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Commentary

Present and future of health inequalities: Rationale for investing in the *biological capital*

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Good health is not, and probably never has been, equally distributed across countries and individuals. Social conditions can predict and stratify patterns in health in a population far better than any biological feature, risk factor or other variable [1]. Disadvantaged groups experience far worse health outcomes than their more affluent fellows, as, for instance, recently documented by the International Agency for Research on Cancer in a comprehensive review of social inequalities in cancer [1]. The different magnitude of health inequalities across countries and over time strongly suggests that some health systems fare better than others in supporting health for individuals, even when countries are experiencing economic downturns. Also, there is good evidence that health inequalities start in early life.

Following the 2007–2008 financial crisis, Case and Deaton reported an unexpected inversion of the long-lasting increase in life expectancy in the U.S. [2]. Premature mortality in the U.S., affecting particularly white poor/middle class, was predominantly due to reasons related to social problems, e.g., increasing drug abuse and alcohol poisoning, suicide, liver disease, and was significantly exacerbated by the 2007/2008 recession [2]. In contrast, the average life expectancy in the World Health Organization (WHO) European Region has continued to steadily rise from 76.7 years in 2010 to 77.8 years in 2015. The more favorable scenario in Europe is likely due to the beneficial impact of the Welfare approach to health that acted as a buffer against the decline in health of sectors of the underserved population [3].

However, despite relatively strong commitment to providing social protection (i.e., access to health care, basic income security, access to nutrition, education, care and any other necessary goods and services) for all citizens, Europe is not immune from major health inequalities either. The recent WHO "*Healthy, prosperous lives for all: the European Health Equity Status Report*" describes the current status of health inequalities across the continent and the major driving factors [4]. Worryingly, deindustrialization has progressively led to high unemployment levels and declining income security while, concurrently, the average country expenditure on social protection has also plummeted. On average, 17 out of 100 people live in relative poverty (defined as the percentage of people living on or below 60% of median household disposable income after taxes and transfers) across the Region, i.e., an increase from 15 out of 100 in the year 2005.

The overwhelming evidence showing that premature mortality in mid- and late-adulthood disproportionately affects socially disadvantaged people [5] is linked to social patterning observed in physical functioning, physiological wear-and-tear, and in molecular processes including epigenetic age acceleration [6]. All these changes are also mediated by risk factors including smoking, BMI and metabolic disorders, such as fatty liver and diabetes. However, the biological consequences of early exposure to social disadvantage begin well before a person has fully taken up individual health behaviors like smoking or poor diet. Overall, the accumulation of biological fingerprints of adverse conditions and hazardous exposures has an impact on the individual's *biological capital*, a concept that is not yet well characterized but that adds to the well-known concepts of economic, social and cultural capitals as proposed long ago by the sociologist Pierre Bourdieu [7].

Whereas preventive measures in the adult phase of life can only be based on a *harm reduction* approach, by promoting better health and mitigating the risks of previous exposures, recent empirical research highlights the importance of addressing also early life to magnify the benefits of these interventions and to mitigate social inequalities in health at all ages. Thus, it is necessary to simultaneously intervene on both traditional risk factors – such as smoking, alcohol, diet, overweight and obesity, and physical activity - and also on factors that lead to social deprivation, beginning in childhood [4]. Expenditure and investment in primary prevention in a child's early years of life could be more effective and cheaper than later interventions or mitigation.

The Welfare State is key in buffering health inequalities, and social protection nets should be increasing, not shrinking, in order to reduce health disparities. Policies should be coordinated so that they impact each life stage, starting in infancy, if not at conception. A better understanding of the underlying mechanisms and of the *biological capital* is necessary to effectively implement primary prevention, avoid or interrupt exposure to hazardous behaviors and environments, and enable timely identification of health damage though appropriate early detection tools.

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Declaration of Competing Interest

The authors have no conflict of interest to disclose.

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