

Asthma in Morocco: Retrospective Analysis of Case Characteristics reported by Hospital Units

Jamila Rida¹✉ Houda Moubachir² and Youssef Bouchriti³

¹Health Sciences Research Laboratory, National School of Applied Sciences, Ibn Zohr University, Agadir, Morocco

³Geosciences and Environment Group, Department of Earth Sciences, Faculty of Sciences, Ibn Zohr University, PO Box 8106 Dakhla Street, 80000, Agadir, Morocco

✉ **Corresponding Author:** Jamila Rida, **E-mail:** rida.j.iss@gmail.com

ARTICLE INFORMATION

Received: 11 October 2021
Accepted: 25 November 2021
Published: 02 December 2021
DOI: 10.32996/jmhs.2021.2.2.14

KEYWORDS

Asthma, Epidemiology, Control, Surveillance

ABSTRACT

Asthma is a serious public health problem. This study aimed to identify the characteristics of asthma cases reported by Agadir's Souss-Massa Regional Hospital Center (SMRHC). A retrospective analysis was carried out at the SMRHC's pneumology and paediatrics departments in 2019. As data support, reporting records and a data collection worksheet were used. This year, 141 cases were reported. The highest frequencies were observed in February (21.9%) and April (26.6%). Both males and females were affected (sex ratio Male/Female = 0.98). The asthmatics were, on average 40.7 ± 25.1 years old. The majority of the cases are from areas that are easily accessible for medical consultation at the SMRHC. To obtain more accurate knowledge and contribute to the research, related studies should be undertaken on this topic. Our findings, we hope, will act as a foundation for future research into improving the case registration system (digital support) and upgrading patient data in accordance with WHO and GINA guidelines.

1. Introduction

The Global Initiative for Asthma (GINA) considers asthma as a heterogeneous disease characterized by persistent airway inflammation, according to its latest recent update in 2021 GINA, (2021). According to World Health Organization (WHO), asthma is the most common chronic disease among children WHO, (2021).

In 2019, asthma affected an estimated 262 million people, causing 461000 deaths Vos et al., (2020). Depending on the country, global prevalence ranges from 1% to 18% (Asher et al., 2006; Carvajal-Urueña et al., 2005; Masoli et al., 2004; Pearce et al., 2007; Urrutia et al., 2007; Yan et al., 2005).

In Morocco, between 10% and 20% of the population are involved Nejari et al., (2019). A rising trend in national asthma prevalence has been documented by various research since 1986 (Beasley, 1998; Bouayad et al., 2006; Chaulet, 1989).

Current statistics show a relatively high prevalence of asthma in Moroccan children, as well as unsatisfactory symptom control (El Ftouh et al., 2009; Nafti et al., 2009).

In both urban and rural Morocco, there has been a steady increase in prevalence rates. Depending on the region and area, the highest-prevalence age group fluctuated Sadeq et al., (2015). In 2012, the adjusted prevalence of asthma consultations in children aged less than five years in the Souss-Massa-Draa region was between 1 and 5 per 1000.

In Agadir, a city in the Souss-Massa region, asthma research is uncommon. According to a recent study, the prevalence of asthma cases reported by primary healthcare centers was 1 per 1000 Bouchriti et al., (2021).

The purpose of this study is to conduct a retrospective analysis to describe the characteristics of asthma cases reported at the Souss-Massa Regional Hospital Center's hospital departments.

2. Methodology

The research is based on a review of asthma patients reported to the Souss-Massa Regional Hospital Center's pneumology and paediatrics departments. The selected city was Agadir, a city in southern Morocco (30°25'12" N, 9°35'53" W, altitude above sea level: 31 m). Agadir is located on a narrow continental shelf that opens onto the Souss-Massa plain. It is limited by the Atlantic Ocean in the west and by the mountain chain of the High Atlas in the north. Agadir is known for its arid and semi-arid climate and counts almost eight dry months during a year. It is characterized by low rainfall (243.9 mm per year), significant cloudiness, high relative humidity, and low thermal amplitude. In 2014, the population of the city was 421,844. The data were inserted after correction and validation in a spreadsheet and analyzed using Epi Info™ software version 7.2 (CDC, 2016). Categorical variables are described by absolute and relative frequency, and continuous variables by the mean and standard deviation. The Wilson score method was adopted for calculating 95% confidence intervals of the proportions.

3. Results

Several characteristics about treatment and control were not recorded or were not specified when using the information available to register asthmatics in the pneumology and pediatrics departments. As a result, we had no choice but to leave them out of the study; they will be looked at more in the future.

The gender, age, admission time, and origin of the cases are all reported in this section. Males and females account for almost the same proportion of cases, as shown in Table 1 (a slight advantage for females).

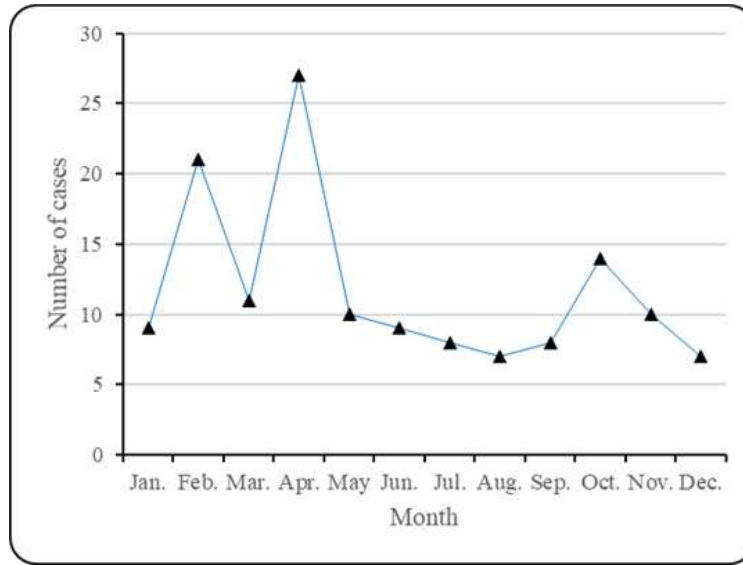
Table 1. Asthma cases distribution by trimester, n = 141, pneumology and pediatrics departments of the Souss-Massa Regional Hospital Center, 2019

Variables	Absolute frequency (Relative frequency in %)	LCL-UCL Wilson 95% (*)
Gender	-	-
Male	70 (49.6)	14.1 – 58.2
Female	71 (50.4)	41.8 – 58.9
Age (years)	-	-
< 5	13 (9.2)	5.0 – 15.3
5 – 10	18 (12.8)	7.7 – 19.4
10 – 20	5 (3.6)	1.2 – 8.1
≥ 20	105 (74.5)	66.5 – 81.4
Quarter	-	-
1 st quarter	41 (29.1)	21.7 – 37.3
2 nd quarter	46 (32.6)	25.0 – 41.0
3 rd quarter	23 (16.3)	10.6 – 23.5
4 th quarter	31 (22.0)	15.5 – 29.7
Provenance	-	-
Agadir	67 (47.5)	39.1 – 56.1
Inezgane	29 (20.6)	14.2 – 28.2
Biougra	13 (9.2)	5 – 15.6
Others less the 5 cases	32 (19.9)	16.1 – 30.5

(*): LCL: Lower Confidence Limits, UCL: Upper Confidence Limits.

In February and April, there were two peaks, with 21 (14.9 %) and 27 (19.2 %) cases, respectively (Fig. 1). This year's first semester accounts for 61.7 % of all cumulative cases.

Fig. 1. Asthma cases distribution per month, n = 141, pneumology and pediatrics departments of the Souss-Massa Regional Hospital Center, 2019

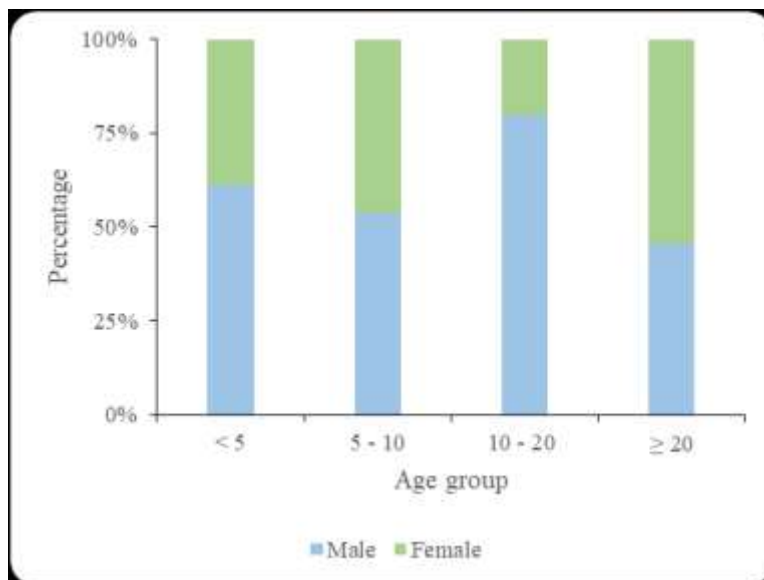


With the exception of October, the number of reported cases exceeded 10 from January to May, and from June to December, the number of reported cases was less than ten, as shown in Fig.1.

About three-quarters of the cases involved people above the age of 20. Under the age of 5 years, and 5 to under 10 years, accounted for 9.2% and 12.8% of all cases, respectively (Table 1).

For the age groups under 5 years, 5 to under 10 years, and 10 to under 20 years, we found that male cases were greater than female cases. Male cases, on the other hand, were frequent in the over-20 age group (Fig. 2).

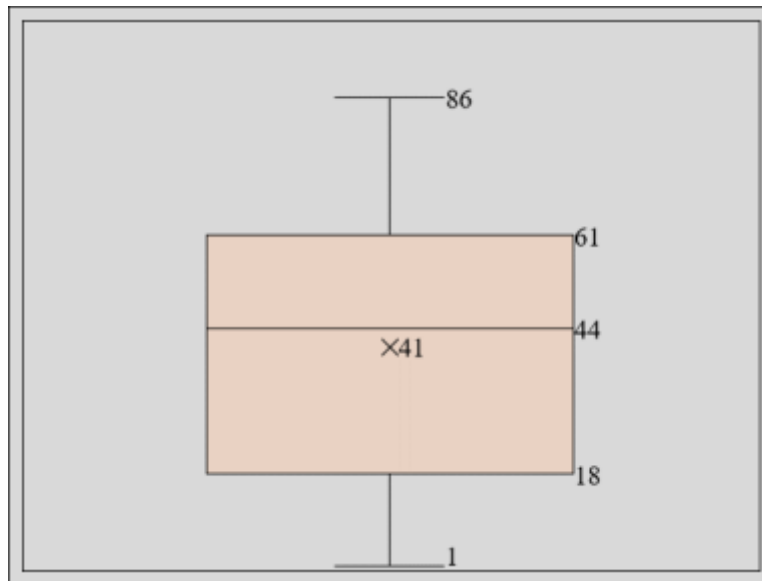
Fig. 2. Asthma case distribution by gender and age group, n = 141, pneumology and pediatrics departments of the Souss-Massa Regional Hospital Center, 2019



With a range of 9 months to 86 years, the mean age was 40.7 ± 25.1 years. Between the ages of 18 and 61, 50% of the cases were reported (Fig. 3).

A quarter of the cases concerned people who were under the age of 18. The age distribution is skewed left (Pearson skewness coefficient = -0.2) as compared to the mean. (Fig. 3)

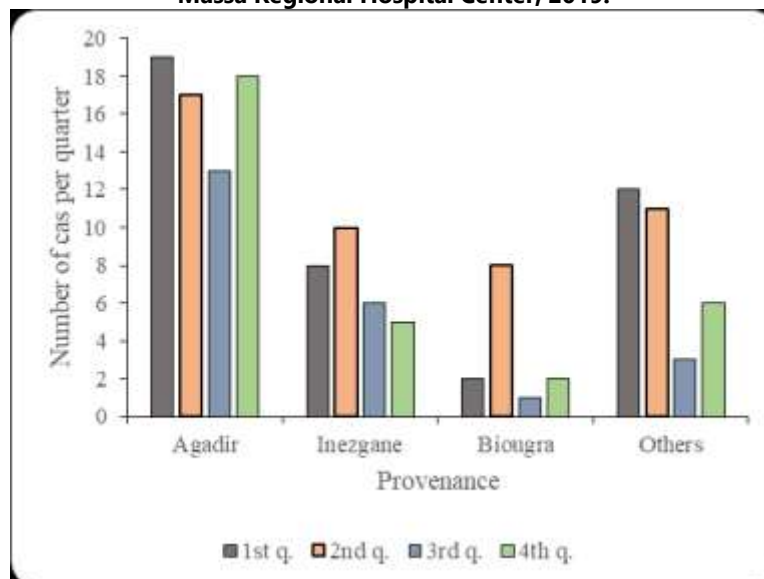
Fig. 3. Age variable box-plot of asthma cases, n = 141, pneumology and pediatrics departments of the Souss-Massa Regional Hospital Center, 2019.



We observed that 18 localities had less than 5 cases, with 7 of them being outside of Agadir city. Agadir, Inezgane, Drarga, and Chtouka Ait Baha were particularly affected.

Agadir and Inezgane patients accounted for 68.1% of all cases (Table 1). Other localities with less than 5 cases accounted for 20.6%. The patients of Agadir presented to the healthcare services in the first and fourth quarters. Inezgane and Biougra localities, on the other hand, are in the second trimester (Fig. 4).

Fig. 4. Case distribution by provenance and by quarter, n = 141, pneumology and pediatrics departments of the Souss-Massa Regional Hospital Center, 2019.



4. Discussion

The asthma population had a similar mean age (adult people) as reported in other Moroccan studies (Benjelloun et al., 2021; El Fadili et al., 2016; Ketfi et al., 2018). This disease is also affecting children and adults. Those above the age of 20 were more affected

in this study. Given the differences in research protocols, particularly the study population sampling, this result should be considered carefully. In some studies, the sample was selected from a specific age range, while in others, this parameter was not used.

As in other Moroccan cities, asthma affects both males and females in this city (Benjelloun et al., 2021; El Ftouh et al., 2009). However, we should emphasize that one gender is more affected than the other in another Moroccan research (Benjelloun et al., 2021; Bouchriti et al., 2021).

The asthmatics who presented to the healthcare services in this study were from an urban area, as has been reported in other Moroccan cities (Ait-Khaled et al., 2007; Benjelloun et al., 2021). Indeed, asthma could be due to several environmental factors related to urbanization, socioeconomic level, and lifestyle (Douwes & Pearce, 2002; WHO, 2021). We might also emphasize the population's relatively easy access to healthcare services.

Environmental sensitivity to allergens and irritants can explain the peaks observed in the first and second quarters, specifically in February and April. According to research, climate change has an impact on respiratory health, contributing to the development of allergic respiratory disorders and asthma (D'Amato et al., 2020).

Also, mold allergen has been associated with a higher prevalence of asthma hospital admissions Michaels, (2017). Worldwide, the sensitization rate to pollen allergens is around 40% Lake et al., (2017). In Morocco, olive pollinosis appears to be the most common, followed by grass pollen allergy, the prevalence in Agadir is 7.7% Alaoui Yazidi & Bartal, (2000). It may be established that asthma is correlated to allergen exposure in Agadir. As a result, in-depth research on this subject is required.

Exacerbation of asthma symptoms is another issue we'd want to investigate. Unfortunately, the data supplied in the emergency department disallowed this. We may estimate the yearly prevalence of asthma in Agadir in 2019 as 0.3 per 1000 if we consider just the cases of asthma reported in 2019 by the pneumology and pediatrics departments (141 cases), and the population of Agadir as of the latest census in 2014 (i.e., 421,844). This is a lower prevalence than the regional and national averages. As information biases are likely, this finding should be treated with care and backed up by further detailed study.

5. Conclusion

The purpose of this study was to identify the characteristics of asthma cases reported by the Souss-Massa Regional Hospital Center (CHRSM) in Agadir. The highest frequencies were recorded in February and April. The asthmatics were mostly young adults from areas near the CHRSM. This study emphasized the importance of improving registration methods in order to accurately identify the epidemiology of asthma in this city, as well as the importance of strengthening follow-up and treatment control, particularly during the first semester. We propose an additional study axis for this topic, such as the effect of the environment on the occurrence of asthmatic cases and the development of an allergy map.

Funding: This research received no external funding

Conflicts of Interest: The authors declare no conflict of interest.

Acknowledgments: We would like to express our thanks to the professionals at the Souss-Massa Regional Hospital Center's pneumology and paediatrics departments. We would like to thank Maryem Oulhint, Maryem Agharghar, and Ikram Elhankour, students at Agadir's Higher Institute of Nursing Professions and Technical Health, for their assistance in collecting data.

References

- [1] Ait-Khaled, N., Odhiambo, J., Pearce, N., Adjoh, K. S., Maesano, I. A., Benhabyles, B., Bouhayad, Z., Bahati, E., Camara, L., Catteau, C., El Sony, A., Esamai, F. O., Hypolite, I. E., Melaku, K., Musa, O. A., Ng'ang'a, L., Onadeko, B. O., Saad, O., Jerray, M., ... Zar, H. J. (2007). Prevalence of symptoms of asthma, rhinitis, and eczema in 13- to 14-year-old children in Africa: The International Study of Asthma and Allergies in Childhood Phase III: ISAAC Phase III in Africa. *Allergy*, 62(3), 247–258. <https://doi.org/10.1111/j.1398-9995.2007.01325.x>
- [2] Alaoui Yazidi, A., & Bartal, M. (2000). Prevalence of sensitization to olive pollen determined by skin prick test in Morocco. A multicentric study. [In French]. *Revue Française d'Allergologie et d'Immunologie Clinique*, 40(4), 481–488. [https://doi.org/10.1016/S0335-7457\(00\)80089-1](https://doi.org/10.1016/S0335-7457(00)80089-1)
- [3] Asher, M. I., Montefort, S., Björkstén, B., Lai, C. K., Strachan, D. P., Weiland, S. K., & Williams, H. (2006). Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. *The Lancet*, 368(9537), 733–743. [https://doi.org/10.1016/S0140-6736\(06\)69283-0](https://doi.org/10.1016/S0140-6736(06)69283-0)
- [4] Beasley, R. (1998). Worldwide variation in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. *The Lancet*, 351(9111), 1225–1232. [https://doi.org/10.1016/S0140-6736\(97\)07302-9](https://doi.org/10.1016/S0140-6736(97)07302-9)
- [5] Benjelloun, A., Ait Nasser, K., Janah, H., Benchanna, R., & Bouchentouf, R. (2021). Particularity of asthmatic patients in the Sahara: Example of the Guelmim Oued Noun region, Morocco. [In French]. *Revue Française d'Allergologie*, 61(3), 177–183. <https://doi.org/10.1016/j.reval.2020.10.001>

- [6] Bouayad, Z., Aichane, A., Afif, A., Benouhoud, N., Trombati, N., Chan-Yeung, M., & Ait-Khaled, N. (2006). Prevalence and trend of self-reported asthma and other allergic disease symptoms in Morocco: ISAAC phase I and III. *The International Journal of Tuberculosis and Lung Disease: The Official Journal of the International Union Against Tuberculosis and Lung Disease*, 10(4), 371–377
- [7] Bouchriti, Y., Elghazali, O., Kharbach, A., Gougueni, H., Haddou, M. A., & Achbani, A. (2021). Characteristics of Patients with Asthma and Asthma Control: A Retrospective Analysis of Reported Data from Primary Healthcare Centers in Agadir city, Morocco (2013 - 2019). *Journal of Clinical and Experimental Investigations*, 12(2), em00766. <https://doi.org/10.29333/jcei/9566>
- [8] Carvajal-Urueña, I., García-Marcos, L., Busquets-Monge, R., Morales Suárez-Varela, M., García de Andoin, N., Batlles-Garrido, J., Blanco-Quirós, A., López-Silvarrey, A., García-Hernández, G., Guillén-Grima, F., González-Díaz, C., & Bellido-Blasco, J. (2005). Geographic Variation in the Prevalence of Asthma Symptoms in Spanish Children and Adolescents. International Study of Asthma and Allergies in Childhood (ISAAC) Phase 3, Spain. *Archivos de Bronconeumología ((English Edition))*, 41(12), 659–666. [https://doi.org/10.1016/S1579-2129\(06\)60333-9](https://doi.org/10.1016/S1579-2129(06)60333-9)
- [9] CDC. (2016). Dean AG, Arner TG, Sunki GG, Friedman R, Lantinga M, Sangam S, Zubieta JC, Sullivan KM, Brendel KA, Gao Z, Fontaine N, Shu M, Fuller G, Smith DC, Nitschke DA, and Fagan RF. Epi InfoTM, a database and statistics program for public health professionals. CDC, Atlanta, GA, USA, 2011. (7.2) [Computer software].
- [10] Chaulet, P. (1989). Asthma and Chronic Bronchitis in Africa: Evidence from Epidemiologic Studies. *Chest*, 96(3, Supplement), 334S-339S. https://doi.org/10.1378/chest.96.3_Supplement.334S
- [11] D'Amato, G., Chong-Neto, H. J., Monge Ortega, O. P., Vitale, C., Ansotegui, I., Rosario, N., Haahtela, T., Galan, C., Pawankar, R., Murrieta-Aguttes, M., Cecchi, L., Bergmann, C., Ridolo, E., Ramon, G., Gonzalez Diaz, S., D'Amato, M., & Annesi-Maesano, I. (2020). The effects of climate change on respiratory allergy and asthma induced by pollen and mold allergens. *Allergy*, 75(9), 2219–2228. <https://doi.org/10.1111/all.14476>
- [12] Douwes, J., & Pearce, N. (2002). Asthma and the westernization 'package.' *International Journal of Epidemiology*, 31(6), 1098–1102. <https://doi.org/10.1093/ije/31.6.1098>
- [13] El Fadli, S., Batahar, S. A., Sajai, H., Serhane, H., & Amro, L. (2016). Évaluation du contrôle d'asthme à Marrakech. *Revue Française d'Allergologie*, 56(3), 323. <https://doi.org/10.1016/j.reval.2016.02.179>
- [14] El Ftouh, M., Yassine, N., Benkheder, A., Bouacha, H., Nafti, S., Taright, S., Fakhfakh, H., Ali-Khoudja, M., Texier, N., & El Hasnaoui, A. (2009). Paediatric asthma in North Africa: The Asthma Insights and Reality in the Maghreb (AIRMAG) study. *Respiratory Medicine*, 103, S21–S29. [https://doi.org/10.1016/S0954-6111\(09\)70024-1](https://doi.org/10.1016/S0954-6111(09)70024-1)
- [15] GINA. (2021). Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention, 2021. Available from: www.ginasthma.org
- [16] Ketfi, A., Benchia, S., Khaldi, F., & Gharnaout, M. (2018). Contrôle de l'asthme en consultations spécialisées. *Revue des Maladies Respiratoires*, 35, A82. <https://doi.org/10.1016/j.rmr.2017.10.175>
- [17] Lake, I. R., Jones, N. R., Agnew, M., Goodess, C. M., Giorgi, F., Hamaoui-Laguel, L., Semenov, M. A., Solomon, F., Storkey, J., Vautard, R., & Epstein, M. M. (2017). Climate Change and Future Pollen Allergy in Europe. *Environmental Health Perspectives*, 125(3), 385–391. <https://doi.org/10.1289/EHP173>
- [18] Masoli, M., Fabian, D., Holt, S., Beasley, R., & Global Initiative for Asthma (GINA) Program. (2004). The global burden of asthma: Executive summary of the GINA Dissemination Committee Report. *Allergy*, 59(5), 469–478. <https://doi.org/10.1111/j.1398-9995.2004.00526.x>
- [19] Michaels, R. A. (2017). Environmental Moisture, Molds, and Asthma—Emerging Fungal Risks in the Context of Climate Change. *Environmental Claims Journal*, 29(3), 171–193. <https://doi.org/10.1080/10406026.2017.1345521>
- [20] Nafti, S., Taright, S., El Ftouh, M., Yassine, N., Benkheder, A., Bouacha, H., Fakhfakh, H., Ali-Khoudja, M., Texier, N., & El Hasnaoui, A. (2009). Prevalence of asthma in North Africa: The Asthma Insights and Reality in the Maghreb (AIRMAG) study. *Respiratory Medicine*, 103, S2–S11. [https://doi.org/10.1016/S0954-6111\(09\)70022-8](https://doi.org/10.1016/S0954-6111(09)70022-8)
- [21] Nejari, R., Elaissaoui, Y., Tebaa, A., & Rachida, S. (2019). 5PSQ-091 Asthma in the Moroccan population. *Section 5: Patient Safety and Quality Assurance, A243.2-A243*. <https://doi.org/10.1136/ejhpharm-2019-eahpconf.524>
- [22] Pearce, N., Ait-Khaled, N., Beasley, R., Mallol, J., Keil, U., Mitchell, E., & Robertson, C. (2007). Worldwide trends in the prevalence of asthma symptoms: Phase III of the International Study of Asthma and Allergies in Childhood (ISAAC). *Thorax*, 62(9), 758–766. <https://doi.org/10.1136/thx.2006.070169>
- [23] Sadeq, M., Abouqal, R., & ElMarnissi, A. (2015). Secular trends in consultations for asthma in early childhood, the 16 administrative regions of Morocco, 2004–2012. *BMC Public Health*, 15(1), 905. <https://doi.org/10.1186/s12889-015-2262-8>
- [24] Urrutia, I., Aguirre, U., Sunyer, J., Plana, E., Muniozgueren, N., Martínez-Moratalla, J., Payo, F., Maldonado, J. A., & Anto, J. M. (2007). Changes in the Prevalence of Asthma in the Spanish Cohort of the European Community Respiratory Health Survey (ECRHS-II). *Archivos de Bronconeumología ((English Edition))*, 43(8), 425–430. [https://doi.org/10.1016/S1579-2129\(07\)60098-6](https://doi.org/10.1016/S1579-2129(07)60098-6)
- [25] Vos, T., Lim, S. S., Abbafati, C., Abbas, K. M., Abbasi, M., Abbasifard, M., Abbasi-Kangevari, M., Abbastabar, H., Abd-Allah, F., Abdelalim, A., Abdollahi, M., Abdollahpour, I., Abolhassani, H., Aboyans, V., Abrams, E. M., Abreu, L. G., Abrigo, M. R. M., Abu-Raddad, L. J., Abushouk, A. I., ... Murray, C. J. L. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1204–1222. [https://doi.org/10.1016/S0140-6736\(20\)30925-9](https://doi.org/10.1016/S0140-6736(20)30925-9)
- [26] WHO. (2021, May 3). Asthma, Key facts. WHO. <https://www.who.int/news-room/fact-sheets/detail/asthma>
- [27] Yan, D.-C., Ou, L.-S., Tsai, T.-L., Wu, W.-F., & Huang, J.-L. (2005). Prevalence and severity of symptoms of asthma, rhinitis, and eczema in 13- to 14-year-old children in Taipei, Taiwan. *Annals of Allergy, Asthma & Immunology*, 95(6), 579–585. [https://doi.org/10.1016/S1081-1206\(10\)61022-8](https://doi.org/10.1016/S1081-1206(10)61022-8)