





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]

Yuli Pilar Osorio Calle* , Katterin J. Sebastian Aquino , Roxana L. Rodriguez Matos , Mónica Elisa Meneses La Riva 

Instituto Nacional de Enfermedades Neoplásicas, Peru.

* ypilar0210@hotmail.com

Received: 12 August 2022; Accepted: 26 August 2022; Published: 02 September 2022

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 (Tarrantes, 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

Search question	What is the association of night work and breast cancer in female nurses?
Population	Nursing staff performing night work
Intervention	Occupational exposure, night shift
comparator	Risk factors for breast cancer
Results	Level of association between night work and breast cancer in female nurses.

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

Database	Number of articles	Number of preselected articles	selected Articles
PubMed	59	20	12
Science Direct,	30	8	2
Scielo	4	2	1
Dialnet	5	2	1

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

Words MeSH	Words Desc
Shift work schedule	Shift work schedule
Breast cancer	Breast Cancer
Nurse	nurse
Circadian rhythm	Circadian rhythm
Melatonin	melatonin

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

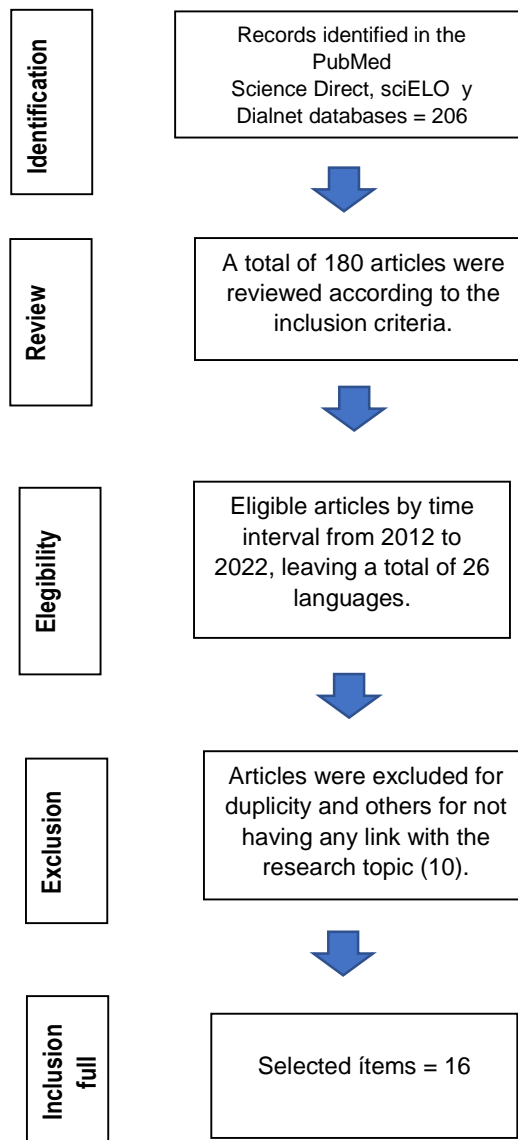


Figure 1. Flowchart of the publications search and selection process

3. Results

Table 4 Findings from the systematic review

Author/year	Research Objective	Design Context	Population Interest for this review	Conclusions
(1) Fagundo-Rivera, J., Allande-Cussó, R., Ortega-Moreno, M., García-Iglesias, JJ, Romero, A., Ruiz-Frutos, C., & Gómez-Salgado, J. (2021).	To analyze the risk of breast cancer that nurses had in relation to their lifestyle and work factors related to shift work.	Descriptive Switzerland 966 nurses	Breast cancer Nurses working in shifts Breast cancer	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.
(2)Gómez-Salgado, J., Fagundo-Rivera, J., Ortega-Moreno, M., Allande-Cussó, R., Ayuso-Murillo, D., & Ruiz-Frutos, C. (2021).	To analyze the relationship between night work and the development of breast cancer risk factors in nurses.	Descriptive Spain 980 nurses	Night work Occupational hazards Breast cancer	Night work increases breast cancer risk in nurses.
(3)Fagundo-Rivera, J.,(2021)	To analyze the relationship between shift work, especially night work, and the risk of developing breast cancer in nursing professionals in Spain.	Descriptive Spain 966 nurses	Work exposure Rotating shifts Breast Cancer	Night work performed by nurses increases the incidence of breast cancer.
(4)Clarke, R., Amini, H., James, P., von Euler-Chelpin, M., Jørgensen, J. T., Mehta, A., Cole-Hunter, T., Westendorp, R., Mortensen, L. H., Loft, S., Brandt, J., Hertel, O., Ketznel, M., Backalarz, C., Andersen, Z. J., & Lim, Y. H. (2021).	We examined the association between outdoor residential LAN and breast cancer incidence: general and subtypes classified by estrogen receptor (ER) and progesterone (PR) status.	Cohort study Denmark 16,941 nurses	Outdoor light at night Incidence of breast cancer	Outdoor light at night Incidence of breast cancer
(5)Cheng-Ting Shen, Hui-Min Hsieh, Chih-Hong Pan, Ming-Tsang Wu, Yun-Shiuan Chuang (2021)	To investigate the risks of incident breast cancer among female health professionals compared to non-health professionals in Taiwan.	Cohort study Taiwan 277 543 health professionals	Breast cancer risk Female health professionals	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.
(6) Fagundo-Rivera, J., Gómez-Salgado, J., García-Iglesias, JJ, Gómez-Salgado, C., Camacho-Martín, S., & Ruiz-Frutos, C. (2020).	To evaluate the possible relationship between shift work, especially night work, and the occurrence of breast cancer among female nurses.	Systematic review Spain 12 articles.	Night shifts Breast cancer nurse Circadian rhythm.	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

(7) Rosa, D., Terzoni, S., Dellafiore, F., & Destrebecq, A. (2019).	To describe the effects of shift work and the desynchronization of circadian rhythms on nurse's health	Systematic review 24 articles	Breast cancer, sleep disorder.	markers and breast cancer.
(8) Asmat Inostrosa, Marita del Pilar, De La Torre Robles, José Manuel, Casares Del Rio, María Victoria, & Espadas Lazo, Carmen. (2018).	To identify the prevalence of intrinsic and extrinsic factors associated with breast cancer in the healthcare personnel of a III level hospital.	Descriptive Spain 49 health personnel	Night shift, extrinsic and intrinsic factors	Shift work alternates psychophysical hemostasis, leading to poor work performance and risk of diseases such as breast cancer. Night work can increase the risk of breast cancer, so it is working, it is unlikely to eliminate this work schedule, therefore, one of the protective and preventive measures is to improve lifestyles, such as diet, exercise, trying to respect the hours of sleep.
(9) Peplonska, B., Bukowska, A., Lie, J. A., Gromadzinska, J., & Zienolddiny, S. (2016).	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.	Cross-sectional descriptive 532 nurses and midwives	Night shift work, nurse, hormone	Night work performed by nurses elevates breast cancer incidence.
(10) Wegrzyn, L., Tamimi, R., Rosner, B., Brown, S., Stevens, R., Eliassen, A., Laden, F., Willett, W. C., Hankinson, S., & Schernhammer, E. (2017).	To examine the associations between rotating night shift work and breast cancer risk.	Cohort study USA 121 701 nurses	Breast cancer Work tolerance Estrogen receptor	Night work in nurses increases the risk of breast cancer, especially in young adulthood.
(11) James, P., Bertrand, K., Hart, J., Schernhammer, E., Tamimi, R. y Laden, F. (2017).	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.	Cohort study USA 109 672 women	Artificial light at night, Breast cancer in nurses	More studies are required to confirm that artificial nighttime light causes breast cancer, but according to our evidence obtained LAN may cause a risk of invasive breast cancer.
(12) Pijpe, A., Slottje, P., van Pelt, C., Stehmann, F., Kromhout, H., van Leeuwen, FE, Vermeulen, RC y Rookus, MA (2014).	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.	Cohort study The Netherlands 192 931 women	Occupational exposures, Breast cancer, a chronic disease.	The increase in night work nowadays has brought with it chronic diseases, but more rigorous studies are needed to associate it with breast cancer.

(13) Lie, J. A., Kjuus, H., Zienolddiny, S., Haugen, A., & Kjærheim, K. (2013).	Investigar si el trabajo nocturno está relacionado con el estado del receptor del cáncer de mama	Case study control Norway 513 nurses	- Breast cancer, hormone receptors.	Progesterone may play an important role in a negative way in night work, considering a high risk in breast cancer.
(14) Zienolddiny, S., Haugen, A., Lie, JA, Kjuus, H., Anmarkrud, KH y Kjærheim, K. (2013).	Explorar el papel de los polimorfismos del gen circadiano en la susceptibilidad al riesgo de cáncer de mama relacionado con el trabajo nocturno.	Case study control Norway 1182 women	- Breast cancer. Circadian clock.	Similarities were found in associations between several polymorphisms in circadian genes and night work, leading to a high risk of breast cancer in nurses working at least three consecutive night shifts.
(15) Hansen, J., & Stevens, R. G. (2012).	Identificar el impacto del trabajo por turno y el riesgo de cáncer de mama en enfermeras danesas.	Case control study Denmark 91104 nurses	Breast cancer, shift system.	Increased odds of breast cancer risk from night work, more studies on circadian rhythm, markers of circadian genetic alteration required.
(16) Dickerman, B., & Liu, J. (2012).	Identificar artículos de impacto de la exposición a LAN en el riesgo de cáncer de mama entre las enfermeras del turno de noche.	Systematic review USA 11 articles	Breast cancer Night work Occupational health	It is unlikely that this mode of work will be eliminated, despite studies of the occupational risk of nighttime light producing breast cancer, but more studies are still needed to prove it.

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; Wegryzn 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

- American Cancer Society, 2019, breast cancer. <https://www.cancer.org/es/cancer/cancer-de-seno/acerca/como-se-forma-el-cancer-de-seno.html>
- Asmat, M., De La Torre, J., Casares Del Rio, M., & Espadas, C. 2018. Night work and breast cancer in healthcare personnel. *Journal of the Spanish Association of Specialists in Occupational Medicine.*, 27(3), 141-149. http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1132-62552018000300141&lng=es&tlng=es.
- Barahona, A., Vidaurre, E., Sevilla, F., Rodríguez, J, Monge, S., 2013. Night work and its implications on the health of doctors, nurses and security officers of the Costa Rican Social Security Fund hospitals in Costa Rica. *Legal Medicine of Costa Rica*, 30(1), 17-36. http://www.scielo.sa.cr/scielo.php?script=sci_arttext&pid=S1409-00152013000100003&lng=en&tlng=es

- Clarke, R., Amini, H., James, P., von Euler-Chelpin, M., Jørgensen, J. T., Mehta, A., Cole-Hunter, T., Westendorp, R., Mortensen, L. H., Loft, S., Brandt, J., Hertel, O., Ketzler, M., Backalarz, C., Andersen, Z. J., & Lim, Y. H. 2021. Outdoor light at night and breast cancer incidence in the Danish Nurse Cohort. *Environmental research*, 194, 110631. <https://doi.org/10.1016/j.envres.2020.110631>
- Cheng-Ting., S., Hui-Min H., Chih-Hong, P., Ming-Tsang, W., Yun-Shiuan C. 2021. Breast Cancer Risk Among Female Health Professionals: A 35-Year Population-Based Longitudinal Cohort Study in Taiwan. *American Journal of Preventive Medicine*, 61(6), 831-840, <https://doi.org/10.1016/j.amepre.2021.05.024>.
- Dickerman, B., & Liu, J. 2012. Does current scientific evidence support a link between light at night and breast cancer among female night-shift nurses? Review of evidence and implications for occupational and environmental health nurses. *Workplace health & safety*, 60(6), 273–282. <https://doi.org/10.1177/21650799120600060>
- Elsevier Connect., 2018. Night shift increases cancer risk in nurses. <https://www.elsevier.com/es-es/connect/enfermeria/el-turno-de-noche-aumenta-el-riesgo-de-padecer-cancer-en-las-enfermeras>
- Fagundo, J. 2021. Occupational exposure to breast cancer risk factors. Night work in nursing personnel. <https://dialnet.unirioja.es/servlet/tesis?codigo=296790>
- Fagundo, J., Allande, R., Ortega, M., García, J. J., Romero, A., Ruiz, C., & Gómez, J. 2021. Implications of Lifestyle and Occupational Factors on the Risk of Breast Cancer in Shiftwork Nurses. *Healthcare (Basel, Switzerland)*, 9(6), 649. <https://doi.org/10.3390/healthcare9060649>
- Fagundo-Rivera, J., Gómez-Salgado, J., García-Iglesias, JJ, Gómez-Salgado, C., Camacho-Martín, S., Ruiz-Frutos, C. 2020. Relationship between Night Shifts and Risk of Breast Cancer among Nurses: A Systematic Review. *Medicina (Kaunas, Lithuania)*, 56(12), 680. <https://doi.org/10.3390/medicina56120680>
- Fresneda, F., Gómez, J. & Bascopé, H. 2013. Riesgo de cáncer de mama en trabajadoras de turno nocturno. *Medicina y Seguridad del Trabajo*, 59(230), 146-158. <https://dx.doi.org/10.4321/S0465-546X2013000100010>
- Gómez-Salgado, J., Fagundo-Rivera, J., Ortega-Moreno, M., Allande-Cussó, R., Ayuso-Murillo, D., & Ruiz-Frutos, C. 2021. Night Work and Breast Cancer Risk in Nurses: Multifactorial Risk Analysis. *Cancers*, 13(6), 1470. <https://doi.org/10.3390/cancers13061470>
- González, M., & Padrón, A., 2019. Melatonin and its role in inflammatory processes. *Cuban Journal of Rheumatology*, 21(2), e89. Epub http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1817-59962019000200015&lng=es&tlng=es
- Grundy, A., Richardson, H., Burstyn, I., Lohrisch, C., SenGupta, S. K., Lai, A. S., Lee, D., Spinelli, J. J., & Aronson, K. 2013. Increased risk of breast cancer associated with long-term shift work in Canada. *Occupational and environmental medicine*, 70(12), 831–838. <https://doi.org/10.1136/oemed-2013-101482>

- Hansen, J., Stevens, R. 2012. Case-control study of shift-work and breast cancer risk in Danish nurses: Impact of shift systems, *European Journal of Cancer*, 48(11),1722-1729. <https://doi.org/10.1016/j.ejca.2011.07.005>
- Izu, M., Antunes, E, Cavalcanti., G., Rosa, Z. 2011. Night work as a risk factor in carcinogenesis. *Ciencia y enfermería*, 17(3), 83-95. <https://dx.doi.org/10.4067/S0717-95532011000300008>
- Intramed. 2021. Noticias médicas. <https://www.intramed.net/contenidover.asp?contenidoid=99459>
- James, P., Bertrand, K., Hart, J., Schernhammer, E., Tamimi, R., Laden, F. 2017. Outdoor Light at Night and Breast Cancer Incidence in the Nurses' Health Study II. *Environmental health perspectives*, 125(8), 087010. <https://doi.org/10.1289/EHP935>
- Juarez, D., & Landero, R. 2014. Circadian rhythms in oncology patients. *Psicogente*, 17(32), 352-364. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0124-01372014000200008&lng=en&tlng=es
- Leonardi, G., Rapisarda, V., Marconi, A., Scalisi, A., Catalano, F., Proietti, L., Travali, S., Libra, M., & Fenga, C. 2012. Correlation of the risk of breast cancer and disruption of the circadian rhythm (Review). *Oncology reports*, 28(2), 418-428. <https://doi.org/10.3892/or.2012.1839>
- Lie, J. A., Kjuus, H., Zienolddiny, S., Haugen, A., & Kjærheim, K. 2013. Breast cancer among nurses: is the intensity of night work related to hormone receptor status? *American journal of epidemiology*, 178(1), 110-117. <https://doi.org/10.1093/aje/kws42>
- MINSA, 2021. National plan for the prevention and control of breast cancer in Peru. <http://bvs.minsa.gob.pe/local/MINSA/4234.pdf>
- Organización Panamericana de la Salud (2020). *Enfermería*. <https://www.paho.org/es/temas/enfermeria>
- Palmero, P., Lassard, R., Juárez, A., et al., 2021. Breast cancer: an overview. *Acta Med.*;19(3):354-360. DOI: 10.35366/101727
- Peplonska, B., Bukowska, A., Lie, J. A., Gromadzinska, J., & Zienolddiny, S. 2016. Night shift work and other determinants of estradiol, testosterone, and dehydroepiandrosterone sulfate among middle-aged nurses and midwives. *Scandinavian journal of work, environment & health*, 42(5), 435-446. <https://doi.org/10.5271/sjweh.3581>
- Pijpe, A., Slottje, P., van Pelt, C., Stehmann, F., Kromhout, H., van Leeuwen, F. E., Vermeulen, R. C., & Rookus, M. 2014. The Nightingale study: rationale, study design and baseline characteristics of a prospective cohort study on shift work and breast cancer risk among nurses. *BMC cancer*, 14, 47. <https://doi.org/10.1186/1471-2407-14-47>
- Romero, T., Molina, R., & Key, M., 2002. Melatonin and breast cancer. *Gaceta Médica de Caracas*, 110(3), 305-309. http://ve.scielo.org/scielo.php?script=sci_arttext&pid=S0367-47622002000300002&lng=es&tlng=es
- Rosa, D., Terzoni, S., Dellafiore, F., & Destrebecq, A. 2019. Systematic review of shift work and nurses' health. *Occupational medicine (Oxford, England)*, 69(4), 237-243. <https://doi.org/10.1093/occmed/kqz063>

- Santisteban, M. 2019. Healthy sleep habits, melatonin and breast cancer. *Annals of the Navarra Health System*, 42(2), 245-248. Epub. <https://dx.doi.org/10.23938/assn.0714>
- Tarrantes, S., 2003, the origin of breast cancer. *Rev. Offarm.* 22(6), 108-116. <https://www.elsevier.es/es-revista-offarm-4-articulo-el-origen-genetico-del-cancer-13049113>
- Wegrzyn, L, Tamimi, R., Rosner, B., Brown, S., Stevens, R., Eliassen, A., Laden, F., Willett, W., Hankinson, S., & Schernhammer, E. 2017. Rotating Night-Shift Work and the Risk of Breast Cancer in the Nurses' Health Studies. *American journal of epidemiology*, 186(5), 532–540. <https://doi.org/10.1093/aje/kwx140>
- World Health Organization, 2021, Cancer de mama. <https://www.who.int/es/news-room/fact-sheets/detail/breast-cancer>
- Zienolddiny, S., Haugen, A., Lie, J., Kjuus, H., Anmarkrud, K., & Kjærheim, K. 2013. Analysis of polymorphisms in the circadian-related genes and breast cancer risk in Norwegian nurses working night shifts. *Breast cancer research: BCR*, 15(4), R53. <https://doi.org/10.1186/bcr3445>