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INTEGRATIVE REVIEW ARTICLE

THE AIR-CONDITIONED ENVIRONMENT AND THE NURSING PROFESSIONAL'S HEALTH: INTEGRATIVE REVIEW

O AMBIENTE CLIMATIZADO E A SAÚDE DO PROFISSIONAL DE ENFERMAGEM: REVISÃO INTEGRATIVA

EL AMBIENTE ACONDICIONADO Y LA SALUD DEL PROFESIONAL DE ENFERMERÍA: REVISIÓN INTEGRADORA

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ABSTRACT

Objective: to analyze scientific studies published between 2000 and 2010 which address health problems arising from the air conditioning system. **Methodology:** this is an integrative literature review study which aims to answer to the following question: "Does the air-conditioned environment generate health problems to the nursing professional?". Data were surveyed on the bases Latin American and Caribbean Health Sciences Literature (LILACS) and Scientific Electronic Library Online (SciELO). After careful reading of studies, one performed the analysis of contents, using the Polit and Hungler technique. An instrument was prepared to evaluate studies, having the 2012 CAPES Qualis classification table as a basis. **Results:** one identified 16 studies, however, when subject to the inclusion criteria set for this study, only 4 studies were selected: 2 from Lilacs and 2 from SciELO; 12 studies were repeated, i.e. they were found in both bases. **Conclusion:** the scientific studies identified proved to be incipient and, given what was exposed, in Brazil, the theme "air-conditioned environment" requires further investigation and constitutes an emerging field for research. **Descriptors:** Air-Conditioned; Biological Contamination; Occupational Risks.

RESUMO

Objetivo: analisar estudos científicos publicados entre 2000 e 2010 que abordam problemas de saúde decorrentes do sistema de ar-condicionado. **Metodologia:** trata-se de estudo de revisão integrativa de literatura que visa a responder a seguinte questão: "O ambiente climatizado gera agravos à saúde do profissional de enfermagem?". Os dados foram levantados nas bases Literatura Latino-Americana e do Caribe em Ciências da Saúde (Lilacs) e Scientific Electronic Library Online (SciELO). Após leitura minuciosa dos estudos, foi realizada a análise dos conteúdos, utilizando a técnica de Polit e Hungler. Foi elaborado um instrumento para avaliação dos estudos, com base na tabela de classificação Qualis da Capes, de 2012. **Resultados:** foram identificados 16 estudos, porém, quando submetidos aos critérios de inclusão estabelecidos para este estudo, apenas 4 estudos foram selecionados: 2 da Lilacs e 2 da SciELO; 12 estudos eram repetidos, isto é, foram encontrados em ambas as bases. **Conclusão:** os estudos científicos identificados mostraram-se incipientes e, diante do exposto, no Brasil, a temática "ambiente climatizado" demanda mais investigação e constitui campo de pesquisa emergente. **Descritores:** Ar-Condicionado; Contaminação Biológica; Riscos Ocupacionais.

RESUMEN

Objetivo: analizar estudios científicos publicados entre 2000 y 2010 que abordan problemas de salud derivados del sistema de aire acondicionado. **Metodología:** esto es un estudio de revisión integradora de literatura que se propone a responder la siguiente pregunta: "El ambiente acondicionado genera problemas de salud al personal de enfermería?". Los datos fueron recogidos en las bases Literatura Latinoamericana y del Caribe en Ciencias de la Salud (Lilacs) y Scientific Electronic Library Online (SciELO). Después de una lectura minuciosa de los estudios, fue realizado el análisis de los contenidos, utilizando la técnica de Polit y Hungler. Fue desarrollado un instrumento para evaluación de los estudios, con base en la tabla de clasificación Qualis de la Capes, de 2012. **Resultados:** fueron identificados 16 estudios, sin embargo, cuando sometidos a los criterios de inclusión establecidos para este estudio, sólo 4 estudios fueron seleccionados: 2 de la Lilacs y 2 de la SciELO; 12 estudios se repitieron, es decir, fueron encontrados en ambas bases. **Conclusión:** los estudios científicos identificados se mostraron incipientes y, a la luz del expuesto, en Brasil, el tema "ambiente acondicionado" demanda más investigación y constituye un campo de investigación emergente. **Descriptor:** Aire Acondicionado; Contaminación Biológica; Riesgos Laborales.

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INTRODUCTION

For broadening the health care's look with regard to the population's living conditions goes beyond the provision of clinical care services: it requires intersectoral actions involving education, basic sanitation, housing, income, labor, feeding, environment, access to goods, essential services, and leisure, among other determining health factors.¹ Through this prism, it's understood that the physical, social, and psychic environment may cause failures in the body's homeostasis, and these changes may stimulate the emergence of diseases. Health is promoted by providing good conditions for living and working.

With the greenhouse effect, the big cities have suffered a lot with the heat wave. Man himself has interfered with temperature, destroying and polluting the environment with physical and chemical vapors. The cluster of buildings erected every day hinders natural ventilation and one realizes a complex engineering just to accommodate the labor needs. It's known that heat has always existed, but, before, there wasn't such a serious interference of man over nature. Buildings were erected slowly. Today, it becomes less and less possible to live and work without an air-conditioned environment.

Generally, strategies are created to serve technology at the workplace and provide the worker with comfort, it's so because some structures require a mild temperature for its conservation. There's no air conditioning only in condominiums, hotels, offices, shopping centers, and hospitals, but also in houses within poor communities. In this context, it's common knowledge that lack of cleanliness and poor maintenance of air conditioning systems may cause or aggravate respiratory problems, when individuals are exposed on a daily basis to contamination by microorganisms. Thus, this study aimed to identify the scientific studies aiming to discuss the effects of an air-conditioned environment on people's health and its implications for the worker's health.

Thinking this way, it's emphasized that an air-conditioned environment is that in which the air temperature and humidity are controlled. It's known that internal comfort, at home or at work, is needed and important, however, the maintenance of equipment and pipelines is a must for its good performance; at the same time they cool the environment and provide a well-being sensation, they dry out the environment.²

For a better understanding and knowledge on the topic, it's important to keep in mind

that constant exposure to unhealthy environments may impair the immune system and cause allergic processes, headache, joint pain, eye and respiratory tract irritation, dry cough, dermatitis, fatigue, drowsiness, difficulty in concentrating, sensitivity to odors, etc.²

We live in a society affected by science and technology; the environment of a health care institution involves risks brought about by chemical, physical, biological, ergonomic and psychosocial agents which are permeated by a great importance, especially with regard to health professional education, having in mind the ideological, social, political, and economic interfaces related to biosecurity.³ In this context, one understands that artificially climate-controlled environments have become usual in large cities; however, if the air ducts, or even the filters, don't receive proper maintenance, they may become sources of contamination by biological agents and particles which are harmful to health.¹

It's known by everyone that the internal environment of buildings represents an ecosystem entirely created by human beings. These air conditioning systems are the primary means to heat or cool this environment and they keep individuals protected from pollution through the exchange of indoor air for outside air. Still following this line of reasoning, one looks for means which can improve the working conditions in these environments, as it's known that the arrangements with regard to the health problems produced by the air conditioning systems are poor.

Given the above, this study aims to analyze the production of knowledge on the health problems resulting from the air-conditioned environment effects on the nursing professional's health, focusing on promoting the health of people who work at this environment.

THEORETICAL GROUNDING

Pollutants are classified as primary or secondary. Primary pollutants are those compounds emitted directly to the air and the secondary ones are the substances which depend on parallel reactions in the atmosphere so that its formation occurs. Indoors, there can be numerous particles of microorganisms and substances toxic to human beings. There're substances known as volatile organic compounds (VOCs) and, when there're deposits of dirt in the air conditioning ducts, the air becomes a contamination source. The performance of

daily life activities in the big hospital companies and other workplaces in intense heat days would be impossible without air conditioning, because people's comfort within their working environment is an important requirement.⁴

Regarding the environment and the individual's health, when one thinks of healthy indoor environments, the first image which comes to mind are bright walls and large windows, for ventilation and abundant solar lighting. However, within the health institutions, closed facilities predominate and air conditioning systems are a must for climate control: both the temperature and the humidity are controlled to provide well-being and thermal comfort to people – since there's a regular and adequate maintenance.⁵

Due to the everyday life needs, human beings get increasingly confined to closed buildings, with artificially climate-controlled environments; this climate control, combined to a set of factors, such as project problems and poor maintenance of ventilation ducts, cause biological contamination by fungi, protozoa, bacteria, and viruses, not to mention the mites circulating in the air. In this context, the buildings which characterize cases of "sick building syndrome" should comply with the standards of the National Agency for Sanitary Surveillance (ANVISA) indicated in the resolutions RDC 50 and RE 176, but this doesn't exclude new buildings, because the maintenance of equipment is an obligation for all buildings. Everything started in the early 20th century, when there was a change in the pattern of architectural buildings, especially the commercial ones, which became increasingly high, glazed, without natural ventilation, and having a greater amount of people per square meter.⁶

Exposure to air components in this environment and the very characteristics of individuals exposed to it determine the clinical manifestations of diseases such as hypersensitivity pneumonitis (HP). This term refers to a predominantly interstitial spectrum of lung disorders and immunologically mediated, caused by exposure to organic dust particles and/or inhaled occupational antigens.³

Stand out more than 200 causative agents involved in various forms of PH, which is due to the inhalation of organic and/or inorganic antigens by susceptible individuals. The three major categories of causative antigens are microbial agents, animal proteins, and chemical substances with low molecular weight (isocyanates and pesticides).⁷

Not only the buildings regarded as sick, but also modern buildings, designed to provide their users with maximum comfort, may constitute a health-threatening environment; there's a high incidence of complaints related to health and environmental discomfort among users of these locations, with a high absenteeism rate, altered mood, dissatisfaction, and poor performance at work.⁴ In order to prevent diseases and problems resulting from air-conditioned environments, ANVISA set standards regulating air quality. One of them is the Resolution RE 9, enacted on January 16, 2003, providing reference guidelines for indoor air quality, in artificially climate-controlled environments, either public or collective – and the health care units fall into this resolution.⁸

In this context, one may clearly apply Florence Nightingale's environmentalist theory to the relationship between environment and patient's health: air renovation, quality, and temperature are regarded as ways to protect the health of those who stay at certain environments.

Thus, in the very workplace, with regard to its physical aspect, one also realizes the presence of stressors related to the often unhealthy conditions under which the professionals work, exposed to accidents and illnesses resulting from the materials and tools used, as well as the conditions posed by temperature, noise, and contact to chemical and bacteriological agents.⁹

Regarding the workplace unhealthy conditions, contamination by dust particles or colonized filters and the spread of bacteria and fungi are crucial to poor air quality indoors and they may play an important role with regard to health problems.¹⁰

In urban areas, it's estimated that today's man spends, on average, 87% of his day indoors; so, as most of the air he inhales is artificially controlled, the analysis on the quality of this air shows to be important. Indoors air pollution isn't restricted to hospitals and health care institutions, it also includes offices and non-industrial environments, such as houses, education institutions, stores and shopping malls, besides airports.¹⁰ Having this scenario in mind, one highlights the nursing professionals in hospital environments, closed, such as the surgical facilities and the very medical clinic, the high-risk outpatient wards, the emergency room, in addition to their exposure to undiagnosed patients – some of the factors constituting a stressful and exhausting job. It's worth remembering that

a patient with tuberculosis, for instance, requires abundant ventilation to prevent contamination, something which doesn't occur in air-conditioned environments in cases of overcrowding: in this case, it is very likely that people breathe contaminated air within this facility.¹¹

It's known that this is a fairly common problem, although poorly studied, particularly in public health and in occupational health, because only in the 17th century Bernardino Ramazzini set the relationship between some work forms and diseases, by observing the frequency of certain diseases acquired by people¹² who practiced certain crafts, also noticing the reflection of adverse working conditions combined to poor hygiene conditions on men's health. In this situation, ANVISA created the *Portaria* 3.523/GM, enacted on August 28, 1998, whose article 5 emphasizes that all climate control systems should have 100% appropriate conditions operating. Article 6 sets the need for a maintenance, operation and control plan.¹³

One emphasizes the importance of keeping air-conditioned environments for promoting workers' health, because the Sundsvall Statement, issued in 1991, calls for the active commitment of everyone to promote health at the workplaces, through more favorable actions aimed to provide a good physical, social, economic, or political environment, which has been included in the documents by the World Health Organization (WHO) as one of the primary points, understanding environment and health as interdependent and inseparable elements.¹ Therefore, thinking through the neuralgic issues with regard to the workplace triggers questions for making managers aware of structured actions based on regular control of the air circulating in the health care units.

In practice, quality of life consists in the individual's life conditions. Whether at the workplace or at home. Thus, it's understood as quality of working life (QWL) the set of worker's characteristics and the situational aspects in the work context, so, it involves systemic action on the organizational and individual characteristics which shape the worker's subjective world.¹⁴

It's worth remembering the search for economic profit, with decreased costs, through the air conditioning systems (in companies, stores, factories, shopping centers, houses, hospitals, clinics and health care centers); they are designed to provide immediate comfort, with no major concerns about the quality of the air people breathe.

The air-conditioned environments, closed, have a multitude of chemical (toxic, carcinogenic, radioactive substances) and biological (pathogens) compounds from various sources and, depending on the physical conditions of the environment (air humidity, air temperature, inadequate ventilation), these compounds can interact with each other.¹⁰

The maintenance of devices and systems is relegated to the background and the technical intervention of maintenance personnel is restricted to the time of solving any problems. The cleaning of filters, ducts, and other accessories is rarely adequate and regular and, due to this practice, the benefit of an air-conditioned environment becomes a real trap. It's important that health care professionals adopt cross-infection control measures, indicate the possibility of fungal infections, and try improving air ventilation, something which includes control of regular cleaning of the air conditioning system, so that the air-conditioned environment brings, in fact, benefits to users in the hospital environment.¹⁵

Thus, considering the complexity of air composition in air-conditioned environments, the pollutants they contain, and the effects of these pollutants on human beings, epidemiological studies show to be an important tool for visualizing the early warning signs of poor air quality in air-conditioned environments.¹⁵

METHOD

Paper developed from the monograph **The air-conditioned environment on the nursing worker's health**, presented to Universidade Federal do Rio de Janeiro. Rio de Janeiro-RJ, Brazil.

This is an integrative review study whose aim is examining the methods and results of researches, enabling a reflection that encourages further studies. This way, this research method seeks to deepen knowledge on a certain phenomenon having previous studies as a basis.¹⁶

This study aims to answer to the following question: "Does the air-conditioned environment generate health problems to the nursing professional". Data were surveyed at the databases Latin American and Caribbean Health Sciences Literature (LILACS) and Scientific Electronic Library Online (SciELO). In the searches, the descriptors air-conditioned, biological contamination, and occupational risks were used, within the period from 2000 to 2010, in Portuguese, and

the studies identified were available online in full text. One identified 16 studies, however, by taking into account the inclusion criteria, only 4 studies were selected: 2 from Lilacs and 2 from SciELO; 12 studies were found in both databases and, because of this, they were excluded from the sample. After a careful reading of the studies, an analysis of content was performed, through the Polit and Hungler technique¹⁶, which addresses the results in detail.

For a critical analysis of the studies, one prepared an instrument, which was submitted to a judge (professor at a public university) experienced in the theme investigated, who made suggestions.

The selected studies were systematically analyzed with regard to their objectives, materials, and methods, providing a synthesis of previous knowledge on the theme under investigation. One used a synoptic box specifically designed for this analysis, covering aspects regarded as pertinent, such as the research’s title, the authors’ name, what has been studied, the results, the recommendations, and the conclusions. One prepared an evaluation instrument for comparing the similarities and differences of studies, pointing out four sections (method, participants, intervention, and clinical outcomes). One adopted as a basis the 2012 CAPES Qualis classification table: one

criterion for including studies was the Qualis classification from A1 to B3; and one criterion for excluding studies was the Qualis classification ≤ B4.

The critical analysis of studies consisted in full reading of all selected studies, according to the instrument prepared, by the first author; half of the sample was read by the second author, in order to validate the process through the concordance index. All disagreements were discussed until a consensus was achieved.

RESULTS AND DISCUSSION

In the analysis of studies, two thematic categories emerged, namely: 1) air conditioning as a comfort item at the workplace; and 2) air conditioning as a transmitter of biological agents. It’s known that the air-conditioned environment is a great ally in warmer days, however, if there’s no regular maintenance, it may cause major health problems. Daily activities, especially in hospitals, would be impossible without air conditioning nowadays⁴ and all selected studies showed a great concern about the air-conditioned environment contamination and the consequences of poor maintenance of the air conditioning system in Brazil (Figure 1).

Studies from LILACS	Author(s)	Publication year
J Pneumol, 26(5)	Filho GPP, Silva MRC, Kritsk LA	2000
Fundação Oswaldo Cruz	Strausz CM	2001
Studies from SciELO		
Rev Soc Bras Med Trop, 39(6)	Mobin M, Salmito AM	2006
Rev Eletrônica Enferm, 8(1)	Afonso MSM, Souza ACS, Tipple AFV, Machado EA, Lucas EA	2010

Figure 1. Summary of the selected studies.

The first study examined fungal microbiota in air conditioning devices in the intensive care units (ICUs) of public and private hospitals in Teresina, Piaui, Brazil, and discussed the adequacy of their cleaning. In all ICUs under investigation, the amount of colony-forming units (CFUs) was above the levels allowed by *Portaria* 176/2000, from the Ministry of Health.

The second study reports and analyzes a fungal accident with workers at the Manguinhos Library, of the Oswaldo Cruz Foundation, in the city of Rio de Janeiro, Brazil, denounced by means of a petition. One identified problems related to uncontrolled environmental temperature, which translated themselves into discomfort, respiratory symptoms, and work leave due to the air-conditioned environment conditions. This event was characterized as a case of “sick building syndrome”, a problem deriving from

poor indoor air quality, especially at artificially climate-controlled environments.

The third study develops a critical analysis of *Portaria* 3,523, enacted on August 28, 1998, from the Ministry of Health, with an emphasis on air contaminants and their consequences for health in air-conditioned environments. There’s also a concise review of infections and hospital areas where their transmission through air may be significant, which require special ventilation systems.

The fourth and last selected study develops an integrative review to identify the factors making the air conditioning system an environmental contamination source, since particles carrying microorganisms circulate in the air.

So, one finds out the concern of scholars^{1,2,7,9,10} with regard to the air-conditioned environment and to the possibility of contaminating the professionals working at

it. Other authors^{1,2,4,14,17} are concerned about these professionals' quality of life.

The indoor air quality is the main concern of many scholars^{5,6,10,18}, while other authors focus on the exposure of nursing professionals to biohazards in these environments.¹¹ In face of this, one investigates with great interest the air quality at hospital settings, such as the neonatal ICU, the adult ICU, and the surgical center^{2,5,8,19}

The importance of biosecurity and its inclusion into the health professional education's syllabus is under discussion.³ Pulmonary changes resulting from exposure to contaminated conditioned air constitute another matter of concern⁷, besides the emission of VOCs. It's worth remembering that in hospitals and other health care facilities the biohazards are very significant; in the ICUs, the air conditioning system, the high density of people, and the use of chemical disinfectant substances may contribute to deteriorate this environment.¹⁸

In this line of thought, one promotes health by providing good living and working conditions; these situations that may compromise a work of excellence by nursing are noticeable and they may compromise the physical and emotional aspects of these professionals.²⁰

CONCLUSION

One concludes that complying with the rules and standards set by ANVISA¹³ will not only bring benefits and quality of life to nursing professionals, but also to all workers who usually stay in air-conditioned environments for most of their lives.

The air conditioning system control in hospitals and health units constitutes a major factor for the nursing professionals' health prevention. It's hoped that the results of this study encourage further studies on the theme, seeking viable and effective solutions.

The search for a healthier air-conditioned environment and better working conditions may impact in a decisive way the individual performance of each professional. Simple measures may be adopted for the maintenance and conservation of the air conditioning system, minimizing infections and allergies acquired in hospital environments. So, thinking of nursing care with quality of life means committing to a dignified and satisfactory labor.²¹

Labor has become a means by which man achieves satisfactory living conditions and the workplace has a great impact on his health, because, generally, he spends most of his life

at the workplace. If this environment is health-friendly, it tends to contribute to a satisfactory performance; on the other hand, an inappropriate work environment may generate health problems and compromise the professionals' performance.²²

Thus, it's known that the QWL constitutes the basis for achieving total quality, especially with regard to health professionals, whose priority is caring for the patient, something which often leads these workers to neglect their own health. One must have in mind that every human being is unique and gifted with individual skills and capabilities – which may be influenced by conditions of the environment concerned.

The scientific studies identified showed up to be incipient, although there's a great interest of scholars with regard to biosecurity; in face of the exposed findings, in Brazil, the theme "air-conditioned environment" requires further investigation and it constitutes an emerging field of research.

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