Out-of-hospital cardiac arrest (OHCA) is a time sensitive and highly mortal condition with substantial variation in survival rates globally. Optimizing OHCA outcomes requires complex coordination of multiple care systems and treatment modalities. Many aspects in the cascade of cardiac arrest care, from prevention to hospital-based postarrest care, are attributed to these variations in outcomes. Patient race, ethnicity, and socioeconomic position (SEP) are also all associated with unacceptable disparities in OHCA outcomes. Attempting to disentangle the interconnectedness of cardiac arrest care modalities with SEP is undeniably complex, but Choi et al present a unique, eloquent, and meaningful approach to isolating factors that might be associated with SEP-related disparities in OHCA outcomes.

Choi et al performed a retrospective study of the Korean nationwide OHCA registry, which is linked to a national health insurance database. The authors defined SEP on the basis of insurance premiums, a surrogate for patient income that is frequently used in other studies that examine SEP and OHCA. The authors evaluated the association between SEP and the care and outcomes of patients who experienced OHCA using logistic regression models. One approach infrequently used in prior studies is the use of mediation analysis and structural equation modeling to investigate possible mediating factors between SEP and OHCA outcome disparities.

Consistent with prior research, patients from the lowest SEP group (medical aid) had poorer OHCA outcomes. Less than one-half of patients with OHCA in the medical aid group survived with good neurological recovery in comparison with the highest SEP group (first quartile). Interestingly though, outcome rates were similar between the 4 higher SEP groups (first through fourth quartiles). These findings somewhat differ from other studies of SEP where there is a more consistent linear association between SEP and survival outcomes. Witnessed arrest, bystander cardiopulmonary resuscitation (CPR), initial shockable rhythm, sustained return of spontaneous circulation, emergency department (ED) level of care, coronary angiography, and targeted temperature management (TTM) were all identified as mediators between lower SEP and poorer OHCA outcomes. In their attempt to quantify mediation proportion, they found that witness status (11.8%), initial rhythm (56.2%), coronary angiography (20.2%), TTM (4.2%), and ED level of care (10.7%) to have the largest independent mediation proportions among patients who survived to hospital admission.

These findings shed important light on modifiable factors amenable to public health interventions to mitigate disparities in OHCA outcomes. As an example, the authors state that witness status may be a product of the lower rate of cardiac arrests in public locations for the lowest SEP group. Public safety net programs are proposed as an intervention to decrease the rates of unwitnessed cardiac arrest, but what cost would be necessary to ensure the presence of an individual at the time of someone’s cardiac arrest? An alternative approach might be wearable devices to monitor for cardiac arrests. Such devices could provide inexpensive monitoring for high-risk patients, alerting emergency medical services to cardiac arrests rapidly. Although witness status is not typically thought of as a modifiable aspect of OHCA care, the authors provoke thought about an often overlooked aspect of OHCA treatment.

Bystander CPR has been a major focus of research on disparities in OHCA outcomes, despite research failing to identify a mediating effect between minoritized race or ethnicity or SEP and poorer outcomes. Choi et al found that bystander CPR had a rather modest mediation proportion...
It is possible that the modest mediation proportion of bystander CPR was due to relatively similar rates of bystander CPR between high (61.7%) and low (56.8%) SEP groups in the study. Alternatively, this finding could indicate that other aspects of cardiac arrest care are more important than bystander CPR for mitigating disparities in OHCA outcomes.

The largest identified mediator found by Choi et al\(^3\) was initial shockable rhythm, which might not seem like a modifiable factor at first glance. However, several factors have been associated with initial shockable rhythm, many of which may be modifiable. Witnessed cardiac arrests by bystanders and experiencing OHCA in public locations more commonly have an initial shockable rhythm as well.\(^6\) Importantly, increased no-flow time is associated with lower rates of initial shockable rhythm.\(^7\)

Although response time was similar between groups, time to recognition of cardiac arrest might have played a role in the lower rate of shockable rhythm in the lowest SEP group.

A closer look at the results of the mediation analysis by Choi et al\(^3\) suggests that the disparate outcomes in the lowest SEP group, a different insurance classification from the other SEP strata, were in part due to differences in medical treatment after return of spontaneous circulation. In Korea, all patients with OHCA are transported to the nearest ED. However, patients in the medical aid group were less likely to be transported to an ED designated as level 1 or 2 (ie, high volume EDs with emergency physicians staffed at all times). Whether the differences in ED level of care are due to geographic proximity or unequal distribution of level 1 and 2 centers is not clear and merits further study. Insurance status was also associated with differences in TTM and coronary angiography, similar to our findings in Texas.\(^5\) Because the Korean emergency medical system is tax-financed and free of charge for all patients, post–cardiac arrest care might be more susceptible to disparities related to insurance status with insurance providers having more time to evaluate compensation potential.

There are certainly limitations to the approach and findings of Choi et al\(^3\). External generalizability is limited due to lower survival rates in comparison to other countries. Additionally, although insurance status is a reasonable surrogate for income, using this definition limits generalizability of results to other countries with different health insurance structures. The authors\(^3\) suggest that decreased copayment for the lower SEP groups may have an inverse impact on the rates of TTM and percutaneous coronary intervention. Yet inequities by SEP persist. Whether these differences are due to decision-making by family members due to concerns about copayments, clinician-level decision-making, or implicit biases is unclear and merits further study. The findings of Choi et al\(^3\) may be different than the findings in countries with private insurance.

With years of research focused on identifying disparities in OHCA care and outcomes, it is no longer acceptable to simply measure and report inequities. We must shift focus toward evolving our understanding factors that have a mediating effect on these outcome disparities. Although any approach outside of a randomized clinical trial will be subject to substantial bias, Choi et al\(^3\) present a complex yet approachable method for taking the next step in identifying ways to address this unacceptable, global problem. Their work provides a blueprint that can be applied in other countries and populations to advance our understanding of the underlying causes of disparities in OHCA outcomes. Their findings are thought-provoking in novel ways, raising many questions. Is it possible to make every cardiac arrest witnessed? Could we save more lives among low-SEP patients through more consistent use of coronary angiography and TTM? What are the structural barriers influencing inequities in destination hospital and hospital-level care? Further research like the Choi et al\(^3\) study will enable efforts by researchers, public health authorities, and clinicians to close unacceptable gaps in cardiac arrest care and save precious lives.
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