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REVIEW ARTICLE

Cardiovascular health worsening in patients with autoimmune rheumatological diseases during the COVID-19 pandemic

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Abstract

Rheumatic autoimmune diseases are associated with a myriad of comorbidities. Of particular importance due to their morbimortality are cardiovascular diseases. COVID-19 greatly impacted the world population in many different areas. Patients with rheumatic diseases had to face changes in their healthcare, in addition to unemployment, a decrease in physical activity, social isolation, and lack of access to certain medications. This review summarizes the impact of COVID-19 pandemic on cardiovascular risk factors, comorbidities, and unhealthy behaviors in patients with rheumatic inflammatory autoimmune diseases, particularly focused on rheumatoid arthritis and systemic lupus erythematosus. Searches were carried out in MEDLINE/PubMed and Scopus from August to December 2022. Four reviewers screened the title and abstract of retrieved records. Potentially eligible reports were then reviewed in full text. Differences were reconciled by either consensus or discussion with an external reviewer. During the COVID-19 pandemic, patients with rheumatic diseases showed an increase in the prevalence of mental health disorders (43.2–57.7%), reduced physical activity (56.8%), and a worsening in eating behaviors. Alcohol intake increased (18.2%), especially in early phases of the pandemic. Smoking prevalence decreased (28.2%). Dyslipidemia and hypertension showed no changes. The pandemic and lockdown affected rheumatic patients not only in disease-related characteristics but in the prevalence of their cardiovascular comorbidities and risk factors. Lifestyle changes, such as healthy eating, physical activity, and optimal management of their rheumatic diseases and comorbidities, are essential to manage the long-lasting consequences of the COVID-19 outbreak.

Key Points

- *During the COVID-19 pandemic, anxiety, depression, sedentarism, obesity, and a worsening in eating behaviors increased.*
- *Patients with rheumatic diseases and comorbidities have worse clinical outcomes and a higher cardiovascular disease burden than those without them.*
- *Comparative studies are necessary to precisely elucidate the pandemic's impact on the prevalence of cardiovascular disease, risk factors, and comorbidities in patients with rheumatoid arthritis and systemic lupus erythematosus.*

Keywords Cardiovascular diseases · Cardiovascular risk factors · Comorbidity · COVID-19 · Rheumatic diseases · SARS-CoV-2

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Introduction

Rheumatic autoimmune diseases are associated with a myriad of comorbidities [1]. Ischemic heart disease, heart failure, cerebrovascular disease, and peripheral arterial disease are important due to their morbimortality [2]. Rheumatoid arthritis (RA) entails an increased prevalence of cardiovascular traditional risk factors, including hypertension, diabetes, smoking, obesity, and dyslipidemia [3]. Additionally, the risk of ischemic heart disease is 5- to eightfold higher in patients with systemic lupus erythematosus (SLE) and 2- to threefold higher in RA than in the general population [4, 5].

The coronavirus disease 2019 (COVID-19) pandemic greatly impacted the world population in many aspects, including personal relationships, work, education, and health. Isolation, quarantine, and the home office impacted lifestyle, becoming a public health challenge [6] with these strategies increasing sitting and screen time [7]. Mental health disorders, such as major depression and anxiety, also increased. The most affected populations were women and young people [8]. The greater increase among females was anticipated because women were more likely affected by the social and economic consequences of the pandemic [9].

Patients with rheumatic autoimmune diseases, such as rheumatoid arthritis and systemic lupus erythematosus, had to face several additional challenges besides COVID-19 infection. These people suffered changes in their medical care, from the availability of qualified rheumatologists to a telemedicine implementation. Unemployment, decreased physical activity, social isolation, and a lack of access to certain medications, including hydroxychloroquine, were other issues they faced [10].

Social isolation measurements applied in many countries have influenced rheumatic patients' health. A decrease in physical activity predisposes an increase in disease activity and flares [11, 12]. Isolation from family and friends could mean denying patient's emotional support, increasing the risk of depression and anxiety [13], and unhealthy eating behaviors, such as increased snacking and consumption of comfort foods [14–16]. At the same time, these actions could lead to an increase in their body weight, and therefore, overweight and obesity. This review summarizes the impact of the COVID-19 pandemic on cardiovascular risk factors and comorbidities in patients with rheumatic autoimmune diseases (Table 1). Since there is a lack of data about changes in comorbidities during the lockdown, we focused on the most relevant of these, for which there is more information, RA and SLE.

Methods

A review of the literature was conducted analyzing the published data about cardiovascular health and its changes in patients with autoimmune rheumatological diseases (particularly RA and SLE) during the COVID-19 pandemic.

Eligibility criteria

It was included articles that contained information on risk factors and comorbidities in general population and patients with rheumatologic diseases before and during the COVID-19 pandemic, in addition to articles that report definitions. It was excluded those did not have information on risk factors and comorbidities of our interest.

Search strategies

Searches on the impact of comorbidities in patients with rheumatoid arthritis and systemic lupus erythematosus were carried out in MEDLINE/PubMed and Scopus from August to December 2022. The keywords used for the search were "rheumatoid arthritis" and "systemic lupus erythematosus" in combination with other keywords such as "COVID-19," "lockdown," "comorbidities," "cardiovascular risk factors," "pandemic," "diabetes," "hypertension," "dyslipidemia," "alcohol intake," "obesity," "sedentarism," "diet," "depression," "anxiety," and "smoking."

Study selection

Four reviewers screened the title and abstract of retrieved records. Potentially eligible reports were then reviewed in full text. Differences were reconciled by either consensus or discussion with an external reviewer.

Risk factors and unhealthy behavior during the COVID-19 pandemic

Sedentarism

Physical activity (PA) is defined as any bodily movement produced by the skeletal muscles that result in energy expenditure above resting (basal) levels [26]. An increase in PA is an intervention that can significantly improve many different disease-related symptoms such as fatigue, functional disability, inflammation, and systemic outcomes (cardiovascular disease risk and body composition) [27]. PA has health benefits for people with rheumatic diseases, and the European Alliance of Associations for Rheumatology (EULAR) recommends exercises in the four domains (cardiorespiratory fitness, muscle strength, flexibility, and neuromotor performance) [28]. In one study, it was shown that after 24 weeks of exercise, subjects had better total cholesterol and triglyceride levels, decreased fat tissue and blood pressure, lower serum levels of proinflammatory C reactive protein (CRP), and higher levels of high-density lipoprotein (HDL) [29]. The COVID-19 pandemic caused many lifestyle changes in the population with chronic health conditions [30], including rheumatic diseases. In addition, the reduction in PA led patients to increased sarcopenia and the deterioration of muscle strength and function more

Table 1 Summary of information available on cardiovascular risk factors and comorbidities in patients with RA and SLE

Place	Cohort	Number of patients with RMDs	Comorbidities	Outcomes	References
Denmark	SLE and RA outpatients at the Department of Rheumatology, Aarhus University Hospital	405 with CRD: 206 SLE patients and 199 RA patients	11% with smoking, 24% with hypertension	A significantly larger proportion of CRD patients ($n=73$, 18.9%) had symptoms of moderate depression compared to blood donors ($n=34$; $p<0.001$). There was no difference in anxiety symptoms between CRD patients and blood donors. SLE patients ($n=47$ of 195, 24.1%) were more affected by moderate depression than RA patients ($n=26$ of 189, 13.8%; $p=0.01$)	[12]
Spain	SLE patients from FELUPUS (lockdown group) and San Cecilio Clinical University Hospital (pre-lockdown group)	276 SLE patients in the lockdown group and 152 from the pre-lockdown group	Not mentioned	SLE lockdown group showed higher scores in SCL-90-R subdomains of depression (74.53; $p \leq 0.05$) and anxiety (74.13; $p \leq 0.05$)	[13]
United Kingdom	IA-COVID cohort	21 inflammatory arthritis patients	Not mentioned	Most participants stated that their diet had got worse during the lockdown due to an increase in emotional eating. Authors did not show numerical statement	[16]
Europe	Online survey with 2731 respondents having RMDs	1800:534 RA patients and 97 SLE patients	20.7% had a smoking habit, and 67.9% consumed alcohol	3.2% started smoking, 24.6% smoked more than before, 33.6% the same as before, 10.3% less than before, and 28.2% quit smoking during the pandemic. Alcohol intake: 18.2% drink more, 37.2% drink the same amount, and 12.5% drink less than before the pandemic. From RA patients, 280 were at risk of anxiety and 227 of depression; from SLE patients, 56 were at risk of anxiety, and 50 were at risk of depression.	[17]
Ireland	RMDs and COVID-19 from database C19-GRA	212	625.5% ever smoked	71.7% were hospitalized (p=0.01), and 20.4% died (p=0.02)	[18]
Brazilian teaching hospitals (Ceará, Minas Gerais, and Rio Grande do Sul)	Patients over 18 years of both sexes diagnosed with RA	791	15% had DM II, 9.2% had SAH, 34.3% had dyslipidemia, and 26.9% had obesity by BMI	RA patients with increased WC have more CVR factors (such as DM II (31.2%), SAH (80.2%), and dyslipidemia (50.0%)) and these variables have an independent influence on the prevalence of obesity	[19]

Table 1 (continued)

Place	Cohort	Number of patients with RMDs	Comorbidities	Outcomes	References
Latin America, 2021	Rheumatologic patients during lockdown	3502 (1694 with RA and 1012 with SLE)	Hypertension, depression, and anxiety	The most common self-reported comorbidities were hypertension (669 patients; 19.1%) and depression/anxiety (455; 13.3%)	[20]
France (including French overseas territories)	SLE patients recruited by their specialist or from AFL +	536 questionnaires from individual SLE patients	Not mentioned	Screening for anxiety and depression was positive for 47.6% and 41.5%, respectively. Difficulties accessing medical care were the only significantly associated factor to anxiety (OR = 1.94, $p = 0.012$). For depression, financial difficulties (OR 2.59, $p = 0.006$) and difficulties accessing medical care (OR = 2.57, $p < 0.0001$) were associated factors	[21]
Japan	RA patients from the KURAMA cohort	108 RA patients	Not mentioned	Definite anxiety percentage increased from 9% (before the pandemic) to 12% during pandemic; doubtful anxiety increased from 8 to 15% during pandemic Definite depression remained at 10% during study period, but more patients reported doubtful depression	[22]
The Philippines	I RA and SLE surveys	512 participants: 405 SLE patients and 107 RA patients two months after lockdown	61% had at least one comorbidity (it was not specified)	Most of the respondents had mild anxiety symptoms; 38.75% reported moderate to severe anxiety symptoms. 27.7% had moderate to extremely severe depression symptoms. The presence of asthma, being a healthcare professional, presence of specific symptoms was associated with adverse mental health ($p < 0.05$)	[23]
Poland	Healthcare and non-healthcare workers from hospitals in the West Pomeranian region of Poland where patients with COVID-19 were diagnosed or hospitalized	424 workers with autoimmune diseases (SLE and Hashimoto disease)	Patients with autoimmune diseases: 8% had hypertension, 1.1% had diabetes mellitus, 0.2% had coronary heart disease, 12.7% had dyslipidemia, and 4% smoked	Patients with autoimmune diseases showed a more than twofold increase in the risk of anxiety symptoms (OR = 2.273, $p < 0.001$) and 2.5-fold increase in the risk of depressive symptoms (OR = 2.559, $p < 0.001$)	[24]

Table 1 (continued)

Place	Cohort	Number of patients with RMDs	Comorbidities	Outcomes	References
New Zealand	PORTAL study	104 patients: 76 RA patients	Not mentioned	Baseline anxiety and COVID-19 fear (perceived risk of infection, theoretical outcomes from being infected, effects on family and mental health) are risk factors for developing anxiety during the lockdown	[25]

SLE, systemic lupus erythematosus; *RA*, rheumatoid arthritis; *CRD*, chronic rheumatic diseases; *FELUPUS*, Spanish Lupus Federation; *SCL-90-R*, SCL-90-R symptom inventory; *IA-COVID*, inflammatory arthritis cohort. *RMD*, rheumatic and musculoskeletal diseases; *COVID-19*, coronavirus disease 2019; *DM II*, type II diabetes mellitus; *SAH*, systemic arterial hypertension; *BMI*, body mass index; *WC*, waist circumference; *CVR*, cardiovascular risk; *AFL+*, Association Française du Lupus et Autres Maladies Auto-Immunes; *OR*, odds ratio

frequently in older populations [31]. During the pandemic, PA was reduced by as much as 56.8%, mostly due to fear of infection, as reported by Saxena et al., and thus, quality of life and disease activity were affected [32].

Researchers around the world have reported sedentary behavior findings during the quarantine. In France, Deschasaux-Tanguy et al. reported that 63.2% of the participants increased sedentary time with an average of 7 h per day spent sitting [33] similar to a study in Europe, North Africa, Western Asia, and the Americas, where the most notable change in the population was a 28.6% increase in the hours per day sitting [34], mostly increased screen time [35], especially TV-viewing. In a comparison of pre-COVID-19 and during the COVID-19 pandemic, people spending more than 5 h per day in front of a screen increased from 14.6 to 37.5%, respectively [36]. PA in patients with RA and SLE is less frequent due to the discomfort caused at the beginning of exercise, even considering the previously described benefits.

Alcohol

A systematic review showed that alcohol drinking remained stable in most of the population examined. However, an important part of the sample increased consumption during the early stages of the pandemic, with a decreasing trend at the end of the lockdown [37]. Those motivated to drink alcohol to cope had a greater increase in consumption [38]. In the same way, a cross-sectional study conducted in seven European countries with 1800 patients with rheumatic diseases (REUMAVID study) showed that most drank the same amount of alcohol. Still, a significant percentage (18.2%) increased their consumption [17].

Consequences of alcohol abuse include increased cardiovascular risk (CVR) and liver disease. It also influences the innate and adaptative immune system. In RA, it is important to consider that alcohol consumption increases the risk of developing a liver injury induced by treatment with methotrexate (MTX). Alcohol added to folate deficiency, the administration of other hepatotoxic drugs and lipid disorders predispose to MTX-induced steatohepatitis and hepatic fibrosis [39]. Several observational studies have investigated the potential relationship between alcohol intake and the risk of rheumatic diseases. One suggested that ethanol and antioxidants in alcohol could suppress the immune response and trigger proinflammatory cytokines, which may play an important role in the risk of RA or SLE [40]. Other emerging studies associate moderate alcohol consumption with protection against both diseases [41, 42]. Nevertheless, the beneficial effects of alcohol have been questioned due to the difficulties in establishing a safe drinking threshold [43].

Smoking

It is well known that smoking negatively affects several disease outcomes of rheumatic and musculoskeletal diseases (RMDs), such as the response to treatment, disease activity, and comorbidities. Tobacco consumption in patients with RA causes a lower response to a first-line disease-modifying antirheumatic drug (DMARD), a greater probability of interstitial lung disease before or after DMARDs, a 2.6-higher risk of EULAR non-remission, higher disease activity, and higher CRP levels compared to non-smokers. SLE patients who smoke have worse 36-Item Short form survey scores and a more severe rash [44]. The REUMAVID study showed that smoking declined in patients with RMDs as 28.2% of the population quit smoking during the pandemic; however, a significant proportion of patients (24.6%) smoked more than before COVID-19 pandemic [17]. Also, in a study made from the COVID-19 Global Rheumatology Alliance database, patients with RMDs who smoked were more likely to be admitted to hospital, and ever smoking was more common in those who died [18].

Dietary changes

There is evidence of the association between diet, both micro- and macronutrients, and immunity regulation and how disturbances in the nutritional status of people can lead to autoimmunity [45]. The COVID-19 pandemic had many, mainly, negative consequences on feeding and dietary habits and could have an important impact on health, including mental health. Most studies reported negative dietary changes, especially an increase in meals and snacks. A possible explanation could be increased intake and consumption of high-caloric foods to cope with anxiety, sadness, and boredom during lockdown [14, 15, 46–49].

Some specific dietary behavior could be associated with gender. Boaz et al. reported women consumed sweet baked goods, vegetables, and olive oil more than men. On the other hand, men consumed red meat and sweetened/carbonated beverages more than women [46]. Most of the information about dietary changes was obtained from studies on the general population. Caton et al. found similar outcomes in patients with rheumatic diseases. Most of these patients declared a worsening in their diet during the lockdown. This finding was explained by an increase in the number of meals and caloric intake, as well as adopting this behavior for emotional coping [16].

Comorbidities during the COVID-19 pandemic

Diabetes mellitus

Diabetes is a very important comorbidity to consider in patients with SLE or RA, increasing by itself the cardiovascular risk in this population, being the cardiovascular disease the main cause of death in people with diabetes mellitus [50].

Various studies carried out before the pandemic documented a prevalence of 15% in patients with RMD, which was reflected in studies carried out during the pandemic, where the prevalence of diabetes mellitus in patients with RA was 14.9% [19, 51], although in another study carried out in 2021, a prevalence of 25.02% was found in patients with rheumatological diseases, mainly RA and SLE [52]. These data could point to a slight increase in this comorbidity in patients with RA and SLE, although more studies are needed to clarify this potential increase.

Obesity

Obesity is prevalent in patients with rheumatic diseases, such as RA [53] and SLE [54]. Observational studies have shown that obesity predisposes to negative outcomes [55]. The negative influence of an excessively high body mass index (BMI) on the risk of developing the disease, on activity indexes, quality of life, and response to treatment is suggested to be strong in inflammatory joint diseases (IJD), such as RA and SLE [56, 57], because of increased cytokine production in visceral adipose tissue [55].

During the COVID-19 outbreak, some studies used weight modifications as an indicator of habit changes [35, 57–61] that could lead to an increase in obesity [35]. Patients that are overweight or obese, in addition to having long-standing and moderate disease activity, have a high risk of cardiovascular disease [53]. Thus, this risk may increase in patients with rheumatic diseases because of the COVID-19 pandemic.

Hypertension

One of the most common comorbidities in severe COVID-19 patients is hypertension, which is also a risk factor for pneumonia and severe disease in the general population and patients with multiple comorbidities, including rheumatic diseases [20, 62–64]. Therefore, blood pressure follow-up during the lockdown was an important point for public health services. In a sample of 72 hypertensive patients, Fucile et al. demonstrated a decrease in blood pressure levels, approximately 7 mmHg in systolic blood pressure and 3 mmHg in diastolic blood pressure [65]. Almost the same results were found in the study by Pengo et al., in which they reported a decrease in blood pressure in 126 patients with a reduction of 6 mmHg in systolic blood pressure in most patients during the first lockdown period [66]. Similar results were found in a French population, with a reduction of about 1.5 mmHg in diastolic blood pressure and 3 mmHg in systolic pressure after 4 weeks of lockdown

[67]. However, these changes in blood pressure did not last beyond the first period of lockdown, according to the blood pressure values recorded between January and March 2021, where there was a slight increase in diastolic and systolic blood pressure values [68]. Although there is insufficient evidence of this behavior in rheumatic patients, the worsening lifestyle in the general population might be similar in rheumatic patients, with a tendency for increased blood pressure.

Hypertension among rheumatic patients hospitalized for COVID-19 was around 50%, and this finding correlated with a higher probability of being admitted than rheumatic patients who do not have hypertension [69–72]. Also, hypertension in this population is an independent determinant of disease severity, increasing mortality risk [64].

In the rheumatic population, an interesting finding was observed by Fouad et al., where most patients with rheumatic diseases and comorbidities such as hypertension dropped their medication or did not adhere to treatment because of the fear generated by COVID-19. They also reported that close to 50% of the rheumatologic patients (mainly RA and SLE) experienced limitations in access to specialized care including DMARDs during this period. Besides, they found a negative impact in mental health in 92% of their patients with 60% of high levels of psychological distress and an increase in patients with uncontrolled disease from 8.3% prior to the pandemic to 20% during it [62].

Pham et al. found that patients with higher values of the 4-item Perceived Stress Scale (PSS-4) have higher values of Routine Assessment of Patient Index Data 3 (RAPID3) score. During the pandemic, most of the patients included in the study presented higher PSS-4 values [73]. Considering the negative impact of the COVID-19 pandemic on mental health mentioned before, the increase in uncontrolled disease, and the correlation found by Pham et al., there is clearly a negative impact on disease activity caused by the COVID-19 pandemic, and derived actions. These findings take importance mainly because of the high prevalence of hypertension among patients with RA. This drop in medication and the high prevalence in psychological distress worsen their cardiovascular risk, increase disease activity, and eventually lead to a major risk of being admitted when infected with SARS-CoV-2 [64, 74].

Dyslipidemia

Dyslipidemia is an important comorbidity among patients with rheumatic diseases mainly because of its role in subclinical atherosclerosis development, increasing the cardiovascular risk and the prevalence of carotid plaque [75, 76]. Although there is a lack of evidence about the behavior of blood lipid levels during the pandemic, some studies showed a trend of increased blood lipid levels when comparing before and after the lockdown in asymptomatic patients [77]. Even patients with an optimal lipid profile before the pandemic were affected by the lockdown. Perrone et al. found that stopping physical activity correlated with an increase of 15.8% in low-density lipoprotein (LDL) and total cholesterol [78, 79]. This behavior in the lipid profile might have also affected patients with RA and SLE due to the stopping of physical activity because of the pandemic, COVID-19, and the dropping of medication mentioned before. This finding is relevant because most people with rheumatic diseases and severe COVID-19 are older than 65 and have a high rate of comorbidities such as hypertension, diabetes, and dyslipidemia [64]. In addition, higher blood lipid levels correlate with a worse prognosis in rheumatic patients hospitalized with COVID-19 and with a higher risk of hospitalization than rheumatic patients who do not have dyslipidemia [63, 64, 71, 80, 81].

Due to the prothrombotic state caused by COVID-19 and accelerated atherosclerosis in patients with rheumatoid arthritis or systemic erythematosus lupus, dyslipidemia needs special attention from physicians, and further investigation about the interactions of SARS-CoV-2, rheumatic diseases, and dyslipidemia in this population might be necessary [82].

Depression and anxiety

Lockdown caused an increase in the prevalence of rheumatic patients with psychopathologies, especially depression and anxiety [12, 13, 21–24, 83, 84]. In the REUMAVID study, of the 534 RA patients included, 53.2% were at risk of anxiety and 43.2% of depression. Meanwhile, of 97 SLE patients included, 57.7% were at risk of anxiety and 51.5% of depression [17]. Fear of infection by SARS-CoV-2 and possible outcomes, familial health concerns, and baseline mental health have been described as possible risk factors for depression and anxiety [25, 83]. Scherlinger et al. reported that difficulties accessing medical care were significantly associated to anxiety (OR 1.94, $p = 0.012$); for depression, financial difficulties (OR 2.59, $p = 0.006$) and difficulties accessing medical care (OR 2.57, $p < 0.0001$) were associated [21]. On the other hand, emotional support and resilience have been mentioned as possible protective factors [13]. The study realized by Tee et al. found that satisfaction with the available health information COVID-19 was associated with depression subscales ($p = 0.005$) and wearing of face masks was associated with lower levels of depression ($p = 0.044$) [23].

The COVID-19 outbreak reduced activities and social interaction, which impacted mental health [11]. Depression and anxiety are highly prevalent in patients with rheumatic diseases [11, 85]. There are many reports about an increase in the frequency of flares in rheumatic patients associated

with a decrease in physical activity levels, which predisposed to depression and anxiety. Inversely, patients suffering from these mental disorders are susceptible to increased disease activity scores [11, 12, 21, 25]. Ammitzbøll et al. found an increase of disease activity in 23.5% of patients, which contrasts with 18.9% of patients who showed symptoms of moderate depression in their study [12].

Depression and anxiety are twice as common in women, which is relevant since they represent a large proportion of rheumatic patients [86, 87]. Although depression and anxiety are not considered traditional cardiovascular risk factors, they have been related to increased cardiovascular events and worse outcomes [87, 88]. Possible mechanisms for this increase in cardiovascular risk are increased inflammatory cytokines, platelet aggregation, oxidative stress, endothelial dysfunction, atherosclerosis progression, and an increase in unhealthy behaviors such as smoking, decreased physical activity, and a higher intake of high-calorie foods associated with these mental disorders [87, 88].

Patients with cognitive impairment have a high prevalence of depression and anxiety, which increased during the lockdown [89, 90]. This data is relevant since the development of cognitive disturbances is common in patients with RA and SLE [91, 92]. Bartolini et al. observed a cognitive dysfunction prevalence of 38 to 71% in RA patients [93]. These findings, and the increased risk of depression and anxiety in RA and SLE, suggest that cognitive impairment could lead to worse cardiovascular outcomes.

Discussion

In this review, we found that during the COVID-19 pandemic, there was an increase in the prevalence of some of the most important cardiovascular comorbidities and risk factors in patients with rheumatic diseases. There was an increase in obesity and sedentarism, which can potentiate immune dysregulation and is linked with increased disease activity and symptoms in patients with RA [94]. When analyzing the impact of the pandemic on mental health, there was an increased prevalence of psychiatric disorders. Several studies associate RMDs, especially RA and SLE, with depression and anxiety. This finding is generally attributed to inflammation and the adverse impact of these diseases on quality of life, functioning, and productivity. Inversely, depression is linked to an increased risk of developing RA and a deteriorating disease course reflected in poor treatment adherence [95]. The effect of the pandemic on alcohol and tobacco consumption is difficult to determine. In general, a positive impact was seen by decreasing smoking prevalence and increasing the intention to quit smoking. As for alcoholism, an increase was reported, especially at the beginning of the pandemic, but it decreased and remained stable in the final phases. An increase in consumption was seen in both risk behaviors in those who used it as a coping mechanism. We must emphasize the importance of reducing these comorbidities, as smoking is considered the most important modifiable risk factor for RA. Alcohol consumption indirectly affects rheumatoid patients by interacting with some drugs used for the disease [39, 96].

It is important to know the behavior of these comorbidities during the pandemic in rheumatic and non-rheumatic patients due to the lack of access to healthcare services that were more available before the lockdown. There were also limited healthcare services for patients with hypertension and dyslipidemia, which also play an important role in rheumatic diseases due to the accelerated development of subclinical atherosclerosis and cardiovascular events [97]. These findings are interesting because most rheumatic patients with hypertension, dyslipidemia, and/or obesity hospitalized for COVID-19 had worse outcomes, such as severe disease or death [81, 98]. It is also important to mention that we need further investigation into the prevalence of these comorbidities in patients with rheumatic diseases due to a lack of information.

Analyzing all these consequences that the pandemic had on patients with rheumatic inflammatory autoimmune diseases, we also researched strategies to reduce comorbidities. The EULAR 2021 recommendations mention the importance of quitting tobacco use due to impaired function, increased symptoms, disease activity, disease progress, and comorbidities. In addition, this habit could affect DMARD treatment in patients with rheumatoid arthritis. Although a low level of alcohol consumption is unlikely to impact rheumatic disease outcomes negatively, people with rheumatoid arthritis and health professionals should be aware because moderate alcohol consumption is associated with an increased risk of rheumatoid arthritis flare and comorbidities. Sometimes, the line between low and moderate alcohol consumption is not well delimited due to misunderstanding or misinformation [99].

Physical activity benefits several aspects of physical and mental health and should be promoted for all. It has a protective effect on the development of depression or can be used to manage symptoms acutely [100]. In the long term, continuous exercise will modulate the immune system and decrease chronic inflammation, offering protection against infections and chronic diseases [29]. Physical activity, specifically aerobic exercise in moderate intensity for at least 150 min per week and strengthening exercise twice a week, has an anti-inflammatory effect that is beneficial in RA and SLE patients by reducing inflammatory markers and joint pain, as well as improving function and quality of life and reducing all-cause mortality in patients with rheumatic autoimmune diseases [99].

This study has limitations worth noting. Information on the behavior of cardiovascular risk factors and comorbidities in

patients with rheumatological diseases is limited. Additionally, disease activity data during and after the pandemic, which may impact cardiovascular risk, are also scarce. Studies that compare these factors longitudinally before, during, and after the COVID-19 pandemic are necessary.

Conclusion

The pandemic and lockdown by COVID-19 affected rheumatic patients, not only in disease-related characteristics but in the prevalence of their comorbidities, predisposing them to the development of new complications and, therefore, an increase in their cardiovascular risk. Lifestyle changes, such as healthy eating, and physical activity, besides optimal management of their rheumatic diseases and comorbidities, are essential to manage the consequences of the COVID-19 outbreak.

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Author contribution All authors contributed to the study conception and design. The idea for the article was performed by Jesus Alberto Cardenas-de la Garza. The literature search was performed by Valeria Gonzalez-Gonzalez, Victor M. Beltran-Aguilar, Angel G. Arias-Peralta, and Natalia De Avila-Gonzalez. The work was critically revised by Dionicio A. Galarza-Delgado, Iris J. Colunga-Pedraza, Jose R. Azpiri-Lopez, Jesus Alberto Cardenas-de la Garza, and Natalia Guajardo-Jauregui. The first draft was written by Valeria Gonzalez-Gonzalez, Victor M. Beltran-Aguilar, Angel G. Arias-Peralta, and Natalia De Avila-Gonzalez and all commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Data Availability The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

Declarations

The manuscript does not contain clinical studies or patient data.

Disclosures None.

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