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Effectiveness and safety of dupilumab in adults with moderate and severe atopic dermatitis in Colombia: Real-life experience

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ABSTRACT

Background: Dupilumab is a treatment approved for uncontrolled moderate-to-severe atopic dermatitis (AD). Tropical and developing countries such as Colombia have characteristics that may impact the natural history of AD and access to medical treatments. In that sense, we aimed to describe the effectiveness and safety of dupilumab in adults with moderate to severe AD in a Colombian multicenter cohort.

Methods: Multicenter descriptive study that included patients who started treatment between March 2018 and May 2020 in 6 centers. Disease severity was assessed using the following: Scoring Atopic Dermatitis (SCORAD), Eczema Area and Severity Index (EASI), Patient Oriented Eczema Measure (POEM), and Dermatology Life Quality Index (DLQI). These measurements were collected according to availability at baseline, 3–5 months, 6–12 months, and more than 12 months. Days of sick leave, hospitalizations, and AD flares before and after dupilumab treatment were reported. Adverse events (AEs) were recorded during follow-up.

Results: Ninety-three patients were included, with a median age of 32 years (IQR: 24.0; 40.0) and a disease evolution time of 21 years (IQR: 16.0; 29.5). 88.2% had at least 1 allergic disease other than AD. An improvement greater than or equal to 75% EASI was observed in 41.7% of patients at 3–5 months, in 73.7% of patients at 6–12 months, and in 75.0% of patients after 12 months. For those reporting SCORAD and POEM, the median percent change ([IQR], n) from baseline in SCORAD was −67.1 ([−79.2; −54.2], n = 16), −70.5 ([−85.8; −47.9], n = 36) and −66.7 ([−77.3; −51.0], n = 13); and POEM, −58.6 ([−66.4; −55.5], n = 4), −73.0 ([−86.5; −66.7], n = 16) and −87.3 ([−93.4; −69.6], n = 8), respectively. Before initiation of dupilumab treatment, 82 (88.2%) patients reported at least 1 flare of AD in the past 12 months. During the follow-up period, 30 (32.3%) patients reported at least 1 exacerbation or flare. Twelve patients (12.9%) presented an AE and 3 (3.2%) patients discontinued dupilumab for this cause.

Conclusions: Dupilumab was effective and safe for the treatment of moderate to severe AD in point-of-care settings, with results similar to randomized controlled and other real-life studies.

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These positive results are still maintained even though a high number of patients had short interruptions in the use of dupilumab due to administrative problems.

Keywords: Atopic dermatitis, Dupilumab, Eczema, Biologic therapy

INTRODUCTION

Atopic dermatitis (AD) is a chronic skin disease that affects 2–5% of adults worldwide.[1] In Colombia, in 2010, a prevalence study showed that 11% of adults reported symptoms compatible with AD in the last year.[2] Although there are no estimates of the proportion of patients with moderate-severe AD in Colombia, studies conducted in different countries estimate that approximately 50% of adults with AD have moderate to severe disease.[3,4]

AD affects patient quality of life, especially in those with moderate-severe disease;[5] at higher severity of AD, patients' perception of their general health, life satisfaction, and mental health is significantly lower.[6] Additionally, among skin disorders, AD caused the highest number of Disability-Adjusted Life Years (DALYs).[7]

Dupilumab has been demonstrated to be effective and safe for moderate-to-severe AD patients, with significant improvement in objective measures of the disease (eg, reduction in Eczema Area and Severity Index [EASI] score from baseline) as in the quality of life measurements.[8–12] However, the available data on efficacy, effectiveness, and safety come from clinical trials or real-life studies conducted in temperate countries, especially in developed countries.[8–12] Therefore, it is necessary to have data on this technology in tropical countries such as Colombia, which have particular characteristics that may impact the natural history of AD.[13] This retrospective study describes the response to dupilumab treatment in adults with moderate-severe AD from a real-life Colombian multicenter cohort.

METHODS

Study design and population

In this study, data collected from a multicenter retrospective cohort of patients with AD from 6 hospitals in Colombia were described. The inclusion criteria were as follows: patients over 18 years of age with a diagnosis of moderate or severe AD and a disease progression of at least 3 years.

We included patients with indications of dupilumab due to poor clinical response to systemic immunosuppressive treatments and topical corticosteroid therapy. Patients with comorbidities that could affect the interpretation of the results (eg, hyper-IgE syndrome and ichthyosis Vulgaris) and patients with mental illness were excluded.

Data collection

The medical records of the patients included in the study were reviewed and the treating physicians completed a questionnaire programmed on the KoBoToolbox® platform. Information was collected on the sociodemographic characteristics of the patients, allergic comorbidities, evolution of AD, previous treatments, and characteristics of treatment with dupilumab. In addition, information on three AD severity assessment scales was collected: Scoring Atopic Dermatitis (SCORAD), Eczema Area and Severity Index (EASI), Patient-Oriented Eczema Measure (POEM), and Dermatology Life Quality Index (DLQI). Discontinuations of dupilumab treatment during the follow-up period and the reasons were described. Adverse events (AEs), number of flares, days of disability, and hospitalizations secondary to AD were collected as available. Exacerbations or flares were

defined as an episode requiring a change in treatment or seeking additional medical service.[14]

Data analysis

Categorical variables were described using absolute and relative frequency distributions. For numerical variables with normal distribution, the mean and standard deviation (SD) were reported; otherwise, the median and interquartile range (IQR; first quartile [Q1] – third quartile [Q3]) were reported. Normality was determined by the Kolmogorov-Smirnov test.

Patients were grouped into 3 time periods according to the availability of the results of SCORAD, EASI, POEM, and DLQI scales; 3–5 months, 6–12 months, and more than 12 months from the start of dupilumab treatment, since there were different follow-up times among the centers. The highest score was taken in patients with more than one test at the same time. During the different periods, the proportion of patients with improvements in SCORAD, EASI, POEM, or DLQI scores of at least 50% (SCORAD-50, EASI-50, POEM-50, or DLQI-50) or 75% was reported. The data were analyzed in R software version 4.0.3 "Bunny-Wunnies Freak Out".

RESULTS

Sociodemographic and clinical characteristics of patients with atopic dermatitis

The study population included 93 patients, 56 (60.2%) men, with a median age of 32 years (IQR: 24.0, 40.0). Forty-nine (52.7%) patients had a family history of allergies (AD, rhinitis, asthma, or food allergy) and 82 (88.2%) had at least 1 allergic comorbidity, with allergic rhinitis being the most frequent manifestation, occurring in 78.5% of patients, followed by asthma, in 41.9% (Table 1). Seventy-nine patients reported the age at onset of dermatitis. Within this group, the median duration of AD was 21 years (IQR: 16.0; 29.5) and 62 (78.5%) reported symptom onset before the age of 18 years (Table 2).

Regarding treatment before starting dupilumab, 90 (96.8%) patients had treatment with topical corticosteroids, and 82 (88.2%) patients were on oral immunosuppressants, the other treatments are detailed in Table 2.

Variables	Value[a]
Sociodemographic factors	
Age in years	
Median (RQI)	32.0 (24.0; 40.0)
Sex	
Women	37 (39.8%)
Men	56 (60.2%)
Socioeconomic status	
1–2 (Low)	6 (16.2%)
3–4 (Medium)	27 (73.0%)
5–6 (High)	4 (10.8%)
Missing values	56
Area of residence	
Rural	11 (11.8%)
Urbana	82 (88.2%)
Healthcare affiliation regime	
Contributory (private)	87 (93.5%)
Special	1 (1.1%)
Subsidized (public)	5 (5.4%)
Medical history	
Personal history of allergic disease	
History of Asthma	
Yes	39 (41.9%)
No	53 (57.0%)
Do not know	1 (1.1%)
History of Rhinitis	
Yes	73 (78.5%)
No	20 (21.5%)
Do not know	0 (0.0%)
History of food allergy	
Yes	23 (24.7%)
No	68 (73.1%)
Do not know	2 (2.2%)
Family history of allergic disease (parent or sibling)	36 (63.2%)
IgE (KU/L)	
Median (IQR)	1560.0 (800.0; 2500.0)
Missing values	22
Eosinophils	
Median (IQR)	618.0 (403.2; 970.0)
Missing values	11

Table 1. Sociodemographic and clinical characteristics of patients with atopic dermatitis in Colombia (N = 93) *[a]The frequencies shown were calculated based on the total data available*

Variables	Value[a]
AD factors	
Duration of AD in years	
Median (RQI)	21.0 (16.0; 29.5)
Missing values	14
Age of symptom onset	
<5 years	28 (35.4%)
5–11 years	26 (32.9%)
11–18 years old	8 (10.1%)
>18 years	17 (21.5%)
Missing values	14
AD treatment history	
Topical treatment	
High potency corticosteroid	77 (82.8%)
Medium potency corticosteroid	24 (25.8%)
Low potency corticosteroid	17 (18.3%)
Topical calcineurin inhibitor	61 (65.6%)
Emollients	86 (92.5%)
Other	23 (24.7%)
Systemic treatment	
Oral immunosuppressants	
Azathioprine	46 (49.5%)
Cyclosporine	29 (31.2%)
Methotrexate	10 (10.8%)
Mycophenolate	56 (60.2%)
Not treated with immunosuppressants	11 (11.8%)
Phototherapy	62 (66.7%)
Oral corticosteroids	70 (75.3%)
Other systemic treatments	19 (20.4%)

Table 2. Characteristics of atopic dermatitis and treatment received by patients prior to dupilumab [a]*The frequencies shown were calculated based on the total data available*

Characteristics of dupilumab treatment

In 91 (97.8%) patients the treatment dose with dupilumab was 300 mg and the frequency of administration in 89 (95.6%) of the participants was every other week. No changes in dose or frequency of administration were recorded. However, 68 (73.1%) patients missed at least 1 dose of dupilumab during the assessed treatment interval. Among the identifiable causes, the main reasons for not receiving a dose were: 25 (26.9%) patients due to lack of authorization by the Healthcare Provider Company, followed by personal problems in 19 (20.3%) patients. Three patients (3.2%) discontinued treatment due to an AE. Additionally, 34 (36.6%) patients reported other causes for which they had to interrupt treatment.

All patients received topical treatment after initiation of dupilumab; 72 (77.4%) received topical corticosteroids, 84 (90.3%) received emollients, 16 (17.2%) topical calcineurin inhibitors, and 7 (7.5%) other topical treatments.

Effectiveness of dupilumab

According to the patient's medical records, 89 (95.7%) had clinical improvement of AD with dupilumab. Of these, 5 (5.6%) patients showed improvement at 15 days, 30 (33.7%) at 1 month, 26 (29.2%) at 2–3 months, and 15 (16.9%) at 4–6 months. Thirteen patients (14.6%) had no record of improvement time.

Of the 93 patients in the cohort, 77 (82.8%) had a report of at least one AD severity assessment scale before dupilumab initiation, 81 (87.1%) after dupilumab initiation, and 67 (72.0%) before and after. Of these patients, the most frequently applied scale was the SCORAD, reported in 81.8% and 86.4%, before and after initiating dupilumab, respectively.

Results comparing the tests at each follow-up time against the baseline are in Table 3 and Fig. 1.

SCORAD

The greatest impact of dupilumab was observed from the 6- to 12-month period, with a median percent change of −70.5 (−85.8; −47.9) and an absolute change of −45.0 (−53.0; −32.8). Likewise, it was in this period that the highest percentage of patients with SCORAD-75 was observed.

EASI

Thirty-three patients (35.4%) had the EASI scale assessed before starting dupilumab and 37 (39.8%) patients had a test afterward. Within this group of patients, it was observed that in the periods of 6–12 months and more than 12 months there was a percentage change of more than 90%. Additionally, in these same periods more than 70% of patients achieved an EASI-75, respectively.

	Baseline	3-5 months	From 6 to 12 months	More than 12 months
SCORAD	**N = 63**	**N = 16**	**N = 36**	**N = 13**
Median (IQR)	63.0 (53.5; 71.0)	23.5 (11.2; 28.0)	18.0 (8.0; 34.0)	18.0 (12.0; 30.0)
Median (IQR) of percent change		−67.1 (−79.2; −54.2)	−70.5 (−85.8; −47,9)	−66.7 (−77.3; −51.0)
SCORAD-50, n (%)		12 (75.0%)	25 (69.4%)	11 (84.6%)
SCORAD-75, n (%)		5 (31.2%)	15 (41.7%)	4 (30.8%)
EASI	**N = 33**	**N = 12**	**N = 19**	**N = 8**
Median (IQR)	38.0 (25.0; 47.0)	19.0 (3.8; 34.5)	3.0 (2.0; 8.5)	4.5 (1.8; 7.0)
Median (IQR) of percent change		−55.2 (−90.5; −25.4)	−91.7 (−94.1; −75.7)	−91.4 (−94.8; −82.4)
EASI-50, n (%)		6 (50.0%)	17 (89.5%)	7 (87.5%)
EASI-75, n (%)		5 (41.7%)	14 (73.7%)	6 (75.0%)
POEM	**N = 26**	**N = 4**	**N = 16**	**N = 8**
Median (IQR)	22; 0 (19; 0; 25; 0)	9.5 (7.8; 10.2)	5.0 (2.8; 8.2)	3.0 (1.8; 4.2)
Median (IQR) of percent change		−58.6 (−66.4; −55.5)	−73.0 (−86.5; −66.7)	−87.3 (−93.4; −69.6)
POEM-50, n (%)		4 (100.0%)	16 (100.0%)	7 (87.5%)
POEM-75, n (%)		1 (25.0%)	7 (43.8%)	6 (75.0%)
DLQI	**N = 14**	**N = 2**	**N = 8**	**N = 6**
Median (IQR)	21.5 (12.5; 28.8)	9.0 (8.0; 10.0)	4.0 (2.8; 6.0)	5.0 (1.8; 6.8)
Median (IQR) of percent change		−63.5 (−64.3; −62.8)	−84.2 (−85.8; −73.8)	−66.2 (−90.0; −53.1)
DLQI-50, n (%)		2 (100.0%)	8 (100.0%)	5 (83.3%)
DLQI-75, n (%)		0 (0.0%)	5 (62.5%)	2 (33.3%)

Table 3. Effectiveness results for the baseline and follow-up periods assessed

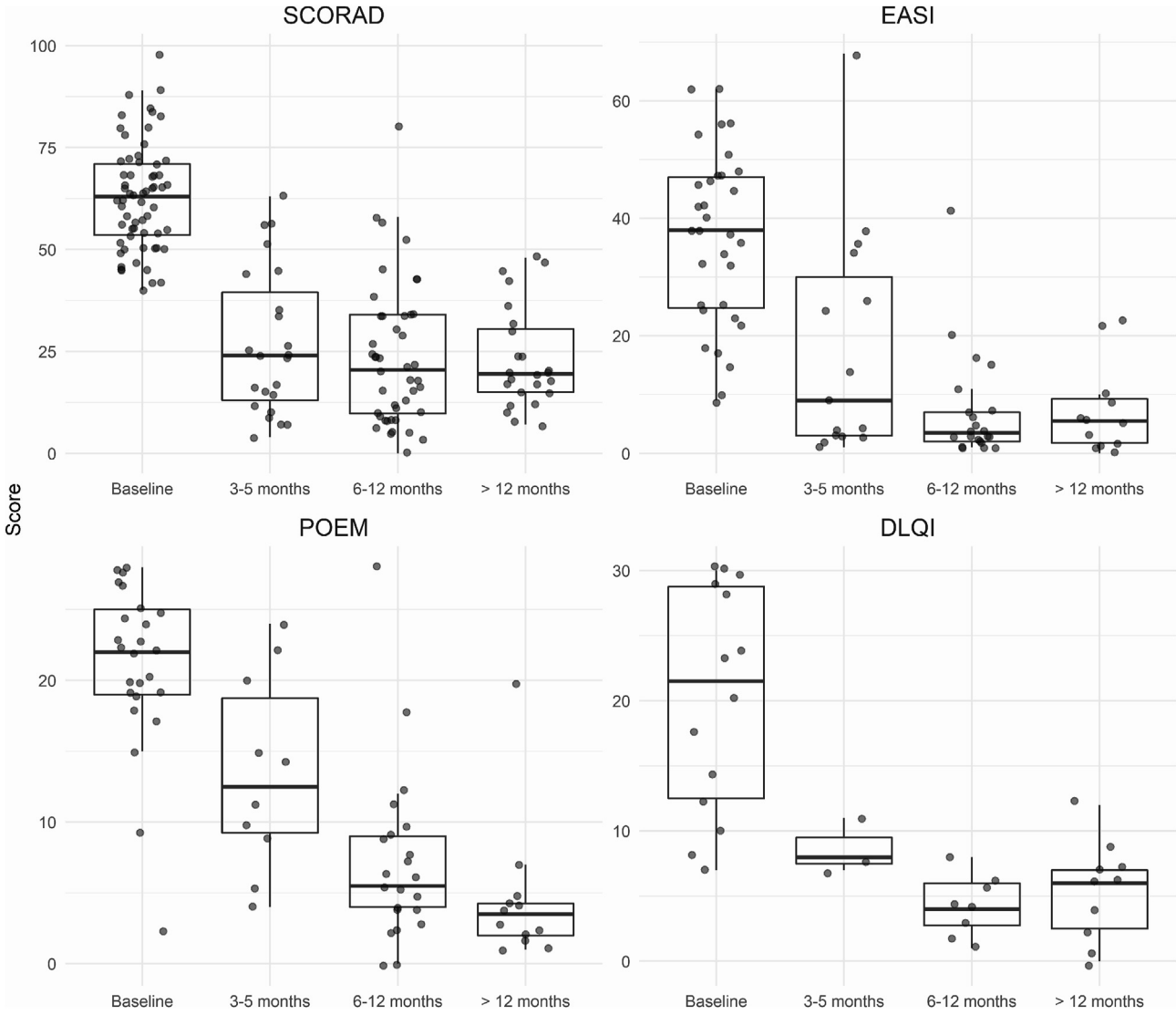

Fig. 1 SCORAD, EASI, POEM and DLQI scores at baseline, 3–5 months, 6–12 months, and more than 12 months

POEM

Regarding the patients assessed using the POEM scale, 100% showed an improvement of at least 50% in the period of 3–5 months and 6–12 months. The largest percentage change was observed in the group older than 12 months with a median of −87.3 (IQR: −93.4; −69.6). Likewise, this group showed the highest percentage of patients with improvement equal to or greater than 75%.

DLQI

Between 3 and 5 months, the 2 patients in this group had an improvement of more than 50% in DLQI score. At 6–12 months, 5 out of 8 patients (62.5%) showed an improvement of up to 75%.

Flares of AD before and after initiation of dupilumab

Eighty-two (88.2%) patients had at least 1 episode of AD flares before dupilumab treatment (Fig. 2a). Twenty-five (26.9%) presented between 1 and 3 flares, 35 (37.6%) between 4 and 6, 9 (9.7%) between 7 and 10, and 2 (2.1%) patients more than 10 flares. Eleven (11.8%) individuals reported at least 1 flare, but the number of episodes was not specified. After initiation of dupilumab, 30 (32.3%) had at least 1 episode of a dermatitis flare, of which 17 (56.7%) had 1 episode, 12 (40%) had 2 to 3 episodes, and 1 person (3.3%) had 3 episodes. Overall, the median number of flares before dupilumab was 3.0 (IQR: 1.0, 5.0) episodes, while after it was 1.0 (IQR: 1.0, 2.0) episodes. This

represented a 66.7% decrease in the number of flares. Of the patients with no reported flare before dupilumab, only 1 (1.1%) patient reported 2 episodes of AD flare after initiating dupilumab treatment.

Effect of dupilumab on other parameters of severity of atopic dermatitis

Seventeen (18.3%) patients have at least 1 day of medical leave in the 12 months before dupilumab treatment (Fig. 2b). Of these patients, 14 (82.4%) reported more than 15 days of medical leave and a median of 22.5 days (IQR: 15.0; 30.0). Ten (58.8%) patients again reported at least 1 day of medical leave within 12 months of starting dupilumab. Of those, 8 (80%) patients reported less than 4 days of medical leave, with a median of 4 days (IQR: 2.25; 4.0). Only 1 patient reported 20 days of medical leave after starting dupilumab.

Twenty-nine patients (31.18%) had at least 1 report of hospitalization in the 12 months before dupilumab initiation (Fig. 2c); of these, 3 (10.3%) were hospitalized once and 1 (3.4%) was hospitalized 4 times in the 12 months following dupilumab initiation. Two patients who had no hospitalizations before dupilumab onset were hospitalized after treatment initiation; 1 patient was hospitalized once and the second patient 4 times due to AD flares.

Adverse events

In this cohort, 12 (12.9%) patients had an adverse event. Three (25%) patients presented conjunctivitis, 2 (16.7%) presented worsening of their baseline conjunctivitis, 1 (8.3%) patient presented ocular pruritus, and another presented unspecified ocular symptoms. Different from the ocular manifestations, 2 (16.7%) patients presented a sensation of dizziness up to 72 h after the application of the drug and 1 patient presented facial erythema added to a worsening of the AD lesions. In 2 (16.7%) patients the presented reaction was not clarified.

Adverse events occurred mostly 1 month after initiation of dupilumab treatment (58.3%). Between months 2 and 4, there were 3 (25.0%) adverse events and 1 (8.3%) at 7 months.

Three (3.2%) patients discontinued dupilumab due to adverse events. One patient discontinued due to the presentation of conjunctivitis, another due to facial erythema added to the worsening of AD lesions. The third patient's adverse event is not specified.

DISCUSSION

Our study described the effectiveness and safety of dupilumab in real-life settings in Colombia. In most patients, treatment with dupilumab improved disease severity by more than 50%, as determined by the SCORAD, EASI, POEM, and DLQI scales. This improvement was maintained even in patients with more than 12 months of treatment, who also showed the most noticeable changes in AD from a personal perspective (POEM scale). Dupilumab was safe for patients, and although 12 (12.9%) patients reported an adverse event, only 3 (3.2%) discontinued the treatment.

In our study, patients' age, male/female ratio, and disease duration were similar to those reported in randomized clinical trials (RCT).[15–17] However, about allergic diseases, there was a higher proportion of patients with allergic rhinitis in our study, probably due to the highest prevalence of allergic diseases in tropical countries compared to temperate countries.[18,19] Finally, according to EASI score at baseline, the median was higher in our patients compared to RCT, whereas SCORAD and POEM scores were similar.[15–17]

According to SCORAD, in our study, we observed effectiveness results like those of efficacy reported in RCT when compared with equivalent periods. Thus, in patients in the 3- to 5-months group, the median percent change in SCORAD was −67.1%, whereas the median percent change at week 16 was between −79.8% and −51.1% among the different RCTs.[15–17] Similarly, in the longer follow-up periods, for patients in the group of more than 12 months, the median percentage change in SCORAD was −66.7%, while at follow-up week 52 of the CHRONOS study the median percentage change was −66.2%.[12]

Prior real-life studies reported similar changes in the SCORAD scores for similar periods.[11,20–24]

Thus a median percentage change was observed at 3–5 months of between −50 and −73%,[11,20,21] at 6–12 months of −64 to −76%,[22,23] and over 12 months of −70 to −80%.[22,24] About the EASI scores, the most significant changes occurred in the 6- to 12-month period. The results obtained in the 3–5 month period are below the results published by RCT, where a mean percentage change at week 16 of around −72% to −62% is observed, with a response rate between 44% and 74%.[15-17] However, over the 6- to 12-month period, our results showed a median percent change of −92% and a response rate of 74% for EASI-75. These results are consistent with data from real-life studies where reductions in EASI at 6 months of −76 to −91% and a response rate of 52%–75% were reported for EASI-75.[22,25-28] A probable explanation for the differences in the EASI scores in our study is the size of the patient sample in the 3- to 5-month period for the EASI. Another explanation could be that AD severity assessment tests have not been validated in Latin America.[29] Conversely, this could be considered a limitation of this study since it makes it difficult to compare the results with other studies in countries where these tests have been evaluated.

Moreover, an improvement in patient-reported measures and quality of life was observed in our population according to POEM and DLQI scores. Thus, in addition to reducing the objective severity of AD, dupilumab can also improve the patient's quality of life and perception of the disease. In addition, a decrease in the number of days of medical leave, number of hospitalizations, and flares of AD was observed. This suggests that dupilumab could have an important effect on reducing the expenses of the Colombian health system in AD long-term care.

Regarding the safety of dupilumab, 12.9% of patients presented at least 1 adverse event in our study. Out of these, the majority presented adverse events related to ocular manifestations (OAE), corresponding to 7.5% of the AE in the total

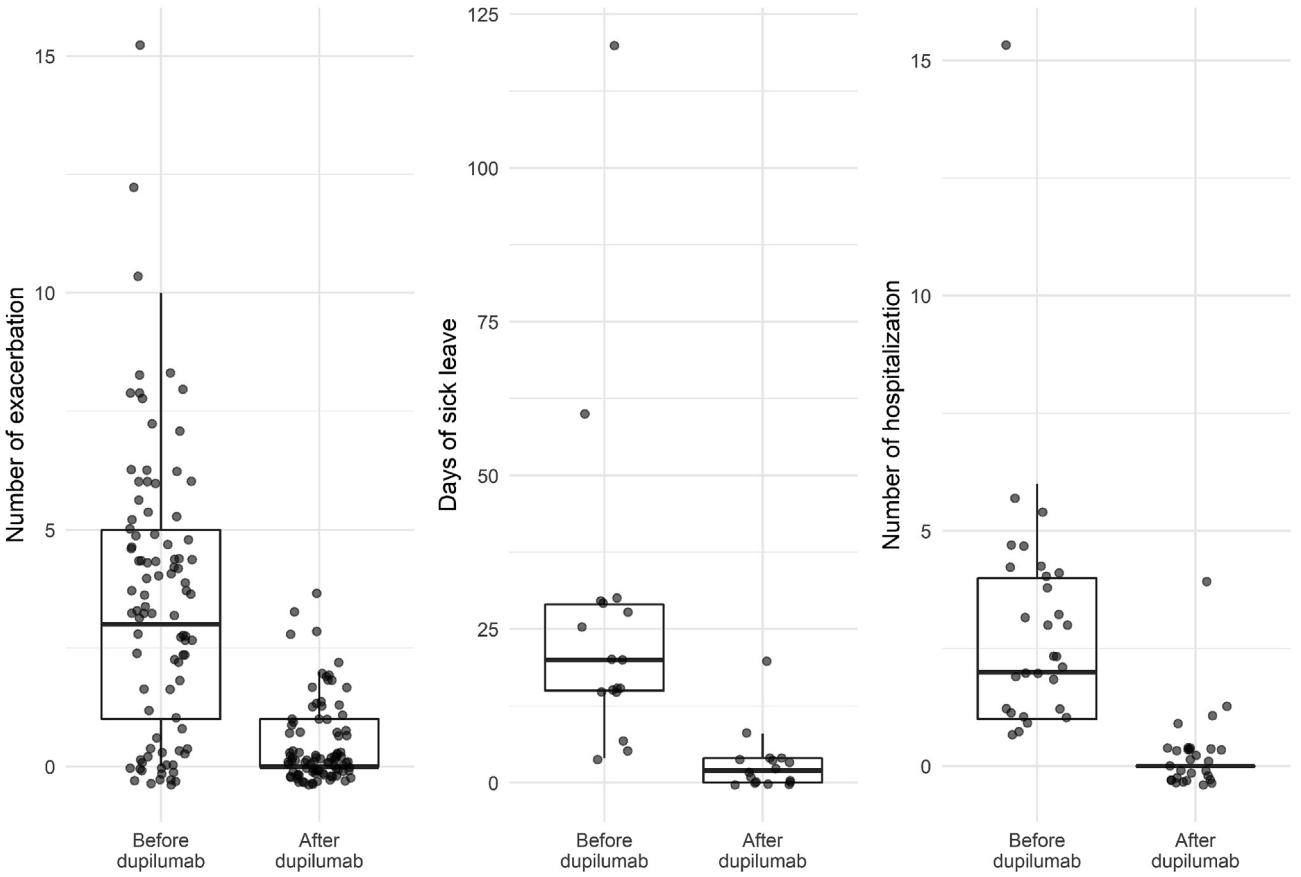

Fig. 2 AD flares, days of sick leave, and number of hospitalizations before and after dupilumab initiation

study population. In RCT and real-life studies, OAE have been reported in 5–70%[11,15–17,30–33] of patients treated with dupilumab with an onset time of two to 44 weeks.[12,16,31,34,35] In our study, the median for the occurrence of OAE was one month and, as reported in the literature,[36] the most frequent manifestation was conjunctivitis, accounting for 71.4% (5 of 7 patients) of the ocular manifestations.

Treatment with dupilumab can lead to an increase in the levels of eosinophils in blood, it has even been described that ocular manifestations and facial redness are associated with elevated peripheral blood eosinophil levels after dupilumab treatment.[37] Although we did not evaluate this outcome in our study, it would be interesting to analyze it in future research since our population showed a high level of eosinophilia before dupilumab treatment, which may impact the reported adverse events.

In this cohort, 73% of patients missed at least 1 dose of dupilumab during the follow-up period. Nevertheless, the favorable clinical effects of dupilumab remained, which suggests that dupilumab in patients with AD allows long-term control. In those patients where an identifiable cause was found, the majority corresponded to a lack of authorization by their Healthcare provider company. However, 52% of patients reported other causes not listed in the questionnaire. Subsequent inquiries with the participating centers in this study showed that in most cases patients did not attend the drug application due to restrictions imposed in the country in 2020 due to the COVID-19 pandemic.

One advantage of our study is that it provides information from different clinical centers, which provides us a broader perspective on the efficacy and safety of dupilumab in Colombia. There are few studies related to this topic in Latin America and other tropical countries. Maspero et al, 2020 published a series of cases in Argentina with 20 patients describing an improvement in AD according to different severity scales (EASI, SCORAD, and DLQI), confirming the benefits of this treatment in our region.[38] On the other hand, the Colombian population has unique characteristics, such as a high proportion of African ancestry, which has been associated with high levels of IgE.[39] The latter may impact the natural history of AD and the response to dupilumab. For example, Touhouche et al, 2021 showed that high IgE levels were associated with a higher probability of developing OAE due to dupilumab.[40] However, our study showed a similar or even lower proportion of OAE than previous studies from temperate territories.[11,15–17] In this context, our study could help decision-making in daily clinical practice in Colombia and other countries like Colombia.

Among the other limitations of our study, we have the size of the patient sample. The retrospective study design resulted in missing data on severity scale scores, leading to the use of the maximum score at 3–5 months, 6–12 months, and more than 12 months as cut-off points to have more homogenous groups. The scoring of AD severity scales was reported by several physicians and may have been subject to inter-observer variation. The definition of flare depended on the treating physician, so it is possible that such episodes were underestimated or that there was no concordance between the different centers in the study. Finally, days of sick leave and hospitalizations secondary to AD are not always recorded in the medical records of the institutions that care for the patients. Only the data of those patients who reported are presented, this does not represent the true number of patients who had days of sick leave or were hospitalized.

In conclusion, in this study we demonstrated that dupilumab is effective and safe for AD patients with moderate-to-severe disease. The results are in concordance with previous clinical trials and real-life studies, showing that most patients benefit from dupilumab even though several patients had short interruptions in the treatment due to administrative problems and mobility restrictions for the COVID-19 pandemic.

Abbreviations

AD, atopic dermatitis; SCORAD, Scoring Atopic Dermatitis; EASI, Eczema Area and Severity Index; POEM, Patient Oriented Eczema Measure; DLQI, Dermatology Life Quality Index; AE, Adverse events; DALYs, Disability-Adjusted Life Years; IQR, Interquartile range; RCT, Randomized clinical trials (RCT); OAE, Ocular manifestations.

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Availability of data and materials
Data supporting our findings are available in the article and the supplementary material. For more information, the corresponding author can provide it upon reasonable request.

Ethics statement
The study was approved by the ethics committee of the Fundación Santa Fe de Bogotá for the UNIMEQ and FUNINDERMA centers (code: CCEI-12275-2020). In the case of Clínica Respiratoria y de Alergias SAS and AUDIOFON SAS, it was approved by the Intitutional Revision Board of IMAT (code: CEI-139-2021 and CEI-140-2021, respectively). The Institutional Revision Board from Fundación Neumológica Colombiana approved the protocol to collect data from their patients, while the Intitutional Revision Board of the IPS Universitaria approved the study for the institution and its Allergology Unit (code: IN25-2021).

Author contribution and consent for publication
EG, JL, LP, EC, LB, CB, DC, and CM participated in the conception and design of the study, assisted with data interpretation, and drafted and reviewed the final manuscript. AL and NA participated in the design of the study, data analysis, interpretation, and drafting of the final manuscript. AMC, MAM, MBG, SM, DC, JS, CB, and YA coordinated or participated in the acquisition of the data, assisted with data interpretation and analysis, and reviewed critically the manuscript. All authors read and gave their consent for the publication of the submitted manuscript in the World Allergy Organization Journal.

Competing interests
Julian Londoño reports lecture fees from Sanofi and Abbvie (outside the submitted work). Jorge Sánchez reports consulting and lecture fees from Thermo-Fisher, FAES, Novartis, Galderma, Sanofi, Becton Dickinson, Nestle, Abbvie, GSK, Astra Zeneca, Pfizer (outside the submitted work). Elizabeth García serves as an advisory board member, speaker, and reports grants and/or other fees from Novartis, AstraZeneca, Sanofi, and GSK. David Castillo reports lecture fees from Abbvie, Pfizer y Jannsen, and grants from Pfizer Janssen y Biopas to develop clinical research (outside the submitted work). Yaicith Arevalo reports lecture fees from Sanofi and Novartis and serves as an advisory board member for AstraZeneca. Ana Lozano and Nelson Alvis are employees of ALZAK Consulting & Research, a center that has developed research projects in conjunction with GSK, Sanofi, MSD, Merck, Abbvie, Bayer, Biopas and received fees for developing this project. The authors from UNIMEQ-ORL reported receiving fees for this research from Sanofi. Cesar Muñoz reports lecture fees from Sanofi and Takeda (outside the submitted work). Laura Botero and Catalina Beltrán are employees of Sanofi de Colombia and may hold shares and/or stock options in the company. The authors report no other conflicts of interest in this work.

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