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Patient perceptions and preferences of biologic therapies in SLE

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ABSTRACT

Objective To evaluate patient perceptions of biologic therapies from a large, population-based cohort of patients with SLE with significant numbers of blacks and whites and across the full spectrum of socioeconomic strata and disease severity.

Methods This was a cross-sectional study of validated patients with SLE enrolled in the Georgians Organized Against Lupus Cohort between September 2014 and August 2015. The survey instrument was developed ad hoc by the authors and contained an introduction on biologics.

Results A total of 676 participants were on average 48.4 years old with 15.9 years of disease; 93.2% were female and 80.6% were black; 34.2% had private health insurance and 9.8% had no insurance; and 26.8% and 27.5% had Medicare or Medicaid, respectively. Of all respondents, 30.8% had heard of biologics, with a significant difference between blacks and whites (25.2% vs 53.4%, respectively). There were no significant differences, however, between blacks and whites with respect to ever having been on biologics (7.6% and 11.5%, respectively) or where they got their information about biologics. Out of 202 individuals who had heard of biologics, 102 (51.3%) were familiar with potential benefits or side effects, and most (n=129, 66.5%) had a neutral perception to risks associated with biologic use. There was no perception of biologics working differently between races/ethnicities. More (n=76, 62.8%) blacks preferred intravenous over subcutaneous modalities compared with whites (n=12, 37.5%) but were not as willing to pay as much out of pocket for it. Individuals with Medicare were significantly more likely to have been on biologics.

Conclusions There are important similarities and differences between blacks and whites with lupus with respect to their perceptions of biologic therapies and their impact. There are opportunities to increase patient exposure to information about biologics and improve their understanding in order for them to make the best informed decision possible.

INTRODUCTION

SLE is the prototypic systemic autoimmune disease characterised by a diverse array of manifestations and the production of autoantibodies. Clinical features are quite heterogeneous and vary in severity between individuals and over time, with flares often occurring unpredictably. Disease activity over time can lead to irreversible damage and accumulate if uncontrolled and/or treated with potentially toxic medications.[1] An estimated 70%–90% of affected persons are women, with an onset usually in the childbearing years. The prevalence is 20–70 cases per 100 000 per year for all women but is as high as 241.5 per 100 000 per year for black women in particular.[2–5] The mean age at onset of SLE is also younger among black people.[2 3 6] Patients from racial minorities are more likely to suffer from multiple comorbidities; they have higher prevalence of depression, cardiovascular disease and diabetes, and worse health-related quality of life than whites.[7–13]

Standard therapies for SLE include corticosteroids, antimalarial agents (eg, hydroxychloroquine), non-steroidal anti-inflammatory drugs, cytotoxic agents like cyclophosphamide, and immunosuppressive/immunomodulatory agents used in cancer or transplantation. Most of these agents have never been formally approved by the US Food and Drug Administration (FDA) for use in SLE, with the exception of glucocorticoids, aspirin and hydroxychloroquine. Although overall survival has improved from less than 50% at 5 years in the 1950s to greater than 90%,[14 15] these therapies continue to be associated with incomplete response and significant toxicity. Furthermore, minorities have a higher burden of disease and worse outcomes on these standard therapies compared with whites.[2 8 9 11–13 16–18]

Biologic therapies (biologics) are engineered proteins designed to enact specific effects on the immune system. Their use has greatly increased in the 21st century and spans a variety of conditions, including rheumatoid arthritis, spondyloarthropathies, multiple sclerosis and cancers. They represent an alternative to conventional immunosuppressive treatments, characterised by targeted effects on the immune system, and have the potential to reduce dependence on corticosteroids and induce and maintain remission. In 2011, belimumab, which inhibits soluble human B-lymphocyte stimulator, or BLyS, became the first drug approved by the FDA for SLE

since hydroxychloroquine and corticosteroids in 1955. As the first and only biologic therapy approved for SLE, belimumab also represents the start of a new biologic era with continued robust activity in the SLE therapeutic pipeline.[19]

This new era comes with additional questions as to which patient subpopulations respond best to belimumab. Multiple reports around the time of the FDA approval in March 2011 were publicised in both the scientific and lay media underscoring the agency's concern that belimumab potentially lacked efficacy in black patients 'with the data hinting of possible harm',[20] despite lack of data. Of note is that the number of African–American patients included in the trials represented only 8.8% of the overall population. An additional trial to further study the effect of belimumab in patients with SLE of black/African ancestry was completed in early 2019 but was unable to meet its primary endpoints.[21] Improvement, while not statistically significant, was observed in favour of belimumab in the overall population. A significant improvement was observed in a subpopulation of patients with greater disease activity. The safety profile was consistent with earlier belimumab studies.

We examined patient perceptions and potential black/white differences of patients' perceptions about biologic therapies in a large, population-based cohort of patients with SLE.

METHODS

Study design

This is a cross-sectional study of patient-reported data collected among the Georgians Organized Against Lupus (GOAL) Cohort participants between September 2014 and August 2015.

Data sources

The Georgians Organized Against Lupus (GOAL) Cohort

The GOAL Cohort encompasses a population-based cohort of consented adult patients with validated diagnoses of SLE from metropolitan Atlanta, Georgia. The overall aim of GOAL is to examine the impact of sociodemographic and healthcare factors on outcomes that are relevant to improving our understanding of health disparities in SLE. Recruitment and data collection methods, as well as the sociodemographic characteristics, have been described previously.[22] Briefly, the primary source of SLE enrollees is the Georgia Lupus Registry (GLR), a population-based registry designed to more accurately estimate the incidence and prevalence of SLE in Atlanta, an area with a large number of African–Americans at high risk for SLE. All diagnoses were validated through review of medical records.[2 23] All participants were mailed a self-report questionnaire to return via mail or complete via internet or phone.

Study sample

Approximately 70% of GOAL participants were recruited from the GLR, and the remaining from clinics that represented the sociodemographic range found in the GLR, including the lupus clinic at Grady Memorial Hospital (the only safety-net hospital in Atlanta), Emory University rheumatology clinics and community rheumatologists in metropolitan Atlanta. The survey has been administered annually since August 2011. For this study, 676 participants with a validated diagnosis of SLE completed the survey.

Inclusion/exclusion criteria

All participants of the GOAL Cohort have a validated diagnosis of SLE with documentation of ≥4 American College of Rheumatology (ACR) criteria[24 25] or 3 ACR criteria with a final diagnosis of SLE by the treating rheumatologist, are ≥18 years of age, and a resident of the metropolitan Atlanta area.

Data captured

The GOAL survey includes questions on sociodemographics and medical insurance. Disease activity was measured using the Systemic Lupus Activity Questionnaire (SLAQ), a validated survey with a recall period of 3 months and a score range of 0–44. Higher scores indicate greater degree of self-reported disease activity. The SLAQ correlates well with physician-rated disease activity[26] and has excellent external reliability (r=0.87).[27] Organ damage was measured using a self-administered version of the Brief Index of Lupus Damage,[28] which was validated in the GOAL Cohort and had excellent criterion validity for 80% of items and excellent test–retest correlation (r=0.92).[29] Scores range from 0 to 10. No organ damage had a score of 0, mild damage 1–2 and severe damage ≥3. General health was assessed using the one question from the Short-Form Health Survey-12 that asks whether the participant's health in general is excellent, very good, good, fair or poor.[30] Medications were captured as currently taking, ever taken, never or do not know.

Measures for primary outcomes

The survey instrument was developed ad hoc by the authors and contained an introduction on biologics followed by questions designed to assess patients' perceptions and preferences as they relate to biologic therapies (see online supplementary material 1). The introduction was developed using patient-directed information found on National Institutes of Health and FDA websites. No further explanation was provided to the participants. The introduction and questions read at a twelfth-grade and eighth-grade reading level, respectively. Questions were pilot-tested by eight diverse individuals with SLE for readability, content, length and cultural concerns. Feedback was incorporated into the final version. This section began with a brief overview and description of biologic therapies. No specific biologic agent was named. Those categorised as ever having been on biologics were either on or had taken the following medications: belimumab, rituximab, etanercept, adalimumab or infliximab.

Responses of 'do not know' were analysed together with those classified as never having been on a biologic.

Statistical analysis

Participants' sociodemographic characteristics and disease information were summarised using numbers and percentages for dichotomous and categorical variables based on the total number of participants who completed each question. Mean and SD were calculated for continuous measures. Variables were compared between those participants ever having been on biologics (yes/no) using χ^2 tests for categorical variables and t-tests for continuous variables. All comparisons are based on 0.05 significance level.

Perception of biologics was summarised by response to each question, and potential association with race (black/white) was assessed using the χ^2 test. Logistic regression analysis was performed to investigate the association between race and the following questions/statements, adjusted for other sociodemographic characteristics (table 3): Have you ever been on biologics to treat your lupus? Do you have family or friends who have received biologics? If your condition worsened and you decided to take biologics, how concerned would you be about potential complications? I believe biologics used to treat lupus work differently in people of different race or ethnicity. In general, how helpful do you think biologics can be to treat lupus? If you were willing to receive biologics to treat your lupus, would your decision change depending on how the medication was given (eg, intravenous infusion or self-administered subcutaneous infection)? Responses were dichotomised, and those with responses of 'Do Not Know', 'Neutral' or 'Neither Agree or Disagree' were grouped in the negative response group. SAS V.9.1 was used for all analyses.

RESULTS

Demographic and clinical characteristics

Table 1 summarises the sociodemographic and clinical characteristics of the cohort. Less than 1% declared a race other than black or white and were excluded from this study. The average age at time of the survey was 48.4 years with 15.9 years of disease duration. Women comprised 93.2% and blacks 80.6% of the participants. The average years of schooling were 14.5 years (some college). Overall, 35.7% were employed and 32.4% were married or with a partner. Private health insurance was held by 34.2% and 9.8% had no insurance. Medicare or Medicaid comprised 26.8% and 27.5% of the sample, respectively. Those reporting their health status as being 'poor' or 'fair' was 50.3%. Across the entire cohort, the burden of damage due to SLE was extensive, with 34.3% reporting damage in the eyes, 25.4% in the heart, 23.5% in the gastrointestinal system, 21.7% in the muscle/bone, 19.4% in the vascular system, 15.9% of women reported early menopause, 14.8% in the neurological system, 14.5% in the pulmonary system and 10.9% had diabetes. Cancer (8.9%), skin damage (8.6%) and renal damage (8.4%) were the only manifestations reported with less than 10% incidence. There were no significant differences between those reporting to have been on biologics versus never on biologics, except with regard to poverty, insurance type and diabetes. Those who were ever on a biologic were less likely to be uninsured and with Medicaid but more likely to have Medicare. Those ever on biologics were more likely to have diabetes (19.6%) compared with those who had never received biologics (10.1%).

Biologic perceptions and preferences, overall and by race

Table 2 summarises the biologic treatment perceptions and preferences overall and by race. Only 8.3% have ever been on biologics and 6.2% have had family members on biologics, while 30.8% have heard of biologics. Sources for hearing about biologics included from a physician (57.4%), the internet (47.5%), another patient with lupus (19.8%) or someone without lupus (6.9%). Of those who had heard of biologics, 51.3% reported being familiar with potential benefits and side effects of biologic treatment, with most having a neutral perception as to how risky biologics may be (66.5%), and about half the respondents were neutral regarding the seriousness of their complications (48.0%). When asked how concerned they would be about potential complications if their condition worsened and warranted the use of a biologic, 21.2% reported that they would be concerned and 32.2% reported they would be very concerned. Many would agree to receive biologics if their physician recommended it (30% somewhat agree, 11.1% strongly agree), but 48.2% were neutral. Regarding the perception of whether biologics work differently by race or ethnicity, 11.7% strongly agreed and 20.6% somewhat agreed, but most were neutral at 49.5%. The majority were neutral (66.9%) as to how helpful biologics were in treating lupus. When asked about this perception if their condition worsened, there were minimal changes in response. When asked whether the modality of administration made a difference in their willingness to receive biologics, 25.5% said 'yes', with the majority (74.5%) stating 'no or don't know'. The preferred modality was intravenous infusion at 57.5%. Self-injection was preferred by 42.5%. Most were willing to pay an annual out-of-pocket expense of ≤$100 (69.8%), with far fewer willing to pay more than that amount.

Regarding racial differences, there were no significant differences between blacks and whites with respect to ever having been on biologics (7.6% vs 11.5%). However, blacks had significantly fewer family members reported to have been on biologics (4.8% vs 11.5%, p=0.0051) and fewer have ever heard of biologics (25.2% vs 53.4%, p<0.0001). Of those having heard of biologics, there was a similar distribution between blacks and whites with regard to the source of information. Most heard of biologics from their physicians (59.8% of blacks and 52.9% of whites) rather than from the internet (50.0% of blacks and 42.9% of whites), from other patients with lupus

Table 1 Sociodemographic and clinical characteristics of the GOAL Cohort (N=676)

Category	Overall (N=676)	Ever on biologics		P value
		No (n=611)	Yes (n=56)	
Age at survey (years), mean±SD	48.4±13.6	48.5±13.5	46.9±14.3	0.39
Age at diagnosis (years), mean±SD	32.5±12.1	32.5±12.1	32.7±12.2	0.9
Disease duration (years), mean±SD	15.9±9.8	16.1±9.9	14.2±8.4	0.17
Gender (female), n (%)	630 (93.2)	568 (93.0)	53 (94.6)	0.63
Race (black), n (%)	545 (80.6)	495 (81.0)	41 (73.2)	0.16
Education (years), mean±SD	14.5±3.1	14.5±3.1	15.2±3.0	0.1
Currently employed, n (%)	241 (35.7)	220 (36.0)	20 (35.7)	0.97
Married or with a partner, n (%)	219 (32.4)	200 (32.7)	19 (33.9)	0.8
Below 100% poverty level, n (%)	244 (36.1)	228 (37.3)	13 (23.2)	0.030
Insurance type, n (%)				
No insurance	66 (9.8)	64 (10.5)	1 (1.8)	0.036
Private	231 (34.2)	211 (34.5)	19 (33.9)	
Medicare	181 (26.8)	156 (25.5)	22 (39.3)	
Medicaid	186 (27.5)	171 (28.0)	12 (21.4)	
Disease activity (SLAQ), mean±SD	16.0±9.3	16.0±9.3	16.4±9.3	0.77
Organ damage (BILD), n (%)				
No damage	81 (12.0)	75 (12.3)	5 (8.9)	0.76
Mild damage	237 (35.1)	213 (34.9)	20 (35.7)	
Severe damage	358 (53.0)	323 (52.9)	31 (55.4)	
Poor/fair health status, n (%)	340 (50.3)	310 (50.7)	27 (48.2)	0.66
Organ damage, n (%)				
Eye damage	232 (34.3)	209 (34.2)	19 (33.9)	0.97
Neurological damage	100 (14.8)	90 (14.7)	9 (16.1)	0.79
Renal damage	57 (8.4)	53 (8.7)	4 (7.1)	0.69
Pulmonary damage	98 (14.5)	91 (14.9)	7 (12.5)	0.63
Heart damage	172 (25.4)	154 (25.2)	18 (32.1)	0.26
Vascular damage	131 (19.4)	114 (18.7)	16 (28.6)	0.073
Gastrointestinal damage	159 (23.5)	139 (22.7)	18 (32.1)	0.11
Muscle/bone damage	147 (21.7)	135 (22.1)	12 (21.4)	0.91
Skin damage	58 (8.6)	54 (8.8)	4 (7.1)	0.67
Early menopause	70 (15.9)	62 (15.5)	7 (20.0)	0.49
Diabetes	74 (10.9)	62 (10.1)	11 (19.6)	0.029
Cancer	60 (8.9)	55 (9.0)	4 (7.1)	0.64

Early menopause responses were from women only.
BILD: no damage (score=0), mild damage (score=1–2), severe damage (score ≥3).
9 participants did not provide biologic information.
BILD, Brief Index of Lupus Damage; GOAL, Georgians Organized Against Lupus; SLAQ, Systemic Lupus Activity Questionnaire.

(18.9% of blacks and 21.4% of whites) or from another person without lupus (7.6% of blacks and 5.7% of whites). For the patients who had heard of biologics, there was no significant difference between blacks and whites with respect to familiarity with potential benefits or side effects of biologics (53.1% vs 47.8%). With respect to how risky or dangerous biologics are or how serious their complications might be, there was no significant difference between blacks and whites. However, when asked about the concern of potential complications from biologics if their condition worsened, more blacks were concerned or very concerned compared with whites (57.7% vs 36.6%, p<0.0001). When asked if they were willing to receive biologics if their physician recommended it, there was no significant difference between blacks and whites. With regard to whether biologics work differently between races/ethnicities, how helpful biologics are in treating lupus and how helpful biologics would be if the patient

Table 2 Biologic perceptions and preferences, overall and by race

Characteristics			Category	Overall (black or white) n=655†	By race		
					Black n=524	White n=131	P value
Ever on biologics			No or don't know	593 (91.7)	477 (92.4)	116 (88.5)	0.15
			Yes	54 (8.3)	39 (7.6)	15 (11.5)	
Family ever on biologics			No or don't know	607 (93.8)	491 (95.2)	116 (88.5)	0.0051
			Yes	40 (6.2)	25 (4.8)	15 (11.5)	
Ever heard of biologics			No	453 (69.2)	392 (74.8)	61 (46.6)	<0.0001
			Yes	202 (30.8)	132 (25.2)	70 (53.4)	
For those ever having heard of biologics (n=202)	Source of hearing about biologics*	Doctor	No	86 (42.6)	53 (40.2)	33 (47.1)	0.34
			Yes	116 (57.4)	79 (59.8)	37 (52.9)	
		Website	No	106 (52.5)	66 (50.0)	40 (57.1)	0.33
			Yes	96 (47.5)	66 (50.0)	30 (42.9)	
		Another patient with lupus	No	162 (80.2)	107 (81.1)	55 (78.6)	0.67
			Yes	40 (19.8)	25 (18.9)	15 (21.4)	
		Another person without lupus	No	188 (93.1)	122 (92.4)	66 (94.3)	0.62
			Yes	14 (6.9)	10 (7.6)	4 (5.7)	
	Familiar with potential benefits or side effects of biologics		No	97 (48.7)	61 (46.9)	36 (52.2)	0.48
			Yes	102 (51.3)	69 (53.1)	33 (47.8)	
	How risky and dangerous are biologics		1. Very harmless	7 (3.6)	5 (4.0)	2 (2.9)	0.53
			2. Harmless	5 (2.6)	5 (4.0)		
			3. Neutral	129 (66.5)	83 (65.9)	46 (67.6)	
			4. Harmful	41 (21.1)	25 (19.8)	16 (23.5)	
			5. Very harmful	12 (6.2)	8 (6.3)	4 (5.9)	
	How serious are the complication from taking biologics		1. Not at all serious	5 (2.6)	5 (3.9)		0.41
			2. Somewhat serious	53 (27.0)	36 (28.1)	17 (25.0)	
			3. Neutral	94 (48.0)	61 (47.7)	33 (48.5)	
			4. Serious	27 (13.8)	15 (11.7)	12 (17.6)	
			5. Very serious	17 (8.7)	11 (8.6)	6 (8.8)	
If condition worsened and decided to take biologics, how concerned about potential complications			1. Not at all concerned	27 (4.5)	24 (5.0)	3 (2.4)	<0.0001
			2. Somewhat concerned	137 (22.6)	95 (19.7)	42 (34.1)	
			3. Neutral	118 (19.5)	85 (17.6)	33 (26.8)	
			4. Concerned	128 (21.2)	104 (21.6)	24 (19.5)	
			5. Very concerned	195 (32.2)	174 (36.1)	21 (17.1)	
Willing to receive biologics if doctor recommends			1. Strongly agree	70 (11.1)	54 (10.7)	16 (12.6)	0.2
			2. Somewhat agree	189 (30.0)	141 (28.0)	48 (37.8)	
			3. Neutral	304 (48.2)	253 (50.2)	51 (40.2)	
			4. Disagree	40 (6.3)	33 (6.5)	7 (5.5)	

Continued

Table 2 Continued

Characteristics	Category	Overall (black or white) n=655†	By race		
			Black n=524	White n=131	P value
	5. Strongly disagree	28 (4.4)	23 (4.6)	5 (3.9)	
Believe biologics work differently by race or ethnicity (restricted to those who have heard of biologics)	1. Strongly agree	25 (11.7)	19 (13.4)	6 (8.3)	0.084
	2. Somewhat agree	44 (20.6)	35 (24.6)	9 (12.5)	
	3. Neutral	106 (49.5)	62 (43.7)	44 (61.1)	
	4. Disagree	19 (8.9)	14 (9.9)	5 (6.9)	
	5. Strongly disagree	20 (9.3)	12 (8.5)	8 (11.1)	
In general, how helpful are biologics in treating lupus	1. Very unhelpful	16 (2.6)	14 (2.9)	2 (1.6)	0.31
	2. Unhelpful	16 (2.6)	15 (3.1)	1 (0.8)	
	3. Neutral	407 (66.9)	327 (67.7)	80 (64.0)	
	4. Helpful	128 (21.1)	96 (19.9)	32 (25.6)	
	5. Very helpful	41 (6.7)	31 (6.4)	10 (8.0)	
How helpful biologics would be for you, if condition worsened and decided to take biologics	1. Very unhelpful	21 (3.5)	18 (3.8)	3 (2.4)	0.5
	2. Unhelpful	16 (2.6)	13 (2.7)	3 (2.4)	
	3. Neutral	396 (65.6)	316 (66.1)	80 (63.5)	
	4. Helpful	127 (21.0)	94 (19.7)	33 (26.2)	
	5. Very helpful	44 (7.3)	37 (7.7)	7 (5.6)	
If willing to receive biologics, would decision change based on how medication was given	No or don't know	471 (74.5)	377 (74.8)	94 (73.4)	0.75
	Yes	161 (25.5)	127 (25.2)	34 (26.6)	
If yes, prefer	1. Intravenous infusion	88 (57.5)	76 (62.8)	12 (37.5)	0.010
	2. Subcutaneous	65 (42.5)	45 (37.2)	20 (62.5)	
Annual out-of-pocket costs you would be willing to pay for biologics	1. ≤$100	367 (69.8)	320 (76.6)	47 (43.5)	<0.0001
	2. $101–$250	71 (13.5)	52 (12.4)	19 (17.6)	
	3. $251–$500	46 (8.7)	31 (7.4)	15 (13.9)	
	4. $501–$1000	25 (4.8)	10 (2.4)	15 (13.9)	
	5. >$1000	17 (3.2)	5 (1.2)	12 (11.1)	

*Respondents may report more than one source.
†Totals are limited to those who classified themselves as black or white and may not add up to 655 due to incomplete responses. Percentages are based on those who actually answered the respective question.

taking the survey had a worsening condition, there were also no significant differences between blacks and whites. When asked whether the modality of how biologics were administered impacted their decision, there was no significant difference between blacks and whites, with the majority replying 'no or don't know' (74.8% of blacks and 73.4% of whites). More blacks preferred intravenous infusion to self-injection compared with whites (62.8% vs 37.5%, p=0.010). There was also a racial difference in how much they would be willing to pay out of pocket for biologic therapy, with 11% of blacks willing to spend >$250 annually compared with 38.9% of whites (p<0.0001).

Multivariable model

When controlling for multiple covariates (table 3), logistic regression analysis showed that fewer blacks had family members or friends on a biologic (OR 0.39, p=0.028) and had significantly more concern about complications (OR 2.15, p=0.0023) compared with whites. Those who are older were less likely of ever being on a biologic therapy (OR 0.86, p=0.047). Women had significantly increased odds of having concerns about complications from biologics (OR 2.98, p=0.0083). Compared with those with no disease damage, those with mild disease damage had significantly less concern of complications from biologic therapy (OR 0.36, p=0.0068) but did indicate that their decision to receive a biologic was dependent on the mode of administration (OR=2.29, p=0.032). Those with severe damage did not have any significant differences compared with those without damage. With regard to insurance status, compared with those with private insurance, Medicare recipients were significantly more likely to have been on biologics (OR 3.61, p=0.0015) and with less concern of its complications (OR 0.59, p=0.034). Significantly more Medicaid recipients believed biologics are helpful in treating lupus than those with private insurance (OR=2.16, p=0.027). There were no significant associations with education, poverty level, employment and marriage status, as well as disease duration and activity, on the various perceptions asked about biologics.

DISCUSSION

In this first study evaluating racial differences in perceptions of biologic therapies in SLE, overall, only 30.8% of respondents have heard of biologics, and approximately half of those individuals were familiar with potential benefits or side effects and most had a neutral perception (66.5%) to risks associated with biologic use. There is a need to improve general education about biologics in the lupus population. Given the disproportionate impact of SLE in those of African ancestry, there were no significant differences between blacks and whites with respect to ever having been on biologics and where they got their information about biologics. There was less biologic use among family members and knowledge of biologics in blacks. However, despite only 25.2% of blacks having ever heard of biologics, 7.6% had been on a biologic, indicating a significant proportion of blacks who are made aware of biologics are being treated with biologics. Blacks generally were less familiar with potential benefits or side effects of biologics compared with whites, and this may be impacting their potential decision-making about biologics. More blacks were concerned about complications from biologics if their condition were to worsen and warrant such potential therapies. This may reflect concerns for medications in general or it may be specific to biologics. Further study is warranted in this area. Despite this potential concern, both blacks and whites were equally willing to receive biologics if their physician recommended it, with many agreeing strongly or agreeing somewhat (30% somewhat agree, 11.1% strongly agree) but most remain neutral (48.2%). This may reflect the generally positive experiences of patient-centred decision-making that the African–American patients in our cohort experienced (data not presented here), as well as the potential to improve perceptions through education and awareness. There were no racial differences in the perception of biologics working differently between races/ethnicities. Of all cohort participants, 66.9% were neutral with regard to how helpful biologics may be in treating lupus, suggesting again significant potential to impact perceptions in this area. About 25% of those surveyed indicated that their decision to receive biologics would change depending on the mode of administration. Further questioning of this group indicated 57.5% prefer intravenous and 42.5% prefer subcutaneous use. Notably, blacks preferred intravenous over subcutaneous (62.8%) compared with whites (37.5%) and were not as willing to pay as much out of pocket for it.

Those with mild disease damage compared with those without damage had less concern of complications from biologic therapy, but their decision to receive a biologic was dependent on the mode of administration. There were no significant differences in those with severe damage compared with those without damage. This may indicate a threshold effect up to which a certain degree of damage heightens the sense of the need for new therapy while being discriminatory regarding modality but goes away after accumulating significant damage. Disease activity did not show any significant association and may not have enough chronicity to impact perceptions.

Access to care and different insurance plans, or lack thereof, can significantly drive perceptions about any treatment. Although the cohort is relatively young (mean age of 48.4 years at the time of the survey), 26.8% were on Medicare, with 27.5% on Medicaid and 9.8% without any insurance. Individuals with Medicare were significantly more likely than those with private insurance to have been on biologics, which may be an indicator of access to care and/or disease severity.

Risk of SLE flare is greater with patients of African ancestry compared with other ethnic groups.

An analysis from the Hopkins Lupus Cohort showed that the African–American race independently predicted risk of flare over the course of 1 year. They also found flare

Table 3 Logistics regression model of biologic perceptions and preferences, adjusted by sociodemographic characteristics

	Ever on biologics (n=543)		Family/friends on biologics (n=544)		Concern about potential complications from biologics (n=513)		Biologics work differently by race/ethnicity (n=520)		Biologics are helpful in treating lupus (n=515)		Biologic treatment decision based on modality (n=534)	
Variable	**OR**	**P value**	**OR**	**P value**	**OR**	**P value**	**OR**	**P value**	**OR**	**P value**	**OR**	**P value**
Race (black vs white)	0.65 (0.30–1.40)	0.27	0.39 (0.17–0.90)	0.028	2.15 (1.31–3.53)	0.0023	1.32 (0.71–2.46)	0.38	0.63 (0.38–1.06)	0.082	1.19 (0.70–2.04)	0.52
Age at survey (per 5 years↑)	0.86 (0.73–1.00)	0.047	1.01 (0.84–1.21)	0.91	1.08 (0.98–1.18)	0.11	0.98 (0.88–1.08)	0.65	0.96 (0.87–1.05)	0.38	0.91 (0.82–1.00)	0.052
Disease duration (per 5 years↑)	0.85 (0.68–1.05)	0.14	1.14 (0.93–1.41)	0.22	0.97 (0.87–1.09)	0.59	0.96 (0.84–1.10)	0.58	0.95 (0.84–1.08)	0.43	0.97 (0.85–1.10)	0.62
Disease activity (per 3 units↑)	1.03 (0.92–1.15)	0.58	1.13 (0.99–1.29)	0.069	0.98 (0.92–1.05)	0.58	0.95 (0.88–1.03)	0.19	0.98 (0.92–1.06)	0.65	1.00 (0.93–1.07)	0.99
Education (per 3 years↑)	1.17 (0.82–1.67)	0.38	1.25 (0.86–1.83)	0.24	0.85 (0.68–1.05)	0.13	0.97 (0.76–1.25)	0.84	1.16 (0.93–1.46)	0.19	0.95 (0.75–1.21)	0.7
Gender (female vs male)	1.05 (0.28–3.89)	0.94	0.52 (0.14–1.94)	0.33	2.98 (1.32–6.69)	0.0083	1.57 (0.61–4.08)	0.35	0.51 (0.24–1.10)	0.086	0.94 (0.42–2.10)	0.88
Below poverty (compared with those not below poverty)	0.59 (0.25–1.44)	0.25	0.59 (0.20–1.79)	0.35	1.23 (0.74–2.04)	0.43	0.59 (0.33–1.06)	0.075	0.97 (0.56–1.68)	0.93	0.72 (0.41–1.27)	0.26
Damage (reference: no) mild damage	1.91 (0.60–6.06)	0.19	1.71 (0.45–6.43)	0.14	0.36 (0.18–0.70)	0.0068	0.88 (0.43–1.79)	0.72	1.12 (0.57–2.21)	0.42	2.29 (1.12–4.71)	0.032
Severe damage	1.32 (0.38–4.53)	0.91	0.80 (0.19–3.40)	0.34	0.44 (0.22–0.89)	0.21	0.65 (0.30–1.39)	0.18	0.87 (0.42–1.78)	0.43	1.87 (0.87–4.03)	0.43
Insurance (reference: private) no insurance	0.28 (0.03–2.40)	0.1	0.65 (0.12–3.44)	0.9	0.90 (0.42–1.94)	0.96	2.21 (0.93–5.25)	0.39	0.95 (0.40–2.27)	0.23	0.93 (0.42–2.06)	0.58
Medicare	3.61 (1.33–9.83)	0.0015	0.70 (0.24–2.04)	0.99	0.59 (0.33–1.07)	0.034	1.90 (0.93–3.87)	0.65	1.68 (0.87–3.23)	0.32	0.75 (0.40–1.42)	0.79
Medicaid	1.15 (0.36–3.75)	0.81	0.52 (0.14–1.95)	0.52	1.16 (0.60–2.24)	0.16	2.07 (0.96–4.48)	0.4	2.16 (1.07–4.38)	0.027	0.57 (0.28–1.16)	0.13
Employed	1.18 (0.48–2.88)	0.72	0.69 (0.26–1.81)	0.45	0.93 (0.56–1.55)	0.79	1.03 (0.56–1.90)	0.93	1.07 (0.61–1.88)	0.8	1.12 (0.65–1.93)	0.67
Married	1.01 (0.48–2.12)	0.98	0.64 (0.28–1.48)	0.3	0.79 (0.52–1.22)	0.29	0.71 (0.42–1.19)	0.19	0.90 (0.56–1.43)	0.65	1.02 (0.64–1.63)	0.92
(Hosmer and Lemeshow goodness-of-fit test)	–	0.32	–	0.89	–	0.67	–	0.50	–	0.17	–	0.86

'Don't Know' or 'Neutral' responses are included in the 'NO' group.

rates over 1 year to be higher compared with a similar UK study, attributing the higher frequency of flare to differences in ethnicity, particularly the larger number of African–American patients in the Hopkins cohort.[18] The greater burden of disease flares in the minority population, particularly African–Americans, has contributed significantly to persistent health disparities.

As of the date of this publication, only one biologic therapy has been approved for SLE. However, many are in the drug development pipeline, as well as several that have failed in phase III clinical trials due to lack of efficacy but not due to safety concerns.[31] Given SLE's predilection to afflict younger, minority women, it is imperative to evaluate perceptions and preferences related to biologic therapy in order to improve and better target education and awareness efforts, particularly when more biologic therapies hit the market.

Limitations

The GOAL survey contains entirely patient-reported data and is subject to recall bias. We did not account for duration of therapy and differential responses according to various outcomes (eg, remission, partial remission, discontinuation due to adverse events). Other significant covariates may not have been taken into account. Given the population-based nature of the cohort, we depended on remote (mail and internet) capture of data. Some participants with known lower health literacy were given options to complete the surveys by phone or inperson during their clinic visits. However, this was not available systematically throughout the cohort and could be a source of bias. Furthermore, no additional explanation of the term 'biologics' or the questions was provided, which may have impacted the understanding and responses of those with marginal health literacy.

CONCLUSION

There are racial differences in biologic perception and preferences in SLE. However, these differences did not constitute the majority of the observations. Overall, there remains a neutral perception in many domains that may indicate cautiousness on behalf of the patients and/or need for more information in order to make an informed decision. As new biologic therapies enter the market, there should be efforts to better understand the gaps in patient understanding with subsequent targeted education.

Contributors The Emory authors led the development of the protocol, collected the data, performed the statistical analyses and developed the study report. The Hopkins author contributed to both the protocol and the study report. The GSK author contributed to both the protocol and the study report. SSL, HK, BFP and CD were involved in the study design. All authors were involved in the analysis and interpretation of data. All authors reviewed the manuscript and approved the final version to be submitted.

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Competing interests SSL and CD and GB are associated with Emory University. BFP is an employee of GlaxoSmithKline (GSK). HK and BFP own GSK stock. SSL, CD and GB disclosed no conflict of interest. HK was an employee of GSK at the time of the study.

Patient and public involvement statement A lupus patient advisory committee, which comprised a diverse group of individuals, reviewed the general study design and content areas and provided input regarding the burden of the surveys. Research questions were informed from their input, based on their priorities, experiences and preferences. Patients and the public were not directly involved in the design of the study. Patients with lupus were part of the paid and trained research staff involved in recruitment and conduct of the study under the direction of the investigators. Patients and the public will be informed of the study results on the GOAL website: lupusingeorgia.org.

Patient consent for publication Not required.

Ethics approval The Emory University Institutional Review Board (approval 00003656), Grady Health System Research Oversight Committee and the Georgia Department of Public Health Institutional Review Board approved the GOAL study protocol. All GOAL participants gave written, informed consent.

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REFERENCES

1. Toloza SMA, Roseman JM, Alarcón GS, *et al*. Systemic lupus erythematosus in a multiethnic US cohort (LUMINA): XXII. predictors of time to the occurrence of initial damage. *Arthritis Rheum* 2004;50:3177–86.
2. Lim SS, Bayakly AR, Helmick CG, *et al*. The incidence and prevalence of systemic lupus erythematosus, 2002-2004: the Georgia lupus registry. *Arthritis Rheumatol* 2014;66:357–68.
3. Fernández M, Alarcón GS, Apte M, *et al*. Systemic lupus erythematosus in a multiethnic US cohort: XLIII. The significance of thrombocytopenia as a prognostic factor. *Arthritis Rheum* 2007;56:614–21.
4. Somers EC, Marder W, Cagnoli P, *et al*. Population-Based incidence and prevalence of systemic lupus erythematosus: the Michigan lupus epidemiology and surveillance program. *Arthritis Rheumatol* 2014;66:369–78.
5. Löfgren SE, Yin H, Delgado-Vega AM, *et al*. Promoter insertion/deletion in the *IRF5* gene is highly associated with susceptibility to systemic lupus erythematosus in distinct populations, but exerts a modest effect on gene expression in peripheral blood mononuclear cells. *J Rheumatol* 2010;37:574–8.
6. Cooper GS, Parks CG, Treadwell EL, *et al*. Differences by race, sex and age in the clinical and immunologic features of recently diagnosed systemic lupus erythematosus patients in the southeastern United States. *Lupus* 2002;11:161–7.
7. Alarcón GS, McGwin G, Uribe A, *et al*. Systemic lupus erythematosus in a multiethnic lupus cohort (LUMINA). XVII. predictors of self-reported health-related quality of life early in the disease course. *Arthritis Care Res* 2004;51:465–74.
8. Alarcón GS, Mcgwin G, Roseman JM, *et al*. Systemic lupus erythematosus in three ethnic groups. XIX. natural history of the accrual of the American College of rheumatology criteria prior to the occurrence of criteria diagnosis. *Arthritis Care Res* 2004;51:609–15.
9. Costenbader KH, Desai A, Alarcón GS, *et al*. Trends in the incidence, demographics, and outcomes of end-stage renal disease due to lupus nephritis in the US from 1995 to 2006. *Arthritis Rheum* 2011;63:1681–8.
10. Hanly JG, Urowitz MB, Su L, *et al*. Seizure disorders in systemic lupus erythematosus results from an international, prospective, inception cohort study. *Ann Rheum Dis* 2012;71:1502–9.
11. Cooper GS, Treadwell EL, St Clair EW, *et al*. Sociodemographic associations with early disease damage in patients with systemic lupus erythematosus. *Arthritis Rheum* 2007;57:993–9.
12. Rhew EY, Manzi SM, Dyer AR, *et al*. Differences in subclinical cardiovascular disease between African American and Caucasian women with systemic lupus erythematosus. *Transl Res* 2009;153:51–9.
13. Pons-Estel GJ, Gonzalez LA, Zhang J, *et al*. Predictors of cardiovascular damage in patients with systemic lupus

erythematosus: data from LUMINA (LXVIII), a multiethnic US cohort. *Rheumatology* 2009;48:817–22.
14. Merrell M, Shulman LE. Determination of prognosis in chronic disease, illustrated by systemic lupus erythematosus. *J Chronic Dis* 1955;1:12–32.
15. Doria A, Iaccarino L, Ghirardello A, *et al*. Long-Term prognosis and causes of death in systemic lupus erythematosus. *Am J Med* 2006;119:700–6.
16. Hanly JG, Urowitz MB, Su L, *et al*. Seizure disorders in systemic lupus erythematosus results from an international, prospective, inception cohort study. *Ann Rheum Dis* 2012.
17. Petri M, Perez-Gutthann S, Longenecker JC, *et al*. Morbidity of systemic lupus erythematosus: role of race and socioeconomic status. *Am J Med* 1991;91:345–53.
18. Petri M, Singh S, Tesfasyone H, *et al*. Prevalence of flare and influence of demographic and serologic factors on flare risk in systemic lupus erythematosus: a prospective study. *J Rheumatol* 2009;36:2476–80.
19. Bernal CB, Zamora LD, Navarra SV. Biologic therapies in systemic lupus erythematosus. *Int J Rheum Dis* 2015;18:146–53.
20. Mitka M. Treatment for lupus, first in 50 years, offers modest benefits, hope to patients. *JAMA* 2011;305:1754–5.
21. D'Cruz D M-MK, Oates J, Santiago MB, *et al*. Efficacy and safety of belimumab in patients of black race with systemic lupus erythematosus. results from the embrace study. *Lupus Sci Med* 2019;6(Suppl 1):A149–A150.
22. Drenkard C, Rask KJ, Easley KA, *et al*. *Primary preventive services in patients with systemic lupus erythematosus: study from a population-based sample in Southeast us. paper presented at: primary preventive services in patients with systemic lupus erythematosus*. study from a population-based sample in Southeast US, 2013.
23. Lim SS, Drenkard C, McCune WJ, *et al*. Population-Based lupus registries: advancing our epidemiologic understanding. *Arthritis Rheum* 2009;61:1462–6.
24. Hochberg MC. Updating the American College of rheumatology revised criteria for the classification of systemic lupus erythematosus. *Arthritis & Rheumatism* 1997;40.
25. Tan EM, Cohen AS, Fries JF, *et al*. The 1982 revised criteria for the classification of systemic lupus erythematosus. *Arthritis Rheum* 1982;25:1271–7.
26. Karlson EW, Daltroy LH, Rivest C, *et al*. Validation of a systemic lupus activity questionnaire (SLAQ) for population studies. *Lupus* 2003;12:280–6.
27. Yazdany J, Yelin EH, Panopalis P, *et al*. Validation of the systemic lupus erythematosus activity questionnaire in a large observational cohort. *Arthritis Rheum* 2008;59:136–43.
28. Yazdany J, Trupin L, Gansky SA, *et al*. Brief index of lupus damage: a patient-reported measure of damage in systemic lupus erythematosus. *Arthritis Care Res* 2011;63:1170–7.
29. Drenkard C, Yazdany J, Trupin L, *et al*. Validity of a self-administered version of the brief index of lupus damage in a predominantly African American systemic lupus erythematosus cohort. *Arthritis Care Res* 2014;66:888–96.
30. Ware J, Kosinski M, Keller SD. A 12-Item short-form health survey: construction of scales and preliminary tests of reliability and validity. *Med Care* 1996;34:220–33.
31. Merrill JT, Manzi S, Aranow C, *et al*. Lupus community panel proposals for optimising clinical trials: 2018. *Lupus Sci Med* 2018;5.