase, this population remains the lowest in risk to recidivate [2]. Particularly, recidivism rate for the aging population is significantly lower than any other age category [6]. More so, recidivism rates decreased significantly with age, regardless of level of education or even prior violent crime convictions and sentences [2]. Furthermore, the United States Sentencing Commission [10] revealed a 15% re-arrest rate for incarcerated individuals who were 65 or older; in comparison, incarcerated individuals who were 21 years or younger had a 68% chance of being re-arrested. Most recently, research has shown that one of the best predictors of recidivism is age, instead of sentence length, length of stay, and crime type [10]. Regardless of producing the lowest recidivism rate, significant expenses continue to be linked to the aging incarcerated population, specifically due to their medical and health impacts.

Current Study

Previous research has shown that the overall aging population poses unique physical, mental, and social health and care needs [1,3]. The aging incarcerated population suffers from disproportionally greater rates of overall physical and mental health problems than non-incarcerated aging populations [1]. However, their rates of recidivism continue to be the lowest. Regardless of posing minimal threat to public safety, significant expenses continue to be associated with the aging incarcerated population, including being at the greater risk for victimization, injury, and illness [2]. Further understanding the medical impact of the aging incarcerated population is essential. The purpose of this study includes evaluating the health impact of the aging prison population by examining the similarities and differences between the aging and non-aging incarcerated population by medical, dental, nursing, and mental health encounters and reviewing the medical claim counts and costs by age amongst the incarcerated population.

The findings will highlight the prevalence of (a) health care encounters, (b) health claims and costs and (c) health services codes by age, criminogenic risk, and custody level.

Methods

Experimental Design

To examine the medical impact of the aging incarcerated population, a quasi-experimental design was utilized to evaluate the similarities and differences. Age was broken down into two cohorts: aging (i.e., defined as individuals who were 55 years and older) and non-aging (i.e., defined as individuals who were 54 years and younger).

Participants

Our investigation included a convenience sample of incarcerated individuals (N = 17,833) from a mid-sized correctional department who were either 54 years and younger

or 55 years and older. Participants' age ranged from 18 to 91 years old. 15,550 of those incarcerated individuals were 54 years and younger while the rest (n = 2,285) were 55 years and older. The aging cohort had a mean age of 61.8 and median age of 60, while the younger age cohort had a mean age of 35.8 and median age of 35. Incarcerated individuals included 16,396 males and 1,439 females; most incarcerated individuals were male (91.9%) which was similarly found among the aging cohort (94.7%) and non-aging cohort (91.5%).

Materials

Several measures were utilized to further evaluate the medical differences within the aging and no-aging population. These measures included various demographic characteristics such as gender, age, homelessness status, and race/ethnicity. Additionally, custody level (i.e., supervision level categorized as closed, maximum, medium, or minimum), risk level (i.e., risk to return to prison categorized as low, moderate, High Non-Violent (HNV), High Drug (HD), High Property (HP), High Violent (HV), or High Violent, Property and Drug (HVPD)). Health data included health care encounters (i.e., categorized as dental, medical, mental health, and nursing encounters), health claims (i.e., claim types include all but Medicaid claims) and costs associated with illnesses, and health services codes (PULHES-DXT: P (general health service utilization), U (medication delivery requirements), L (limitations of mobility), H (developmental disability), E (sensory disability), S (mental health service utilization), D (dental service utilization), X (ADA accommodations), and T (transportation)).

Results

The characteristics of the mid-sized stare correctional incarcerated population by age (< = 54 or > = 55) in terms of risk and custody level, offense type, and prior prison, to name a few, were shown on Table 1. While there were no significant differences in demographic characteristics, there were significant difference regarding custody level (χ^2 (3, N = 16,617) = 50.17, p < .001) suggesting that that aging individuals were less likely placed in maximum custody (.8%) and more likely placed in minimum custody (70.0%) than their younger cohort. Also, risk level between these two age groups differed (χ^2 (7, N = 17,835) = 2,337.16, p < .001). 68% and 7.5% of the aging incarcerated individuals were classified as low risk or high violent, respectively, compared to 22.2% and 25.8% of the non-aging incarcerated individuals.

Table 1: Percentage of Incarcerated Individuals Demographics.

	< = 54	> = 55	Total		< = 54	> = 55	Total
Total (N)	15,550	2,285	17,835	**Offense**			
Age				Murder	12.2	23.8	13.7
Mean	35.8	61.8	39.1	Manslaughter	2.4	1.7	2.3
Median	35	60	37	Sex	17.2	36.8	19.7
Gender				Robbery	9.0	5.4	8.6
Female	8.5	5.3	8.1	Assault	24.2	13.8	22.9
Male	91.5	94.7	91.9	Property	23.3	9.5	21.6
Race				Drug	8.8	6.3	8.4
White	56.4	72.3	58.5	**Sentence Length**			
Black	18.0	15.9	17.7	< 2 years	42.9	21.2	40.1
Hispanic	14.7	5.6	13.6	2-5 years	19.2	12.5	18.2
Other	10.9	6.1	10.3	5.1-10 years	12.9	13.8	13.0
Risk Level				>10 years	22.7	40.2	24.9
HD	5.8	7.5	6.0	LWOP	2.3	12.3	3.6
HNV	--	--	--	**Time Served**			
HP	14.8	4.9	13.6	< = 1 year	55.5	29.8	52.2
HV	25.8	7.5	23.5	1-2 years	10.1	7.3	9.8
HVPD	21.8	1.3	19.2	2.1-3 years	6.3	4.6	6.1
Low	22.2	67.4	28.0	3.1-4 years	4.4	3.7	4.3
Mod	9.4	11.3	9.7	4.1-6 years	6.2	6.3	6.2
Missing	--	--	--	6.1-10 years	8.1	12.3	8.6
Prior				> = 10 years	9.4	36.1	12.8
Prison	48.2	41.3	47.3	**Time to Serve**			
Homeless				< = 1 year	57.7	50.7	56.8
Yes	11.4	8.4	11.0	1-2 years	10.1	9.2	10.0
Custody Level				2.1-3 years	5.8	7.3	6.0
Minimum	61.6	69.8	62.6	3.1-4 years	3.8	4.3	3.9
Medium	20.6	19.5	20.5	4.1-6 years	5.2	6.5	5.4
Closed	8.6	6.0	8.3	6.1-10 years	6.1	7.8	6.3
Maximum	2.0	0.8	1.8	> = 10 years	11.3	14.2	11.6

Note: Due to low Ns, some data were removed. Detail may not sum to total due to rounding. Age is described in years. Offense is defined as the worst crime sentenced. Sentence length is defined as length of stay from admission date to release date (or expected release date). Time served is defined as the length of stay from admission date to December 31, 2018. Time to serve is defined as the length of stay from December 31, 2018, dependent on snapshot population) to release date (or expected release date). Abbreviations include: High Violent Property Drug (HVPD); High Violent (HV); High Non-Violent (HNV); High Property (HP); High Drug (HD); Moderate Risk to Reoffend (MOD); Lower Risk to Reoffend (LOW); Life without the possibility of parole (LWOP).

Health Care Encounters

Health care encounters (i.e., dental, medical, nursing, and mental health) were evaluated by age, custody level, and criminogenic risk. Out of the 33,448 dental encounters initiated by the incarcerated population, the aging initiated 4,587 encounters while the non-aging initiated 28,861; there were an average of 2.01 encounters per one aging incarcerated individual compared to an average of 1.86 encounters, (t (11,928) = -10.19, p < .001, d = 0.30). The incarcerated population initiated 54,525 medical encounters (aging initiating 12,620 of those encounters while the non-aging initiated 41,905); the aging incarcerated individuals were twice as likely to have a medical encounter than the non-aging incarcerated individuals, (t (14,194) = -29.43, p < .001, d = 0.70). Out of the 171,572 nursing encounters, the aging initiated 50,196 encounters and the non-aging initiated 121,376; aging incarcerated individuals were 3 times as likely to have a nursing encounter than the non-aging incarcerated individuals, (t (17,181) = -18.92, p < .001, d = 0.43). Lastly, 154,596 mental health encounters were initiated with the aging initiating 18,300 mental health encounters while the non-aging initiated 136,296 mental health encounters; there were 8.01 mental health encounters per one aging incarcerated individual compared to 9.94 mental health encounters, (t (12,248) = -1.45, p = 0.15, d = 0.04).

Univariate general linear models revealed significant differences between age and custody levels in health care encounters. Results showed that aging incarcerated individuals in low custody were most likely to have dental encounters than any other custody or age group (F (9, 17,833) = 37.49, p < .001, η_p^2= 0.02) - an average of 2.14 encounters per one aging incarcerated individual under low custody. In terms of medical and nursing encounters, aging incarcerated individuals under closed custody were more likely to have medical and nursing encounters than any other custody or age group (F (9, 17,833) = 176.57, p < .001, η_p^2= 0.08) and (F (9, 17,833) = 115.95, p < .001, η_p^2= 0.06), respectively. Results revealed that an average of 6.5 medical and 86.1 nursing encounters per one aging incarcerated individual under closed custody. Aging incarcerated individuals in maximum custody were more likely to have mental health encounters than any other custody or age group (F (9, 17,833) = 399.87, p < .001, η_p^2= 0.15); there was an average of 118.2 encounters per one aging individual in maximum custody.

Utilizing F-tests, findings revealed significant differences with the incarcerated population's health care encounters by age and by criminogenic risk level. Results showed that aging HD-risk incarcerated individuals were more likely to have dental encounters than any other cohort (F (15, 17,833) = 13.97, p < .001, η_p^2= 0.01); there was an average of 2.7 encounters per one aging HD-risk incarcerated individual. Aging HV-risk incarcerated individuals were more likely to have mental health encounters than any other group (F (15, 17,833) = 17.63, p < .001, η_p^2= 0.02); there was an average of 15.7 encounters per one aging HV-risk incarcerated individual. In terms of medical encounters, results showed that aging HVPD-risk incarcerated individuals were most likely to have medical encounters than any other group (F (15, 17,833) = 85.96, p < .001, η_p^2= 0.07) - findings showed that an average of 6.8 medical encounters per one aging HVPD-risk incarcerated individual. Aging low risk incarcerated individuals were more likely to have nursing encounters than any other criminogenic risk or age group (F (15, 17,833) = 26.09, p < .001, η_p^2= 0.02); there was an average of 22.9 encounters per one aging low risk incarcerated individual.

Health Care Claims

Health care claims were evaluated by age, criminogenic risk, and custody level. Overall, 6,424 individuals had at least one claim for a total of 29,762 claims; the aging population averaged 4.30 claims per individual while the non-aging cohort averaged 1.09 claims.

Utilizing F-tests, findings revealed significant differences by age and custody level, (F (9, 17,833) = 127.57, p < .001, η_p^2= 0.06). The aging population under closed custody averaged 3 claims per individual while the non-aging under closed custody cohort averaged 0.91 claims. The aging population under maximum custody averaged 0.89 claims per individual while the non-aging under maximum custody cohort averaged 1.21 claims. The aging population under medium custody averaged 3.72 claims per individual while the non-aging under medium custody cohort averaged 0.79 claims. Lastly, the aging population under minimum custody averaged 3.64 claims per individual while the non-aging under minimum custody cohort averaged 1.06 claims. In terms of criminogenic risk level, significant differences with health care claim were present (F (15, 17,833) = 71.21, p < .001, η_p^2= 0.06). Overall, the aging low risk population averaged 3.55 claims per individual while the non-aging low risk averaged 1.19 claims. The aging moderate population averaged 1.06 claims per individual while the non-aging moderate risk averaged 3.90 claims. Additionally, the aging HVPD-risk population averaged 3.79 claims per individual while the non-aging HVPD-risk averaged 0.62 claims.

Health Care Costs

In terms of health care costs, similarities and differences were reviewed by age. Overall, findings revealed that in the 2018 snapshot aging population averaged $1,660.84 per individual while the non-aging cohort averaged $351.66 per individual. In distinguishing the 2018 snapshot incarcerated population's health care costs by age and by custody level, findings revealed significant differences (F (9, 17,833) = 65.78, p < .001, η_p^2= 0.03).

Aging incarcerated individuals under minimum custody averaged $1,778.34 per individual while the non-aging minimum custody cohort averaged approximately $421.02 per individual. The non-aging incarcerated individuals under medium custody averaged $268.59 per individual while the aging medium custody counterpart averaged $1,760.74 per individual. Aging incarcerated individuals under maximum custody averaged $413.00 per individual while the non-aging maximum custody cohort averaged $381.44 per individual. The non-aging incarcerated individuals under closed custody averaged $316.30 per individual while the aging closed custody counterpart averaged $1,050.92 per individual. In terms of criminogenic risk level, findings revealed significant differences (F (15, 17,833) = 37.49, p < .001, η_p^2= 0.03). Aging low risk

incarcerated individuals averaged $1,710.90 per individual while the non-aging low risk cohort averaged a $491.01 per individual. The non-aging moderate risk incarcerated individuals averaged $351.57 per individual while the aging moderate risk counterpart averaged $2,026.78. Aging HD-risk incarcerated individuals averaged $1,557.93 per individual while the non-aging HD-risk cohort averaged $477.95. The non-aging HP-risk incarcerated individuals averaged $307.81 per individual while the aging HP-risk counterpart averaged $1,375.69 per individual. Aging HV-risk incarcerated individuals averaged $995.35 per individual while the non-aging HV-risk cohort averaged $342.36. The non-aging HVPD-risk incarcerated individuals averaged $218.44 per individual while the aging HVPD-risk counterpart averaged $1,469.72.

Health Services Codes (PULHES-DXT)

Employing F-tests, findings revealed significant differences with health services codes (PULHES-DXT) and age. In terms of general health service utilization (P), findings revealed significant differences ($F (1, 17,811) = 1,713.38$, $p < .001$, $\eta_p^2 = 0.09$); findings revealed that 57.7% of the non-aging incarcerated individuals reported normal physical conditions (i.e., with no special requirements or needs) versus 19% of the aging cohort. 62.5% of the aging incarcerated individuals reported some organic systemic disease, condition or physical defect as compared to 38.6% of their non-aging counterpart. 3.6% of the non-aging incarcerated individuals reported organic systemic disease (i.e., requiring frequent monitoring and on-site medical care) or significant health service needs (i.e., requiring assistance with activities of daily living (ADLs)) versus 18.5% of the aging incarcerated individuals. Findings revealed significant differences in terms of medication delivery requirements (U) ($F (1, 17,811) = 165.02$, $p < .001$, $\eta_p^2 = 0.01$). Findings revealed that the majority (86.2%) of the non-aging incarcerated individuals reported limited medication management while 19.3% of the aging incarcerated individuals reported a need for daily pill line medication administration. Results showed significant differences in terms of limited of mobility (L), ($F (1, 17,811) = 1,349.37$, $p < .001$, $\eta_p^2 = 0.07$). 94.8% of the non-aging incarcerated individuals reported no mobility restrictions as compared to 73.6% of the aging cohort. 22.3% of the aging incarcerated individuals reported mild restrictions (i.e., limited muscle strength or control, impaired coordination, limited range of motion, use of assistive devices) compared to 4.8% of the non-aging counterpart. In terms of limited of developmental disability (H), results revealed significant differences ($F (1, 17,811) = 4.23$, $p = .04$, $\eta_p^2 = 0.01$). Most incarcerated individuals reported no identified intellectual or adaptive functioning impairment (97.8% for aging compared to 98.7% of non-aging).

Findings revealed significant differences in terms of limited of sensory disability (E) ($F (1, 17,811) = 290.86$, $p < .001$, $\eta_p^2 = 0.02$). 96.2% reported no apparent sensory disability as compared to the 89.9% of their aging counterpart. 7.1% of aging incarcerated individuals reported significant visual or auditory impairment as compared to 3.3% of the non-aging cohort. Results showed significant differences in terms of mental health functioning (S), ($F (1, 17,811) = 12.37$, $p < .001$, $\eta_p^2 = 0.01$). 71.7% of the non-aging incarcerated individuals reported no serious mental health symptoms or need for ongoing mental health counseling or psychotropic medications versus the 68.9% of the aging cohort. 5.1% of the aging incarcerated individuals reported a mental disorder with current active symptoms (i.e., these symptoms meet medical necessity for treatment due to mild to moderate adaptive functioning deficits) as compared to the 3.3% of non-aging counterpart. In terms of dental service utilization (D), results revealed significant differences; 18.1% of the non-aging incarcerated individuals reported visible and radiographic decay with imminent medical issues as compared to the 10.9% of the aging incarcerated individuals. In terms of ADA accommodation needs (X), results were significantly different ($F (1, 17,811) = 878.74$, $p < .001$, $\eta_p^2 = 0.05$); 74.9% of non-aging incarcerated individuals reported unrestricted activity and ability while 74.3% of aging incarcerated individuals reported minor restrictions on types of work/ activities. Findings showed significant different in terms of transportation (T) ($F (1, 17,811) = 367.15$, $p < .001$, $\eta_p^2 = 0.02$). Almost all non-aging incarcerated individuals (99.7%) reported no special transportation needs while 4.1% of aging incarcerated individuals reported special transportation requirements.

Utilizing F-tests, findings revealed significant differences in health services codes (PULHES-DXT) by custody level. Findings revealed that aging incarcerated individuals under minimum custody were more likely to have a condition or disease that needed health services available (P-code) onsite ($F (9, 17,811) = 200.04$, $p < .001$, $\eta_p^2 = 0.09$). While most aging and non-aging incarcerated individuals under minimum custody reported that the medication delivery requirement (U-code) included keep on person (KOP), significant differences were present in higher custody levels ($F (9, 17,811) = 59.36$, $p < .001$, $\eta_p^2 = 0.03$). While most aging and non-aging incarcerated individuals under minimum custody had no mobility restrictions (L-code), non-aging incarcerated individuals under closed custody had significant restrictions (i.e., unable to move around without assist) ($F (9, 17,811) = 167.35$, $p < .001$, $\eta_p^2 = 0.08$). Similar results were found in developmental disability (H-code), most incarcerated individuals had no intellectual/cognitive impairments, while 20% of non-aging and 19% of aging incarcerated individuals with medium custody had mild intellectual/cognitive impairments ($F (9, 17,811) = 2.42$, $p = .010$, $\eta_p^2 = 0.01$). Significant differences were found in terms of sensory disability (E-code) by age and custody level ($F (9, 17,811) = 34.47$, $p < .001$, $\eta_p^2 = 0.02$); more than a third of aging incarcerated individuals under medium, closed, or max custody reported significant visual and hearing impairment. Significant differences were found in mental health functioning (S-code) by age and custody level S ($F (9, 17,811) = 38.48$, $p < .001$, $\eta_p^2 = 0.02$); about 50% aging incarcerated individuals under medium, closed, or max custody reported mild to significant active symptoms. Significant differences were found with dental service utilization (D) ($F (9, 17,811) = 33.33$, $p < .001$, $\eta_p^2 = 0.02$), ADA accommodation (X) ($F (9, 17,811) = 101.80$, $p < .001$, $\eta_p^2 = 0.05$), and transportation (T) ($F (9, 17,811) = 47.32$, $p < .001$, $\eta_p^2 = 0.02$).

Utilizing F-tests, findings revealed significant differences with the incarcerated population health services codes (PULHES-

DXT) by age and criminogenic risk. Results revealed significant differences in terms of general health service utilization (P) ($F(15, 17{,}811) = 120.01$, $p < .001$, $\eta_p^2 = 0.09$) showing that 41.5% of aging low risk revealed some organic systemic disease or condition or physical defect compared to the 9.5% of non-aging low risk counterpart. Findings showed significant differences in terms of medication delivery requirements (U) ($F(15, 17{,}811) = 18.92$, $p < .001$, $\eta_p^2 = 0.02$) revealing that 52.1% aging low risk revealed limited medical management compared to the 19.4% of non-aging low cohort. In terms of limitations of mobility (L), findings revealed significant difference ($F(15, 17{,}811) = 98.52$, $p < .001$, $\eta_p^2 = 0.08$) showing that non-aging HV-risk (24.4%) and HVPD-risk (21.3%) reported no mobility restrictions while 15.6% of aging low risk reported mild restrictions. Results showed significant differences in terms of developmental disabilities (H) ($F(15, 17{,}811) = 2.36$, $p = .002$, $\eta_p^2 = 0.01$) revealing that 66.4% of aging low risk reported no intellectual/ cognitive impairments as compared to the non-aging HV-risk (25.4%), HVPD-risk (21.7%), or HP-risk (14.9%). In terms of sensory disabilities (E), findings revealed significant difference ($F(15, 17{,}811) = 22.51$, $p < .001$, $\eta_p^2 = 0.02$) showing that most aging low risk (60.5%) revealed no sensory disability as compared to the non-aging HV-risk (24.8%), HVPD-risk (21.4%), or HP-risk (14.3%). Findings revealed significant differences in terms of mental health service utilization (S) ($F(15, 17{,}811) = 8.99$, $p < .001$, $\eta_p^2 = 0.01$) showing that 15.3% of aging low risk reported complete or near remission of a major mental disorder or mild to moderate symptoms of a less severe mental disorder versus 5% of their non-aging low-risk counterpart. Significant differences were also found with dental service utilization (D) ($F(15, 17{,}811) = 72.07$, $p < .001$, $\eta_p^2 = 0.06$), ADA accommodation (X) ($F(15, 17{,}811) = 66.82$, $p < .001$, $\eta_p^2 = 0.05$), and transportation (T) ($F(15, 17{,}811) = 27.41$, $p < .001$, $\eta_p^2 = 0.02$).

Discussion

The aging incarcerated populations add a significant medical and health burden which equates to considerable expenses [4]. Recent research has shown that the aging incarcerated individual costs up to three times more than their younger counterpart [4,6]. These considerable expenses come from medical and health care expenditures such as prescription medications, specialized nursing care, diagnostic tests, and hospitalizations [1,3]. Outside of true medical and health care expenses, other costs are also associated to these costs including travel (e.g., to and from hospitals, emergency rooms), custody/ security (e.g., 1 to 1 supervision, physical support), and medical transportation/out trips [3,4].

Previous research has shown that the aging incarcerated population suffers from disproportionally greater physical and mental health problems than other populations which poses maximum financial and ethical concern [1]. However, research has also shown that this aging population are also less likely to recidivate, which poses a minimal threat to public safety [2]. As these significant expenses continue to be linked to the aging incarcerated population, further understanding the medical and health impact of the aging incarcerated population is essential, especially as they produce less risk to the community. The findings of this study highlight the prevalence of (a) health care encounters, (b) health claims and costs and (c) health services codes by age, criminogenic risk, and custody level.

Limitations

The study is obscured by a few limitations. First, in comparing the aging to the non-aging incarcerated population, several measures were utilized. While findings revealed significant differences between the two age groups, some variance might come from specific variables. For example, the aging incarceration population might be more likely to have prior health concerns preceding their prison serving. Second, this endeavor employed a non-qualitative research design. While the data provided the ability to evaluate the impact of the graying population, a qualitative research design could provide greater detail that might offer more possibilities to garner insights that what can be found in the data sets. Additionally, qualitative research designs can provide the opportunity to understand through the lens of an individual's emotional and behavioral responses through questionnaires and surveys that might be lost in translating the data sets.

Lastly, the medical cost data did not truly capture the exact cost of the aging individuals as travel (e.g., to and from hospitals, emergency rooms), custody/ security (e.g., 1 to 1 supervision) were not collected, most likely underreporting the true expense of the aging population. While the current findings demonstrate important differences between the older and younger prison populations in regard to health care services use and costs, there are other costs to consider. For example, special diets, mobility aid products (e.g., walking canes, braces, and wheelchairs), medical support (e.g., dentures, eyeglasses, prosthetic devices), medical transportation costs, and comorbid disabilities and diseases were not reviewed. Additionally, the costs associated with hospice care and palliative services, as well as housing and other facility requirements support accessibility and appropriate care are also necessary considerations. Employing more outcomes, both through qualitative and quantitative efforts, would aid in further revealing the impact of the aging population and cultivating our understanding of the factors that affect this work.

Implications

Endeavors such as this should continue to examine the factors that have accelerated the growth in the elderly inmate population, investigate innovative approaches for dealing with health and mental health issues of the aging inmates, and help increase Agency knowledge regarding the needs of the aging incarcerated population. Furthermore, finding possible avenues taken by other states in addressing the issues of an aging inmate population can help provide possible solutions to the overwhelming expenses of housing and caring for the elderly inmates. Through this work, a number of factors can be looked at. This includes consideration of policy changes, concern of geriatric and inmate physical and mental health, and consideration of new programs that target on the influences that impact the aging incarcerated population.

The increase of the aging prison population is yielding many more challenges that correctional departments and facilities

expected. Overall, correctional departments and facilities must house aging incarcerated individuals in facilities that were never constructed to shelter older individuals. Now, correctional departments and facilities must identify and find appropriate accommodations to best support their graying population. Particularly, some of the concerns include changing the structure of the facilities to allow for handi-capable systems, programs to support the cognitive and physical decline including providing assistance with daily activities, as well as hospice care and palliative services. Importantly, more research needs to be conducted to better address the necessary steps needed to support integral changes to support the aging incarcerated population. Along with the physical changes in the correctional facilities, there is a need for rehabilitation, educational, and recreational programs and services specifically targeted for the aging incarcerated individuals. Such programs and services can help facilitate the support and care of aging individuals.

Due to the unique health and care needs, there is a need to reconsider the high price of incarcerating individuals who are aging, chronically or terminally ill. This includes but is not limited to special diets, physical assistance (e.g., walking cane, brace, or wheelchair), medical support (e.g., dentures, eyeglasses, prosthetic devices) and comorbid disabilities and diseases. As findings in this study showed, aging incarcerated individuals produce an increased burden on medical claims and costs – doubling the rates of non-aging incarcerated individuals. This burden, as shown in this study, produced increased rates of healthcare utilization, which subsequently leads to increased costs. Furthermore, the increase of comorbid conditions in aging incarcerated individuals compared to non-aging incarcerated individuals also amplifies the health care costs – this consists of more diagnostic tests, more infirmary visits, more assistive devices, more prescription drugs, and subsequently, more long-term health care. Importantly, more research need be conducted to better address inmates' physical needs to provide adequate care.

Lastly, trainings to support the aging incarcerated individuals are important in order to address the care of the aging incarcerated individuals. This includes providing training and programs to educate correctional staff on the unique needs of the aging individuals. Most correctional staff have limited, if at all, any, training designed to support aging incarcerated individuals. Particularly, correctional staff need to be more vigilant of the challenges and risks that impact this unique group. Through specified training, correctional staff will be able to utilize additional measures and resources to protect this elderly group. This training would not only support the need to maintain safety around the correctional facilities, but also decrease potential legal issues for inadequately taking precautionary measures to effectively protect and support aging incarcerated individuals.

Future work should continue to assess the factors that have impacted the aging acceleration in incarcerated populations, investigate innovative approaches for dealing with medical and mental health issues of the aging inmates, and help increase agency knowledge regarding the needs of the aging incarcerated population. Work like this can benefit in providing consideration to policy changes focusing on the geriatric population, attention to the aging population's physical and mental health, and evaluation of new programs that can positively impact the aging incarcerated population.

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