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We Have the Technology: Why Aren't Better Blood Pressure Data Available from Nursing Home Residents?

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There are over 1 million residents of nursing facilities in the United States, with over 50% of these residents estimated to have hypertension.1 Despite the high prevalence of hypertension, nursing home (NH) residents have been excluded from every major trial of hypertension treatment strategies, leading to considerable uncertainty around appropriate treatment strategies in this population.2 In this issue of the *Journal of American Geriatrics Society*, Liu *et al.* begin to address this paucity of data, leveraging unique data resources available in the Veterans Affairs (VA) system and its Community Living Center (CLC) nursing home facilities. In a cohort of 36,634 VA CLC residents, the authors examine the association of baseline systolic blood pressure at admission (SBP, averaged during the first week of NH admission) with the incidence of cardiovascular disease (CVD) and all-cause mortality, stratified by the number of antihypertensive medications.3 In residents taking no antihypertensive medications, there was no association between SBP and CVD events, while both low (<110 mm Hg) and high SBP (≥150 mm Hg) were associated with increased all-cause mortality risk. Conversely, in residents taking antihypertensive medication, low SBP was associated with both increased risk of incident CVD and mortality relative to those with SBP in the 130 – 149 mm Hg reference group.

The analyses of Liu *et al.* are impressive, highlighting the opportunity within the VA to link data on outpatient care, vital signs and medication use, and follow-up for outcomes among a large number of CLC residents. The extensive heterogeneity inherent to this population is also clearly demonstrated. As is the case among NH residents overall, VA CLC residents include short- and long-stay cohorts, those receiving intensive rehabilitation and those receiving end-of-life care. An acknowledged limitation from the work of Liu *et al.* is that its CLC resident population is 98% male. Moreover, it should be noted that the population of residents admitted to VA CLC facilities differs in many other key categories relative to NH residents overall, even when restricting the comparison to only male residents. In

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comparison with male NH post-acute residents, CLC post-acute residents have a higher proportion of Black residents (19.9% vs 12.2%), more residents with cancer (20.0% vs 12.8%) and greater hospice care utilization (16.4% vs 1.0%). The prevalence of chronic diseases also varies widely in male VA CLC residents, with >20% of residents diagnosed with dementia, 14% diagnosed with chronic pain, 30% with a diagnosis of depression, 15% with heart failure, and 13% with end stage kidney disease.4,5 These differences, in addition to gender, may further limit the generalizability of this study's results to the overall population of post-acute NH residents.

Another critical consideration is the nature of BP measurement in NH settings. The lack of concordance between real-world settings and BP measurement following guideline protocols is well-documented.6,7 The differences in BP measurement make it impossible to compare blood pressure readings from real-world settings versus treatment targets and attained blood pressure levels from randomized trials. The magnitude of this discrepancy may be even greater in the NH setting. Standardized protocols for BP measurement do not exist for NH settings. The data reporting required by Centers for Medicare and Medicaid Services (CMS) in the Minimum Data Set at NH admission and every three months thereafter does not include vital signs or BP measurement information.8

While the results of Liu *et al.* clearly exhibit the heterogeneous associations of SBP with the incidence of CVD and mortality in NH residents, the results do not address the causal question of what would happen if antihypertensive medications were adjusted in this population upon admission. Addressing this question would require a target trial emulation approach, in which analyses would focus on residents in which antihypertensive medications changed upon admission, inclusive of either intensification or de-prescribing.9 While the sample size in the study of Liu *et al.* is large, it is likely insufficient for pursuing this type of causal framework. In addition, the study focused on BP and prescribed medications from just the first week of NH admission. No specific analyses of BP trajectories over time were included, nor were medication changes examined beyond the first month of admission. Moreover, a cohort of NH residents on no antihypertensive medications with low SBP are extremely different relative to a cohort on three or more antihypertensive medications with low SBP. These factors significantly limit the impact of the study of Liu *et al*, making it challenging, if not impossible, to disentangle whether the observed heterogeneity reflects an opportunity for intervention, versus a myriad of epidemiologic influences and biases (prevalent user bias,10 terminal decline in blood pressure,11 etc.).

Does the work of Liu *et al.* demonstrate sufficient need and equipoise to justify a randomized trial that tested optimizing BP control in the NH setting? The lack of data in this population certainly suggests a need for clarity, however, this is counterbalanced by several considerations. First, the expected time horizon for effects of antihypertensive medication on CVD and mortality is generally on the order of years. Follow-up in this cohort of VA CLC residents was not lengthy, with a median follow-up of 0.51 years for cardiovascular events and 1.30 years for mortality. In community dwelling adults ≥65 years, meta-analyses have estimated a time to benefit of 1.7 years to prevent 1 stroke in 200 patients with more intensive BP control.12 Second, related to the heterogeneity of VA CLC residents, many antihypertensive medications have indications beyond BP control, for

example for the treatment of heart failure, rate control in atrial fibrillation, and reducing the risk of progression in patients with chronic kidney disease. For example, these comorbidities may explain why 62% of the CLC cohort was receiving a beta-blocker. Third, cost-effective simulations informed by the Optimising Treatment for Mild Systolic Hypertension in the Elderly trial in community-dwelling adults ≥80 years suggest that de-prescribing would lead to increased CVD events.13 The more compressed life expectancy of NH residents may alter this observation, however it still suggests that optimizing BP control may at best be unlikely to produce benefit, or worse lead to increases in CVD events. Of course, there are other important considerations beyond the prevention of CVD in the NH population, such as the incidence of falls, effects on physical and cognitive function, as well as quality of life. Taken together, while the study of Liu *et al.* clearly demonstrates heterogeneity, and raises valid questions about the care of NH residents, it is only a small first step in understanding whether blood pressure management interventions should be tested in NH residents.

Further data will be required to evaluate the potential utility of optimizing antihypertensive therapy incorporating a holistic assessment of potential benefits and risks. While the CMS MDS report contains a number of relevant functional metrics, it notably lacks objective measures related to chronic diseases such as hypertension. A recommended first step to obtaining these data is to request CMS to add BP information to the MDS data required in the quarterly updates, including stipulating a standardized BP measurement approach. The updated 2019 American Heart Association's Scientific Statement on blood pressure measurement favors using validated oscillometric devices over auscultatory measurements.[14] NH staff would require training in appropriate BP measurement protocols using automated office BP devices (AOBP, preparing the resident, proper cuff size, etc.), but the training requirements are less complex than for auscultatory methods. In addition, the human errors incumbent with auscultatory readings are avoided, and multiple BP measurements can be readily obtained and averaged. Another AOBP advantage is that postural BP readings can be more easily obtained. A corollary recommendation is for CMS to require documentation of postural BP readings on NH admission, with the quarterly MDS data updates, and whenever a resident fall is reported. After all, we do have the technology.

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