Special Article

Effective Sustainable Design of a Care Communal Building Facility for People with Musculoskeletal Disorders

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Abstract

In this paper a review is made for efficient building and associative construction facilities for people with musculoskeletal disorders in a community health care unit. Literature review based on studies and reviews derived from international (Medline, PubMed, Cinahl, Scopus) data bases concerning social and functional problems of people with musculoskeletal disorders. Were used some keywords *Musculoskeletal disorders, Communal Health Building Design, Health Care, Sustainable Design.* Also, were used some articles (Greek National Law) by the State Printing of Greece.

An introduction is made on how people with musculoskeletal disorders are excluded from society. An evaluation is made of implementation communal building design solutions so that provides assistance for people with musculoskeletal disorders. In the end useful conclusions are presented for efficient communal building designs and associated communal sanitary engineering designs for people with musculoskeletal disorders in care communal building facilities.

Key Words: Musculoskeletal disorders, Communal Health Building Design, Health Care, Communal Sanitary Engineering Facilities

Introduction

Musculoskeletal disorders (MSDs) are injuries or disorders of the muscles, nerves, tendons, cartilage, joints, an disorders of the tendons, nerves, muscles and supporting structures of the upper and lower limbs, neck, and lower back that are caused, precipitated or exacerbated by sudden exertion or prolonged exposure to physical factors such as force, vibration, repetition or awkward posture.

Therefore, MSDs are pain or injuries in the body's joints, igaments, muscles, nerves, tendons, and structures that support limbs, neck and back (Howard, 2006; National Research Council and the Institute of Medicine, 2001; HSE, 2013).

MSDs are significant health and safety issues for which opportunities and challenges exist to better understand objective causes and effects, effective strategies, and economic impacts to prevent and treat these complicated disorders.

MSDs are degenerative diseases and inflammatory conditions that cause pain and impair normal activities. They can affect many different parts of the body including lower and upper back, shoulders, neck and extremities (arms, feet, legs, and hands). MSDs can arise from a sudden exertion (e.g., lifting a heavy object), or they can arise from making the same motions repeatedly repetitive strain, or from

repeated exposure to force, vibration, or awkward posture.

Examples of specific MSD disorders are carpal tunnel syndrome, epicondylitis, and tendinitis. Abrasions, contusions, and fractures that occur from sudden physical contact with objects that might occur in an accident are not considered MSDs (Howard, 2006; Côté et al., 2013; Barbe et al., 2013; HSE, 2013; Elefteriou et al., 2015 a; Elefteriou et al., 2015 b).

The most common diseases in the musculoskeletal system is non-specific pain, rheumatoid arthritis (RA), osteoarthritis (OA) and osteoporosis. The global prevalence of RA have been estimated at about 0.5-1.0 percent worldwide with a higher prevalence observed in northern Europe countries and the United States compared with southern Europe and developing countries (Lundkvist et al., 2008). In addition, 40 million people in the European Union (EU) are estimated to have osteoarthritis, corresponding to 0.5 percent of total gross domestic product (GDP), and in 2010, also 22 million women and 5.5 million men were estimated to have osteoporosis (Conaghan et al., 2014).

These figures are just a sample of diseases within the musculoskeletal system but nevertheless demonstrates the size of the problem. Musculoskeletal disorders also includes injuries caused by accidents.

The World Health Organization (WHO) estimated that approximately 5.8 million people die worldwide each year from injury, accounting for 11 percent of global mortality. This implies that injuries have a significantly impact on the society on a physical, psychological and economical level.

The total costs have been estimated at US$518 billion globally, meaning that injuries are a major cause of total health care costs in the world (Willenberg et al., 2012).

Efficient communal building facilities for people with musculoskeletal disorders

Efficient communal building facilities have to be improved based on past case studies of people with musculoskeletal disorders. Old health care building systems or new ones should follow proper construction designs in order to develop building facilities that minimize accidents supporting effective sustainable solutions. Special care should be given in cases that elderly people with musculoskeletal disorders have also Alzheimer's disease (Koliopoulos et al., 2016a). In the health care professionals the occupational Low back pain (LBP) is a very common complaint. LBP is usually defined as muscle tension, pain, or stiffness localized above the inferior gluteal folds, with or without leg pain (sciatica). LPB is a major health problem around the world which accounts for considerable socioeconomic and health care burden. The life time incidence of LBP has been reported between 60-80 % (Twomey et al., 2002; O'Sullivan, 2005).

In a study determined the prevalence of occupational LBP, the association of personal and work related factors with occupational LBP in health care workers at the university hospitals. Positive family history and smoking were found to be related to an increased risk of low back pain. The results of this study were yearly chronic low back pain prevalence was 16% and back pain prevalence was 34.3%. Sex, social status, race, weight, history of pregnancy or sports activities and daily living activities were not found to be related to low back pain (Altinel et al., 2007).

Researchers determined the prevalence of LBP in nurses who are working at public hospitals (Yilmaz and Ozkan, 2008). Researchers found that 39.9% of the nurses had experienced an episode of LBP and statistical correlation between LBP and working period, sleep regime and income level. In another study described musculoskeletal problems resulting from occupation and work setting in medical doctors who work in a hospital. Researchers established that 41 of 123 subjects had at least one musculoskeletal problem resulting from work setting and working so long time with the same position and repeating the same activities during wok day lead to a risk factor about musculoskeletal problems in medical doctor (Buker and Aslan, 2006).

Studies on the association between occupational risk factors and low back pain are hampered by the difficulties of measuring specific exposures. Occupational stressors, in particular stress from safety, physical environment, and ergonomics, were important predictors of musculoskeletal pain, as was coping by eating behavior, coping styles as eating, drinking coffee, tea, alcohol and smoking. Other coping styles, escaping/abreaction, external/social, and internal

were also found to have an impact on pain in different body regions. Psychosocial factors at work have also been shown to play important roles in the development of LBP. According to another research (Ghaffari et al., 2008) was tested the hypothesis that workplace psychosocial factors such as demand, control, support, job satisfaction and job appreciation can predict the future onset of disabling LBP in Iranian industrial workers. A total of 744 subjects reported current LBP, a total of 52 new episodes of disabling LBP were observed during the 1-year follow-up. Male employers reported higher demands, lower control and lower support than female employers.

Approximately 90% of cases of back pain have no identifiable cause and are designated as nonspecific. Many doctors order elaborate studies when nonspecific back pain is presented, including radiographs and magnetic resonance imaging. The results are little guidance to treatment decisions. Inconsistencies remain in the literature over the relative contributions of physical and psychological risk factors to the occurrence of back disorders and back pain. Relatively little is known about risk factors for the transition from acute to chronic LBP can be classified as individual, psychosocial, or occupational factors (World Health Organization, 2009, 2013; European Agency for Safety and Health at Work, 2010).

Moreover, in a health care building facility could be addressed the needs of black and ethnic minority groups which can be complex, as these communities have a diverse set of social beliefs, values, languages and cultural attitudes. There is a generalized belief that arthritis is completely dependent upon factors such as ‘good’ and ‘bad’ foods, or that it is a result of divine intervention. Rheumatoid arthritis may incur stigma, and there is a tendency for minority groups to prefer alternative therapies such as prayer, homeopathy and meditation. In a retrospective study of ethnic differences in response to DMARDs among patients with inflammatory arthritis, people of South Asian ethnicity stopped therapy sooner than North Europeans. Possible explanations for this included problems with effective communication, cultural differences in expectations and response to illness. Recent studies have shown increased pain and disability in South Asian patients with rheumatoid arthritis compared with their Northern European counterparts (National Institute for Health and Clinical Excellence, 2009).

However, there is a paucity of data on the effects of ethnicity on psoriatic arthritis. Data from Asia show a prevalence of 10–100 per 100.000 members of the population in China, and 0.1–1 per 100.000 in Japan. In Singapore, psoriatic arthropathy is more common in the Indian population than among the Chinese population, and therefore Indian ethnicity is acknowledged as a risk factor for arthritis. However, a recent observational study noted that there is a significant difference in disease perception (tender joint count) and pain and health assessment scores among Gujarati patients with psoriatic arthritis compared with their Caucasian counterparts (Tam et al., 2009).

Furthermore, there is little information available about osteoporosis or osteomalacia for minority ethnic groups. The information on osteomoalacia that is available is of limited benefit, as its cultural competence is open to question. To date, the focus on musculoskeletal health in minority ethnic groups in the UK has been lamentably limited. The 2011 UK census indicates a rapidly growing trend towards the UK becoming an even more pluralistic multi-ethnic society. In case the musculoskeletal health is to be truly meaningful for minority ethnic groups then a consensus on good practice is required. Good practice needs to seamlessly extend across the levels of policy, healthcare workers and provider organizations in order to integrate implementation and strategy that is culturally competent for ethnic minority groups (Hamson et al., 2003; Ash and Shireen, 2012).

At the present, approximately more than the half of the US adult population is sedentary. Among those who become physically active or embark upon exercise programs, one quarter will sustain an injury. Nearly all of these injuries will be activity-related, and one-third of those injured will permanently stop their activity as a result. Musculoskeletal complaints account for approximately 10–20% of all visits to family physicians. The lack of studies evaluating the quality of musculoskeletal medical care delivered by family physicians needs to be addressed (Garry, 2003). Clearly, if we are successful from the standpoint of a public health agenda in engaging more of the adult population in activity or exercise programs in building facilities, we

ought to expect to see more musculoskeletal injuries in the outpatient setting.

Over the last 20 years, in all countries of the WHO European Region, the public health challenges facing policy-makers and stakeholders have been significantly shaped by global and regional events and forces, in times of tumultuous change. In order to avoid MSD's, WHO was mandated in its constitution to promote the improvement of environmental hygiene and working conditions. Recognizing that environmental and occupational health are closely linked to public health and health systems development, WHO is addressing more all environmental determinants of health.

In Greece have been published several legislations in order to minimize MSD's in working environments. These legislations are taking into account E.U's legislative directives focused on risk factors, and measures that could take place in community health care units' working environments. A list of these legislations is presented below:

- Law 3850/2010 (FEK 84/A`/2.6.2010) Code of laws for the health and safety in working environments.
- Law 3762/2009 (FEK 75/A`/15.5.2009) Body for working inspection, organizations that are related to the Ministry of Social Protection and Work.
- Law 3385/05 (FEK 210/A/19.8.05) Promotion of the work to the society and support of the social cohesion.
- Law Π.Δ. 159/1999 (FEK 157/A`/3.8.1999) Modification of the law π.δ 17/96 neasures to improve the health and safety in working environments according to the E.C directives 89/391/EC and 91/383/EC (11/A).
- Law P.O. 95/1999 (FEK 102/A`/ 26.5.1999) Terms for the operation of services for civil protection.
- Law P.O. 17/96 (FEK 11/A/18.1.96) Measures for the improvement of health and safety in the working environment according to the E.C directives 89/391/EC and 91/383/EC (11/A).
- Law P.O. 368/1989 (FEK 163/A`/ 16.6.1989) Organization of the Ministry of Work.
- Law P.O. 294/88 (FEK 138/A/ 21.6.1988) Minimum working contract for technical safety inspector and work physician, level of knowledge and professional specialization for the enterprises, exploitations and works according to article 1, paragraph 1 of Law N.1568/85.
- Law 1568/85 (FEK 177/A/18.10.1985) Health and safety of the working staff.

With over 240 million workers in the European Union, EU labor law rights benefit large numbers of citizens directly and have a positive impact on one of the most important and tangible areas of their daily lives. (E.U's portal, 2016). The above legislations should be applied in all working activities in Greece including the working staff in health care building facilities so as to avoid any associated accidents that lead to MSD's.

Moreover, a bioclimatic efficient design is essential in health care communal building facilities for people MSD's in order to live in comfort conditions. Therefore should be supported and followed the main principles of bioclimatic design in health care communal building facilities for people MSD's in terms of ventilation, temperature comfort ability, lightness, openings, noise protection, and consumption of renewable resources (Liebard and Herde, 2015; Koliopoulos et al., 2016a).

Proper design principles should be applied in terms of sanitary engineering design principles for the health care professionals and people with MSD's living in community health care units for people with disabilities (Tchobanoglous et al., 1993; Tchobanoglous et al., 2003; Koliopoulos et al., 2003; Koliopoulos et al., 2007; Koliopoulos, 2010; Koliopoulos and Koliopoulou, 2006, 2007a,b,c, 2008, 2009; Koliopoulos, 2014a). Hence, drinking water, water quality monitoring, waste management designs and associative waste water design supportive facilities in health care facilities for people with MSD's should be analogous to the operational needs the geographic hydrological characteristics and the number of patients living in the health care facilities and the respective working nursing staff, physicians, and other health care professionals (Kollias, 1998; Husband, 2008; Dawoud, 2011; Carayanni et al., 2011).

Ergonomic principles and automations should exist both in working places and health care building facilities for people with MSD's (Ulrich, 1997, 1999; Uhlig et al., 2002; Ulrich et al., 2004). Hence, in this way prevalence will

exist, where occupational accidents could be minimized in working environments of health care units.

For people with disabilities building designs and automations should exist in community health care units based on building design regulations like the Greek ones, New Building regulation, published in Law 4067, ΦΕΚ 79/A/2012. Therefore, in the design of footbridges, parking areas or corridors lighting sensors should include motion sensors in case of sudden accidents and drop of patients with MDS or accidents of nursing working staff. Special assistance should be supported in health care building communal design facilities for disabled persons and persons with reduced mobility according to the stipulations of regulation (EC) No. 1107/2006. Risk assessment decision making should exist so as to design building plans for emergency routes in case of fire, earthquake disasters, explosions and associated risks.

Health care communal building facilities should exist close or to have transport facilities accessing easy to bus stops, metro undergrounds, and suburban railway stations. In this case disabled persons or relatives of them could move with comfort to and from the health care communal building facility having access to mass transport means.

Successful integration of ergonomic accessible communal design into the whole health care operational process requires careful consideration of potentially life cycle goals for a sustainable project at its earliest stages. The design should be focused on sustainability of current land uses as well as future building expansions and mobility urban facilities in order to meet project challenges for people with MSD's. Nursing staff, physicians and patients should be in a health care communal unit that follows a construction design with new construction materials and associative innovations which are supporting operational sustainability, effective building systems in energy consumption, health and safety, safe pathways in emergencies, security in road zones and mobility for people with disabilities to access easily the particular facilities of a communal health center.

An effective sustainable design of a communal health care facility for people with MDS should identify potential locations that construction projects will support innovative combinations of construction materials successfully for all of the stakeholders. The latter fact could be realized by the good planning of access into and around the spaces within the health care facility focused on the next crucial construction design points.

- Plan effective location of accessible entrances and facility access points around health care building facility positions in order to limit mobility travel distances for people with MSD's from site arrival points, public transportation stops, such as public sidewalks, and parking, to accessible building and facility entrances;
- Choose lighting options which accommodate MSD's people with low-vision;
- Apply lamps class A+ or A++ for lighting, using automations for lighting in late hours to switch off/on them and not in peak hours when nursing staff and physicians are working in the health care community unit;
- Support construction materials and innovative associative structural combinations in order to assist an effective bioclimatic design and to reduce health care building's energy consumption;
- Limit the need for travel between levels and the reliance on elevators and lifts, applying properly footbridges design for access to spaces within the health care facility if possible;
- Design corridors and main operational spaces in community health care units or in hospitals adjacent to community health care units that will have low noise in peak hours;
- Qualitative indoor environment with good air conditions avoiding smoke and odors;
- Design and apply construction materials with good thermal conductivity in order to upgrade old or build new ones health care community units in terms of qualitative building energy consumption for heating, cooling and use of hot water;
- Utilize modern technology so as to consume natural gas; energy from biomass or other ecological devices in energy consumption for heating, cooling and use of hot water, avoiding greenhouse emissions and energy consumption from non-renewable resources;
- Utilize modern technology so as to apply for heating, cooling and use of hot water,

avoiding greenhouse emissions and energy consumption from non-renewable resources;

- Utilize modern technology for heating radiators and place them in crucial locations in community health building units so as to provide optimum heat mass transfer;
- Provide equal access and flexibility to the particular health care unit's spaces between nursing staff, physicians and persons with MSD's.

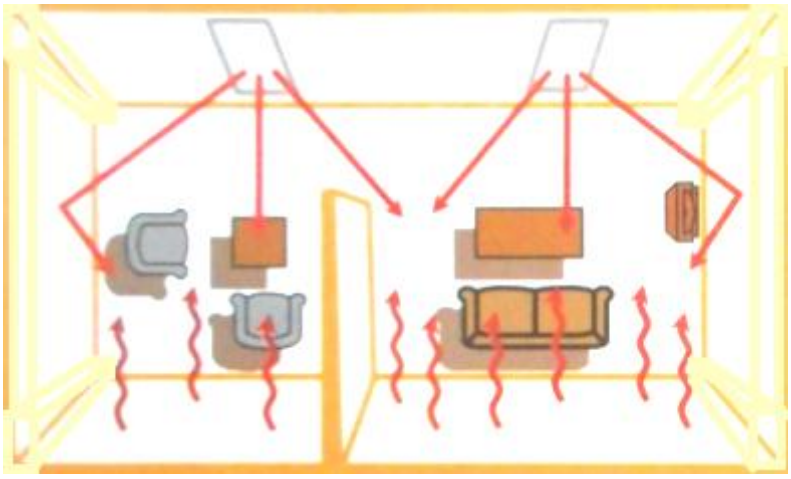

Fig. 1. Plan of an interior space in a community health building unit with proper construction materials, air conditioners and/or heating radiators placed in crucial locations so as to provide optimum heat mass transfer in operational building spaces. (Source: Koliopoulos, T., 2016b)

In figure 1 is presented a plan of interior spaces in community building health care units. Utilizing modern technology for air conditioners and/or heating radiators placed them in crucial locations units so as to provide optimum heat/cool mass transfer for people with MSD's, working staff and clinicians. The right location of construction materials with the right thermal conductivity property, installations of heating, cooling radiators and air conditioners are semantic for the qualitative heating or cooling of closed spaces in a community health care unit following the principles of the heat mass energy diffusion phenomenon. Structural beams and columns are highlighted in figure 1 as they present different thermal properties than the shear walls and decorative interior wall systems.

According to the above the goal of accessible design is to provide equal use of the built environment for all people working and living in the health care facility. Being proactive by planning for flexible design features and products will increase the likelihood of providing equal access over the life cycle of the facility. Effective sustainable accessible design benefits all of the stakeholders working and living in a health care facility.

Effective sustainable communal building design to support social events and to operate recreational activities for people with musculoskeletal disorders to be included in the society

Design objectives within a total project context should be focused on particular points in order to achieve quality, effectiveness and high-performance minimizing operational costs, social and health inequalities in communal health care facility buildings and open spaces for recreational activities. Recreational activities are encouraging not only people with MSD's but also nursing staff to be creative helping each other to the final cause which is the solidarity. In difficult economic times solidarity is essential to support social and health inequalities of our society. Jobs are coming up for nursing staff funded by E.U so as to be joined in solidarity programs assisting people with MSD's and immigrants with MSD's in difficult economic times like in Greece where austerity economic

measures have been increased during the last five years in the society.

New jobs could come up not only for nursing staff and physicians but also for engineering staff and technicians in community health care units for people with MSD's. In difficult economic time sanitary engineering and civil engineering principles should take their effort in smart designs combined with automations and information communication technologies in order to support effective sustainable constructions and to minimize energy consumption and equivalent carbon dioxide emissions.

Health care units could be constructed on old brownfield areas in terms of land cost's economy. Gardens and open areas for recreational activities could be constructed in community health care units after proper reclamation of former brownfields like closed landfills or former industrial areas. In case of landfills risk assessment tools should take place (Koliopoulos, 2010; Koliopoulou, 2010; Koliopoulos et al., 2016a). Therefore a list of essential points that should be taken into account for the good operation of a health care unit is presented below:

- Provide accessible routes in the health care facility which require low-effort, providing walks with no more than 1:20 running slope over ramps;
- Provide equivalent, easy, safe, and compliant access into the health care facility while maximizing security in emergencies;
- Provide equivalent mobility travel options and access to those provided for people without disabilities;
- Planning for access to spaces within the communal health care facility;
- Layout spaces whenever possible to limit travel distance between elements within the space;
- Group and centralize spaces to limit the amount of travel required between the operational spaces;
- Apply proper project management in open spaces like gardens installing effective composite prefabricated construction materials, centrally locating the main space for interactive activities and associated amentias is preferred to locating the main space and amenities at one end of the site;
- Apply modern sanitary engineering design systems utilizing properly waste water technologies for energy consumption or heating aesthetic greenhouses from biogas;
- A grid of motion sensors should set up so as to recognize probable accidents of people with MSD's i.e. drop of human body of elderly people on the floor or ramp;
- Horse riding for people with MSD's and sustainable precast design with steel roofs & steel structures;
- Follow regulations in digesters of horses wastes and compost materials;
- Support recreational activities for patients in health care units like running; swimming pool use and apply sanitary standards for pools operation;
- Support effective sanitary engineering designs for communal building facilities like water springs in building facility; horse riding for therapy of young people with MSD's; operate spring waters and constructions to make patients to interact more with the environment so as to cure their problems;
- Set up monitoring systems so as to avoid explosions by methane gas in waste treatment digesters installing properly sensors to be located for monitoring.

Technological advances have made available to health-care professionals a wide set of innovative training tools. Among these, Visual Reading seems to have a great potential to enhance the learning process. Teaching and Learning in digital environments are necessary for all the care professionals so as to be more productive a community health care unit (Romiszowski, 1997; Hill and Hannafin, 2001).

Good operational design should exist and good services should be provided by health care professionals to the patients with MSD's in order not to disappoint the users of a community health care unit having the aim to encourage them to be included in the society. Also a continuous development and improvement of a community health care unit should exist as a result of periodical questionnaires to the patients with MSD's. In this way will be improved the

operational design and services focused on health groups with different disorders and social inequalities. Employment opportunities and assistive building technology for disabilities should take place analyzing the results of the questionnaire.

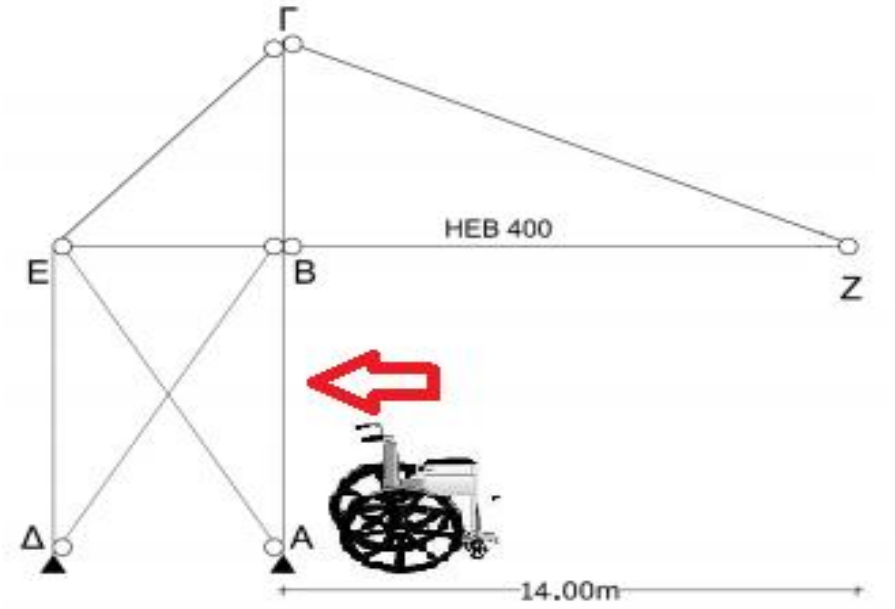

Fig. 2. Application of robust sustainable structural steel designs in health care systems so as to support recreational activities like horse riding competitions and social events or bazaars for people with MSD's. (Source: Koliopoulos, T., 2016c)

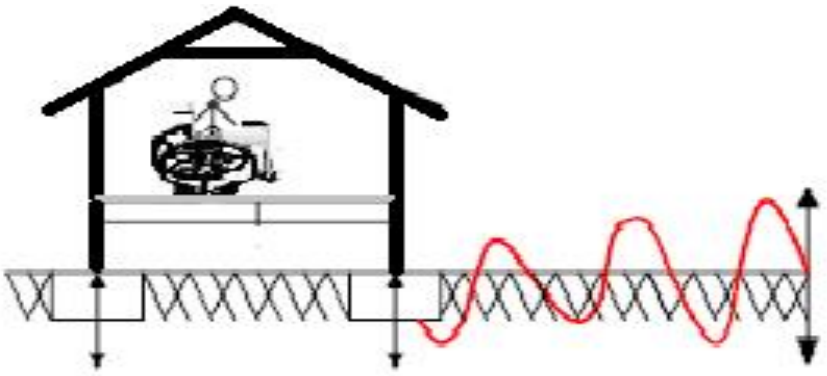

Fig. 3. Health care building facility and surface waves. At a health care unit building's settlements and cracks should be monitored frequently in order to support constructions for good building operation, structural behavior and foundation geotechnical stability of a communal health care facility in time. (Source: Koliopoulos, T., 2016d)

Due to the economic circumstances and the lack of big capitals recreational activities or health care facilities could be constructed on former brownfield areas after proper reclamation works. Associated risk assessment monitoring tools should take place in order to avoid surface waves due to explosive gases from the brownfields ie. methane gas from closed landfills or terrorist attacks. Also in case that there is a high seismic zone on the construction site of a community health unit the building's settlements and magnitude of cracks should be monitored

frequently in order to support relative constructions for good building operation, structural behavior and foundation geotechnical stability of a communal health care facility in time. For the latter two above mentioned cases in figure 3 is presented a health care unit and the surface waves, where building's settlements should be monitored frequently in order to support constructions for good structural and foundation geotechnical stability of a communal health care facility in time (Stevens et al., 1991; Deierlein et al., 2010).

Stimulation-oriented treatments include art, music and pet therapies, exercise, horse riding and any other kind of recreational activities. Stimulation has modest support for improving mood, behavior, and, to a lesser extent, function. Nevertheless, as important as these effects are, the main support for the use of stimulation therapies is the change in the person's with MSD's routine.

In figure 2 is presented a steel design structure with 14 meter - big span using HEB 400 series for beam design. It can be used as prefabricated structure instead of a reinforced concrete one presenting effective sustainable constructions with low equivalent carbon dioxide emissions. However, motion sensors could be installed on locations by the half length of columns or next to the edge of beams in order to monitor not only probable accidents by wheeled chairs between people with MSD's but also deflections of structural members caused by accidents with wheeled chairs or other physical loadings and moving actions. Continuous maintenance and support should take place in time.

Intellectual activities such as relaxing and doing particular gymnastic exercises relative to the MSD's problem or regular social interaction could be linked to a reduced risk of MSD's. Also a questionnaire to know what kinds of maintenance are necessary for the improvement of a health care communal building design and associated constructions is presented below.

- Are there indicators that exist drainage problems?
- Are there settlements in locations of a communal health care building facility? List the locations and magnitude results by engineering expert teams.
- Are there indications of leakage in drinking water; in waste water, gas or irrigation pipe network? List the locations and magnitude results by engineering expert teams.
- What kind of existing constructions should support new construction materials with low equivalent carbon dioxide emissions?
- What kind of existing building locations and constructions should support new automations with sensor motions? List places and locations that exist frequent accidents in health care facilities and hospital spaces.
- What kind of constructions should support new innovative design of construction materials to support operational health care communal building facility?
- What activities took place for interactivities of people with MSD's. What problems reported in terms of ergonomy and access of people with MSD's to the spaces of activities.
- What other rooms for therapy for people with MSD's and public health protection should exist?
- What other bioclimatic architecture renews; landscape innovations and constructions should exist in case of expansion of a health care communal building facility or change a part of land uses with an adjacent hospital facility?
- What project management methodologies should exist in renews operational construction activities and economic extensions in land uses?
- What kind of sanitary engineering constructions should exist to support sustainable design supporting operational energy consumption costs for a health care communal building facility?
- What kind of sanitary water quality monitoring equipment exist and what problems have been reported for maintenance and public health protection?
- What sanitary engineering monitoring installations exist on site with changed land uses on former brownfields?
- What sanitary engineering installations exist for upgrading landscape and associative land uses on health care communal activity gardens?

- What sanitary engineering installations exist for upgrading landscape and associative land uses on health care communal activity gardens?
- What sanitary engineering designed installations exist for waste water treatment; compost units and leachates' treatment in irrigations for upgrading landscape land uses on a health care communal building facility?
- What kind of sanitary engineering design; associative technologies and maintenance exist in terms of renewable resources by biogas exploitation (i.e. energy recovery, greenhouse heating, avoid explosions, fires etc.)?
- What risk assessment tools there for monitoring operational engineering designs in the life cycle of a communal health care building facility?
- What sanitary engineering facilities exist in terms of noise minimization?
- What sanitary engineering facilities exist in terms of greenhouse gases minimization?

Updating the above questionnaire and monitoring all the associated health care building's constructions it helps to maintain and operate a community health care unit properly in an effective sustainable way. Also water quality monitoring is the key to environmental protection of watercourses and for reliable process control and wastewater treatment for irrigations and aesthetic waterways in adjacent open spaces to the community health care building and particular locations for recreations.

Conclusions

Based on the above presented virtual learning educational utilities are necessary not only for nursing staff and health care professionals but also for patients to learn how to avoid any accidents in the working environments and during the intellectual activities respectively in a community health care unit.

Moreover, a continuous monitoring schedule is necessary for hydrological data; water levels; water quality parameters to be monitored continuously on site of a health care unit and recorded by a data logger; results can be either manually downloaded or automatically sent back to a website to real-time telemetry systems so as to take the right measures in time protecting public health i.e. operation of pumping, project management in emergencies etc. (Koliopoulos, 2014b). All of our water quality monitoring equipment is should be designed to be low powered as possible making it suitable for remote deployment and/or portable use.

Communal building facilities should be expanded in urban areas to serve massive population for people with MSD's. Demographic data should be updated frequently utilizing properly geographic information systems so as to follow the ongoing process of evaluating the health needs of social communities on given geographies. It should facilitate prioritization of health care needs and a strategy to address current solidarity support measures for people with disabilities. Constructions in a community health care unit should be focused on people to be included in the society. Also inspectors of public health are necessary to work in integrated scientific teams of a community health care unit. Sanitary engineering principles should be monitored continuously in a community health care unit in terms of air quality, recycling compost, sewage, drainage operation systems and water quality in total organic carbon concentrations, safe irrigation systems for gardening for walking and other associated sanitary technologies protecting public health.

Also foot bridges should be preferred in a communal building health design as they could operate better instead of using frequent elevators avoiding not only long routes for people with MSD's in a health care unit but also recovering energy consumption in operational costs of a health care unit. Continuous monitoring of deflections and cracks of structural members of a community health care building facility is necessary so as to realize proper maintenance constructions in time.

Environmental geotechnics and associated sanitary engineering constructions are necessary to upgrade old reclamation brownfields for walking and tracking in aesthetic waterways. Renewable energy should be used in terms of biogas exploitation for electricity consumption and heating of greenhouses in health care's maintenance gardening facilities. Recycling construction materials for construction or indoor monumental architecture and support in mobility of parts of museums to be guested in a health care facility have to be encouraged for the ethics and the good psychology of patients with MSD's

and health care professionals in a community health care system.

Furthermore optimization of openings and shadowing in terms of good natural or artificial lighting and design of land use openings for accurate detection of operational problems are necessary in an integrated sustainable design of a community health care unit. Community health care design may help improve patient safety directly by reducing patient falls, nosocomial infections, and medication errors. Health care design may also help improve patient safety indirectly by reducing staff stress, staff walking and patient transfer, and by improving handwashing compliance. However, there is still a need for more focused studies in order to improve communal heath care building facilities and associated constructions. Some reported contradictions on these links also need to be resolved. Meanwhile, the growing body of evidence in the field may already have an impact on how community health care units and health professionals should be designed and be operated respectively in the coming years.

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