Bread and Brain, Education and Poverty
Pontifical Academy of Sciences, Scripta Varia 125, Vatican City 2014
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Sleep, Slums and Shelter: Impact of a Slum-housing Upgrading Program

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Abstract

The unprecedented urban growth in face of increasing poverty and social inequity in developing countries is posing an immense challenge at all levels. The urbanization of poverty is reflected mainly by the proliferation and expansion of slums. Over one billion people (about 14 percent of the world population) are slum dwellers. According to UN-HABITAT predictions, the number of slum dwellers could double by the year 2030, due to the increase of social inequality and poverty in the context of an extraordinary urban growth. Slum dwellers do share the fact that they live in the most adverse of circumstances and poor sleep conditions presumably could amplify health related problems typical of the slum environment like psychological distress, poor diet, a sedentary lifestyle and cardiovascular disease. In a first part of our study we applied a brief version of the Pittsburgh sleep quality index (PSQI) to the sample population examined by the Barómetro de la Deuda Social Argentina, Pontificia Universidad Católica Argentina (N= 5766). The aim of this program is the identification, monitoring and evaluation of the dynamics and scope of the social debt understood as deficit in human development capabilities and social integration of the population. It also assesses the effect of policies and public-private actions affecting its state and evolution. Analysis of the distribution of sleep disorders as a function of socioeconomic status, residential status and place of residence indicated that the very low socio-economic stratum had a higher percentage

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of subjects with poor quality of sleep and daytime sleepiness ($p < 0.001$). The residence in slums was associated with a higher percentage of subjects with poor sleep quality and obesity ($p < 0.001$). In the second part of our study we evaluated the impact of a housing transition on sleep quality and quality of life in slum dwellers, participating in a slum-housing upgrading program in 5 slums located in Buenos Aires' Metropolitan Area. A total of 150 slum dwellers benefited by a housing program of a non-profit organization ("TECHO") moving from their very low quality house to a basic prefabricated 18 m^2 modular house, This was an observational before-and-after study with a convergent-parallel mixed method design. The PSQI and WHO quality of life (QOL) brief scales were administered before and after housing upgrading. Semi-structured interviews were used to expand and nuance quantitative data obtained from a poorly educated sample. Results showed that sleep quality significantly increased after the housing program ($p < 0.001$). Overall QOL and physical health domain, psychological well-being domain and environmental domain of QOL were also improved. Therefore a minimal improvement of basic housing can significantly increase sleep quality and quality of life among slum dwellers.

1. Introduction

Sleep is an essential process in life. It is a behavioral state defined by: (i) characteristic relaxation of posture; (ii) raised sensory thresholds; (iii) distinctive electroencephalographic (EEG) pattern; and (iv) ready reversibility (1). One difficulty in understanding sleep is that it is not a unitary state but composed of two sub-states. Based on polysomnographic measures, sleep has been divided into categories of rapid eye movement (REM) sleep and non-REM (NREM) sleep (also called slow wave sleep). Sleep alternates between NREM and REM stages approximately every 90-120 min. Periods of NREM sleep constitute about 80% of the total sleep time and NREM reaches its greatest depth during the first half of the night (1). The recurrent cycles of NREM and REM sleep are accompanied by major changes in physiology. Indeed, it can be said that we live sequentially in three different physiological states ("or bodies"): that of wakefulness, that of NREM sleep and that of REM sleep. Since epidemiological data indicate that in our modern society we indulge about 6 h of sleep per day, the relatively longer wakefulness stage, and the relatively shorter NREM stage, have strong negative consequences for health. There is an increasing evidence that a number of endemic pathologies like obesity, the metabolic syndrome and neurodegenerative diseases can be related to the prevalence of wakefulness in face of NREM sleep loss in contemporary, 24/7 Society (2-4).

2. Sleep disturbances are very common in the general population

Healthy adults need 7-9 hours of sleep per day and school-age children might require 10-11 hours of sleep (5). In 2010, approximately 30% of USA adults and 44% of shift workers reported less than 6 hours of sleep / day (6), which has been associated with fair/poor general health, frequent mental and physical distress, depressive symptoms, anxiety, and pain (7). Sleep insufficiency can also result from sleep disorders such as chronic insomnia, restless legs syndrome, sleep apnea, or narcolepsy (8).

Thus the impact of sleep restriction is relevant and matter of public concern. On the one hand, sleep impairment is linked as a contributing factor to motor vehicle crashes, industrial disasters, and medical and other occupational errors. On the other hand, persons experiencing sleep insufficiency are more likely to have chronic diseases such as cardiovascular disease, diabetes, depression, or obesity (9,10).

In addition to biological and psychological determinants, sleep quality is strongly influenced by social factors. Among them, the place and type of residence, socioeconomic status and working conditions, among others, are relevant (11). In Argentina field studies on this matter are lacking regardless of their necessity for designing public health policies to mitigate biological, psychological and social impact of a sleep deprived society. In the first part of this study we assessed the possible link of sleep disorders, demographic characteristics and health status in the general population sample surveyed by the Barómetro de la Deuda Social Argentina, Pontificia Universidad Católica Argentina. The aim of this program is the identification, monitoring and evaluation of the dynamics and scope of the social debt understood as deficit in human development capabilities and social integration of the population. It also assesses the effect of policies and public-private actions affecting its state and evolution. In Latin America despite the significant economic progress over the past two decades, many of the region's city inhabitants are poorly housed. Of the 130 million urban families in the region, 5 million rely on another family for shelter, 3 million live in houses that are beyond repair, and another 34 million live in houses that lack either title, water, sewerage, adequate flooring, or sufficient space (12). The second part of our study evaluates the transitional impacts on quality of life, sleep quality and sleep conditions of slum dwellers who participated in the slum-housing upgrading program run by the nonprofit organization TECHO in the metropolitan area of Buenos Aires, Argentina.

3. Socio-demographic aspects of sleep habits and their relationship with health

In a survey we conducted in large urban areas of Latin America (Buenos Aires, Sao Paulo and Mexico City) two thirds of the population reported sleep problems, a quarter of it with a poor quality of life because of these problems (13) In that study a daily "sleep debt" (hours of desired sleep minus hours of actual sleep) of about two hours was verified, quite in agreement to the longitudinal evaluation of sleep length decreased recorded in the last 30 years (5).

In the present study we assessed the possible link of sleep disorders, demographic characteristics and health status in the general population sample surveyed by the Barómetro de la Deuda Social Argentina, Pontificia Universidad Católica Argentina (N= 5766). We applied 5 questions derived from the Spanish version of the Pittsburgh Sleep Quality index (PSQI) (14,15) plus a question about nap habits. The questions were: 1. During the last month: At what time do you usually lay down to sleep at night?; 2. After turning off the light to sleep: how long it took to fall asleep on average?; 3. At what time do you

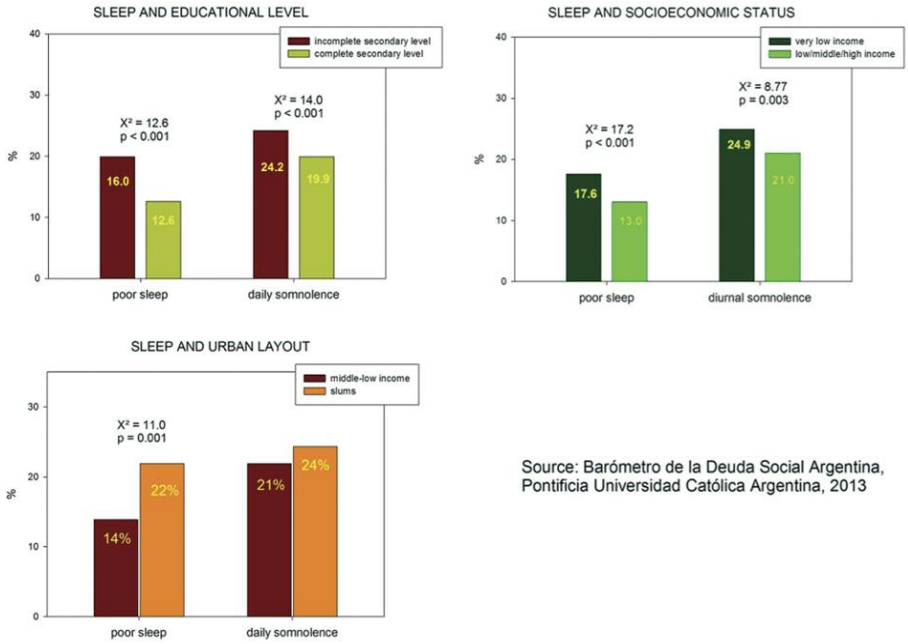

Figure 1. The distribution of sleep disruptions as a function of the educational level, socioeconomic status and urban layout in Argentina (N= 5766).

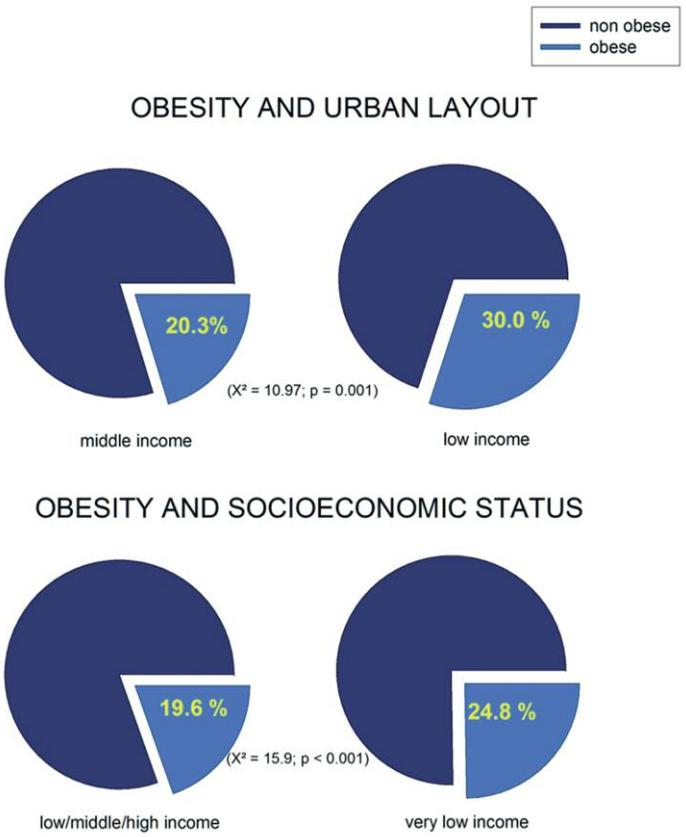

Figure 2. Obesity as a function of the educational level and urban layout in Argentina (N= 5766).

usually wake up in the morning?; 4. How would you rate your overall quality of sleep? (Very good, fairly good, fairly bad or very bad); 5. How often have you had trouble staying awake during the day? (Never, or rarely, once or twice a week, three or more times a week), 6. If you nap on a regular basis (every day or almost every day) how long do you nap?

Total Sleep Time (TST) was calculated as "time in bed - time to fall asleep + nap time"). TST was divided into two categories: < 6 hours and > 6 hours. Sleep was defined as "poor sleep" as the presence of "fairly bad" or "very bad" quality of sleep. Daytime somnolence was defined as the presence of daily sleepiness one or more times a week. Additionally, body mass index (BMI) was calculated as "weight/height^2", from recorded weight and

height data. The presence of overweight was defined by BMI ≥ 25 kg/m^2 and of obesity by BMI ≥ 30 kg/m^2. Data were analyzed according to sex, age, education level, socioeconomic status, and type and place of residence. We also evaluated how the presence of sleep disorders was associated with perceived health status or obesity. The variables were reported as percentages of total number of subjects. Assessment of statistical significance was done through the ^{2} test.

The prevalence of TST less than 6 hours/day was 14.8%. Poor sleep quality or daily somnolence was reported by 14.2 and 22.0% of the individuals surveyed. The percentage of men with TST < 6 h was higher than that of women (^{2}= 15.9, p < 0.001) whereas the percentage of women with poor sleep quality was higher than that of men (^{2}= 20.2, p < 0.001). A higher percentage of subjects with TST < 6 h lay in the range 35-59 years (^{2}= 127.3, p < 0001). This age group also reported the lowest sleep quality (^{2}= 12.2, p= 0.002). Large metropolitan areas had a higher percentage of individuals with poor quality of sleep (^{2}= 20.1, p < 0.001). The distribution of sleep disturbance as a function of socioeconomic status,

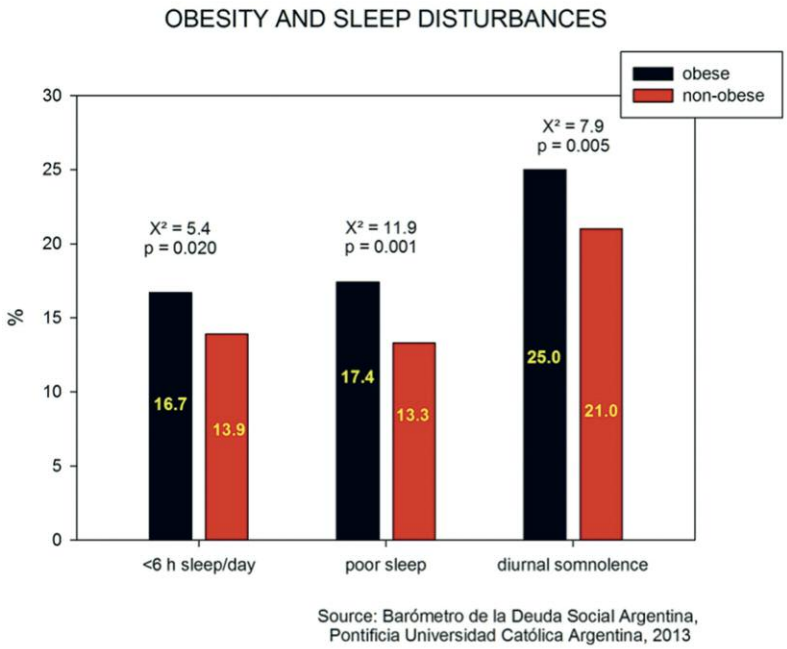

Figure 3. Relationship between obesity and sleep disturbances in Argentina (N= 5766).

educational level and residential status is summarized in Fig. 1. A low level of education was associated with a higher percentage of subjects reporting poor quality of sleep (^{2}= 12.6, p < 0.001) and daytime sleepiness (^{2}= 14.0, p < 0.001). The socio-economic stratum classified as very low had a higher percentage of subjects with poor quality of sleep (^{2}= 17.2, p < 0.001) and daytime sleepiness (^{2}= 8.77, p= 0.003). The residence in slums was associated with a higher percentage of subjects with poor sleep quality (^{2}= 11.0, p= 0.001) (Fig. 1).

Obesity was more prevalent in subjects with low socioeconomic status (^{2}= 61.6, p < 0.001), and living in slums (^{2}= 52.7, p < 0.001) (Fig. 2). The presence of obesity was associated with a higher percentage of subjects with TST < 6 hours (^{2}= 9.5, p= 0.009), poor quality of sleep (^{2}= 11.9, p= 0.001) and daytime sleepiness (^{2}= 7.9, p= 0.005) (Fig. 3). A perceived health status reported as severely poor was associated with a higher percentage of subjects with poor quality of sleep (^{2}= 130.1, p < 0.001) and daytime sleepiness (^{2}= 5.0, p= 0.025).

In summary, we observed asymmetries in the distribution of sleep disorders associated with substandard housing, a very low socio-economic status and educational level. Likewise the present survey supports the link between poor sleep quality and health problems, including obesity.

3. Impact of a slum-housing upgrading program on sleep

The unprecedented urban growth in face of increasing poverty and social inequity in developing countries is posing an immense challenge at all levels. Urbanization of poverty is shown mainly by the proliferation and expansion of slums (16). Such places generally contain houses built using plywood, wood boards, cardboard, corrugated metal and sheets of plastic. Over one billion people (approximately 14 percent of world population) are slum dwellers (17). According to UN-HABITAT predictions, the number of slum dwellers could double by the year 2030, due to the increase in poverty and social inequality in the context of an extraordinary urban growth (18). Slums can vary substantially in their structure, composition, and culture; those involved in our study differed in a variety of aspects that ranged from electricity access to flood risk, from crime to contamination and the size of parcels. Nevertheless, slum dwellers do share the fact that they live in the most adverse of circumstances. In this context poor sleep could amplify other health-related problems typical of the slum environment, such as psychological distress, poor diet, a sedentary lifestyle and cardiovascular disease, demonstrating its important role in chronic illness and health (19-26).

The Latin American youth-led nonprofit organization TECHO, which is active in 19 countries of Latin America and the Caribbean, defines slums as settlements of eight or more families occupying land and lacking at least one of three basic services: water, electricity or sewage. Through the joint work of families living in extreme poverty with young volunteers, TECHO seeks to overcome poverty in slums. TECHO's first phase of intervention is in assessment of the family's need and promotion of organization, participation and community co-responsibility. During the second phase, TECHO focuses on building of transitional housing to urgently address the need for adequate shelter that is present in most slums. These transitional houses are based on a prefabricated 18 m^2 module that is elevated off the floor, includes a zinc roof, and is built in a lapse of about two days.

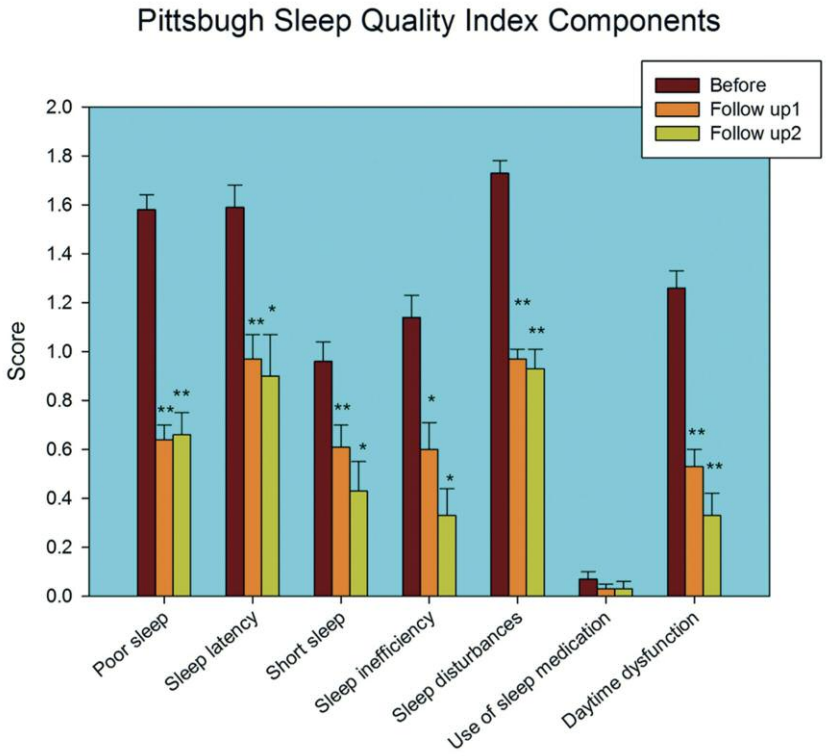

Figure 4. Pittsburgh Sleep Quality Index components before and after house upgrading. Follow up 1= 1month, follow up 2= 6 months after intervention. TECHO study.

However, the quality of sleep, sleep routine, sleep context and sleep habits among slum dwellers has not yet been examined in the scientific literature. Understanding sleep disparity within this unique population could provide insight into quality of life parameters, and can aid with the development and use of novel interventions.

A total of 150 adult slum dwellers on the waiting list for the TECHO housing program, were invited to participate in the study carried out from April to October, 2011. They were all residents of slums located in the metropolitan area of Buenos Aires, Argentina. All participants met selection criteria defined by TECHO. These criteria are based on a thorough evaluation of housing conditions, income, family size and composition, health conditions and access to social networks.

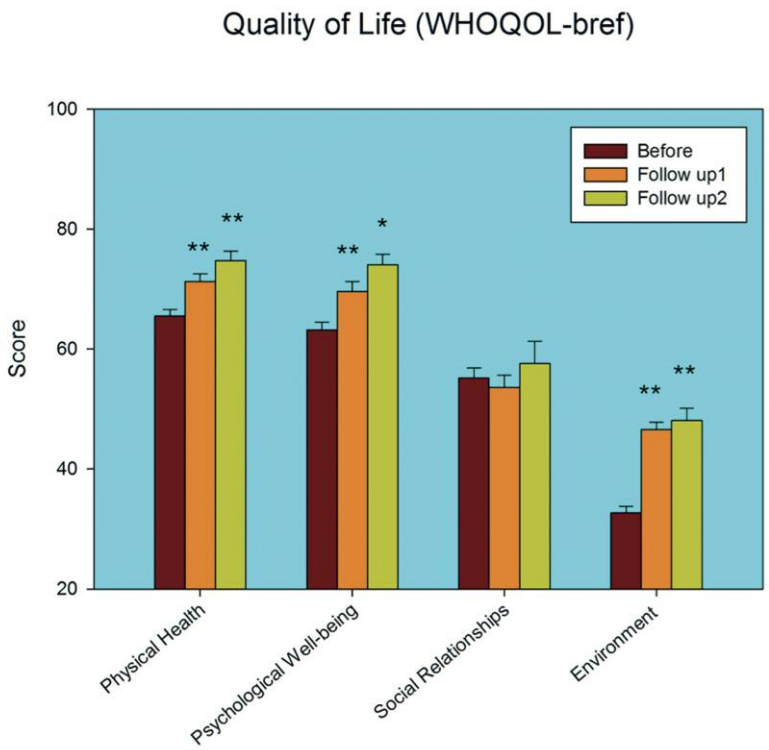

Figure 5. Quality of life (WHOQOL-BREF) before and after house upgrading. Follow up 1= 1month, follow up 2= 6 months after intervention. TECHO study.

Among 150 participants (91 females and 59 males), 77 (47 females and 30 males) successfully completed the protocol by answering questionnaires once before and once after the housing improvement. A total of 30 (19 females and 11 males) were available for a re-interview after six months with the same measurement tools.

The mean ± SEM age of the initial sample was 30.6 ± 0.74 years. The average income per family member was considerably below the poverty line according to the national standard measured by the access to an average diet. The families also matched at least two criteria from unsatisfied basic needs (more than three people living in the same room, living in a substandard house/tenancy, a children aged 6 to 12 not attending to school or no sewage), another complementary tool used to measure poverty. The entire sample attended primary school, however only 46% completed the 7th Grade (from a total of 12 years of compulsory education). A total of 4% had finished high school and none had attended post-secondary education. Subjects were asked about income level, formal education, attained demographic and health data including age, height, body weight and the presence (yes or no) of smoking habits, cardiovascular disease family history, and diagnosed diabetes, hypertension or dyslipidemia.

Participants answered questions about self-perceived psychological stress defined as a feeling of tension, irritability or anxiety, or as having sleeping difficulties as a result of conditions at work or at home during the past month.

To assess sleep, a Spanish version of PSQI (14) was used (15). The questions generated seven component domain scores: subjective sleep quality; sleep latency; sleep duration; habitual sleep efficiency; sleep disturbances; use of sleep medication; and daytime dysfunction. Each of them was weighted equally from "0 "to "3" and the global PSQI score ranges from "0" to "21", with higher scores indicating poorer sleep quality.

For assessing quality of life the WHO Quality of Life (WHOQOL-BREF) was used. The brief version of WHOQOL is a self-report generic quality of life inventory of 26 items, including 4 domains: a) Physical health: activities of daily living, dependence on medicinal substances and medical aids, energy and fatigue, mobility, pain and discomfort, sleep and rest, work capacity. b) Psychological well-being: bodily image and appearance, negative feelings, positive feelings, self-esteem, spirituality/religion/personal beliefs, thinking, learning, memory and concentration. c) Social relationships: personal relationships, social support, sexual activity. d) Environment: financial resources, freedom, physical safety and security, health and social care: accessibility and quality, home environment, opportunities for acquiring new information and skills, participation in and opportunities for recreation/leisure activities, physical environment

(pollution/noise/traffic/climate), transport. Two of the items measure Overall QoL/health. The measure is rated on a 5-point Likert scale ranging 0 to 100 with higher scores indicating better QoL (27,28).

The first phase used questionnaires to evaluate quality of life sleep and sleep quality before moving to the new house. The second phase explored sleep and life's changes through the same questionnaires.

The PSQI and WHOQOL-BREF were applied before and one month after the housing upgrading (follow up 1). Data on housing conditions, sleeping conditions, income, education, and cardiovascular risk were also collected. Participants who successfully completed the questionnaires after one month were re-interviewed after 6 months (follow up 2). The semi-structured interview took place during phase 2, i.e. between one and six months of living in the new house.

Housing conditions significantly improved after the program. The percentage of people who reported struggling weekly with structural aspects of their roof decreased from 57.3 to 2.6%, the number of cases in which rain was considered a big problem decreased from 70.0 to 3.9% and the number of cases where dampness was considered a major problem decreased from 70.0 to 1.3% (p 0.001). Overall dissatisfaction with housing conditions decreased from 78.7 to 2.6% (p 0.001). Before the housing intervention 39.4% of participants reported being stressed quite often, while after one month and six months that percentage decreased to 5.6 and 3.3% respectively (p 0.001).

Figure 4 and 5 summarize the results of the different domains of the PSQI and WHOQOL-BREF before and after TECHO intervention. Marked improvements were seen in subjective sleep quality, sleep distur-

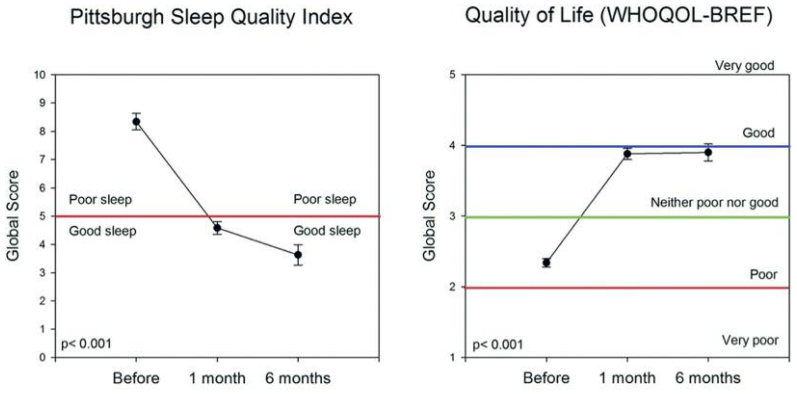

Figure 6. Overall improvement in sleep quality and quality of life after housing improvement. TECHO study.

bances and daytime dysfunction. The use of sleep medication was similar before and after intervention. After six months of follow up, results remain mostly the same (Fig. 4). In the case of WHOQOL-BREF, the most significant difference was seen in overall quality of life and environment domain, while changes were non-significant as far as the social relationship domain (Fig. 5). As shown in Fig. 6 global score of PSQI and WHOQOL-BREF improved significantly after TECHO intervention.

4. Conclusions

Although several studies support the conclusion that sleep problems are associated with an increasing number of diseases and health problems (see e.g., (9,10)), few observations have been published on the way social factors can predict or influence the length and quality of sleep. It has been reported that a higher level of education is associated with better quality of sleep through the possibility of obtaining a higher level of income (29). The data presented herein allow us to conclude that socioeconomic status, type of dwelling, place of residence and level of education are important determinants of health. Disorders in the length and quality of sleep may have an important role in explaining how these social factors translate into specific pathologies.

As shown in the second part of the present study a slum-house upgrade has a significant positive impact on sleep quality and QOL. This could be showed in both quantitative (reported herein) as well as in qualitative results (see (30). Sleep quality was mostly associated with QOL domains before but not after the intervention.

It has been proposed that sleep quality is a significant mediator and amplifying factor in the association between neighborhood and psychological disorder (19,31). Additionally, being a resident of a disadvantaged neighborhood and low socioeconomics in general, have been associated with poor sleep and worse self-reported health (32-34). Interestingly, our result show that a good sleep is possible even in a very poor and adverse environment, providing that you have four solid walls, a roof and you feel serene.

In the future, the use of physiological measurements may be necessary to glean a broader perspective of sleep in urban slums. The neighborhood structure, location and other slum conditions should also be taken into account since slums can vary substantially between one another in their composition and its level of urbanization and integration to the city. The addition of semi-structured interviews to questionnaires showed context orient answers, even to a standardized questionnaire. More mixed method researches could enhance and nuance knowledge about sleep. Concurrent investigations of low cost housing interventions that can lessen the adverse

societal effects of poor sleep with a consequent impact on quality of life are warranted.

Acknowledgments

Studies in authors' laboratory were supported by grants from Agencia Nacional de Promoción Científica y Tecnológica, Argentina (PICT 2007-01045, PICT 2010-1465 and PICT 2012-0984). DPC and DEV are Research Career Awardees from the Argentine Research Council (CONICET).

Conflict of Interest

The authors report no conflicts of interest.

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