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ABSTRACT

The Modification of Social Space as a Tool for Lowering Social Stress*

The social stress experienced by an individual from having a low relative income or from having a low income-based rank is a derivative of the individual's location in social space, and is the outcome of unfavorable comparisons with other individuals in that space. (The term social space stands for the set of individuals with whose incomes or with whose income-based ranks the individual compares his income or his income-based rank.) The stress that arises from unfavorable social comparisons can cause physical and mental harm. Essentially, there are three ways to thwart unfavorable income-related comparisons experienced by an individual: to operate on the individual's income or on a characteristic (an attribute) of the individual's income; to operate on the incomes or on a characteristic of the incomes of the individual's comparators; or to modify the individual's social space. The first two approaches feature extensively in the existing literature. The third does not. In this communication, I analyze this third approach, keeping in mind its application as a policy tool for lowering social stress.

JEL Classification: D01, D63, D91, I10, I14, I31, Z18

Keywords: social space, unfavorable income-related comparisons, low relative income, low income-based rank, social stress, adverse health outcomes, forming a health-related policy

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1. Introduction

There are compelling reasons for enacting public health policies aimed at reducing social stress. The raison d'être is that social stress (social pain) is a mental stress. And the path from mental stress to physical diseases can be short: stress can activate bodily mechanisms such as over-activity of the immune system and inflammation, both of which are harmful to health. Medical science tells us in no uncertain terms that stress arising from adverse social conditions can cause physical and mental harm. For references, consult Stark (2023).[1] Medical science differentiates between two types of stress factors: internal, where stress is caused by illness and medical treatment, and external, which arises from adverse social conditions. In this communication, I refer to social stress that is income related, and is caused by the distress that arises from having a low relative income (that is, an income that is lower than the incomes of other individuals with whose incomes the individual compares his income) or from having low income-based rank (that is, an income-based rank that is lower than the income-based ranks of other individuals with whose income-based ranks the individual compares his income-based rank).

Policy makers aiming to improve public health by keeping a contaminant in check often harbor little doubt about the correct policy prescriptions. For example, in the recent past, several studies addressing the infection and fatality rates of COVID-19 noted a link between income inequality, social stress, and measures of infection and mortality, and recommended reducing income inequality by lowering the Gini coefficient. For references, consult, once again, Stark (2023). The latter challenges this apparently seamless line of reasoning. I argue that what harms public health (and social welfare) is not necessarily a high Gini coefficient but a high level of a *component* of the Gini coefficient, showing that lowering the Gini coefficient can actually *raise* the level of that component. Social stress will then rise. As a public health policy, the lowering of the Gini coefficient turns out to be a failed policy.

The large body of work that attributes adverse health outcomes to income-related stress shares a common recommendation: operate on the incomes. Taking the comparators of

[1] Existing studies go as far as to claim that unfavorable comparisons with others can cause physical pain. Lieberman and Eisenberger (2009, p. 891) write that "pain [is] caused by negative social comparisons," and Eisenberger (2012) reports that an adverse social experience activates neural regions in the brain that are typically associated with physical pain. In turn, pain has been identified as a cause of a host of adverse physical and psychological conditions. Fine (2011, p. 996) writes that pain "negatively impacts multiple aspects of health."

individuals as given, the prescribed income-related methods of "social engineering" are to increase low incomes and decrease high incomes. As a result, income disparities will be reduced.[2] Here, I propose a different tool aimed at lowering social stress: operate on the landscape of incomes, not on the incomes themselves. My idea is as follows. The social stress experienced by an individual from having low relative income or from having a low income-based rank is the outcome of unfavorable comparisons with other individuals in the individual's social space. In my context, the social space of an individual is the set of individuals with whose incomes or with whose income-based ranks the individual compares his income or his income-based rank. Essentially, there are three ways to thwart unfavorable income-related comparisons experienced by an individual: to operate on the individual's income or on a characteristic of the individual's income; to operate on the incomes or on a characteristic of the incomes of the individual's comparators; or to operate on the individual's comparison space, namely to modify the set of the individuals with whom the individual compares his income or his income-based rank. In this communication, I attend to this third approach.

Section 2 illustrates the proposed idea with an example, Section 3 presents generalizations, and Section 4 discusses measures of robustness. Section 5 concludes with several complementary reflections.

2. An example

Suppose that four individuals whose incomes are pair-wise different are located either in two separate facilities - two in each facility - or, alternatively, all four in the same facility. By "facility" I have in mind the physical space that is home to the individuals' comparison group, that is, the environment that is home to the set of the individuals with whose incomes or with whose income-based ranks the individual compares his income or his income-based rank. A helpful way of conceiving this is to think of, for example, a classroom and classmates or a workplace and co-workers. The pioneering 1949 two-volume study by Stouffer et al. *Studies*

[2] A stark example of this prescription is provided by recent research related to COVID-19. This body of work attests to a keen interest in documenting variations in the incidence (the infection and fatality rates) of COVID-19, in identifying causes of the variations, and in forming policy responses. Several recent studies report an association / correlation between income inequality as measured by the Gini coefficient and measures of infection and mortality of COVID-19. A common theme in these studies is an explicit or implicit policy recommendation: lower income inequality - reduce the Gini coefficient. A sample of these studies includes Elgar et al. (2020), Oronce et al. (2020), Liao and De Maio (2021), and Tan et al. (2021). For example, Tan et al. (2021) write: "Targeted interventions should … focus on income inequality measured by the Gini coefficient to … flatten the [COVID-19 pandemic] curve."

in Social Psychology in World War II: The American Soldier documented the lower dissatisfaction of Black soldiers stationed in the South, who compared themselves with Black civilians in the South rather than the dissatisfaction of their counterparts stationed in the North, who compared themselves with Black civilians in the North. Here, the South and the North are the "facilities," and the Black civilians constitute the set of comparators. Suppose, too, that an individual compares his income or his income-based rank with the income or with the income-based rank of another individual or other individuals in his facility, but not with individuals who occupy another facility. I consider two modes of comparison: an ordinal comparison of income-based rank, and a cardinal comparison of income-based relative deprivation. (The terms "rank" and "relative deprivation" are defined below.) An unfavorable comparison causes income-based social-psychological stress. I show why, according to each of the two modes of comparison, the aggregate level of stress when the four individuals are in the same facility is higher than the sum of the levels of stress of the individuals when two individuals are in one facility, and two individuals are in another facility.

Let the income of individual i, $i = 1,2,3,4$, be x_i, where $0 < x_1 < x_2 < x_3 < x_4$.

(i) A comparison of income-based rank. I label by A and B two facilities, each of which is occupied by two individuals. When the individuals occupy the same facility, I label that facility C. The three possible allocations when two individuals are in facility A and two individuals are in facility B are as follows (there is no need to list the possibilities that arise when A and B are interchanged because this change is merely a change of labels, and because, in all relevant respects, the two facilities are identical).

Individuals 2 and 1 are in facility A, individuals 4 and 3 are in facility B.

Individuals 3 and 1 are in facility A, individuals 4 and 2 are in facility B.

Individuals 4 and 1 are in facility A, individuals 3 and 2 are in facility B.

In each of these three allocations, the sum of the rank deprivations is 2: the individual at the top has no rank deprivation, and the individual who comes second has a rank deprivation of 1. Rank deprivation is measured by the number of rungs between a particular individual and the individual who is positioned at the top of the hierarchy of rungs. Alternatively, and intuitively, the rank deprivation of an individual is the number of individuals in the individual's facility whose incomes are higher than his. For example, when the incomes of four individuals in a facility are $0 < x_1 < x_2 < x_3 < x_4$, then the individual who occupies the top rung has no income-based rank deprivation, the individual who occupies the second rung has an income-based rank deprivation of 1, the individual who occupies the third rung has an income-based rank deprivation of 2, and the individual who occupies the fourth rung has an income-based rank deprivation of 3.

When the four individuals are in the same facility C, then their ranks are 1, 2, 3, and 4; drawing on the exposition in the final sentence of the preceding paragraph, the sum of the rank deprivations of the individuals who are income-rank deprived is 6. Because $6 > 2$, then there is deterioration of the aggregate measure of income-based rank; when the individuals are in facility C as opposed to when they are in facilities A and B, the rank-based aggregate stress is higher.

(ii) A comparison of income-based relative deprivation. Let $x_i = i$, $i = 1,2,3,4$. The relative deprivation of an individual is defined as the aggregate of the income excesses in the individual's facility (comparison group) divided by the number of individuals in the facility (the size of the comparison group).[3] Formally, in facility $F = \{1,2,\ldots,f\}$, $f \geq 2$, where $x = (x_1,...,x_n)$ is the vector of the incomes of the *n* individuals who populate the facility, and where the incomes are ordered, $0 < x_1 < x_2 < \ldots < x_n$, the relative deprivation of individual *i*, $i = 1,2,...,n-1$, whose income is x_i, denoted by RD_i, is defined as $RD_i \equiv \frac{1}{n}\sum_{j=i+1}^{n}(x_j - x_i)$, and where it is understood that $RD_n \equiv 0$. I denote the sum of the levels of RD_i in a facility by *TRD* (*T* for total, *R* for relative, *D* for deprivation), that is, $TRD \equiv \frac{1}{n}\sum_{i=1}^{n-1}\sum_{j=i+1}^{n}(x_j - x_i)$. To simplify, and for the sake of added clarity, when I calculate the *TRD* of individuals whose incomes are *k* and *l*, I write $TRD(k,l)$, when I calculate the *TRD* of individuals whose incomes are *k*, *l*, and *m*, I write $TRD(k,l,m)$, and so on.

[3] By definition and construction, the concept of relative deprivation is the dual of the concept of reference group or comparison group. There is a substantial body of literature on this topic, spanning from Stouffer et al. (1949) through Akerlof (1997) and all the way to recent writings, for example, of Stark et al. (2017), Stark (2020), and Stark (2023). These works include discussions about the identity of the reference group, and they provide references to related works.

The three possible allocations when two individuals are in facility A and two individuals are in facility B are as follows (as already noted in case (i), there is no need to list the possibilities that arise when A and B are interchanged).

Individuals 4 and 3 are in facility A, individuals 2 and 1 are in facility B.

Individuals 4 and 2 are in facility A, individuals 3 and 1 are in facility B.

Individuals 4 and 1 are in facility A; individuals 3 and 2 are in facility B.

The corresponding sums of the levels of relative deprivation are:

$$TRD(4,3)+TRD(2,1)=\frac{1}{2}\cdot 1+\frac{1}{2}\cdot 1=1.$$

$$TRD(4,2)+TRD(3,1)=\frac{1}{2}\cdot 2+\frac{1}{2}\cdot 2=2.$$

$$TRD(4,1)+TRD(3,2)=\frac{1}{2}\cdot 3+\frac{1}{2}\cdot 1=2.$$

When the four individuals are in the same facility C, then the sum of the levels of their relative deprivation is $TRD(3,2,1)=\frac{1}{4}\cdot 1+\frac{1}{4}\cdot(1+2)+\frac{1}{4}\cdot(1+2+3)=2\frac{1}{2}.$ Because $2\frac{1}{2}>2,$ then there is an overall deterioration of the income-based relative deprivation; when the individuals are in facility C as opposed to when they are in facilities A and B, the aggregate stress caused by their income-based relative deprivation is higher.

3. **Generalizations**

(i') Let there be n individuals whose incomes are $0<x_1<x_2<...<x_n$. For the sake of simplicity, let n be an even number. (An analogous procedure to the one presented below can be conducted for an odd n, yielding qualitatively the same outcome.) When the individuals are distributed evenly between facilities A and B, then the sum of the levels of the rank-based deprivation of the individuals who are income-rank deprived is $2(1+...+\frac{n}{2}-1)=\frac{n^2}{4}-\frac{n}{2}.$

It is easy to show that if the n individuals were to be distributed between the two facilities in an uneven way, then the sum of the levels of their rank-based deprivation would be higher than $\frac{n^2}{4}-\frac{n}{2}$, so their aggregate rank-based stress would be higher. A proof of that is in the Appendix.

When the n individuals are in the same facility C, then the sum of the levels of the rank-based deprivation of the individuals who are income-rank deprived is $(1+...+n-1)=\frac{n^2}{2}-\frac{n}{2}$. Because $\frac{n^2}{2}-\frac{n}{2}>\frac{n^2}{4}-\frac{n}{2}$, I conclude that there is an overall deterioration of the aggregate measure of the income-based rank; the rank-based aggregate stress is higher.

Any distribution of the n individuals between facilities A and B other than an even distribution yields an aggregate rank-based stress that is higher than the aggregate rank-based stress of an even distribution, although not as high as the aggregate rank-based stress when the n individuals are in the same facility C.

(ii') When deprivation is measured cardinally, I consider a generalization of the $x_i = i$, $i=1,2,3,4$ example, in that I assume that the distinct pair-wise different incomes of the four individuals are such that, without loss of generality, the smallest income is 1, and that it is of an individual who is in facility A. Thus, the incomes in facility A are

$$1,\ 1+\alpha,$$

and the incomes in facility B are

$$1+\beta,\ 1+\beta+\delta,$$

where $\alpha,\beta,\delta>0$ are arbitrary. Clearly, the sums of the levels of relative deprivation in facilities A and B, TRD_A and TRD_B, respectively, are

$$TRD_A=\frac{\alpha}{2}, \text{ and } TRD_B=\frac{\delta}{2}.$$

As a supportive "lemma," in order to evaluate the sum of the levels of relative deprivation of four individuals with incomes

$$1,\ 1+a,\ 1+a+b,\ 1+a+b+c,$$

where $a,b,c>0$ are arbitrary, I note, referring to the four individuals as (1), (2), (3), and (4), that

$$RD(1)=\frac{1}{4}[a+(a+b)+(a+b+c)],\ RD(2)=\frac{1}{4}[b+(b+c)], RD(3)=\frac{c}{4}, RD(4)=0.$$

Therefore,

$$TRD(1,2,3,4)=RD(1)+RD(2)+RD(3)+0=\frac{1}{4}(3a+4b+3c)\,. \tag{1}$$

I now consider the sum of the levels of relative deprivation when the four individuals are in facility C. I denote this sum by TRD_C. Depending on the relative magnitudes of α,β,δ, there are three cases to consider: $\alpha<\beta$; $\beta<\alpha<\beta+\delta$; and $\alpha>\beta+\delta$. I attend here to the second case; the proof of the other two cases is analogous.

When $\beta<\alpha<\beta+\delta$, then $\alpha=\beta+\varepsilon$ for some $\varepsilon>0$. Consequently, I arrange the incomes as

$$1, 1+\beta,\ 1+\beta+\varepsilon,\ 1+\beta+\varepsilon+(\delta-\varepsilon),$$

and I note that because $\beta+\delta>\alpha$, then $\delta-\varepsilon>0$. The displayed arrangement of the four incomes enables me to use (1), which results in

$$TRD_C=\frac{1}{4}[3\beta+4\varepsilon+3(\delta-\varepsilon)]>\frac{1}{4}(3\beta+2\varepsilon+2\delta)>\frac{\beta+\varepsilon}{2}+\frac{\delta}{2}=\frac{\alpha}{2}+\frac{\delta}{2}=TRD_A+TRD_B.$$

Once again, there is an overall deterioration of the income-based relative deprivation: when the four individuals are in C, as opposed to when two are in A and two are in B, the aggregate stress caused by their income-based relative deprivation is higher.

4. Measures of robustness

Remark 1. A simple way of gaining insight into the results reported in this communication would be to compare averages. For example, in case (i) of a comparison of income-based rank, the *per individual* income-based rank deprivation when the four individuals are in facility C is $\frac{6}{4}$, whereas the *per individual* income-based rank deprivation when two individuals are in facility A and two individuals are in facility B is $\frac{1}{2}$; when distribution replaces concentration, a measure of social stress registers a decline.

Remark 2. Suppose that in case (i) of a comparison of income-based rank with four individuals whose incomes are $0 < x_1 < x_2 < x_3 < x_4$, the individuals are initially all in the same facility, and that they are able to move to another facility at no cost. When, in terms of the outcome of rank comparisons, the facilities are equally attractive (a tie), the individuals do not move. Suppose, too, that the individuals are "far-sighted," in the sense that in considering moving between facilities, they identify and take into account the move decisions that will be taken by other individuals who are higher up in the hierarchy of income distribution. In this case, the individuals will sort themselves between the facilities in such a way that the aggregate stress from unfavorable rank-based comparisons with others will be at a minimum. That is, a distribution in which individuals 3 and 1 are in one facility, and individuals 4 and 2 are in the other facility, will be reached. The reasoning is as follows. Individual 4 will stay in the "base" facility A. Individual 3 will move to facility B and stay there. Knowing this, individual 2 will stay in facility A. By the same logic, aware of the facility choices of individuals 4, 3, and 2, individual 1 will move to facility B and stay there. At that point, no individual wishes to change his facility and an equilibrium obtains. This reasoning suggests that, in the described setting, there is no need for a "social planner" to take action aimed at reducing the stress or pressure that arises from individuals making social comparisons with higher-income individuals; acting of their own accord, the individuals achieve a "socially preferred" distribution. Stated in slightly different terminology: the described self-serving behavior of the individuals leads to a collectively desired outcome.

Remark 3. There is an obvious difference between the allocation of individuals who are not as yet allocated to a facility or to two facilities, and the transfer of individuals from a facility. Reallocation can involve a cost, whereas allocation "from scratch" does not. Put differently, transferring individuals between facilities may not be as cost free as directing individuals to a facility. Consider, then, setting (ii) of individuals whose incomes are 1,2,3,4, and assume that these four individuals are all in the same facility. Leaving individuals 3 and 4 in that facility and transferring individuals 2 and 1 to a second facility requires a cost of $\varepsilon > 0$, to be borne by each of the transferred individuals. But now, that incomes are not constant, I need to measure wellbeing by a combination of income and relative deprivation, which I do by means of a weighted sum of income and relative deprivation. Thus, let the wellbeing of individual i be defined as $W_i \equiv (1-\alpha)x_i - \alpha RD_i$, where $\alpha \in (0,1)$: individual i accords weight $1-\alpha$ to income and weight α to relative deprivation. When individuals 2 and

1 are transferred and each of them incurs a cost of ε, individual 1 will be better off being moved than not being moved if $W_1 = (1-\alpha)(1-\varepsilon) - \alpha\frac{1}{2} > (1-\alpha)\cdot 1 - \alpha\frac{6}{4}$, that is, if $\varepsilon < \frac{\alpha}{1-\alpha}$. And individual 2 will be better off being moved than not being moved if $W_2 = (1-\alpha)(2-\varepsilon) > (1-\alpha)\cdot 2 - \alpha\frac{3}{4}$, that is, if $\varepsilon < \frac{3\alpha}{4(1-\alpha)}$. Thus, for $\varepsilon < \min\left[\frac{\alpha}{1-\alpha}, \frac{3\alpha}{4(1-\alpha)}\right]$, which implies that for $\varepsilon < \frac{3\alpha}{4(1-\alpha)}$, individuals 1 and 2 will both be better off in their own facility than when together with individuals 3 and 4, even though transferring them involves a cost, provided that the cost is less than $\frac{3\alpha}{4(1-\alpha)}$. The higher is α, the higher the cost that will still favor a transfer. This is intuitive: the more individuals care about income-based (relative deprivation) stress - which a transfer will enable them to reduce - the less they will be impeded by a transfer cost.

5. Concluding reflections

An implication of the analysis conducted in this communication is that while the distribution of individuals between two facilities, rather than having them all occupy the same facility, could come about at the expense of a loss of (some measures of) efficiency brought about by scale, the distribution confers a social welfare gain, given that a low level of aggregate stress is socially preferable to a high level of aggregate stress.

Suppose that I replace income with health, and unfavorable income-related comparisons with unfavorable health-related comparisons. In the context of the example in Section 2, let there then be four individuals who suffer from the same illness, but with different degrees of severity: individual 1 is the most seriously ill, individual 4 is the least ill. The individuals require hospitalization. The individuals are medically stressed, and individuals 1, 2, and 3 will also experience social stress from comparing the gravity of their illness with that of the individuals / individual who are / is not as severely ill as they are. The hospital is organized in such a way that the four individuals can be placed in one room or in two rooms. There will be no (direct) medical effect from distributing the individuals evenly between two rooms rather than placing them in one room. Because the comparison group will differ, the extent of the individuals' social stress will differ, assuming that the hospital room is the comparison environment. The example in Section 2 suggests that the way to place the four individuals in rooms so that their aggregate social stress will be minimized is not to have them all in the same room, and when allocated to two rooms, that the division of {1,2,3,4} into the two subsets of {4,3} and {2,1} will minimize the group's aggregate social stress.

The social space of people is a comparison space: people value what they have in a relative sense and are distressed when they fall behind others. The idea presented in this communication is that when a given number of people are allocated to social spaces, their placement in a set of small social spaces can result in a lower level of aggregate stress than when their placement is in a "grand" social space. When it comes to alleviating discontent, "geography" can substitute for "medicine."

Appendix

Claim. The sum of the aggregate of the levels of the rank-based deprivation of n individuals who are distributed between two facilities is the lowest when the individuals are distributed evenly.

Proof. I have already shown that when the individuals are distributed evenly between facilities A and B, then the sum of the levels of the rank-based deprivations of the individuals who are income-rank deprived is $2(1+...+\frac{n}{2}-1)=\frac{n^2}{4}-\frac{n}{2}$.

I now move k individuals, where $k=1, 2, ..., \frac{n}{2}-1$, from one of the facilities to the other facility. This means that there will be $\frac{n}{2}-1+k$ individuals who are income-based deprived in one facility, and $\frac{n}{2}-1-k$ individuals who are income-based deprived in the other facility. Consequently, the sum of the levels of the rank-based deprivation of the individuals who are income-rank deprived will be

$$\left\{\left[1+2+...+\left(\frac{n}{2}-1+k\right)\right]+\left[1+2+...+\left(\frac{n}{2}-1-k\right)\right]\right\}$$
$$=\left[\left(\frac{n}{2}+k\right)\cdot\frac{\left(\frac{n}{2}-1+k\right)}{2}+\left(\frac{n}{2}-k\right)\cdot\frac{\left(\frac{n}{2}-1-k\right)}{2}\right]$$
$$=\frac{n^2}{4}-\frac{n}{2}+k^2.$$

Because $\frac{n^2}{4}-\frac{n}{2}+k^2>\frac{n^2}{4}-\frac{n}{2}$, I conclude that following this change in the distribution of the individuals between the two facilities, the individuals' aggregate level of rank-based deprivation will be higher. Q.E.D.

References

Akerlof, George A. (1997). "Social distance and social decisions." *Econometrica* 65: 1005-1027.

Eisenberger, Naomi I. (2012). "The neural bases of social pain: Evidence for shared representations with physical pain." *Psychosomatic Medicine* 74(2): 126-135.

Elgar, Frank J., Stefaniak, Anna, and Wohl, Michael J. A. (2020). "The trouble with trust: Time-series analysis of social capital, income inequality, and COVID-19 deaths in 84 countries." *Social Science & Medicine* 263: 113365.

Fine, Perry G. (2011). "Long-term consequences of chronic pain: Mounting evidence for pain as a neurological disease and parallels with other chronic disease states." *Pain Medicine* 12: 996-1004.

Liao, Tim F. and De Maio, Fernando (2021). "Association of social and economic inequality with Coronavirus disease 2019 incidence and mortality across US counties." *Journal of the American Medical Association Network Open* 4(1): 1-10.

Lieberman, Matthew D. and Eisenberger, Naomi I. (2009). "Pains and pleasures of social life." *Science* 323: 890-891.

Oronce, Carlos Irwin A., Scannell, Christopher A., Kawachi, Ichiro, and Tsugawa, Yusuke (2020). "Association between state-level income inequality and COVID-19 cases and mortality in the USA." *Journal of General Internal Medicine* 35(9): 2791-2793.

Stark, Oded (2020). "Relative deprivation as a cause of risky behaviors." *Journal of Mathematical Sociology* 44(3): 138-146.

Stark, Oded (2023). "On a tendency in health economics to dwell on income inequality and underestimate social stress." *Economics and Human Biology* 49: 101232.

Stark, Oded, Bielawski, Jakub, and Falniowski, Fryderyk (2017). "A class of proximity-sensitive measures of relative deprivation." *Economics Letters* 160: 105-110.

Stouffer, Samuel A., Suchman, Edward A., DeVinney, Leland C., Star, Shirley A., and Williams Jr., Robin M. (1949). *The American Soldier*: *Adjustment During Army Life*, Vol. I. Stouffer, Samuel A., Lumsdaine, Arthur A., Lumsdaine, Marion H., Williams Jr., Robin M., Smith, Brewster M., Janis, Irving L., Star, Shirley A., and Cottrell Jr., Leonard S. (1949). *The American Soldier*: *Combat and its Aftermath*, Vol. II. *Studies in Social Psychology in World War II*. Princeton, NJ: Princeton University Press.

Tan, Annabel X., Hinman, Jessica A., Abdel Magid, Hoda S., Nelson, Lorene M., and Odden, Michelle C. (2021). "Association between income inequality and county-level COVID-19 cases and deaths in the US." *Journal of the American Medical Association Network Open* 4(5): e218799.