

# Physiologic frailty in chronically homeless young adults determined by the handgrip strength

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## Abstract

If there are only few studies on homelessness, scientific research addressing the physiological conditions of the homeless are almost nil. In order to examine the feasibility of such investigations, we conducted a study analyzing the prevalence of frailty among fifty chronically homeless young adults in Mexico City through measuring their handgrip strength and then comparing it with the same information gathered from a group of 50 university students who had never been homeless and who comprised a control sample. The frailty syndrome has more often been associated with aging and chronic illnesses. Its presence in homeless young adults proves that it can also be caused by adverse life conditions. This supports the idea that their general health is an index of the

social suffering, stress, exclusion and violence that they have to deal with on a daily basis and that it causes an accelerated aging that explains their high mortality index. This study is part of a wider ethnographical research effort that seeks to better understand their general state of being and improve it through more precisely designed interventions that are relevant to their skills and capacities. Keywords: Chronically Homeless, Frailty, Handgrip Strength, Adverse Life Conditions, Young adults

## Homelessness: a global human crisis

In the United Nations' *Report on adequate housing as a component of the right to an adequate standard of living*, the Special Rapporteur concludes that: "homelessness is a global human rights crisis that demands an urgent global response" (UN, 2015: 3). Being made homeless results from a lack of guarantee of fundamental rights for people whose rights then keep being systematically violated while living on the streets. Those who face discrimination on the grounds of race, ethnicity, place of origin, religion, socioeconomic status, gender, mental or physical disability, sexual orientation, or age; are more likely to become homeless, and once homeless, experience additional discrimination. The last global survey attempted by the United Nations (UN,2015) estimated that up to one hundred million people were homeless worldwide and assured that the number is constantly increasing.

Because the phenomenon is caused by the intersection of both individual circumstances and a range of structural sociohistorical causes (Ruiz, 2016), when studying homelessness one can find regional patterns. In Latin America, homelessness is typically associated with unplanned

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urbanization, centralization of services, unequal access to land and property, poverty and isolation. It is also linked to widespread violence, massive displacement and broken families due to drug-trafficking related conflicts. Other causes include a lack of policies that can efficiently deal with mental illness, psychosocial disability, domestic violence, child abuse and drug abuse. Even the colonial past of the countries plays a role: racial inequality intersects strongly with homelessness. The Inter-American Commission on Human Rights has acted several times against states that had violently forced indigenous communities from their homes and traditional lands into a situation of ongoing displacement (Elguera, 2016). The same happens with black people. For example, in Brazil, black families are seven times more likely to be homeless than white families, and 67 per cent of the homeless in 2008 were black (MDSCF, 2009).

Data collection on homelessness remains a challenge. The European Federation of National Organizations Working with the Homeless (FEANTSA) has greatly advanced this route by encouraging the adoption of shared definitions, methodologies and indicators within its 130 member organizations working in 30 European countries. This creates a common language that facilitates the exchange of information and permits a better understanding of the nature of homelessness as well as enabling wider solutions. In Latin America, such a common language does not exist. In most Latin American countries, data on homelessness is either dispersed, scarce or nil, and when available, the national collections -each obtained by its own particular methodology- are hardly comparable. Put together, they only reveal the most general features of the phenomenon: in Latin America almost all of the chronically homeless live in the capital cities but less than half were born there. From 82 to 94 per cent are males and around 60 per cent are aged between 18 and 30 years. Although 60 per cent have not even completed elementary school, 80 per cent make a living from informal jobs, mainly redeeming recyclables and cleaning cars. Due to the different methodologies used in Latin America, reporting on drug abuse varies widely between censuses, going from 38 to 93 per cent, nevertheless it is considered important in conjunction with discrimination and health issues (SDTBSASC

2005; MDSCF 2009; UA 2009; OSPI 2011; UNC 2011; MDS 2012; SDIS 2012; IASIS 2017).

In Mexico City, the last survey claims that there are 6754 persons living on the streets (IASIS,2017). Because of its methodology, the survey underestimates the total number of homeless (Ruiz, 2017), yet, it is consistent with the regional tendencies: most of them are young men, national immigrants, uneducated glue sniffers condemned to informal survival activities. For this reason, apart from the humanitarian costs, homelessness has financial costs to governments (DCLG, 2012). The direct costs include health, employment, social support, security and justice services. The indirect costs of having a large number of young people who would be expected to be economically productive constrained to survival and informal activities are nevertheless significant.

These current issues have historical dimensions. In 1984, in Brasilia, took place the first (and only) Latin American Seminar on Community Alternatives for Street Children (Lusk, 2015). It was a response to the worrying increase of the number of children living by themselves on the streets of main cities and who were also identified as glue sniffers. At that time, the United Nations Children's Fund (Unicef) estimated that there were between 25 and 40 million children living and/or working on the streets of Latin America (Unicef ,1981). Few of those children were successfully reintegrated into society. Some died on the streets and many of them grew up on the streets to become the undeniable testimony of the States' failure to effectively solve the problem thirty years ago. This is the reason why the majority of the Latin American homeless population are young men. Latin American states keep failing them, with inefficient strategies often tainted with prejudice and stigmatization. Now, a new generation of children who are born on the streets from homeless parents is the new outcome of that prevailing inefficiency.

In 2016, the Human Rights Programme for Mexico City convened the homeless to a mass meeting, where they could expose the facts and difficulties of their living, express their concerns and propose solutions. It is noteworthy that notwithstanding all their needs, their unequivocal claim was to be treated like human beings:

“Despite what we look like, despite the way we live, despite all the differences, we are equal, we are human beings, like any of you. We are not animals. We are not things to drop. We are humans” (PDHDF, 2016).

### **Why is the Frailty phenotype useful for addressing the homeless?**

There is no standardized definition of Frailty (Rockwood, 2005; Gobbens, 2010). The term was first used in Gerontology to describe a condition found in older adults who are physiologically most vulnerable to external stressors. For this reason, initially, it was considered to be a geriatric syndrome (Fried et al 2009). A syndrome being a multifactorial condition provoked by the interaction of a large number of risk factors involving different organ systems. On these terms, physiologic frailty is the ultimate outcome of a cluster of cumulative declines over multiple physiologic systems that is clinically displayed by physical inactivity, exhaustion, weight loss, slow gait speed and weak strength (Gobbens, 2010). It is highly prevalent in old age and confers high risk for falls, worsening mobility, disability, hospitalization and death (Al Snih et al 2002; Bohannon 2008 and 2015; Taekema, 2010; Sydall et al 2017; García-Peña et al 2013).

Although the prevalence of Frailty increases with age, it is also common among middle-aged persons and even children with: chronic kidney disease (Roshanravan, 2013), cardiovascular disease (Newman et al. 2001), survivors of cancer (Ness, 2013; Geach, 2014; Henderson, 2014), dialysis patients (Johansen et al 2007; Bao et al 2012), people infected with human immunodeficiency virus (HIV) (Önen et al 2011; Brothers et al 2013), diabetes mellitus patients (Morley ,2008) and critical ill patients (Naeem, 2008; Mc Dermid et al 2011). The presence of frailty in young adults and children may be explained as the result of an accelerated and premature aging due to illness. Mitsinki et al (2002) offered an explanation suggesting that frailty is closer associated to biological rather than to chronological age. Biological age is estimated by the proportion of deficits accumulated by an individual compared to other individuals of the same chronological age. Frailty is more present among the aged because the time span for

accumulating deficits is longer, and in the ill because the number of deficits is higher, that's why neither only nor all the elders are frail.

Some other studies have rather emphasized the association between frailty and sociodemographic variables posing that ethnicity, education, income (Fried et al. 2009), emotional/social support and financial status are important variables associated to frailty (Johansen, 2007). Also habits and lifestyle behaviors of the person like its nutritional status, smoking status, alcohol use, drug abuse and exercise have been proved to be relevant risk factors (Pérez-Zepeda, 2016). Even homelessness has already been approached. Salem et al (2013; 2014) developed a frailty framework for homeless and other vulnerable populations seeking all the antecedents that contribute to physical, psychological and social frailty. These studies nonetheless, examine the sociodemographic variables and lifestyle behaviors as factors that can lessen or worsen the frailty acquired by aging or by illness, not like being the main cause of frailty as we argue here.

From the complexity perspective, frailty has been understood as the system's loss of resiliency and adaptability due to the accumulation of deficits resulting in generalized impairment of function (Goldberger, 1992 and 1996; Fossión, 2010). Function is accomplished by integrating the dynamic interplay of multiple regulatory mechanisms. The physiological plasticity that is needed to effectively sustain the complex balance between them, changes as the organism ages. Goldberger (1992) demonstrated that complexity declines with aging by providing evidence of declining complexity of trabecular or neuronal architecture, decreased long-range correlations in time series data such as blood pressure measurements, as well as increased randomness or stochastic activity in terms of cardiac intervals. They proposed that such alterations in the dynamics of physiologic systems contribute to frailty and functional decline.

According to Kirkwood (1997), the body regulates the key mechanisms of somatic maintenance and repair in order to secure the optimum balance between surviving long enough and spending too much on maintenance, hence a progressive accumulation of unrepaired somatic damage through life takes place. So, from the

complexity perspective, the physiology underlying health is just as important as the system's environment, for it is the latter that determines the nature, number, and intensity of the challenges that the system will have to undertake, as well as the resources it may dispose for doing so. The homeless' environment is highly challenging and demands a huge amount of resources for both survival and maintenance. On the other hand, the resources it provides are rather scarce and degraded, usually being someone else's waste. This imbalance leads to an accelerated ebb on their complexity, it is a loss of resiliency and adaptability in spite of their young age.

This is the reason why the Frailty phenotype is useful for addressing the homeless: it is a qualitative-quantitative indicator of child abandonment, material deprivation, social exclusion and physical degradation. As described before, most homeless in Mexico City are street children who grew up uneducated and abandoned and became youths. In their bodies, one can find the traces and accumulative effects of the adverse circumstances they went through and continue to endure every day. Under this basis, we hypothesized that frailty would be prevalent among chronically homeless young adults and would represent a predictive marker of poor health, future morbidity and subsequent mortality.

We assessed the frail condition through the handgrip strength. Handgrip strength is quantified by measuring the amount of static force that the patient uses to squeeze as hard as he possibly can the gauge of a dynamometer with the extremity held in a standard position. Grip strength is widely used as a marker of frailty in clinical practice and is known to be a powerful predictor of disability, morbidity and mortality. It is a general physical performance test that depicts the global health and overall state of strength of the patient and has been used in most frail scores as well as a single marker of frailty (Sydall et al. 2003). Published normative data for handgrip strength divided into age and gender subgroups is available (Roberts, 2011). The test takes few minutes, can be displayed in the street itself, causes no harm to the patient and requires nothing else than a dynamometer, which is an inexpensive, portable equipment that one can learn to use with only little training. For all this reasons, the handgrip strength proved to be a

feasible validated method, most appropriate for assessing frailty in the homeless and confront the logistical complications arising from their nomadic lifestyle.

### **Description of the Study**

Between May and October 2017, 50 chronically homeless young adults, participated in a pilot study designed to inquire whether the handgrip strength is a measurement feasible to be obtained from the homeless to assess the prevalence of frailty among this population. Ethical approval for the study was obtained from the Medical School Ethics Committee of the National Autonomous University of Mexico as being part of a larger study on Health and Disease from the Complexity Perspective (Conacyt FC-2015-2/1093).

With the support of the experts of Ednica IAP, a non profit NGO dealing with homelessness in Mexico City, subjects were explained the study in detail and were invited to participate. Those who agreed to participate signed informed consent. The test was performed either in Ednica or in the street itself. Previously, a trained anthropologist carried out the anthropometry. Height was measured with an INBODY BSM370 portable stadiometer. An Omron HBF-510W full body composition monitor and scale was used to measure body weight and to estimate body mass index, body fat percentage, skeletal muscle and visceral fat level. The grip strength was measured with a Baseline Spring Type dynamometer. They performed three trials per hand interspersed with a minute rest, using the standard arm position as recommended by the American Society of Hand Therapists: shoulder adducted and neutrally rotated, elbow at 90° flexion and forearm in neutral (ASHT 1992). Standard instructions were given and the highest measure obtained was utilized for analysis.

A brief interview followed the testing in order to gather information addressing their clinical and social history. For inquiring on the first, the variables included were: age, gender, nickname, place of birth, drugs use, smoking habits, alcohol use, diagnosed chronicle diseases, surgery and hospitalization history, self reported general health state, visual evaluation of the subject's general health state by the researcher, and self reported fatigue. For the second, we sought information

about the reason and date when they started sleeping rough, the area where they usually stay overnight, the length of their last continuous homelessness period, their literacy skills, the number of years of schooling completed, their criminal record, social network, marital status and whether they had or not identity documents and access to health and social services. The information was collected in a 24 questions questionnaire that guided the interviews. After the testing, all participants received printed information containing their measurements placed in the normative scale and were explained its meaning. We gathered the same information from 50 university students who conformed a control sample.

The study was based on non-probability sampling. The target population consisted of chronically homeless young adults. A chronically homeless is: “an unaccompanied homeless individual who has been continuously homeless for a year or more [...] or has had at least four episodes of homelessness in the last three years” (OCPD, 2007). According to the World Health Organization (OMS 1986), young adults age between 18 and 32 years. Under these criteria we selected the subjects. It is generally agreed that men have greater grip strength than women and this trend is true irrespective of age and dominant hand (Petersen et al 1989; Agnew and Mass 1982, Massey-Westropp 2011). In order to increase the homogeneity of the sample we selected only right-handed men, excluding those who had been diagnosed with chronic diseases, had a disabling condition such as mental illness or physical disability, were under the influence of alcohol or drugs, were suffering pain or had maimed arms, hands or fingers; couldn't stand still by themselves or didn't accomplish at least six months post-hospitalization. The same requirements were asked from the subjects of the control sample, except being or having ever been homeless.

The results of the study were consistent with the hypotheses. We were able to gather data from 50 young adults who had been sleeping rough in the streets of Mexico City for at least a year and for five years on average. They found it fun and participated enthusiastically. So we proved that handgrip strength is an objective measurement

feasible to be obtained from the homeless. The results also unmistakably showed the prevalence of frailty in the group despite their young age and although not having been diagnosed with any chronic disease. The normative values of the mean maximum dominant-hand grip strength for healthy men on the age between 18 and 30 years varies little among studies: 107 lb (Crosby et al 1994); 43.4 kg (Bercot-Budziareck et al 2008); 105 lb (Peters et al 2011); 44.7 kg (Montalcini et al 2013); 41.8 kg (Spruit et al 2013); 42.8 kg (Schlüssel et al 2008). The mean maximum dominant-hand grip strength that we obtained from the control sample was of 50 kg and of 34.8 kg among the homeless. It is noteworthy that Ranten et al(1999) obtained similar but greater values from frail adults aged 54 (39.2 kg) and Sydal et al (2003) from frail elders who were 67.5 years old on average (38.3kg).

Body mass (Schlüssel et al 2008), height (Spruit et al 2013) and weight (Gale, 2006) have been found previously to correlate with grip strength. Surprisingly, the average body mass of the sample was of 19.9, with only two subjects having an index lower than normal: 17.6 and 17.2. The average weight was of 53.9 kg and the average height of 162.72 cm; so none of these variables can explain the low strength rates. What the results do testify for, is a negative correlation between hand grip strength and the number of years that the person has been homeless. What makes time so relevant is the adverse conditions contained in each day of street survival. 76% were found to be chronic glue sniffers who inhale a quarter liter or more every day; 54% smoke tobacco, 67% drink more than half a liter of alcohol at least three times a week seeking to get drunk. 62% had incomplete primary school and 24% never went to school and could neither read nor write. Only 26% has an identity document but none of them benefits from governmental health or social services. 40% declared having been in prison or juvenile detention. The same number had had at least a surgery, while 80% had been hospitalized at least once. Through the interviews, we found stories in which poverty, violence, discrimination, migration, disability, broken families and weak social networks, were most common.

## Conclusions

A homeless person is a complex system forced to adapt for survival to a particular niche, the street. The peculiar life style that arises from adaptation and through the relationships that they establish with their social and material environment, submerges them into a process of accelerated social, physical and psychological degradation. Because of their social status, the resources that they can intake from this niche are rather scarce and energetically poor. On the other hand, this violent, stressful life style demands from them big amounts of resources and energy to maintain and repair their body. So, biological and social constrains intertwined inseparably to perpetuate the imbalance between energy intake and energy spending that causes accelerated ageing, malfunction, disability and ultimately premature death in the homeless.

The data that we obtained confirmed our initial hypotheses. We found frailty to be prevalent among chronically homeless young adults in Mexico City and that their biological age differs from their chronological age. No such records have ever been obtained from homeless young and implementation of policy responses and determine whether the institutions are meeting their human rights obligations.

Each human being is an irreducible unit, we do not *own* a body, we *are* our body. So, in the bodies of the homeless, in their physiology, one can find the traces of their social suffering, of the poverty, the marginalization, the violence and the neglect that they have to endure on a daily basis. To date, only a small number of investigations have addressed the general health state of the homeless and none has searched for frailty in young adults. Thus, this gap could justify our investigation. Our study, although initial and small in its scale, sought to obtain first-hand data of a scarcely studied social sector. This approach provides quantitative objective indexes that might help to ensure the highest attainable level of health for the homeless by developing interdisciplinary, transversal, evidence-based, comprehensive, multi-dimensional, rights-based, participatory, needs-based and bottom-up interventions. This perspective should undermine explanations of homelessness as personal failures to be solved with acts of charity, and instead explore the social

adults. The importance of this findings arises from the fact that frailty has been described as a syndrome resulting of chronological ageing or from suffering chronic illnesses. Adverse life conditions have been proved to worsen acquired frailty. Yet, our study found frailty in subjects who are neither old nor chronic ill but who endure adverse life conditions chronically, so, they are evidence that adverse life conditions may cause frailty and can accelerate the process of ageing.

Beyond its novelty, our study might open the way to the diffusion of the handgrip strength assessment as it is a feasible, cheap, simple, and reliable method that might ease the identification of individuals who may benefit from an intervention for the prevention of disability, to detect persons at risk of death, to determine the effectiveness of various interventions, to set realistic individual goals, to assess the person's ability of employment and, more general to design more accurate pedagogic and occupational policies for the homeless that are relevant to their skills and capacities. Measuring the handgrip strength helps to assess priorities, ensure effective design

patterns that foster inequality and injustice and that should be addressed scientifically to guarantee that those who are homeless are recognized with the right to be equal members of society.

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## Ethics approval statement

Ethical approval for the study was obtained from the Medical School Ethics Committee at the National Autonomous University of Mexico as being part of a larger study on Health and Disease from the Complexity Perspective (Conacyt FC-2015-2/1093). Subjects were informed about study in detail and were invited to participate. Those who agreed to participate signed informed consent

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