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Controversies in geriatric medicine

## Frailty and vulnerability: Are the two terms equivalent in paediatrics and geriatrics?

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### ABSTRACT

The recent medical literature has been using the term vulnerability to refer to harm to human integrity. The concept is multifaceted. Bioethics researchers conceive vulnerability as one of the basic anthropological features of the human condition. On the other hand, some bioethics scholars advocate using the terms susceptibility or variable vulnerability to refer to diseased or destitute populations. Also, frailty and variable vulnerability are correlated but not equivalent conditions which have been described somehow interchangeably in the recent medical literature, especially in the study of the ageing phenomena. The extremes of age are especially vulnerable periods of life and there has been growing evidence that neonatal and early life events have long-term influence on both the ageing process and frailty. This paper discusses some issues relevant to vulnerability and frailty and how one could possibly distinguish between them. There is still much to be learned about how frailty and variable vulnerability affect the ageing process across the life span.

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### 1. Introduction

The concept of basic vulnerability as a human characteristic, a *condition humana*, has been on the mind of European thinkers for over 200 years. Kottow cites Heidegger to explain that the human mode of being is a struggle for fulfillment, a process prone to failures and defects [1]. Awareness of that risk for failure makes human beings vulnerable. Kottow goes on to distinguish basic human vulnerability from another, which he calls variable vulnerability or susceptibility [1]. Susceptibility may be approached as an epidemiological concept, from the individual or population standpoint, related to risk for health issues [2]. Susceptible individuals are no longer intact and, as such, vulnerable to potential injury. They may be viewed as being in a state of injured integrity, a specific and accidental condition which entails suffering and should be diagnosed and treated [1]. The simple term vulnerability is thus misleading, when it refers to the concept of susceptibility as it has been used in the recent literature on frailty.

There are two life periods where the individual is more than usually susceptible to morbidity and mortality, be it for the physiological vulnerability associated or to the biological or the

social vulnerability particular to those age groups. Neonates and the elderly are at higher risk for health problems, either for their biological features or the shared social condition of dependency.

Certain risk factors are associated with increased mortality and morbidity. The most common preventable risks are those related to neonatal and infant features, nutritional factors, unsafe sex, use of tobacco, harmful use of alcohol, unsafe water and lack of sanitation. Together, these preventable risks contribute to over 40% of deaths that occur worldwide annually [3]. It is also acknowledged that different multifactorial diseases share some environmental and genetic risk factors and, perhaps as a consequence, cluster [4].

Demographic and socioeconomic factors are also major determinants of health. As fertility declines, income rises, populations become more urbanized and age. Such demographic transition entails what is well known as the epidemiological transition with an increasing rate of noncommunicable diseases, accidents and other external causes contributing to the burden of disease.

The general level of variable vulnerability increases as people age, but at different individual rates, for genetic and environmental reasons. Those who are frail are expected to express an aggregate of risks that result from age or disease-associated physiologic accumulation of subthreshold decrements that affect multiple physiologic systems [5]. The early stages of this process may be clinically silent. However, clinicians typically apply the word 'frail' to functionally limited or overtly disabled elders who are suffering

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**Table 1**

Example of the correlation of life expectancy and neonatal mortality in three different countries.

Country	Life expectancy at birth in 1990 (years)	Life expectancy at birth in 2007 (years)	Healthy life expectancy in 1990 (years)	Healthy life expectancy in 2007 (years)	Neonatal mortality rate in 2004 (in 1000 life births)
Brazil	66	73	62	64	13
France	77	81	71	73	2
Botswana	66	56	49	49	46

the cumulative effects of disease-related, psychosocial, and environmental challenges, which led Whitson, Purser and Cohen to distinguish this full-blown functional frailty syndrome from a state of pure physiologic vulnerability [6]. Interestingly, susceptibility of young children seems to correlate with that of the older population in the same region. Countries with low life expectancy invariably have high levels of child mortality (Table 1). Ranking the WHO regions according to those Health Status Indicators from the best to the worst, one would have: European Region, the Americas, Western Pacific Region, South-East Asia, Eastern Mediterranean and African Region. Furthermore, not only does fatal outcome of a disease measure health in a given population. Non-fatal health outcomes must be taken into account as well [3].

Individuals are heterogeneous in their health care needs and presentation. Health Services Administration, planning health services and costs must take into account the different population susceptibilities. Studies on this issue usually have age as an important variable [7]. Increasing education, especially of women, also has a major impact on the use of health care and on health status [3]. Moreover, socioeconomic status in early childhood seems to affect health outcomes at all stages of life [8]. Should all biological factors be taken into account, social issues and health care resources play a role in the constructor of risk factors in health. Specific training and practical guidelines have shown to help minimize some of those risk factors [9].

Mortality prediction models have been used to stratify patients in research trials and to compare different systems of health care delivery. Both chronic conditions and functional limitations are powerful independent predictors of mortality, but they might behave differently in people at different ages [10].

## 2. Neonate and infancy

Variable vulnerability is clearly an issue in the early periods of life. Nearly 10 million children under the age of five die each year – more than 1000 every hour – but most could survive threats and thrive with access to simple, affordable interventions.

The risk of death is highest in the first month of life. The neonate period is thus one of the periods in human life that holds one of the greatest morbidity and mortality. Preterm birth, birth asphyxia and infections cause most newborn deaths. Health risks to newborns are minimized by:

- quality care during pregnancy;
- safe delivery by a skilled birth attendant;
- strong neonatal care: immediate attention to breathing and warmth, hygienic cord and skin care, and early initiation of exclusive breastfeeding.

From one month to five years of age, the main causes of death are pneumonia, diarrhea, malaria, measles and HIV. Malnutrition is estimated to contribute to more than one third of all child deaths.

General reduction of mortality in neonates has been achieved with intensive care. Survival has improved, but developmental disorders of variable intensity have not. As a matter of fact, trends for cerebral palsy have increased in preterm babies since the end of the last century to the beginning of the present century [11]. Of

those children requiring intensive neonatal care assistance, one third is considered to be at high risk, but all have some risk for developmental or other neurological disorders. At seven years of age low birth weight children perform worse in language and visual-motor tasks [12]. Therefore, all very low birth weight infants need a careful follow-up.

The high level of variable vulnerability puts infants and young children at particular risk in regard to their social, emotional, cognitive and physical development. Genetic factors interact with environmental ones to strengthen or weaken human beings from the newborn period through infancy and childhood. For instance, early severe stress and maltreatment produces neurobiological events that may determine adverse outcomes in brain development. This interplay of factors, particularly in the psychiatric field, is a great subject for research [13].

There has been growing evidence relating the fetal environment, as reflected in birth size, to the risk of noncommunicable diseases in adult life [14]. Hanson et al. point out that the development of the fetal origins of adult disease paradigm has changed the focus of research effort from the relation of the fetal environment and perinatal medicine to the consideration of the lifelong consequences of perinatal influences on chronic diseases [14]. Apparently, not only are environmental risk factors in early life related to chronic diseases such as diabetes mellitus and coronary artery disease, but to frailty as well [15].

## 3. The aging process

It is difficult to make exact distinctions in the geriatrics literature between vulnerability and frailty. Frailty is an evolving concept and, likewise, many researchers have defined the latter as a state of vulnerability [16]. A consensus meeting of the American Geriatrics Society defined frailty as a physiological syndrome characterized by decreased reserve and diminished resistance to stressors, resulting from cumulative decline across multiple physiological systems, and causing vulnerability to adverse outcomes [17]. Frailty has also been characterized as a state of physiologic vulnerability that may arise before any apparent clinical manifestations or functional limitations due to the intersecting influences of comorbidities, environmental and psychosocial interactions [6,18]. On the other hand, physiologic vulnerability has been conceived as a state of impairment “(...) especially in the absence of devastating functional loss (...)” [6]. Therefore, a state of physiologic impairment might precede any full blown clinical frailty syndrome, or even any apparent clinical manifestations [6]. Whitson et al. propose a theoretical continuum along which patients may progress from one state to another until they may reach the state of clinical frailty with its consequent compromised function [6].

Rockwood suggests accepting the plethora of current definitions of frailty for the sake of conducting legitimate research without limiting oneself to one preponderant definition that, currently, does not meet enough validity criteria to be successful over the other. He goes on to cite the approach taken by the Canadian Initiative on Frailty and Aging, which classifies frailty definitions in one of four classes: (i) physiological definitions; (ii) definitions based on frailty as a complex syndrome; (iii) frailty based on a balance model; (iv) frailty defined on the basis of a

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