Night shift occupational risk related to breast cancer in nurses: A systematic review.

[Riesgo laboral en turno nocturno relacionado al cáncer de mama en enfermeras: Una revisión sistemática]

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Resumen
Objetivo: Identificar las evidencias científicas del riesgo laboral en turno nocturno relacionado al cáncer de mama en enfermeras.
Método: Se realizó una revisión de la literatura mediante la consulta de las siguientes bases de datos: PubMed, Science Direct, Scielo y Dialnet. Se seleccionaron registros entre los años 2012 al 2022, en español, portugués e inglés sobre la temática de interés.
Resultados: Después del análisis de la lectura crítica se identificaron un total de 16 estudios. La mayoría de los estudios reportan el riesgo ocupacional de la enfermera está relacionado al cáncer de mama con los turnos nocturnos más de 3 por mes, melatonina, exposición a la luz artificial durante la noche, ritmo circadiano entre otros.
Conclusiones: Los riesgos ocupacionales están presentes, por lo que la enfermera ante el incremento del riesgo de padecer de cáncer debe asumir acciones de autocuidado preventivo-promocional para favorecer su calidad de vida

Palabras clave: Cáncer de mama, enfermera, horario de trabajo por turnos.

Abstract
Objective: To identify the scientific evidence of occupational risk in night shift related to breast cancer in nurses.
Methods: A review of the literature was carried out by consulting the following databases: PubMed, Science Direct, Scielo and Dialnet. Records were selected from 2012 to 2022, in Spanish, Portuguese and English on the topic of interest.
Results: After critical reading analysis, a total of 16 studies were identified. Most studies report the occupational risk of the nurse is related to breast cancer with night shifts more than 3 per month, melatonin, exposure to artificial light during the night, circadian rhythm among others.
Conclusions: Occupational risks are present, so the nurse in the face of increased risk of cancer should assume preventive-promotional self-care actions to promote their quality of life.

Keywords: Breast cancer, nurse, shift work schedule.
1. Introduction

Breast cancer is the most common type of cancer in women, according to statistics in 2020 there were more than 2.2 million women who were diagnosed with this type of cancer, being the leading cause of mortality, at least 685,000 died as a result of this disease (WHO, 2021). According to the World Health Organization, the incidence of death has decreased by 2% to 4% annually and it is estimated that by 2020 to 2040, more than 2.5 million deaths from breast cancer will be avoided (Intramed, 2021).

Breast cancer originates from DNA change or mutations causing abnormal cell growth, these mutations can be hereditary or can also be acquired. It occurs during the course of a person's life (American Cancer Society, 2019) being 5-10% hereditary, while 95%-90% is sporadic (Torrantes, 2003). There are two genes highly related to breast cancer such as BCRA1 and BCRA2 that cause hereditary breast cancer, and there are also other genes such as Rb, p53 and NF-1 that are mutated; in turn this breast cancer has a multifactorial origin such as exposure to radiation, nulliparity, age over 50 years, sedentary lifestyle, high consumption of lipids (Palmero et al., 2021).

In Peru, the situation of breast cancer is increasing, being the third most frequent disease, with an incidence of 28 cases per 100,000 inhabitants, the mortality rate is 8.2 per 100,000 thousand inhabitants (MINSA, 2021).

In view of this situation, cancer patients require highly qualified professionals for their care, according to the Pan American Health Organization (PAHO), it is estimated that worldwide there are approximately 28 million nursing professionals, occupying the largest number of health professionals, despite this number, there is still a deficit of 5.9 million nurses in African countries, Southeast Asia and some Latin American countries (PAHO, 2020). Thus, nurses who perform health care activities are those who perform rotating shifts of 24 hours in day and night shifts is very frequent, with approximately 10-15% working at night, especially in the entities in charge of health, such as hospitals, health Centers, etc., being the personnel such as doctors, nurses, laboratorians, assistants, among others.

On the other hand, regarding night shifts, nurses need artificial light to perform nursing care activities, so they are constantly exposed to artificial light for an average of twelve hours, therefore, they have a job that constitutes a risk factor for acquiring breast cancer (Barahona et al., 2013). Night work is a factor of increased risk of breast cancer due to the interruption of the circadian rhythm, exposure to night light decreases the production of melatonin, which generates an increase in estrogen production, thus increasing the risk of breast cancer (Grundy et al., 2013). Finally, the study aims to make this phenomenon visible in order to understand and take preventive actions to benefit the quality of life of nurses working in the health care area.

2. Materials and methods

The literature review was descriptive and four databases were consulted: SciELO, Pubmed, Scopus and Google Scholar, and 20 articles were found and 15 scientific articles were selected according to the thematic of preventive actions on contrast extravasation in patients. Likewise, the inclusion criteria were used: from 2010 to 2021, English, Spanish and Portuguese languages; indexed articles were excluded; researches that were found repeated in the databases and that presented only abstracts, texts that were not related to the topic and with publication dates prior to 2010 were excluded. Gray literature was also excluded, with the exception of doctoral theses, records excluded because they did not have open access or full text in PDF.

For a visualization in both databases, see details:
A literature review of records from different databases was performed, following a pre-established protocol to minimize the risk of bias both in the choice and publication, also ensuring a correct structuring and content from PRISMA standards, (16) following the PICO format (Table 1).

### Table 1. Research question and keywords, peak format

<table>
<thead>
<tr>
<th>Search question</th>
<th>What is the association of night work and breast cancer in female nurses?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Nursing staff performing night work</td>
</tr>
<tr>
<td>Intervention</td>
<td>Occupational exposure, night shift</td>
</tr>
<tr>
<td>Comparator</td>
<td>Risk factors for breast cancer</td>
</tr>
<tr>
<td>Results</td>
<td>Level of association between night work and breast cancer in female nurses.</td>
</tr>
</tbody>
</table>

### Database:
The literature search was conducted between June 15 and July 15, 2022. Table 2 shows the total results obtained in the different phases of the bibliographic search, while Figure 1 shows the process of preselection of articles with the main causes of exclusion of the studies.

### Table 2. Bibliographic search results

<table>
<thead>
<tr>
<th>Database</th>
<th>Number of articles</th>
<th>Number of preselected articles</th>
<th>selected Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>PubMed</td>
<td>59</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Science Direct,</td>
<td>30</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Scielo</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Dialnet</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

### Keyword:
The search used keywords obtained from the descriptors in health sciences (DeCS) and medical subject headings (MeSH) used, as well as search education (Table 3).

### Table 3. Keyword peak format

<table>
<thead>
<tr>
<th>Words MeSH</th>
<th>Words Desc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift work schedule</td>
<td>Shift work schedule</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>Breast Cancer</td>
</tr>
<tr>
<td>Nurse</td>
<td>nurse</td>
</tr>
<tr>
<td>Circadian rhythm</td>
<td>Circadian rhythm</td>
</tr>
<tr>
<td>Melatonin</td>
<td>melatonin</td>
</tr>
</tbody>
</table>

### Inclusion and exclusion criteria:
Systematic reviews, descriptive studies and case-control studies on night work and breast cancer in nurses, written in English, Spanish and Portuguese and published from 2012 to 2022 were included. Studies that are focused on night work and its relationship in other types of cancer, studies whose languages were different from those mentioned in the inclusion criteria were excluded.

### Inclusion criteria:
- Studies conducted in the last 10 years (2012-2022).
- Studies in English, Spanish and Portuguese.
- Open access studies.

### Exclusion criteria:
- Studies with low scientific evidence
Figure 1. Flowchart of the publications search and selection process

- **Identification**: Records identified in the PubMed, Science Direct, sciELO, and Dialnet databases = 206
- **Eligibility**: Eligible articles by time interval from 2012 to 2022, leaving a total of 26 languages.
- **Exclusion**: Articles were excluded for duplicity and others for not having any link with the research topic (10).
- **Inclusion**: Selected items = 16

A total of 180 articles were reviewed according to the inclusion criteria.
3. Results

Table 4 Findings from the systematic review

<table>
<thead>
<tr>
<th>Author/year</th>
<th>Research Objective</th>
<th>Design Context</th>
<th>Population Interest for this review</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Fagundo-Rivera, J., Allande-Cussó, R., Ortega-Moreno, M., García-Iglesias, JJ, Romero, A., Ruiz-Frutos, C., &amp; Gómez-Salgado, J. (2021).</td>
<td>To analyze the risk of breast cancer that nurses had in relation to their lifestyle and work factors related to shift work.</td>
<td>Descriptive Switzerland 966 nurses</td>
<td>Breast cancer Nurses working in shifts Breast cancer</td>
<td>This study reports a significant increase in the risk of breast cancer in nurses, related to night work activity of more than 3 night shifts per month.</td>
</tr>
<tr>
<td>(3) Fagundo-Rivera, J., (2021)</td>
<td>To analyze the relationship between shift work, especially night work, and the risk of developing breast cancer in nursing professionals in Spain.</td>
<td>Descriptive Spain 966 nurses</td>
<td>Work exposure Rotating shifts Breast Cancer</td>
<td>Night work performed by nurses increases the incidence of breast cancer.</td>
</tr>
<tr>
<td>(5) Cheng-Ting Shen, Hui-Min Hsieh, Chih-Hong Pan, Ming-Tsang Wu, Yun-Shiuw Chuang (2021)</td>
<td>To investigate the risks of incident breast cancer among female health professionals compared to non-health professionals in Taiwan.</td>
<td>Cohort study Taiwan 277 543 health professionals</td>
<td>Breast cancer risk Female health professionals</td>
<td>An elevated risk of breast cancer in general was found in female health professionals. Regular mammography screening is important starting at age 45 years in female nurses and ultrasound in women younger than 45 years.</td>
</tr>
<tr>
<td>(6) Fagundo-Rivera, J., Gómez-Salgado, J., García-Iglesias, JJ, Gómez-Salgado, C., Camacho-Martín, S., &amp; Ruiz-Frutos, C. (2020).</td>
<td>To evaluate the possible relationship between shift work, especially night work, and the occurrence of breast cancer among female nurses.</td>
<td>Systematic review Spain 12 articles.</td>
<td>Night shifts Breast cancer nurse Circadian rhythm.</td>
<td>The different studies in this review show significant associations between breast cancer and prolonged rotating night shifts. Likewise, there is a relationship between alterations in certain circadian rhythm</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Title</td>
<td>Study Design</td>
<td>Location</td>
<td>Participants</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
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<td>--------------</td>
</tr>
<tr>
<td>Rosa, D., Terzoni, S., Dellafiore, F., &amp; Destrebecq, A. (2019)</td>
<td>To describe the effects of shift work and the desynchronization of circadian rhythms on nurse's health</td>
<td>Systematic review</td>
<td>24 articles</td>
<td>Breast cancer, sleep disorder.</td>
</tr>
<tr>
<td>Asmat Inostrosa, Marita del Pilar, De La Torre Robles, José Manuel, Casares Del Rio, María Victoria, &amp; Espadas Lazo, Carmen. (2018)</td>
<td>To identify the prevalence of intrinsic and extrinsic factors associated with breast cancer in the healthcare personnel of a III level hospital.</td>
<td>Descriptive study</td>
<td>Spain, 49 health personnel</td>
<td>Night shift, intrinsic and extrinsic factors</td>
</tr>
<tr>
<td>Peplonska, B., Bukowska, A., Lie, J. A., Gromadzinska, J., &amp; Zienolddiny, S. (2016)</td>
<td>To investigate the association between rotating night shift work and blood concentrations of estradiol, testosterone and dehydroepiandrosterone sulfate (DHEAS) and (2) to assess the role of their non-occupational determinants.</td>
<td>Cross-sectional study</td>
<td>532 nurses and midwives</td>
<td>Night shift work, nurse, hormone</td>
</tr>
<tr>
<td>James, P., Bertrand, K., Hart, J., Schernhammer, E., Tamimi, R. y Laden, F. (2017)</td>
<td>Examinar la asociación entre la LAN al aire libre residencial y la incidencia de cáncer de mama utilizando datos de la cohorte del Estudio de Salud de Enfermeras II a nivel nacional con sede en EE. UU.</td>
<td>Cohort study</td>
<td>USA, 109 672 women</td>
<td>Artificial light at night, Breast cancer in nurses</td>
</tr>
<tr>
<td>Pijpe, A., Slottje, P., van Pelt, C., Stehmann, F., Kromhout, H., van Leeuwen, FE, Vermeulen, RC y Rookus, MA (2014).</td>
<td>Examinar las exposiciones ocupacionales y riesgos de enfermedades crónicas entre enfermeras y la asociación potencial entre el trabajo por turnos y el riesgo de cáncer de mama.</td>
<td>Cohort study</td>
<td>The Netherlands, 192 931 women</td>
<td>Occupational exposures, Breast cancer, a chronic disease.</td>
</tr>
</tbody>
</table>
4. Discussion

The study is a comprehensive review of the literature analysis of the articles in the various databases was performed finding a total of 4 descriptive studies; 6 case-control; 4 cohort study and 2 systematic review. Regarding the findings, the following categories are highlighted:

Breast cancer is related to nocturnal work activity. International studies in various countries report that there is a greater predisposition to breast cancer in women nurses who work night shifts more than 3 times per month, as well as prolonged work shifts (Fagundo-Rivera et al., 2020; Gómez-Salgado et al., 2021; Fagundo-Rivera et al.,2021). In addition, they suggest that the increased risk of cancer according to scientific evidence is due to the alteration of circadian rhythm markers significantly affecting work performance (Clarke, 2021; Cheng-Ting et al., 2021; Fagundo-Rivera et al.,2021; Rosa et al., 2019; Asmat et al., 2018).

Likewise, studies from 2012 to the present report that this population group continues to carry out these activities, so it is essential to carry out promotion and prevention activities aimed at nurses to raise awareness and incorporate healthy lifestyles (diet, exercise, rest and sleep and recreational activities, among others), to prevent the development of this disease. (Peplonska et al., 2016; Wegrzyn et al., 2017; James et al., 2017; Pijpe et al., 2014; Lie et al., 2013).

In this sense, it is relevant to consider that the presence of several polymorphisms in circadian genes and night work, leads to a high risk of suffering from cancer (Zienolddiny et al.,2013), accompanied to artificial light during their working day of an average of twelve hours that increases the risk of cancer as reported (Hansen, et al.,2012; Dickerman et al.,2012). Given the...
above, preventive actions play a very important role in the fight against cancer, so the annual medical evaluation, as well as ancillary tests such as mammography and ultrasound is a form of control. Therefore, nurses must take preventive actions for self-care to avoid the disease. Occupational risks are latent, however, the responsibility to assume self-care is personal and institutional (Fagundo et al., 2021).

Circadian rhythms are responsible for maintaining homeostasis in the organism for which the alteration could generate imbalance in the organism, causing various diseases, as is the case of breast cancer (Juarez & Landero, 2014); the alteration of the circadian rhythm can cause failures in the balance of cell division and inhibition (Izu et al., 2011).

Melatonin, known as the hormone of darkness, is produced by the pineal gland (Romero et al., 2002), this hormone is secreted during the night between midnight and four o'clock in the morning, at that time is where it reaches its peak production (Santisteban, 2019). It is also secreted, but in small quantities by the retina, skin; its function in the body is antioxidant, immunostimulant, synchronizes circadian rhythms and sleep-wake cycle (González & Padrón, 2019). Melatonin when exposed to artificial light during night work decreases the levels of secretion, causing to develop a risk of breast cancer (Leonardi et al., 2012).

The relationship between night work in nurses and breast cancer is that due to shift schedules that are twenty-four hours, being twelve hours of day and twelve hours of night, thus generating a desynchronization between sleep-wakefulness and other biological rhythms, therefore, the circadian rhythms that are controlled by the biological clock are altered, causing the functioning of the pineal glands, responsible for secreting melatonin, which in turn is suppressed by the presence of artificial light causing a disorder of the genes that are responsible for the onset of cancer (Fresneda et al., 2013). That is why in various studies consider the nurse as an occupational group of increased risk for carcinogenesis among them breast cancer (Elsevier, 2018). Finally, the study allows to see the gaps in knowledge so it is important to continue investigating this phenomenon with other study variables.

Finally, the literature review evidences the need to recognize and identify risk factors to assume self-care actions, healthy lifestyles, use of personal protection measures, self-exploration, preventive medical evaluation and adequate use of photoprotectors that allow you to avoid the disease.

References


