The Cardiovascular Health Burdens of Solitary Confinement

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INTRODUCTION

The American Medical Association recently called for the elimination of solitary confinement for the mentally ill, citing its mental health harms.[1] In solitary confinement, people are held in a prison cell roughly the size of a parking space for ~ 22–23 h per day with 1 or 2 h of exercise, also in isolation.[2] Although the living conditions in these units (e.g., limited exercise, extreme loneliness) are known risk factors for adverse physical health outcomes including cardiovascular disease,[2] the lifetime cardiovascular burden of solitary confinement is unknown.

METHODS

To estimate the lifetime cardiovascular disease burden and costs associated with solitary confinement, we used public data from a 2015 lawsuit[3] describing the prevalence of hypertension diagnoses among two groups of incarcerated men ages 27–45: those housed in one prison's solitary confinement "supermax" units and those in the prison's less-isolating maximum security units (Table 1). Those in solitary confinement received no group recreation or contact visits and few (if any) phone calls; those in maximum security received 2 h of daily group recreation, contact visits, and more calls. Individuals in solitary confinement scored an average of 54.9 on the UCLA Loneliness Scale (scale ranges 20–80, 80 is most lonely); those in maximum security averaged 41.6.[3]

Using the Cardiovascular Disease Policy Model, a computer simulation of cardiovascular disease in US adults,[4] we estimated the lifetime incremental burden of disease, loss of quality-adjusted life years (QALYs), and medical costs associated with new diagnoses of hypertension at age 35. We assumed average systolic blood pressure distributions and control rates among hypertensive 35-year-olds based on the 2011–2014 National Health and Nutrition Examination Survey. Quality-of-life weights were based on observational data from the Global Burden of Disease study. Medical costs were estimated using California's Office of Statewide Health Planning and Development, deflated using cost-to-charge ratios and the ratio of the US national average costs to California's, and then inflated to 2017 dollars using the Consumer Price Index.

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RESULTS

Over a lifetime, 1000 men with newly diagnosed hypertension at age 35 are expected to experience 10 additional myocardial infarctions and 21 additional cardiovascular accidents, representing a loss of 732 QALYs and over $20 million in additional healthcare costs. Because individuals in solitary confinement experienced an absolute 31% higher hypertension prevalence than those in maximum security units (Table 1), nearly one-third may experience this higher burden of cardiovascular disease and cost.

Because we used previously collected data, this analysis assumed the following: (1) hypertension diagnoses persist over a lifetime; and (2) individuals in prison and the community experience the same control and cardiovascular effects of hypertension. These assumptions are reasonable based on the epidemiology of hypertension and likely conservative (we do not, for example, account for the larger effect sizes for hypertension on cardiovascular outcomes for African Americans, a population over-represented in prisons). We focused on hypertension-related cardiovascular disease and did not consider other possible conditions caused or worsened by solitary confinement, suggesting this analysis underestimates solitary confinement's overall impact on health and related costs. While a wealth of research describes the impact of isolation on stress hormone dysfunction and adverse cardiovascular outcomes including hypertension and mortality,[3] use of secondary data limited our ability to assess whether additional factors contributed to the increased hypertension prevalence among those housed in solitary confinement.

Table 1 Calculation of the 31% Difference in Hypertension from the 2015 Hawkley Report. Values from the 2015 Hawkley Report[3]

Age	Individuals in solitary confinement with hypertension	Total individuals in solitary confinement	Individuals living in the general prison population* with hypertension	Total Individuals living in the general prison*
27-35	35	56	36	206
36-45	108	245	24	157
Total (27-45)	**143**	**301**	**60**	**363**

Hypertension rates among individuals in solitary confinement	**Hypertension rates among individuals living in the general prison population**
$\frac{\textit{Hypertensive individuals in solitary confinment}}{\textit{Total individuals in solitary confinement}}$	$\frac{\textit{Hypertensive individuals in general prison population}}{\textit{Total individuals in general prison population}}$
$= \frac{143}{301} = 47.51\%$	$= \frac{60}{363} = 16.53\%$

Difference in solitary confinement and general prison population hypertension rate:
47.51% - 16.53% = 31%

**In the maximum security wing of the same prison*

DISCUSSION

This study projects the lifetime cardiovascular disease and cost burden associated with the increased prevalence of hypertension diagnoses found in persons in solitary confinement compared with maximum security housing in the same prison. In 2017, over 60,000 US individuals were held in solitary confinement for 15 days or longer.[5] Applying our findings to *just* the 25,000 individuals held in "supermax" solitary confinement units[6] would alone result in $155 million in additional future healthcare costs and a loss of 5673 QALYs (Fig. 1)—likely significant underestimates given the widespread use of solitary confinement outside of "supermax" units. These findings, coupled with the growing consensus that solitary confinement is counter-productive as a public safety measure,[5, 6] suggest an urgent need to dramatically

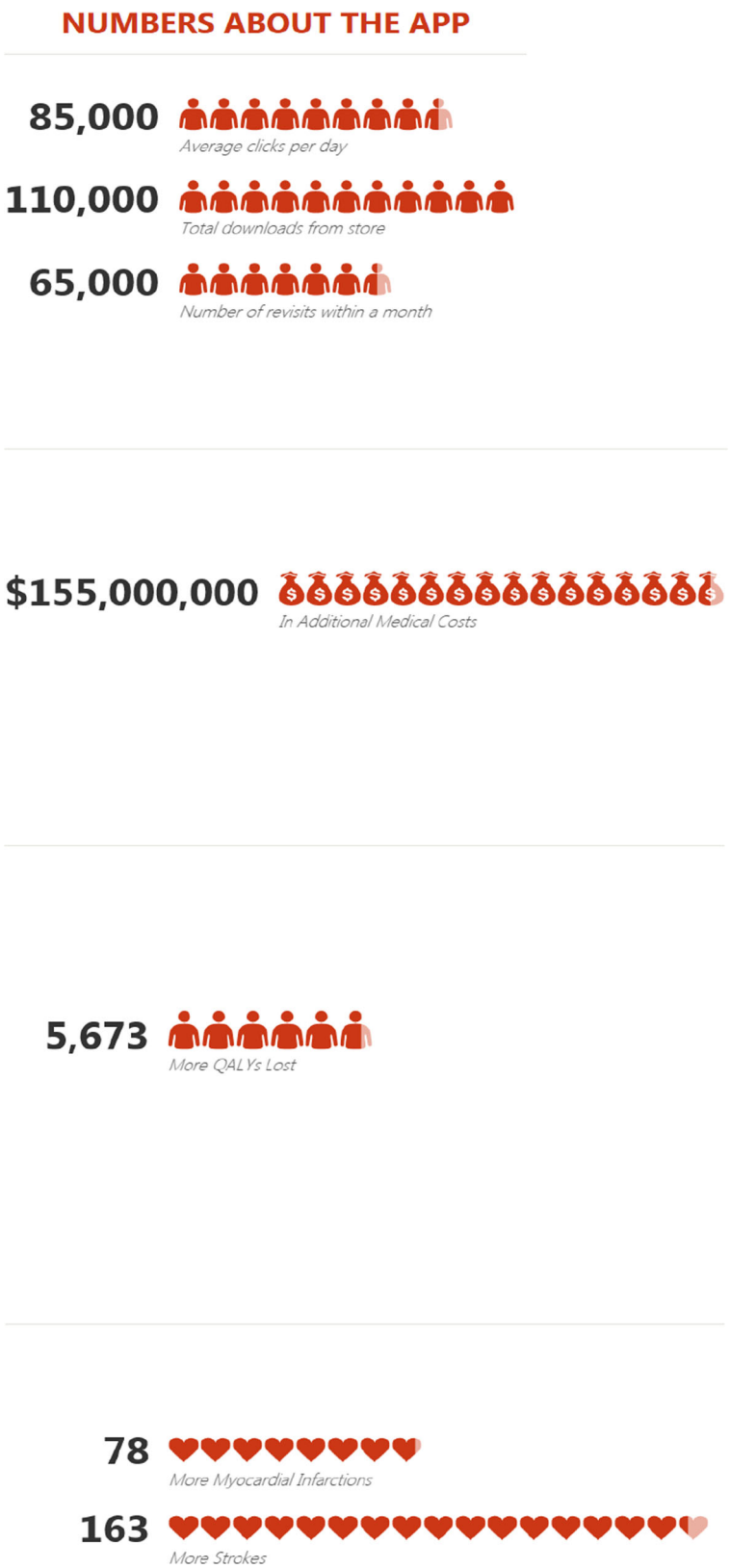

Figure 1 Increased adverse cardiovascular outcomes and high associated costs. For the 25,000 people currently in solitary confinement in US supermax prisons, a 31% increase in prevalence of hypertension will result in the following additional outcomes over the next 45 years (assuming an average life expectancy of 80 years old and the development of premature hypertension at age 35), compared with their counterparts in the maximum security wing of the same prison who experience less social isolation.

reduce solitary confinement using alternative strategies that achieve safety without compromising health. This study also suggests cardiovascular disease organizations could join other associations in calling for solitary confinement reform and for the study of environmental health risks experienced by people in prison, including those in solitary confinement.

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Compliance with Ethical Standards:

Conflict of Interest: *Dr. Williams has served as an expert witness and as a court consultant in legal cases related to prison conditions of confinement. These relationships have included the National American Civil Liberties Union; Squire Patton Boggs; the Center for Constitutional Rights; and others. Dr. Williams was an informal consultant on a different aspect of the case described in this study and did not testify about it in court. No organization played a role in the decision to write this manuscript or in the analysis described in this manuscript. No other authors have conflicts of interest to report.*

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