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EDITORIAL COMMENT

One Thing Leads to Another

Embracing Complexity in Geriatric Cardiology*

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Borrowing from a 1983 popular song by the English band the Fixx, one thing can lead to another.[1] Although teenage romance is not the current focus, the similarities with geriatric cardiology is the necessity to embrace and navigate complexity. The teenage years are often linked to social complexities. During the Elderhood[2] years, part of the difficulty is the complexity connected with multiple chronic medical conditions. The interactions between the passage of time and medical illnesses often result in a loss of skeletal muscle strength, mass, or function, and/or cognitive decline that can range from minimally disruptive to sometimes devastating consequences. In fact, these 2 disorders create sufficiently high complexity in the lives of older adults and are closely associated with conditions such as falls, loss of automobile driving privileges, diminished hearing, urinary and fecal incontinence, depression, delirium, elder abuse, polypharmacy, and a higher probability of residing at a skilled nursing home or other models of care aside from one's own home.

Focusing only on the iceberg tip will certainly miss the wealth of data beneath the surface. Addressing social difficulties in the teenage years as a behavior problem can miss important details. Similarly, the focus on the dominant cardiovascular morbidity will miss the myriad of other geriatric conditions in older adults that are pertinent toward cardiovascular care (**Figure 1**). A mindset of embracing the complexity, by increasing awareness and comfort of geriatric conditions/syndromes, will bear fruit in multiple ways. At the bedside, this is the comprehensive geriatric examination.

With this background, in this issue of *JACC: Advances*, Damluji et al[3] report on a study evaluating the relationship between physical function, cognitive function, and the development of major adverse cardiovascular events (MACEs). Their source population was from the National Health and Aging Trends Study (NHATS)[4] data set, which began in 2011. The focus of NHATS was to foster research to decrease disability, maximize health, and maintain independent functioning.[2] NHATS investigators conduct yearly interviews of a nationally representative sample of Medicare beneficiaries ≥65 years enriched with African Americans to gather a plethora of geriatric and disease-specific conditions at baseline and follow-up.

The current study population (n = 2,189) were those who did not have any coronary artery disease prior to their baseline visit in 2011. The exposure variable was a 4-level category based on the presence or absence of cognitive impairment (CI) (AD8 score ≥2), impairment in at least 1 cognitive domain (executive function, memory), self-reported diagnosis of minor neurocognitive impairment or major neurocognitive impairment (dementia), and physical frailty (Fried score) during the 2 years of follow-up. It was divided as Intact (no frailty or CI reference); Frail-first (physical frailty, no CI); CI-first (CI, no physical frailty); Frail-CI (both). The primary composite (all-cause mortality, acute myocardial infarction, any coronary heart disease, stroke, or peripheral vascular disease) MACE outcome was the time to first event.

For the cardiovascular team, some of the utilized gerocentric variables may not be recognized. The average age was highest in those with both physical

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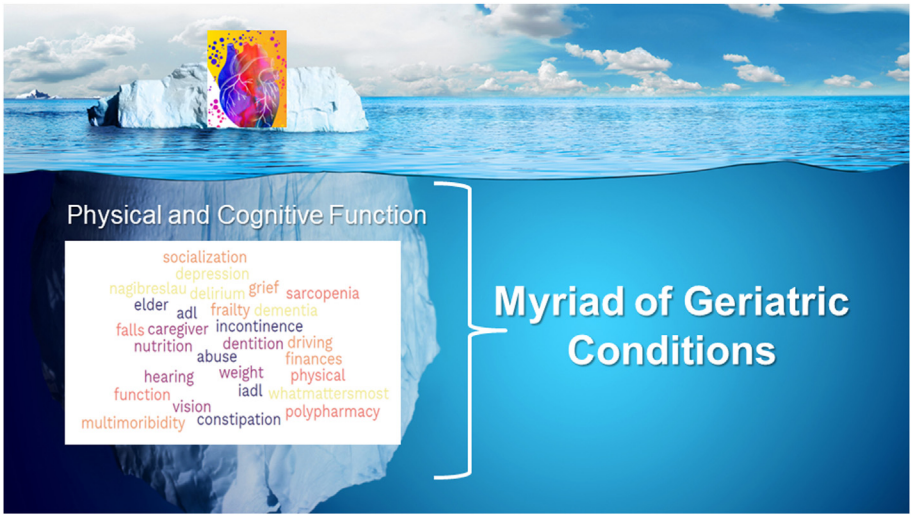
FIGURE 1 **Looking Under the Iceberg Beyond the Dominant Cardiac Morbidity**



and cognitive dysfunction and lowest in those with no impairments (83.9 years vs 74.6 years). Interestingly, there was a female:male (60:40) preponderance in the study cohort. Self-reported, noncardiac diseases were displayed and those with both frailty-CI had often the highest prevalence in the individual disease states and in the cumulative number of diseases. The investigators did not have a cumulative burden index, such as the Elixhauser or Charlson scores, which could have improved the characterization of global multimorbidity. Understandably, those with both CI and frailty had the greatest number of Katz activities of daily living (ADL) or Lawton instrumental ADL (IADL) disabilities along with the highest health care utilizations as per hospital length of stay.

A standardized geriatric evaluation across cardiovascular diseases is needed. Although the ascertainment of physical and cognitive function at the time of surgery or transcatheter approaches to valvular diseases have caught the cardiovascular teams' eye, knowledge and understanding of independence in Katz ADLs (bathing, toileting, walking/transferring, eating, dressing), Lawton IADLs (telephone use, driving, chores [preparing meals, light housework, shopping], managing money, managing medications) and cognition (age related, minor CI, or dementia) is essential in routine cardiovascular care. There are well-validated tools to assess physical functional changes such as Fried Frailty Score, and screen for cognitive dysfunction by Alzheimer's dementia screening (AD8), and Mini-Cog. More formal evaluation using Montreal Cognitive Assessment, Mini Mental Status Examination, or Saint Louis University Mental Status will need additional expertise. However, the cardiovascular team should have a cursory comfort of these tools.

The authors describe the temporal occurrences of physical and CIs and the association with MACE. Among a total of 2,189 older adults, they found that 7% developed Frail-first, 38% developed CI-first, 9% developed both Frail-CI with 46% classified as Intact. The risk-adjusted Frail-CI group showed the highest hazard ratio (HR) of MACE (1.81, 95% CI: 1.47-2.23), followed by the Frail-first (1.46, 95% CI: 1.17-1.81) and CI-first (1.31, 95% CI: 1.15-1.50). A competing risks analysis found the risk-adjusted subhazard ratio for MACE in the Frail-CI group significantly reduced at 0.57 (95% CI: 0.40-0.80) possibly related to the high risk of death, confounding or undetected effect modification.

Although the exposure category suggests a temporal trend of one occurring before the other, the potential mechanisms are not clear and could be associations (with shared risk factors), causal (through different pathways), or epiphenomenon (treatment of hypertension such as with beta-blockers causing frailty or CI). Historically, major cardiovascular randomized controlled trials have excluded older adults with multiple geriatric conditions, such as polypharmacy, frailty, or CIs, making the understanding of the interplay on cardiovascular outcomes even harder. In that context, the current article holds the critical value of attempting to untangle the complex

interplay of 2 dominant geriatric conditions on MACE among older adults with incident cardiovascular diseases.

The investigators should be commended on their desire to look beyond the surface. They attempted to untangle the complex relationships between geriatric conditions and cardiovascular diseases to identify which one thing, among the 3 (frailty, CI, or MACE), leads to another. In geriatric cardiology, the associations between a geriatric condition and cardiovascular diseases outcomes or between 2 geriatric conditions are fairly well studied.[5] Previous work from this group showed that frailty, without prior coronary artery disease, was associated with a higher relative risk of MACE and all-cause mortality (HR: 1.77, 95% CI: 1.53-2.06).[6] Other studies have shown that frailty is a risk factor of accelerated development of other geriatric adverse outcomes such as dementia, loss of independence, ADL disability, IADL disability, and mobility disability.

Additionally, the authors point out the important clinical implications of cardiovascular clinicians routinely incorporating geriatric condition assessments, such as frailty or CI, before planning a cardiovascular care strategy. Frailty assessments using Fried's frailty phenotype and CI using established diagnosis or AD8 score were the tools available in the data set. However, in real practice, cardiovascular clinicians may not have sufficient training and resources to assess geriatric conditions using such tools. For example, to use the Fried's frailty phenotype, grip strength and walking speed need to be assessed. However, most cardiovascular clinics may not have the dynamometer to assess the grip strength or ruler and stop-watch to check the walking speed. Furthermore, their fast-paced clinics may not have embedded workflows to assess frailty or CI. In such cases, cardiovascular clinics may choose to use other tools to assess frailty using Clinical Frailty Scale or FRAIL scale questionnaire, which do not require additional equipment.

To establish a diagnosis of dementia, the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) requires 3 items. A cognitive domain deficit. That the deficit be associated with diminished IADL (functional loss) and that the decline is new and not associated with delirium or other medical/psychiatric conditions. Well-validated tools to screen for dementia, such as Montreal Cognitive Assessment or Saint Louis University Mental Status require not only extra time to perform but also training. A Mini-Cog is a quick screening option. Of course, older adults with cardiovascular diseases may have other geriatric conditions including falls, social isolation, or malnutrition that deserves attention from the cardiovascular clinicians. Therefore, practical and feasible tools that can assess geriatric conditions in a comprehensive fashion but also fit the cardiovascular clinic's resources should be selected to provide optimal geriatric cardiology care.[6]

In conclusion, one thing can lead to another but the whammy of 2 things (frailty and CI) is often fraught with badness. The cardiovascular team should recognize the role of physical frailty, CI, and its associations with MACE. The assessment and care of older adults with cardiovascular diseases and geriatric conditions is difficult. It will require a multidisciplinary team approach. This is one frontier among the challenges facing geriatric cardiology.

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