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COMMENTARY

Confusing cause and effect in public health policy

Andrea Bevelaqua[1], Claus Muss[2]

1 Master of Health Sciences (MSC); Social worker and psychologist; PHD doctoral student at St. Elisabeth University Bratislava, Slovakia.
2 Professor Public Health St. Elisabeth University Bratislava, Slovakia.

Correspondence to: Andrea Bevelaqua
St. Elisabeth University of Bratislava, Department Public Health, Slovakia.
e-mail: bevelaqua.andrea@gmail.com

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Abstract

The authors comment on the expanding phenomenon of presenting research results in public health policy. Their arguments are supported by their own research experiment, whose design and presentation of results replicate the criticized practice of presenting treatments aimed at eliminating symptoms as solutions. The authors advocate for a systems approach to health policy and argue that incorporating a method or formalized health intervention into a set of recommended treatment strategies requires the inclusion of not only epidemiological but also economic parameters. The policy maker necessarily considers not only the efficacy of the method, but also its cost, the availability of capacity to apply the method, its side effects and, last but not least, alternatives that may be more accessible, cheaper and thus ultimately more effective than the method itself.

INTRODUCTION

When studying the literature on current public health policy challenges, a number of rankings can be found, created from data collected and processed by different methods and from different sources, ordering the challenges by their significance. Inevitably, in global studies, there are errors caused by averaging data across populations that differ significantly in population size and the causes of the decline in disability-adjusted life years (DALYs), potentially in combination with years of life lost (YLL) and years of life lived with disability (YLD), that may serve as indicators of the health status of a given population (Lopez 2005). Averaging data from populations that differ significantly in size, the larger population dominates and the main causes of health problems may be the same in both populations, and malnutrition and infectious diseases should be targeted, although in the smaller population cardiovascular disease is the main risk. A study published in 2018 shows that there are significant differences between countries and regions in the causes of the decline in DALYs and the increase in YLL and YLD (Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980-2017: a systematic analysis for the Global Burden of Disease Study 2017 2018).

Some similarities in the order of factors influencing the above indicators can be found in populations with comparable economic performance. In the so-called developed countries, demographic development, in other words, low birth rates resulting in aging of the population, and a significant increase in psychological disorders, are considered to be the core problem (Walker *et al.* 2015). Caution is needed in assessing the latter issue; bias may arise because mental health is given more attention in developed countries than in areas where even basic needs such as

sufficient food and drinking water are not fully met, or where stressors such as military conflict or terrorism are present. On the other hand, lifestyles, associated with an abundance or surplus of resources and, thanks to generous social systems, the risk of dissolving the line between work and reward and the consequent absence of meaningful activity can pose a risk to the development of mental disorders (Dogra *et al.* 2022; Kim *et al.* 2013).

Even with a cautious approach to global data, time is another factor that increases the opacity of the public health landscape. Over the last 30 years, there has been a significant rearrangement in the ranking of the most important factors influencing DALYs, YLL, and YLD. The top spot occupied in 1990 by lower respiratory tract infections has been taken by coronary heart disease in 2020, diarrheal diseases by unipolar depression and perinatal conditions, perhaps somewhat surprisingly, by traffic accidents (Anish & Sreelakshmi 2013).

A 2011 study shows that the population that is considered healthy in the general sense, especially in the so-called Western world, i.e. children and adolescents, are most at risk of neuropsychiatric diseases, followed by injuries and accidents, and then substance abuse (Gore *et al.* 2011). Added to these are the phenomena associated with the technological developments of the new millennium, in particular the dependence on technology and the resulting anxiety disorders, sleep disorders, and social interaction disorders, which are reaching tragicomic proportions, with members of recent generations suffering from fatigue caused by compulsive searching and reading of social networking posts due to the 'fear of missing out' (Sharma *et al.* 2023).

An analysis of these sources suggests that the younger generation suffers from anxiety at a higher than acceptable rate and that this public health problem needs to be addressed. One of the solutions offered is the application of relaxation techniques and their effect on indicators of physical function, which we present as an illustrative example to provide a basis for public health policy. Examining the problem of increasing anxiety in the population in publications indexed on the Web of Science and Pubmed revealed an increasing proportion of papers aimed at verifying the impact of various therapeutic interventions on stress levels in the young generation. At this point, a scientometric and ethical problem arises. Many of these papers do not meet the standards for scientific work in terms of sample description, replicability and comparability of the results obtained. However, citing them would de facto increase their value in the current understanding of scientometrics, which would conflict with the intent of our work. We, therefore, decided to replicate such work and conduct our own research experiment with identical starting points, descriptions, and conclusions. The Intervention were performed in the youth Center (Boje) Kreuzlingen Kanton Thurgau Switzerland, all participants or their legal guardians signed informed consent and the study design was approved by a panel of senior managers responsible for ensuring adherence to ethical standards of scientific work in medicine. We present the work in extenso in the following paragraphs under the collective title "The Case".

THE CASE

Introduction

The autonomic nervous system maintains vital functions such as breathing and metabolism, even in sleep or unconsciousness. Emotional, psychological, and physical stress can affect the autonomic nervous system, which mediates the link between the neuroendocrine and immune systems and metabolism (Schedlowski & Schmidt 1996).

The autonomic nervous system has a special role in controlling all vital functions of the body. The sympathetic nervous system stimulates increased performance and greater physical activity by releasing catecholamines (neurotransmitters such as adrenaline and noradrenaline). During periods of prolonged stress, the parasympathetic nervous system counteracts this tendency and provides balanced relaxation and stress compensation (Eiden 2013).

In the daytime and during times of stress, the sympathetic nervous system usually overrides the parasympathetic nervous system. At night and during times of relaxation, the situation may be more balanced or even reversed. When relaxation is consciously initiated, the parasympathetic system balances the body's stress functions (Winzeler *et al.* 2017). The inability to compensate for prolonged stress can contribute to autonomic dystonia and to behavioral problems, learning difficulties, and lack of motivation (Koch-Institut 2019; Susanne *et al.* 2013).

Deteriorating school conditions and recent experiences of social isolation during the pandemic have increased the risk of these stress-related disorders in children and have been associated with an increase in psychotropic substance use among young adults in recent years (Mohler-Kuo *et al.* 2021).

Various studies have looked at the effect of music on the functioning of the human brain. Pleasurable responses to music have been found to correlate with activity in brain regions associated with reward and emotion (Sassi *et al.* 2015). Rhythm, as an organizing and energizing force of music, has been found to harmonize autonomic nervous system function and to contribute to balancing heart rate, blood pressure, and respiration. A steady rhythm also controlled impulses, created order, and promoted stable feelings while contributing to better mind-body coordination (cognitive and psychomotor modulation) (Deco *et al.* 2011).

In the current circumstances, it is very important to evaluate and introduce new and alternative

approaches in the control and therapy of stress in young people, as pharmacotherapy should be reserved as a last resort for stressed children.

The selected children received individual relaxation treatment (60 min in duration) with five Tibetan singing bowls (TSB) of different sizes. The children were allowed to feel the vibrations of the singing bowls placed using a special sound bed on their clothed bodies. Being aware of the hypothetical and very unlikely side effects of vibrations from TSB, our adolescent participants were asked about the presence contraindications (i.e. pacemakers, recent operations, pregnancy epilepsy) before the sessions (Lupowitz 2022). A standardized technique (Berntson *et al.* 1997) was used to measure changes in heart rate variability of the targets immediately before and 10 min after the intervention, using chest wall deviation to the nearest 1 millisecond (Sevoz-Couche & Laborde 2022). Children were asked to lie down and breathe calmly (8-15 breaths/min) during the measurement.

Stress index (SI), was calculated as a marker of sympathetic activity of the autonomic nervous system (without unit of measurement). Values were determined by calculating the area histogram. Large bar areas in the histogram represented a low-stress index with higher variability. Small bars in the histogram represented suppressed heart rate variability with corresponding high SI. In contrast to sympathetic activity, RMSSD (Root Mean Square of Successive Differences between adjacent Intervals) was calculated from the square root of the sum of the squared differences between consecutive NN intervals in milliseconds. High values indicated active parasympathetic tone and high RMSSD values indicated parasympathetic control and higher HRV.

Results

Children showed, on average, a significant reduction in heart rate (HR $p = 0.048$) along with a highly significant reduction in sympathetic activity as expressed by SI ($p = 0.028$) and a significant increase in parasympathetic activity (RMSSD $p = 0.028$) in our pooled comparative measurements before and after exposure to the relaxation intervention with Tibetan singing bowls.

The biometric evaluation of these test results showed statistical significance in the rank test (according to Wilcoxon $p = 0.049$).

Discussion

This study aimed to determine whether the influence of an ancient Far Eastern traditional method contributes to a significant anti-stress effect in adolescents and young adults.

All participants in the study felt relaxed after exposure to the sound of Tibetan bowls, and no unpleasant reactions occurred during the intervention. On average, our clients showed a significant decrease in heart rate as an expression of parasympathetic stimulation when exposed to the sound of Tibetan singing bowls, according to Peter Hess. Consistent with this logic, there was also a decrease in sympathetic tension after sonication.

Exposure to the sound of the Tibetan singing bowls seems to have caused a steady relaxation of the autonomic system (unconscious), indicating a response of the parasympathetic nervous system, and thus

Tab. 1. Tabular representation of the heart rate measurements HF1 and HF2 in the test subjects with indication of the maximum values

Statistics		**HF1**	**HF2**
N	Valid	26	26
	Missing	10	10
Average		76,350	69,362
Median		73,100	72,000
Std. deviation		17,8905	17,4553
Minimum		29,0	,0
Maximum		104,4	94,2

Legend: The mean heart rate in the initial examinations HF T1 (HF1) was 76.4 + 17.9 and after singing bowl therapy in HF T2 (HF2) it was 69.0 + 17.5

Tab. 2. Difference in the measured values for sympathetic tone measured at Si1 and Si2 calculated with the Wilcoxon rest (rank test) before and after singing bowl therapy

Wilcoxon test for paired samples	
Si1, Si2	
Summary of the Wilcoxon Test for Related Samples	
Total	26
Test statistics	57,000
Standard error	39,370
Standardized test statistics	-3,010
Asymptotic significance. (two-tailed test)	,003

Legend: The mean value of the SI units (sympathetic tone) during the initial examination and after sound treatment with singing bowls SI (2) in 26 participants

Tab. 3. Compilation of Rmssd T1 and Rmssd 2 as parameters of parasympathetic activity

Wilcoxon test for paired samples	
Rmssd1, Rmssd2	
Summary of the Wilcoxon Test for Related Samples	
Total	26
Test statistics	244,000
Standard error	37,162
Standardized test statistics	2,193
Asymptotic significance. (two-tailed test)	,028

Legend: The mean value of the Rmssd units (parasympathetic tone) during the initial examination and after sounding with sound bowls SI (2) in 26 participants

a promotion of resistance. Relaxation was also evident in the participants after sound exposure.

We conducted our study with adolescents and young adults to explore this method in a sensitive but likely stressed study group, as they are particularly vulnerable and sensitive to various stressors.

Studies dealing with elevated stress in young people have so far been able to offer some direct interventions or compensatory mechanisms (Feng *et al.* 2021; Li *et al.* 2016). Apart from psychotherapy and active coaching, there are few intervention options for relaxation and stress reduction when working with youth. Despite the small number of students recruited for this pathway, the VNS measurements were meaningful enough to demonstrate positive relaxation effects using singing bowls.

The effect of Tibetan singing bowls has remained scientifically unproven. Theories of the effects have included resonance with vibrational waves and reflection on certain in favor of the relaxation method (Lauber & Rössler 2013).

DISCUSSION

The message of the above research is obvious. If you want to reduce the stress levels of children and adolescents, use TSBs, which by their vibration reduce the stress levels during the hour-long session, as the data shows.

Let us now disregard the poorly described sample, in which the sex ratio and the statistical evaluation of age are not provided, and there is no evaluation of the participants in terms of psychiatric or psychological comorbidity and success in the activities that are expected for a given age, i.e. especially school performance and the type and time burden resulting from extracurricular activities. The socioeconomic status and the environment in which the participants grow up - the primary family - are not mentioned in terms of completeness and stability (Morris 2008). We can try to ignore the lack of a (at least hypothetical) description of the mechanism of action of vibration and sound from a medical perspective or valid references for such research - papers that have looked at the effect of music are cited. Music is indeed, formally speaking, a series of sounds, but if it is classical music by one of the greats of the field, then it is a highly organized series, which is not the case in the experiment we are conducting, and the reference to the relationship of vibration and sound with the reward system is more than vague (Fu *et al.* 2021). In our study group, the occurrence of such contraindications was extremely unlikely due to the young age of our participants. Nevertheless, we do not mean to neglected that such possible contraindications must be clarified before any intervention and especially under study conditions.

If such research aspires to be a resource for public health policy, it cannot do without the context of the system surrounding the implications of putting the method under investigation into practice. The application of any policy runs the risk of activating a systems archetype called 'fixes that fail', where a seemingly meaningful intervention produces an unexpected side effect that has the potential to worsen the state of the parameter being improved below its pre-intervention value (Susta 2023). In this sense, regular alcohol administration would appear to be a successful intervention, as its anxiolytic effect has been amply demonstrated, but the adverse side effects of such treatment cannot be ignored (Blanchard *et al.* 1993; Caumiant *et al.* 2023). To detect the undesirable consequences of using alcohol as an anxiolytic, it is necessary to view it in a systems context and not only look for a positive change in the selected parameter but changes in other relevant parameters that are associated with the intervention under study. Thus, one cannot recommend a method that reduces the immediate value of social anxiety, but at the same time leads to disinhibited behavior and induces cerebellar atrophy and liver cirrhosis in the long run. From a public health point of view, therefore, any recommended method should be accompanied by a series of data on the capacity and financial requirements of the proposed procedure, as well as on the duration of the outcome and the resulting need to reapply the procedure and its possible adverse effects.

The decision maker will be interested in whether the effectiveness of the treatment intervention will change over time; if receptivity gradually declines, there will be a need to replace the intervention with another. We are very aware of the weaknesses of our pilot study resulting from the small number of participants and the lack of a control group. Therefore, we have to admit that no far-reaching conclusions for stress prevention in adolescents can be derived from our study results. However, this was not the aim of this pilot study.

It may seem that the above shortcomings are sufficient to declare such an approach to public health policy-making unacceptable. However, all of the above is not the biggest problem with studies of this design. The biggest flaw is creating the false impression that these studies address the problem of stress in a population of children and adolescents. If we were to illus-

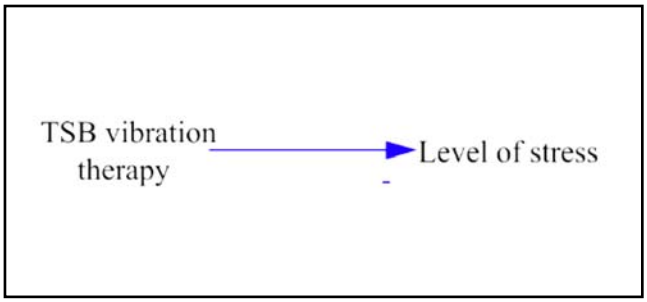

Fig. 1. Illustration of the reasoning behind the goal of the project - the more therapy, the less stress.

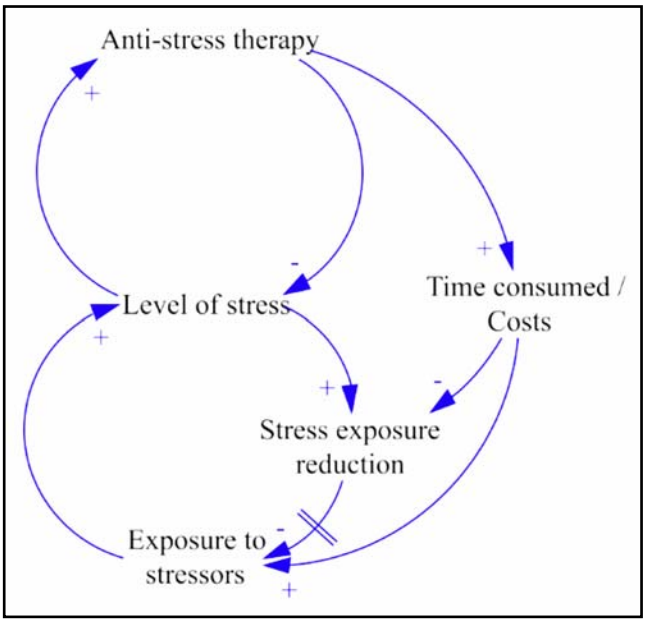

Fig. 2. A simplified representation of the relationship between symptomatic and fundamental solutions. The upper feedback loop shows the efforts to remove the symptom - the larger the space for symptomatic intervention, the more difficult it is to remove the actual cause of the difficulty. The time and financial commitment shown in the diagram can be supplemented by, for example, the level of social media addiction with equally devastating system-wide consequences.

trate such reasoning in a diagram, it could be seen in Figure 1.

It should be stressed, however, that from a public health perspective, stress is merely a symptom, not the root of the problem. The causes of stress are the problem itself, and so research in The Case format comes up with an intervention aimed at addressing the symptom, not the cause. Although there are situations in public health policy where it no longer makes sense to address the cause of an undesirable condition because nothing can be done about it at the current level of knowledge or for technical or capacity reasons, and the optimal policy is to provide palliative care, this certainly cannot be said to be the case when it comes to stress in the maturing generation (Satsangi & Brugnoli 2018). It should be remembered that symptomatic intervention tends to defer the problem to the future and the problem becomes more severe as it moves on.

The true, fundamental solution is always to eliminate the cause, or at least to weaken its influence, as shown in Figure 2. Although anti-stress therapy can reduce stress levels, the stress is caused by exposure to stressors (Torche 2018; Braun 2017). Each symptomatic solution carries with it a side effect (e.g. therapy requires time that cannot be devoted to other tasks, which then remain unfulfilled and/or a financial burden that strains the family budget thereby increasing the number or intensity of stressors, making the fundamental solution more difficult (Susta 2023).

Anti-stress therapy using TSB has the potential to reduce stress levels, but it must not be passed off as a solution to the problem, which in this case is the source of stress that is not affected by the TSB therapy. It is the source of the stress that needs to be addressed, making TSB a potential solution that reduces the severity of symptoms but does not address the cause. Increasing stress among young people represents an immense challenge to public and public health. This problem can only be successfully addressed interactively through common efforts of various stakeholders such as educators, psychologist, sociologists and politicians.

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