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Narcissism of Science Denial

Agnieszka Golec de Zavala

Goldsmiths, University of London, London, UK

Correspondence: Agnieszka Golec de Zavala (agnieszka.golec@gmail.com)

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ABSTRACT

Amid historically low societal trust in science, four cross-sectional studies ($N = 3856$) reveal a link between generic science denial and national narcissism. The findings support the pre-registered hypotheses that (1) national narcissism (a desire for national recognition) and ingroup satisfaction (pride in national value) have opposite unique associations with science denial (rejection of scientific consensus and generalized suspicion toward scientific experts) and (2) opposite indirect associations with specific outcomes of science denial during the COVID-19 pandemic and beyond (climate change denial, anti-vaccination attitude, and support for unregulated "alternative" medicine). After their common variance is controlled, national narcissism is positively associated with generic science denial and its outcomes, while national ingroup satisfaction is associated negatively. National narcissism was the strongest predictor of science denial, surpassing other established predictors such as low education and political conservatism. Studies 1 and 2 showed additionally, that vulnerable narcissistic personality was the second strongest predictor of generic science denial, demonstrating for the first time, that the narcissistic need to be recognized as better than others underlies generic science denial.

1 | Introduction

> "Group narcissism is an irrational belief in the greatness of one's own group, accompanied by a contempt for other groups. It is the pathology of our time, and it is rooted in the failure of modern society to provide the individual with a sense of belonging and purpose. The group, therefore, becomes a substitute for the individual's sense of identity, and the individual identifies with the group to the point of irrationality." (Fromm 1973, 357)

Existing research has linked national collective narcissism—a belief that a country's exaggerated greatness should be, but is not sufficiently, recognized by others (Golec de Zavala 2011, 2018, 2023)—to distrust in specific domains of science, such as climate change (Bertin et al. 2021; Michalski et al. 2023) and vaccination science (Cislak et al. 2022; Górska et al. 2022; Marchlewska et al. 2022). National narcissism is also associated with a variety of specific outcomes of science denial (Morgan et al. 2018, 2023; Meyer and Kramer 2022; Reif et al. 2024), including anti-environmentalism (Cislak et al. 2018, 2021, 2023, 2024), resistance to science-based health guidelines during the COVID-19 pandemic (Nowak et al. 2020; Vaal et al. 2023), and ideologically driven, rather than scientifically grounded, beliefs about gender and sexual orientation (Lantos et al. 2024; Mole et al. 2021). Why is national narcissism linked to such diverse phenomena?

This paper examines, for the first time, the prediction that the diverse correlates of collective narcissism originate from a common root cause: a collective narcissistic generic science denial—a universal rejection of rationality, scientific consensus, and trust in

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scientists and experts (Lewandowsky et al. 2012, 2013, 2016; Liu 2012). Testing this hypothesis has practical implications, as collective narcissism coexists within persons and within groups with ingroup satisfaction, which exhibits contrasting associations with specific outcomes of science denial. Ingroup satisfaction refers to unpretentious pride and contentment in belonging to a valuable group (Crocker and Luhtanen 1990; Golec de Zavala et al. 2019; Leach et al. 2008). Importantly, the contrasting associations of collective narcissism and ingroup satisfaction become clearer when the positive overlap of collective narcissism and ingroup satisfaction is statistically controlled (Bertin et al. 2021; Cislak et al. 2022; Golec de Zavala, 2019; Golec de Zavala & Federico, 2024; Górska et al. 2022; Marchlewska et al. 2022; Michalski et al. 2023). Building on this approach, the present paper tests whether collective narcissism and ingroup satisfaction have opposing, unique associations with generic science denial and opposing, indirect associations with diverse outcomes of generic science denial: collective narcissism positive and ingroup satisfaction negative.

Furthermore, this paper examines whether these opposing predictions of collective narcissism and ingroup satisfaction remain robust when accounting for other established predictors of generic science denial, including low education (Sinatra et al. 2014; see also Levy et al. 2025) and political conservatism. Political conservatism is assessed as conservative self-placement. It is also conceptualized and assessed as a dual process involving right-wing authoritarianism (characterized by authoritarian submission, aggression, and conventionalism) and social dominance orientation (a preference for hierarchically organized social systems, Azevedo and Jost, 2021; Kerr and Wilson 2021; see also Uscinski et al. 2025).

Finally, this paper examines whether collective narcissism and ingroup satisfaction predict generic science denial independently of narcissistic personality traits. Although the role of narcissistic personality in generic science denial has not been thoroughly examined, some authors propose that science denial— refusing to acknowledge the expertise of those who studied and practiced to become experts by those who did not—expresses narcissistic traits, especially entitled, antagonistic, and unempathetic self-aggrandisement (Ferkany 2015; Weintrobe 2021). Narcissistic personality has been linked to support the harassment of scientists (Gligorić et al. 2025) and endorsement of conspiracy theories, including those related to science (Cichocka et al. 2015, 2016; Golec de Zavala et al., 2022; Uscinski et al. 2025).

Differentiating the roles of collective narcissism and narcissistic personality in generic science denial has practical implications. Narcissistic personality traits are challenging to change (Orth et al. 2024), whereas collective narcissism, as an evaluative belief about the ingroup, is more malleable and coexists with alternative, potentially more constructive beliefs, that can dominate collective narcissism (Golec de Zavala et al. 2019). Thus, it is crucial to investigate whether collective narcissism and ingroup satisfaction have unique, opposing associations with generic science denial, independent of narcissistic personality traits.

1.1 | Narcissism and Science Denial

When examining the role of collective narcissism in generic science denial, it is essential to differentiate collective narcissism from narcissistic personality traits and consider that narcissistic personality is a multifaceted phenomenon (e.g., Sedikides 2021). The literature distinguishes between grandiose and vulnerable narcissistic personality traits (Krizan and Herlache 2018; Miller et al. 2017, 2021). Grandiose narcissism is characterized by self-entitlement, inflated self-views, assertive self-worth, vanity, and manipulativeness. Additionally, antagonistic and dominant rivalry aspect of grandiose narcissism was differentiated from more benevolent desire for admiration (Back et al. 2013). In contrast to grandiose narcissism, vulnerable narcissism is marked by low self-esteem, self-criticism, and negative emotionality, particularly envy and shame. Despite these differences, both presentations of narcissistic personality share an underlying feature of antagonistic, inflated self-entitlement (Krizan and Herlache 2018; Miller et al. 2021). This antagonistic quality is also shared by collective narcissism (Golec de Zavala 2023, 2025; see also Gordon and Birney 2025). However, collective narcissism is a belief about the group a person belongs to (an ingroup), rather than an enduring personality trait.

Although the association between collective narcissism and generic science denial has not yet been extensively studied, it has been suggested that collective narcissism biases information processing to the point of irrationality (Fromm 1973; Golec de Zavala 2020, 2023; Golec de Zavala and Keenan, 2021). Collective narcissism has been linked to the endorsement of specific science-related conspiracy theories (see Golec de Zavala et al. 2022 for review). More broadly, collective narcissism is associated with generic conspiratorial ideation (Golec de Zavala et al. 2022; see also Gordon and Birney 2025), with the strength of this association varying by political context (Golec de Zavala and Federico, 2018). The specific links between collective narcissism and the endorsement of particular conspiracy theories may stem from a broader underlying association between collective narcissism and a general tendency toward conspiratorial thinking. By extension, collective narcissism may also be linked to generic science denial and indirectly to the diverse outcomes of science denial.

Evidence supports this expectation. For instance, the relationship between collective narcissism and climate change denial or anti-vaccination attitudes is not fully explained by the endorsement of specific science-related conspiracy theories (Bertin et al. 2021; Cislak et al. 2022; Marchlewska et al. 2022). Furthermore, collective narcissism has been directly associated with behaviors tied to generic science denial by existing research. During the COVID-19 pandemic, collective narcissism was linked to refusal to follow health authorities' recommendations, including vaccination (Cislak et al. 2022; Marchlewska et al. 2022), adherence to lockdown measures, social distancing, and mask-wearing (Nowak et al. 2020; Vaal et al. 2023; cf. van Bavel et al. 2022, which found a positive association between collective narcissism and compliance). It was also associated with support for misguided populist policies during the pandemic, such as reduced COVID-19 testing in the US or the UK's refusal to join the EU's *ventilator scheme" ("the EU solidarity in action")* (Gronfeldt et al. 2023).

Beyond the pandemic, national narcissism has been linked to support for unscientific national policies that harm the environment (Cislak et al. 2018, 2021, 2023, 2024), undermine human

rights (e.g., reproductive rights; Golec de Zavala and Keenan 2024; Szczepańska et al. 2022), and erode social cohesion by increasing inequality (Golec de Zavala and Keenan 2023). For example, in Poland, national narcissism has been associated with beliefs that homosexuality is a personal choice rather than a universal cultural phenomenon (Lantos et al. 2024) and that racial (Keenan and Golec de Zavala 2024) or gender prejudice and inequality (Golec de Zavala, 2022; Golec de Zavala and Bierwiaczonek 2021; Golec de Zavala and Keenan 2024) are no longer societal issues. National narcissism has also been linked to beliefs that White populations need protection from domination or discrimination by ethnic minorities (Cichocka et al. 2022).

These findings highlight the tendency of collective narcissism to suspend rationality in favor of collectively shared beliefs. Indeed, collective narcissism has been interpreted as motivated social cognition, where information processing aims to confirm desired perceptions of reality rather than objective understanding (Golec de Zavala 2020, 2023, 2024; Golec de Zavala et al. 2022). Motivated cognition literature explains that individuals may prioritize confirming preexisting beliefs by noticing, decoding, and storing only information that aligns with them (Kunda 1990). They may also prefer readily available, group-endorsed beliefs (Kruglanski and Webster 1996; Webster and Kruglanski 1994; Kruglanski et al. 2006) to avoid cognitive uncertainty. Collective narcissism has been linked to a high need for cognitive closure—a desire to rigidly hold to simplistic and inadequate beliefs rather than accept uncertainty (Golec de Zavala et al. 2019, see also Gordon and Birney 2025)—as well as susceptibility to misinformation (Pennycook and Rand 2020), gullibility, and low reflectivity (Sternisko et al. 2023). Consequently, collective narcissism may foster susceptibility to unsubstantiated yet salient beliefs endorsed by group norms and leaders, providing cognitive closure at the expense of accurate understanding (Golec de Zavala 2020, 2023).

1.2 | Ingroup Satisfaction as an Alternative to Collective Narcissism

As an evaluative belief about an ingroup, collective narcissism is a component of ingroup identification (Golec de Zavala 2023; 2024), which refers to the degree to which a person's group membership is "psychologically meaningful and socially consequential" (Leach et al. 2008, 144). Ingroup identification is a multidimensional concept that includes, among others, ingroup centrality (the importance of the ingroup to the self), the importance of ties with ingroup members, and positive evaluation of the ingroup (Ashmore et al. 2004; Cameron 2004; Crocker and Luhtanen 1990; Leach et al. 2008; Roccas et al. 2006). Researchers generally agree that the positive evaluation of the ingroup is the most socially significant aspect of ingroup identification (Ashmore et al. 2004; Cameron 2004; Crocker and Luhtanen 1990; Roccas et al. 2006). According to collective narcissism theory, positive ingroup evaluation manifests in two forms: collective narcissism and ingroup satisfaction (Golec de Zavala 2023, 2024; Golec de Zavala et al. 2019). Although social identity theory suggests that ingroup favoritism and outgroup derogation are driven by the desire for positive ingroup distinctiveness (Turner et al. 1987), collective narcissism theory specifies that it is the narcissistic need to have the ingroup recognized as superior to others that motivates downward intergroup comparisons and outgroup derogation, whereas non-narcissistic ingroup satisfaction is associated with positive attitudes toward outgroups (Golec de Zavala 2011; 2023; Golec de Zavala et al. 2020).

Ingroup satisfaction often exhibits opposite associations to those of collective narcissism when the overlap between collective narcissism and ingroup satisfaction is controlled for (see Golec de Zavala 2023 for a review). Although collective narcissism is associated with harmful outcomes (to individuals, outgroups, and ingroups, see Golec de Zavala 2023; 2024 for a review), non-narcissistic ingroup satisfaction appears to be a psychological resource linked to group members' well-being and prosocial behavior. Once the overlap with collective narcissism is removed, ingroup satisfaction correlates with high self-esteem (Golec de Zavala et al. 2020), low individual narcissism (Golec de Zavala 2023), constructive patriotism (Federico et al. 2022; Golec de Zavala et al. 2009), and support for democracy (Federico et al., 2025; Golec de Zavala et al., 2025; Keenan and Golec de Zavala, 2021). These findings suggest that in contrast to collective narcissism, non-narcissistic national ingroup satisfaction may be associated with an appreciation of knowledge, logic, and rationality over blind adherence to group norms and beliefs.

Importantly, partialling out the common variance of closely related variables (such as collective narcissism and ingroup satisfaction) requires clear interpretation of what remains in the residualized forms of these variables—that is, what remains in collective narcissism after separating it from ingroup satisfaction, and vice versa (Lynam et al. 2006). Therefore, it is crucial to clarify that collective narcissism, without ingroup satisfaction, is a demand for special recognition of an ingroup deemed unique and extraordinarily important. In contrast, ingroup satisfaction, without collective narcissism, is a positive evaluation of the ingroup without concerns about its external recognition or comparisons to other groups (Golec de Zavala 2018, 2023; Golec de Zavala et al. 2019; Golec de Zavala and Lantos 2020).

Crucially, collective narcissists rely on ingroup membership to express their narcissistic demand for external recognition (Golec de Zavala et al. 2009, 2019). Thus, interpreting collective narcissism becomes challenging when the subjective importance of ingroup membership (i.e., ingroup centrality) is statistically removed from collective narcissism (e.g., Bertin et al. 2021; Cichocka et al. 2022; Cislak et al. 2018, 2021, 2022, 2023, 2024; Górska et al. 2022; Gronfeldt et al. 2023; Marchlewska et al. 2022). Additionally, collapsing ingroup satisfaction, ingroup centrality, and the appreciation of ties with ingroup members into a single factor, and then demonstrating its positive correlation with collective narcissism, forces us to believe that collective narcissism is linked to a sense of shared bond and solidarity with ingroup members, despite mounting evidence to the contrary (Cichocka et al. 2022; Federico et al. 2021; Gronfeldt et al. 2023).

To inform effective social policy, it is essential to precisely identify which aspects of ingroup identification can be leveraged and which should be marginalized to curb science denial. The present research provides an initial test of the proposition that policies promoting non-narcissistic ingroup satisfaction and limiting national narcissism may offer a pathway to reduce generic science denial.

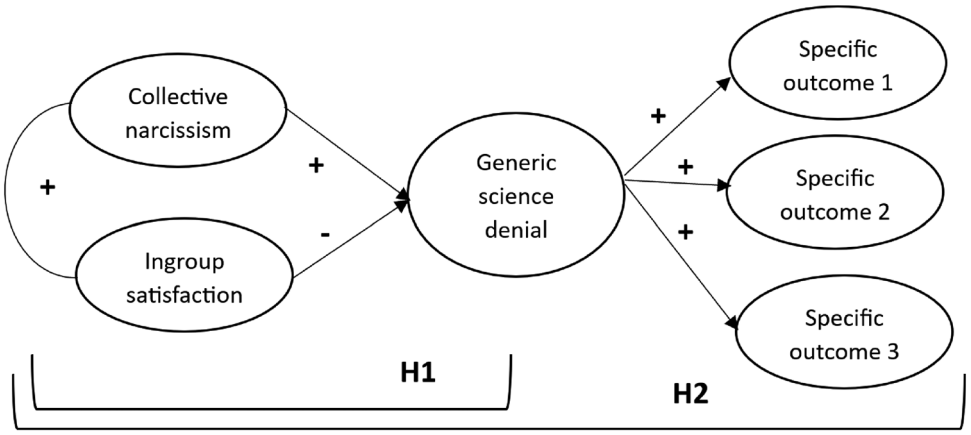

FIGURE 1 | The model of independent, indirect associations between collective narcissism and ingroup satisfaction with distinct outcomes of generic science denial (different number and type of outcomes in Studies 3 and 4) via generic science denial.

1.3 | Overview

This paper tests two preregistered hypotheses[1]. First, all studies examine the hypothesis that national narcissism is uniquely positively associated with generic science denial, while national ingroup satisfaction is uniquely negatively associated with generic science denial (H1). In other words, H1 tests the mutual suppression effects of collective narcissism and ingroup satisfaction (which are positively correlated) on their independent, unique associations with generic science denial.

Next, Studies 1 and 2 test the prediction that the contributions of national narcissism and national ingroup satisfaction to explaining variance in generic science denial are independent of the contributions of other established predictors, such as political conservatism (Azavedo and Jost 2021; Kerr and Wilson 2021; Washburn and Skitka 2018), low education (Sinatra et al. 2014), and demographic variables like gender, age, income, and city size, which are commonly used in this literature (e.g., Rutjens et al. 2018; Seddig et al. 2022; Uscinski et al. 2025).

Study 3 examines the prediction that national narcissism and national ingroup satisfaction have opposite, independent, indirect links with distinct outcomes of science denial during the COVID-19 pandemic (see also Alam and Vitriol 2025): COVID-19 vaccination status, the number of specific regulations followed from health authorities during the pandemic, and attitudes toward health regulations during the pandemic via generic science denial (H2a). In other words, H2a predicts that generic science denial mediates the opposite, independent associations of collective narcissism and ingroup satisfaction with specific outcomes during the COVID-19 pandemic.

Finally, Study 4 tests the prediction that generic science denial mediates the opposite indirect associations of national narcissism and national ingroup satisfaction with various outcomes of generic science denial indicated in the literature (Morgan et al. 2018; Reif et al. 2024): a general anti-vaccination attitude, climate change denial, rejection of the scientific understanding of gender as non-binary, and preference for "alternative" remedies over "scientific" medicine (H2b). The theoretical model being tested is schematically presented in Figure 1.

Studies 1 and 2 were conducted in different countries (Poland and the United States) using different operationalizations of science denial to test whether the findings generalize across national contexts and measurements of generic science denial, political conservatism, and narcissistic personality traits. Poland and the United States provide an adequate context for testing the generalizability of the findings, as they have been among the countries similarly affected by the high presence of ultra-conservative populism (see Golec de Zavala 2023 for a review), inaccurate and delayed responses to the COVID-19 outbreak (Alam and Vitriol 2025; Bayelrein et al. 2021; Lasco 2020), and anti-environmental and anti-vaccination attitudes that can be linked to generic science skepticism (Cislak et al. 2018, 2022; Marchlewska et al. 2022).

1.4 | Analytical Strategy

H1 predicts that once the common variance between collective narcissism and ingroup satisfaction is removed, they will have opposite, independent associations with generic science denial. In other words, collective narcissism and ingroup satisfaction act as mutual suppressors: the association with ingroup satisfaction reduces the strength of the positive association between collective narcissism and science denial, while the association with collective narcissism reduces the negative association between ingroup satisfaction, even reversing its sign compared to the zero-order correlation (MacKinnon et al. 2000; see also Golec de Zavala et al. 2013, 2020). To demonstrate suppression, zero-order correlations among collective narcissism, ingroup satisfaction, and generic science denial are compared with regression coefficients that partial out the common variance between collective narcissism and ingroup satisfaction as predictors of generic science denial. The *z*-test is used to test whether the suppression effects are significant (using the PROCESS macro for R, Hayes 2022), as is standard in this literature (Golec de Zavala et al. 2013, 2020). These analyses were not pre-registered, but follow the same analytical approach used in previous research to demonstrate suppression effects.

Next, in line with recommended practices (Simmons et al. 2011), multiple regression analysis to test H1 is extended to

include covariates. This is done to test the robustness of H1. The extended multiple regression analysis tests the assumption that the predictions of H1 hold over and above demographic variables, narcissistic personality traits, and other predictors identified in the literature, such as low education and political conservatism (across its various assessments). Additionally, the relative importance of all predictors of generic science denial is assessed using random forest analysis. Although these analyses were not pre-registered, they offer an advantage over the pre-registered SEM analysis, which is suited to fitting linear relationships predicted by H2. In contrast, random forest regression is a supervised learning model that examines a weighted combination of predictors to determine which most effectively explains the outcome. A non-parametric estimate of the importance of each predictor accounts for non-linear input effects and helps avoid overfitting. This estimate is derived from the percentage increase in mean square produced by randomly permuting the scores of the input variable (Breiman 2001). Therefore, random forest analysis allows for a more accurate assessment of each predictor's contribution to explaining the variance in generic science denial and provides a more precise test of the role of collective narcissism and ingroup satisfaction, as predicted by H1.

Finally, H2 is tested using the pre-registered SEM multiple regressions in Studies 3 and 4. These analyses were chosen to directly test the unique linear indirect associations of collective narcissism and ingroup satisfaction with various outcomes of generic science denial. The advantage of these analyses is that they account for measurement error and allow for a precise estimation of the strength of the predicted linear relationships.

All sample sizes were predetermined by reasons other than the hypotheses tested in this paper (as explained in each sample presentation). All samples are sufficiently powered to detect a small effect size of $f^2 = 0.02$ (Cohen 1992) with an alpha of 0.05 and power level of 0.80 in a multiple linear regression with two predictors and 10 covariates. The effect sizes reported by previous studies cited above are at least small. All samples are also sufficient ($N > 300$) to detect mediation assuming small coefficient sizes for all tested associations (Qin 2024) and follow accepted recommendation for sample sizes suitable for structural equation models with strong factor loadings (Wolf et al. 2013).

The hypotheses, study designs, and planned analytical approach were pre-registered at https://aspredicted.org/wjy5-3vjw.pdf

2 | Study 1

Study 1 provides an initial test of H1 and its robustness. It utilizes previously analyzed data from a published study that examined racial collective narcissism among White and Black participants in the United States, with data collection limited to these two ethnic groups by the study's hypothesis (Keenan and Golec de Zavala 2024). As such, the sample in Study 1 is not ethnically representative but participants' ethnicity was not hypothesized to affect generic science denial. Study 1 reuses several measures from the prior study to test H1: a measure of national narcissism, national ingroup satisfaction, ethnicity (used in the previous study as predictors of egalitarianism), vulnerable narcissism, the rivalry and admiration aspects of grandiose narcissism, generic science denial, education, political conservatism, and demographic variables (which were not included in analyses in the previous study). In Study 1, the covariates included to test the robustness of H1 were: demographic variables (age, gender, ethnicity, income, city size), education, conservative self-placement, vulnerable narcissism, and the rivalry and admiration aspects of grandiose narcissism.

2.1 | Method

2.1.1 | Participants

Study 1 consisted of a cross-sectional sample of 800 American adults, nationally representative in terms of age, gender (0 = "female," 1 = "male"), education (1 = "no formal education" to 7 = "postgraduate degree"), and city size (1 = "below 100K" to 4 = "over 2M"). Among the participants, 367 were men, 432 were women, and one identified as non-binary/other. Ages ranged from 18 to 87 years ($M = 47.82$; $SD = 17.59$). Of the participants, 365 self-identified as Black, and 435 self-identified as White (0 = "Black," 1 = "White"). The survey was conducted using Computer-Assisted Web Interviewing (CAWI) through the Ariadna Research Panel in January 2023.

2.1.2 | Measures

Unless otherwise indicated, items used a 7-point (1 = "I strongly disagree" to 7 = "I strongly agree"). Items were averaged and where necessary recoded so higher scores reflect higher levels of a variable. Descriptives and zero-order correlations of all key variables are in the Tables 1S–4S.

Science denial was assessed by two items from the Antiestablishment Orientation Scale (Uscinski et al. 2021) that pertain to general distrust in science and experts. Antiestablishment orientation is a negative, contrarian attitude toward the established political system, disdain for established authorities, and a conspiratorial assumption that powerful groups work toward malevolent and unlawful goals. The items reflecting disdain of and distrust in science and experts were: "People who have studied for a long time and have many diplomas do not really know what makes the world go round" and " The opinion of ordinary people is worth more than that of experts and politicians ", $r(788) = 0.46$, $p < 0.001$; $\alpha = 0.63$.

Collective narcissism was assessed using the five-item Collective Narcissism Scale (Golec de Zavala et al. 2009) with reference to a nation. An example item is: "I will never be satisfied until Americans get the recognition they deserve", $\alpha = 0.88$.

Ingroup satisfaction was measured using four items of the ingroup satisfaction subscale of the ingroup identification measure proposed by Leach and colleagues (Leach et al. 2008) with reference to a nation. An example is: "I am glad to be American.", $\alpha = 0.93$.

Vulnerable narcissism was measured by the 10-item Hypersensitive Narcissism Scale (Hendin and Cheek 1997). An example is

"My feelings are easily hurt by ridicule or by the slighting remarks of others", $\alpha = 0.93$.

Admiration and Rivalry aspects of grandiose narcissism were assessed by the short version of the Narcissistic Admiration and Rivalry Questionnaire (Back et al. 2013, Admiration, "I am great", $\alpha = 0.82$; Rivalry, "I want my rivals to fail", $\alpha = 0.84$).

Conservative self-placement was assessed by a one-item liberal-conservative self-placement scale (1 – very conservative to 5 – very liberal) recoded so the higher items reflect more conservative self-placement.

2.1.3 | Results

Correlational analyses revealed that national narcissism, $r(788) = 0.36$, $p < 0.001$ and national ingroup satisfaction, $r(788) = 0.12$, $p < 0.001$ were positively related to science denial and to each other, $r(788) = 0.56$, $p < 0.001$. To test H1, which predicts that collective narcissism is uniquely positively associated with science denial and ingroup satisfaction is uniquely negatively associated with science denial, generic science denial was regressed on collective narcissism and ingroup satisfaction using ordinary least squares multiple regression analysis with *HC3* robust standard errors to correct for heteroskedasticity. The results presented in Table 1 support H1. Collective narcissism was positively associated with generic science denial, with its unique association (indicated by the regression coefficient) being stronger than the zero-order correlation between the two variables. The regression coefficient for the specific association between ingroup satisfaction and science denial was negative, with the association changing direction compared to the zero-order correlation. This pattern suggests suppression effects (MacKinnon et al. 2000). Indeed, the test of suppression effects—of ingroup satisfaction on the link between collective narcissism and science denial and of collective narcissism on the link between ingroup satisfaction and science denial—indicated that both effects were significant, supporting H1 (Table 1).

Next, two estimation methods were used to test whether the predictions of H1 hold above and beyond demographic variables and theoretically relevant variables: political conservatism, education, and narcissistic personality. The analyses also compared the relative predictive power of collective narcissism and ingroup satisfaction to other predictors. First, science denial was regressed on collective narcissism, ingroup satisfaction, all assessed narcissistic personality traits, political conservatism, and demographic covariates (male gender, age, ethnicity, education, city size, and income) using ordinary least squares multiple regression analysis with HC3 robust standard errors. Second, to compare the relative predictive power of the strongest predictors, a random forest regression was carried out. All random forest regressions were conducted in R using the randomForestSRC package, requesting 500 decision trees in each model. The Mahalanobis splitting rule was specified (Ishwaran and Kogalur, 2019). General fit statistics for these models are reproduced exactly, though actual variable importance estimates may vary due to Monte Carlo effects from the random selection of predictors in the construction of each decision tree.

TABLE 1 | Multiple regression analyses testing H1 without covariates, Studies 1–4. The predicted variable is generic science denial.

	Study 1			Study 2			Study 3			Study 4		
Predictor	***b***	**SE (HC3)**	**95%CI [LL, UL]**	***b***	**SE (HC3)**	**95%CI [LL, UL]**	***b***	**SE (HC3)**	**95%CI [LL, UL]**	***b***	**SE (HC3)**	**95%CI [LL, UL]**
Collective narcissism (CN)	0.41***	0.04	[0.33; 0.49]	0.57***	0.04	[0.49; 0.65]	0.53***	0.04	[0.45; 0.61]	0.55***	0.04	[0.48; 0.63]
Ingroup satisfaction (IS)	−0.15***	0.05	[−0.25; −0.05]	−0.27***	0.04	[−0.36; −0.19]	−0.20***	0.04	[−0.28; −0.12]	−0.23***	0.04	[−0.31; −0.15].
Suppression by IS	−0.08***	0.03	[−0.14; −0.03]	−0.07***	0.03	[−0.11; −0.03]	−0.14***	0.03	[−0.20; −0.08]	−0.15***	0.03	[−0.22; −0.10]
Suppression by CN	0.28***	0.03	[0.21; 0.34]	0.32***	0.02	[0.27; 0.36]	0.19***	0.03	[0.13; 0.25]	0.42***	0.03	[0.36; 0.49]

Note: ***$p < .001$

TABLE 2 | Multiple regression and random forest analysis with generic science denial as the criterion, Study 1.

Predictor	*b*	SE (HC3)	95% CI [LL, UL]	Random forest estimates
(Intercept)	2.72**	0.34	[2.18, 3.25]	
Collective narcissism	0.21**	0.06	[0.11, 0.30]	9.82
Ingroup satisfaction	−0.05	0.05	[−0.14, 0.04]	−0.11
Vulnerable narcissism	0.20**	0.07	[0.10, 0.30]	8.22
Rivalry	0.07	0.06	[−0.02, 0.15]	6.00
Admiration	−0.00	0.05	[−0.08, 0.08]	3.38
Conservatism	0.08**	0.03	[0.03, 0.12]	1.43
Gender	−0.02	0.08	[−0.16, 0.13]	−0.04
Age	0.00	0.003	[−0.00, 0.01]	1.90
Ethnicity	−0.16	0.08	[−0.33, 0.00]	1.24
City size	0.01	0.04	[−0.06, 0.08]	0.09
Education	−0.09**	0.03	[−0.15, −0.03]	1.46
Income	0.02	0.01	[−0.00, 0.05]	0.34
			Fit	$R^2 = 0.22$**
				95% CI [0.16, 0.26]

Notes: A significant *b*-weight indicates the semi-partial correlation is also significant. *b* represents unstandardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.
*indicates $p < 0.05$. ** indicates $p < 0.01$.

The results in Table 2 show that, as expected by H1, collective narcissism significantly and positively predicted generic science denial over and above predictors suggested by previous research: education (with a negative significant association) and political conservatism (with a positive significant association). As expected, ingroup satisfaction negatively predicted science denial, but its contribution was smaller and did not reach the accepted level of statistical significance after other covariates were entered into the analysis. Additionally, vulnerable narcissistic personality predicted science denial. Random forest analysis also showed that the contribution of other aspects of narcissistic personality (rivalry and admiration) was substantial, though their contribution was not significant in multiple regression analysis. The random forest regression model produced R^2 statistics of 0.21. It indicated that individual and collective narcissism jointly accounted for a substantial amount of variance in science denial, far exceeding the importance of education and political conservatism. Collective narcissism was the strongest predictor.

In summary, the results of Study 1 provide initial support for H1, supporting the prediction that collective narcissism and ingroup satisfaction have opposite independent associations with generic science denial. However, with covariates, the specific association between ingroup satisfaction and science denial was not significant.

Study 1 used a proxy measure of generic science denial. Although the reliability of this measure was satisfactory, replication with a more robust, multi-item, reliable measure was considered necessary. Lower-than-desirable reliability of the outcome variable increases the probability of not finding the hypothesized effect, even when it exists. Moreover, the use of a measure with higher face validity was expected to improve the clarity of the findings. Therefore, Study 2 used an improved assessment of generic science denial developed specifically for this investigation. Additionally, Study 2 employed alternative assessments of narcissistic personality traits and political conservatism (as a combination of right-wing authoritarianism and social dominance orientation) to test whether the findings from Study 1 generalize across different methods of assessment.

3 | Study 2

Study 2 tested H1 in Poland, employing a newly developed, multi-item measure of generic science denial. Consistent with Study 1, H1 was first examined without covariates. Subsequently, the independent contributions of collective narcissism and ingroup satisfaction were compared to other relevant variables. Among these variables, a specific focus was placed on ingroup centrality—defined as the subjective importance of the group to one's self-concept. This analysis sought to explore whether the combination of ingroup satisfaction and ingroup centrality, often referred to as "authentic" or "secure" ingroup identification (e.g., Bertin et al. 2021; Cislak et al. 2018, 2021, 2022, 2023, 2024), is empirically justified. If such a collapse is valid, ingroup centrality should significantly explain variance in generic science denial, independently of collective narcissism and ingroup satisfaction. Moreover, its independent association with science denial should align with that of ingroup satisfaction—namely, a negative relationship.

In addition, Study 2 compared the contributions of collective narcissism with those of narcissistic personality traits, utilizing

an alternative assessment of grandiose aspect of narcissistic personality. The study further extended the conceptualization of political conservatism, drawing on prior research that defines it as comprising two dimensions: right-wing authoritarianism and social dominance orientation (Duckitt 2001). Thus, the covariates used to test the robustness of H1 included: demographic variables (age, gender, income, and city size), education, political conservatism (self-placement, right-wing authoritarianism, and social dominance), vulnerable and grandiose narcissistic personality traits, and national ingroup centrality.

3.1 | Method

3.1.1 | Participants

Participants were 1026 Polish adults, 553 women and 473 men. Their age ranged from 18 to 84 years old ($M = 45.68$, $SD = 16.10$). The sample was quota representative with respect to gender (0 – "female", 1 – "male"), age, education (from 1 – "basic" to 6 – "post-graduate"), and city size (1 – "below 20K" to 4 – "over 500K"). The CAWI survey was collected by the Ariadna Research Panel as a part of monthly public opinion testing in December 2022.

3.1.2 | Measures

Unless otherwise indicated, items used a 7-point (1 – "I strongly disagree" to 7 – "I strongly agree"). Items were averaged and where necessary recoded so higher scores reflect higher levels of variables. Descriptives and correlations between key variables are shown in Table 2S. Collective narcissism and ingroup satisfaction were measured with reference to the national ingroup.

Science denial was assessed by a 4-item scale constructed for this study. The items were: "Science lies"; "Scientists don't actually know more than ordinary people"; "Scientists use their knowledge to control ordinary people" and "Scientists and politicians conspire to control ordinary people". The items loaded on the single factor, $IF = 2.98$, with factor loadings ranging from 0.82 to 0.92. The scale was reliable, $\alpha = 0.92$.

Collective narcissism ($\alpha = 0.94$) and **ingroup satisfaction** ($\alpha = 0.94$) were measured with reference to the national ingroup as in Study 1. **Vulnerable narcissism** ($\alpha = 0.88$) and **conservative self-placement** were assessed as in Study 1.

Ingroup centrality was measured by a three-item ingroup centrality subscale of the ingroup identification scale proposed by Leach and colleagues (Leach et al. 2008). The items were: "I often think about the fact that I am Polish"; "Being Polish is an important part of my identity"; and "Being Polish is a significant aspect of how I perceive myself", $\alpha = 0.91$.

Grandiose narcissism was assessed by 13-item grandiose narcissism scale (Gentile et al. 2013). An example is: "I like to be the centre of attention", $\alpha = 0.91$.

Social dominance orientation was assessed using first eight items of the 16-items of the Social Dominance Scale (Ho et al. 2015). An example is "Some groups of people must me kept in their place", $\alpha = 0.92$

Right-wing authoritarianism was measured by six-item Very Short Authoritarianism Scale (Bizumic and Duckitt 2018). An example item is "What our country needs most is discipline, with everyone following our leaders in unity", $\alpha = 0.71$.

3.1.3 | Results

Collective narcissism, $r(1024) = 0.39$, $p < 0.001$ and ingroup satisfaction, $r(1024) = 0.15$, $p < 0.001$ were positively associated with generic science denial and with each other, $r(1024) = 0.72$, $p < 0.001$. H1 was first tested using multiple regression analysis without covariates, as in Study 1. The results in Table 1 support H1. Although zero-order correlations indicated a positive association between ingroup satisfaction and science denial, multiple regression analysis and suppression tests clarified that this relationship is explained by the positive overlap between ingroup satisfaction and collective narcissism. When accounting for this overlap, ingroup satisfaction was independently and negatively associated with science denial. Similarly, controlling for this overlap revealed that ingroup satisfaction suppresses the strength of the positive association between collective narcissism and science denial. After accounting for shared variance between the predictors, the independent association of collective narcissism with science denial was stronger than its zero-order correlation.

To test the robustness of H1, Study 2 included a different set of covariates compared to Study 1. The results are shown in Table 3. As expected, collective narcissism significantly and positively predicted generic science denial, even when accounting for all predictors from prior research. Education was negatively associated with science denial, while political conservatism showed a significant positive association (with conservative self-placement and social dominance orientation and a positive but non-significant association with right wing authoritarianism). As anticipated, ingroup satisfaction negatively predicted science denial, and in Study 2, this relationship remained significant even after adding covariates. In contrast, ingroup centrality was positively associated with generic science denial, though its contribution was smaller than that of collective narcissism. Vulnerable narcissism, but not grandiose narcissism, also predicted science denial. The random forest regression model produced an R^2 of 0.24, indicating that collective narcissism was the strongest predictor of generic science denial. Vulnerable narcissism was the next largest contributor, followed by political conservatism.

In summary, the results of Studies 1 and 2 support H1. In both the United States and Poland, national narcissism and national ingroup satisfaction exhibit opposite unique associations with generic science denial—positive and negative, respectively. National narcissism consistently emerges as the strongest predictor of variance in generic science denial. Across both samples, vulnerable narcissism also positively predicts science denial. Ingroup satisfaction, but not ingroup centrality, shows a unique negative association with science denial. Furthermore, the findings align with prior research, confirming that science denial is associated with lower levels of education and higher political conservatism, regardless of the method used to assess conservatism. However, the combined contributions of vulnerable and collective narcissism surpass those of education and political conservatism. The subsequent studies focus on testing H2, which predicts independent and opposing indirect associations

TABLE 3 | Multiple regression and random forest estimates with science denial as the criterion, Studies 2–4.

	Study 2				Study 3				Study 4			
Predictor	***b***	**SE (HC3)**	***B* 95% CI [LL, UL]**	**Random forest estimates**	***b***	**SE (HC3)**	***B* 95% CI [LL, UL]**	**Random forest estimates**	***b***	**SE (HC3)**	***B* 95% CI [LL, UL]**	**Random forest estimates**
(Intercept)	1.99**	0.35	[1.39, 2.58]		3.09**	0.33	[2.53, 3.65]		2.55**	0.33	[1.99, 3.12]	
Collective narcissism	0.28**	0.06	[0.18, 0.38]	8.29	0.42**	0.39	[0.33, 0.52]	20.57	0.43**	0.05	[0.35, 0.52]	20.75
Ingroup satisfaction	−0.25**	0.06	[−0.36, −0.14]	1.86	−0.18**	0.05	[−0.29, −0.06]	2.62	−0.21**	0.06	[−0.31, −0.10]	2.41
Ingroup centrality	0.12*	0.06	[0.01, 0.23]	1.03	0.02	0.07	[−0.10, 0.14]	0.75	0.02	0.06	[−0.09, 0.12]	2.69
Vulnerable narcissism	0.29**	0.06	[0.20, 0.38]	4.95	–	–	–	–	–	–	–	–
Grandiose narcissism	0.01	0.05	[−0.08, 0.10]	1.02	–	–	–	–	–	–	–	–
RWA	0.05	0.06	[−0.05, 0.15]	3.60	0.00	0.08	[−0.10, 0.10]	3.80	0.07	0.06	[−0.03, 0.17]	8.95
SDO	0.10*	0.05	[0.02, 0.18]	2.01	0.08	0.08	[−0.01, 0.18]	2.10	0.11*	0.05	[0.02, 0.19]	1.30
Conservatism	0.11*	0.05	[0.02, 0.21]	3.30	0.11*	0.07	[0.01, 0.21]	4.97	0.08	0.05	[−0.01, 0.17]	5.35
Gender	−0.20*	0.08	[−0.36, −0.03]	0.09	−0.17*	0.07	[−0.34, −0.00]	0.42	−0.04	0.08	[−0.20, 0.12]	0.03
Age	−0.00	0.0004	[−0.01, 0.00]	0.41	−0.01*	0.07	[−0.01, −0.00]	0.30	−0.00	0.003	[−0.01, 0.00]	0.86
City size	−0.06*	0.03	[−0.12, −0.01]	−0.20	−0.05	0.11	[−0.11, 0.01]	2.24	−0.08**	0.03	[−0.13, −0.02]	3.06
Education	−0.15**	0.03	[−0.20, −0.10]	1.59	−0.15**	0.003	[−0.21, −0.10]	0.56	−0.11**	0.03	[−0.16, −0.06]	0.73
Fit	$R^2 = 0.28$** [0.23, 0.32]				$R^2 = 0.23$** [0.18, 0.26]				$R^2 = 0.26$** [0.21, 0.30]			

Notes: A significant *b*-weight indicates the semi-partial correlation is also significant. *b* represents unstandardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. * indicates $p < 0.05$. ** indicates $p < 0.01$.

of national narcissism and ingroup satisfaction with various consequences of generic science denial.

4 | Study 3

Study 3 tests H2a which predicts that national narcissism and ingroup satisfaction exhibit opposite, unique, indirect associations with three outcomes of generic science denial during the COVID-19 pandemic: refusal to vaccinate, lower compliance with health authorities' regulations, and more negative attitudes toward national health authorities and their regulations. In addition, Study 3 replicates the test of H1 (Table 1) and assesses the robustness of these findings (Table 3) against a range of covariates, including demographic variables (age, gender, income, and city size), education, political conservatism (measured through self-placement, right-wing authoritarianism, and social dominance), and national ingroup centrality.

4.1 | Method

4.1.1 | Participants

Participants were 1011 Polish adults, 535 women and 476 men. Their age ranged from 18 to 84 ($M = 45.90$, $SD = 16.13$). The sample was quota representative with respect to gender (0 – female, 1 – male), age, education (from 1 – basic to 6 – postgraduate), and city size (from 1 – below 20K to 4 – over 500K). The CAWI survey was collected by the Ariadna Research Panel as a part of monthly political opinion survey in January 2023. Participants who took part in Study 2 could not participate in Study 3.

4.1.2 | Measurements

Science denial $\alpha = 0.91$, collective narcissism $\alpha = 0.94$, ingroup satisfaction, $\alpha = 0.95$, ingroup centrality, $\alpha = 0.91$, right-wing authoritarianism, $\alpha = 0.72$, and conservative self-placement were assessed as in Study 2.

Social dominance orientation (SDO, $\alpha = 0.90$) was assessed using all items of the 16-items of the Social Dominance Scale (Ho et al. 2015).

Attitude toward health regulations during COVID-19 pandemic was measured by items constructed for the purpose of the study. The items were "Mass vaccinations against COVID-19 were necessary to stop the pandemic"; "Everyone should get vaccinated against COVID-19", "People who have not been vaccinated against COVID-19 endanger others and the entire community"; "Compliance with regulations such as wearing masks in public places helped control the COVID-19 pandemic"; and "Introducing restrictions on movement during the pandemic helped to control it". The items loaded on a single factor, $IF = 4.00$ with factor loadings ranging from 0.80 to 0.97. The scale was reliable, $\alpha = 0.95$.

COVID-19 vaccination was a binary variable assessing whether participants were vaccinated against COVID-19 virus in 2023, 1 – no ($n = 295$), 2 – yes ($n = 716$).

Pandemic behaviors were a count variable summarizing how many regulations of national health authorities participants recalled following during the COVID-19 pandemic. The behaviors were: "Limiting leaving the house during lockdown"; "Travel restrictions"; "Limiting contact with other people"; "Wearing masks in public places"; "Using hand sanitizer gel in public places"; and "Using hand sanitizer gel after contact with other people". The responses ranged from 0 to 6, $M = 3.82$; $SD = 2.2$.

4.1.3 | Results

Collective narcissism, $r(1009) = 0.40$, $p < 0.001$ and ingroup satisfaction, $r(1009) = 0.19$, $p < 0.001$ were positively associated with science denial and with each other, $r(1009) = 0.72$, $p < 0.001$. H1 and its robustness were tested following the same procedures as in previous studies. The results presented in Tables 1 and 3 support H1 demonstrating that the unique, opposite associations of national narcissism and national ingroup satisfaction with generic science denial remain significant even after controlling for the covariates.

Next, H2a was evaluated using mediation analysis within the context of a structural equation model (SEM) conducted with the *lavaan* R package (Rosseel 2012). Collective narcissism and ingroup satisfaction were specified as latent exogenous predictors, with individual scale items serving as indicators. Generic science denial was modeled as a latent mediator, also indicated by scale items. Three outcomes were specified: a latent factor for attitudes toward COVID-19 health regulations (with scale items as indicators), and two latent factors for ordinal variables—vaccination status (not vaccinated vs. vaccinated) and the number of health regulations followed (with higher values indicating more regulations followed). To address the non-normal distribution of ordinal indicators, the model employed the pairwise maximum likelihood (PML) estimator. Fit indices presented in Table 4 indicate that the model demonstrated good fit (Bayesian Information Criterion (BIC) and Akaike's information criterion (AIC) were not computed for models with ordinal indicators). For brevity, the discussion below focuses on hypothesis testing within the structural model; results of the CFA component are available in the Supporting Information. Figure 2 provides a schematic representation of the findings, while Table 5 details the path coefficients associated with the regression aspect of the model.

The results reveal that, independently of one another, collective narcissism was positively related to generic science denial, whereas ingroup satisfaction was negatively related to generic science denial. Science denial, in turn, was associated with a greater likelihood of not being vaccinated by January 2023, fewer health regulations followed during the COVID-19 pandemic, and a more negative attitude toward those regulations. The direct associations between collective narcissism and the outcome variables were non-significant. The direct association between ingroup satisfaction and the number of regulations followed was positive and significant, while the remaining direct associations involving ingroup satisfaction were non-significant.

Notably, all indirect effects presented in Table 6 were significant, supporting H2a. Collective narcissism was indirectly associated with non-vaccinated status, fewer health regulations followed, and a negative attitude toward health authority regulations dur-

TABLE 4 | Model fit indices for the structural equation model in Studies 3 and 4.

Model	χ^2	*df*	χ^2/df	*p*	CFI	TLI	RMSEA [90% CI]	SRMR	AIC	BIC
PML SEM model	743.65	157	4.74	<0.001	0.99	0.99	0.061 [0.57; 0.66]	0.041	–	–
ML SEM model	713.19	181	3.94	<0.001	0.97	0.96	0.05 [0.05, 0.06]	0.04	72.47	72.93

Abbreviations: ML, maximum likelihood; PML, pairwise maximum likelihood.

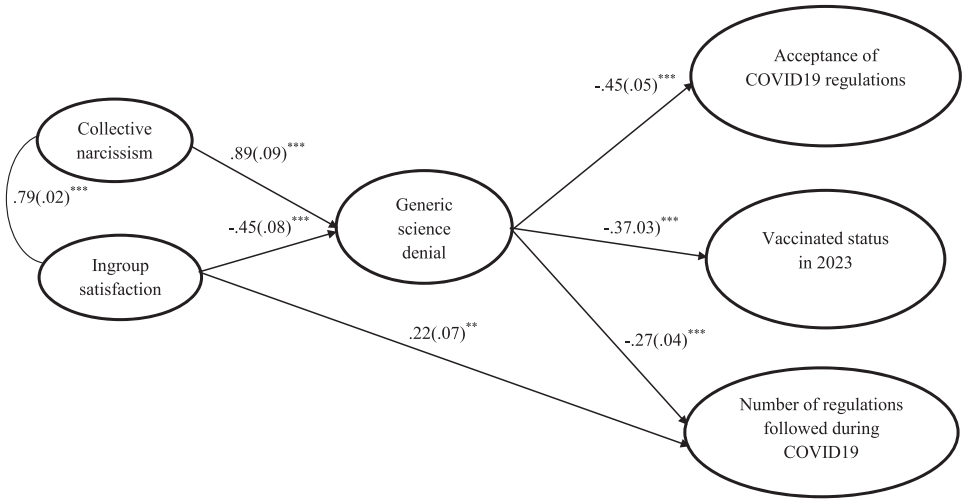

FIGURE 2 | Schematic representation of significant relationships in Study 3. $^{**}p = 0.002$; $^{***}p < 0.001$.

TABLE 5 | Structural regression path coefficients for the structural equation model predicting COVID regulations behaviors and attitudes in Study 3.

Paths	Estimate	SE	*z*	*p*	95%CI
CN→ science denial	0.89	0.09	9.68	<0.001***	[0.71; 1.07]
IS→ science denial	−0.45	0.08	−5.63	<0.001***	[−0.61; −0.30]
Science denial→ vaccination	−0.37	0.03	−10.22	<0.001***	[−0.45; −0.29]
Science denial→ health behaviors	−0.27	0.04	−7.01	<0.001***	[−0.35; −0.20]
Science denial→ attitude toward regulations	−0.45	0.05	−8.71	<0.001***	[−0.55; −0.35]
CN→ vaccination	0.07	0.09	0.80	0.42	[−0.11; 0.52]
CN→ health behaviors	−0.09	0.08	−1.19	0.24	[−0.24; 0.06]
CN→ attitude toward regulations	0.02	0.10	0.24	0.81	[−0.16; 0.21]
IS→ vaccination	−0.02	0.08	−0.19	0.85	[−0.18; 0.15]
IS→ health behaviors	0.22	0.07	3.16	0.002**	[0.08; 0.35]
IS→ attitude toward regulations	0.09	0.09	1.09	0.28	[−0.07; 0.26]

Abbreviations: CN, collective narcissism; IS, ingroup satisfaction.

ing the pandemic via its positive association with generic science denial. Conversely, ingroup satisfaction was indirectly associated with vaccinated status, more regulations followed, and a positive attitude toward health authority regulations through its negative association with generic science denial. These findings underline the mediating role of generic science denial in explaining the divergent behaviors and attitudes during the COVID-19 pandemic linked to collective narcissism and ingroup satisfaction.

5 | Study 4

Study 4 tests H2b, which posits that collective narcissism and ingroup satisfaction exhibit opposite, independent, indirect relationships with distinct outcomes of generic science denial. These outcomes, identified in previous research (Morgan et al. 2018; Reif et al. 2024), include general anti-vaccination attitudes, climate change denial, a preference for unregulated access to

TABLE 6 | Indirect associations of collective narcissism and ingroup satisfaction with COVID behaviors and attitudes via generic science denial in Study 3.

Indirect effect	SE	*z*	*p*	*b*	95% CI (*b*)	*b**	95% CI (*b**)
CN→ science denial → covid vaccination (NO vs. YES)	0.04	−7.36	<0.001***	−0.33	[−0.42, −0.24]	−0.31	[−0.38, −0.23]
IS→ science denial → covid vaccination (NO vs. YES)	0.03	5.17	<0.001***	0.17	[0.10, 0.23]	0.16	[0.10, 0.21]
CN→ science denial → covid behaviors (0–6)	0.04	−6.26	<0.001***	−0.24	[−0.32, −0.17]	−0.23	[−0.30, −0.16]
IS→ science denial →covid behaviors (0–6)	0.02	4.92	<0.001***	0.12	[0.07, 0.17]	0.12	[0.07, 0.16]
CN→ science denial →covid regulations attitude	0.06	−7.05	<0.001***	−0.40	[−0.51, −0.29]	−0.36	[−0.45, −0.27]
IS→ science denial →covid regulations attitude	0.04	4.99	<0.001***	0.20	[0.12, 0.28]	0.18	[0.11, 0.25]

Abbreviations: CN, collective narcissism; IS, ingroup satisfaction.

"alternative" medicine (supplements and psychedelics), and the belief that gender can only be binary. Additionally, Study 4 replicates the tests of H1 presented in Tables 1 and 3, assessing the robustness of H1 against an extended set of covariates. These covariates include demographic variables (age, gender, income, and city size), education, political conservatism (measured as self-placement, right-wing authoritarianism, and social dominance), and national ingroup centrality.

5.1 | Method

5.1.1 | Participants

Participants were 1019 Polish adults, 543 women and 476 men. Their age ranged from 18 to 84 ($M = 45.98$, $SD = 16.17$). The sample was quota representative with respect to gender (0 – female, 1 – male), age, education (from 1 – basic to 6 – postgraduate), and city size (from 1 – below 20K to 4 – over 500K). The CAWI survey was collected by the Ariadna Research Panel in as a part of a monthly political opinion survey in March 2023. Participants who took part in Studies 2 and 3 could not participate in Study 4.

5.1.2 | Measures

Science denial, $\alpha = 0.88$, collective narcissism, $\alpha = 0.94$, and ingroup satisfaction, $\alpha = 0.94$, ingroup centrality, $\alpha = 0.91$, right-wing authoritarianism, $\alpha = 0.70$, social dominance orientation, $\alpha = 0.90$, and conservative self-placement were assessed as in Study 3.

Anti-vaccination attitude was assessed by two items constructed for this study. They were: "People cannot be forced to vaccinate their children" and "Vaccines can be harmful", $\alpha = 0.77$.

Climate change denial was assessed by two items constructed for this study. They were: "Combating human-caused climate change should be our priority" (reversed) and "Something like climate change doesn't exist.", $\alpha = 0.63$.

Unregulated access to unsupported remedies was assessed by two items constructed for this study. They were: "Access to medical supplements should not be regulated" and "Access to psychedelics should not be regulated", $\alpha = 0.53$.

Belief in binary gender was assessed by three items constructed for this study. They were: "There is enough scientific evidence to accept that gender is not binary" (reversed); "There is enough scientific evidence to accept that psychological gender may differ from biological gender" (reversed); and "Gender identity may not align with biological sex", $\alpha = 0.80$.

5.1.3 | Results

Collective narcissism, $r(1017) = 0.43$, $p < 0.001$ and ingroup satisfaction, $r(1017) = 0.20$, $p < 0.001$ were positively associated with science denial and with each other, $r(1017) = 0.73$, $p < 0.001$. The results in Tables 1 and 3 support H1 and its robustness, demonstrating that the unique and opposite associations of national narcissism and national ingroup satisfaction with generic science denial remain significant even when controlling for covariates in Study 4. These findings confirm the stability of the observed relationships across varying contexts and predictor sets.

To test H2b, which hypothesizes that collective narcissism and ingroup satisfaction have opposite, independent, indirect relationships with outcome variables, mediation analysis was conducted within a structural equation modeling (SEM) framework, employing the *lavaan* R package. Collective narcissism, ingroup satisfaction, and generic science denial were modeled as in Study 3. Four continuous outcomes—anti-vaccination attitude, climate change denial, support for unregulated access to supplements and psychedelics, and belief in binary gender—were specified as latent variables, each with individual scale items serving as indicators. The SEM analysis utilized the maximum likelihood estimation method with robust standard errors (MLR). Details of the confirmatory factor analysis (CFA) component are available in the Supporting Information.

Model fit indices in Table 4 indicate a good fit to the data. Figure 3 illustrates the significant relationships observed in the SEM model, while regression path coefficients are detailed in Table 7. Consistent with previous studies, collective narcissism was positively associated with generic science denial, whereas ingroup satisfaction was negatively associated. Generic science denial was positively related to anti-vaccination attitudes, climate change denial, and support for unregulated access to "alternative" medicine, but it was not significantly related to beliefs about binary gender.

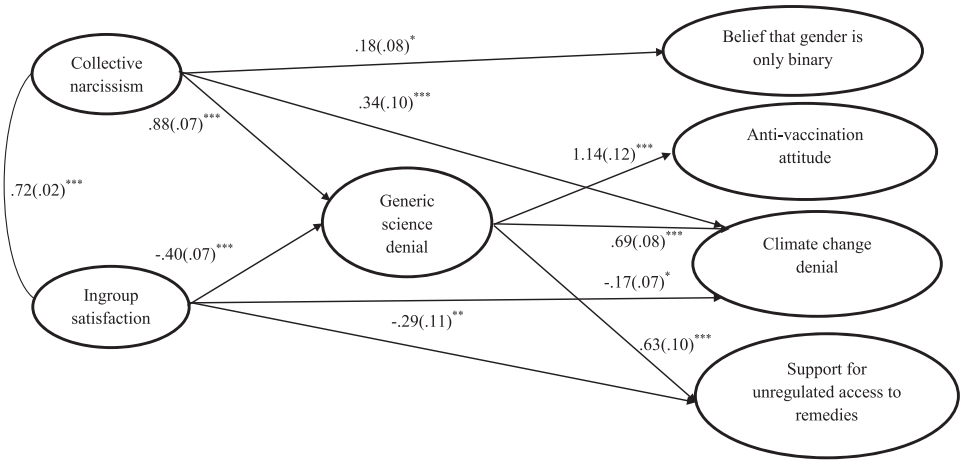

FIGURE 3 | Schematic representation of significant relationships in Study 4. * $p = .02$; ** $p = 0.01$; *** $p < 0.001$.

TABLE 7 | Regression path coefficients for the structural equation model predicting outcomes of science denial in Study 4.

Paths	Estimate	SE	*z*	*p*	95%CI
CN→ science denial	0.88	0.07	11.47	<0.001***	[0.73; 1.03]
IS→ science denial	−0.40	0.07	−6.04	<0.001***	[−0.53; −0.27]
Science denial→ anti-vaccination	1.14	0.12	9.37	<0.001***	[0.90; 1.38]
Science denial→ climate change denial	0.69	0.09	7.92	<0.001***	[0.52; 0.86]
Science denial→ binary gender beliefs	0.06	0.05	1.15	0.25	[−0.04; 0.15]
Science denial→ natural medicine	0.63	0.10	6.20	<0.001***	[0.43; 0.83]
CN→ anti-vaccination	−0.11	0.13	−0.80	0.42	[−0.36; 0.15]
CN→ climate change denial	0.34	0.10	3.62	<0.001***	[0.16; 0.53]
CN→ binary gender beliefs	0.18	0.08	2.56	0.02*	[0.02; 0.34]
CN→ natural medicine	0.19	0.13	1.47	0.14	[−0.06; 0.44]
IS→ anti-vaccination	0.19	0.11	1.67	0.10	[−0.03; 0.40]
IS→ climate change denial	−0.17	0.07	−2.34	0.02*	[−0.32; −0.04]
IS→ binary gender beliefs	0.12	0.07	1.70	0.09	[−0.02; 0.26]
IS→ natural medicine	−0.29	0.11	−2.65	0.01**	[−0.51; −0.08]

Abbreviations: CN, collective narcissism; IS, ingroup satisfaction.

The results also revealed significant direct associations. Collective narcissism was directly and positively associated with climate change denial over and above its indirect association through science denial, and the belief that gender is binary. Ingroup satisfaction was directly and negatively associated with climate change denial and the preference for unregulated access to "alternative" medicine over and above its negative indirect association via science denial. These direct associations suggest additional mechanisms at play.

Indirect associations presented in Table 8 align with H2b for most outcomes. Collective narcissism was indirectly associated with anti-vaccination attitudes, climate change denial, and a preference for unregulated access to "alternative" medicine through its positive relationship with generic science denial. Conversely, ingroup satisfaction was indirectly linked to pro-vaccination attitudes, greater climate change awareness, and support for the unregulated access to "alternative" medicine due to its negative relationship with generic science denial.

However, three deviations from H2b were observed. First, the direct positive association between collective narcissism and climate change denial, as well as the direct negative association between ingroup satisfaction and climate change denial, were significant independently of generic science denial. Second, collective narcissism directly predicted beliefs about gender being binary, without mediation by generic science denial, as the latter showed no significant relationship with this belief. Finally, ingroup satisfaction was directly negatively associated with support for unregulated access to "alternative" medicine.

These findings suggest that while generic science denial serves as a key mediating mechanism for many outcomes associated with collective narcissism and ingroup satisfaction, certain direct path-

TABLE 8 | Indirect associations of collective narcissism and ingroup satisfaction with outcomes of science denial in Study 4.

Indirect effect	SE	*Z*	*p*	*b*	95% CI (*b*)	*b**	95% CI (*b**)
CN→ science denial →anti-vaccination attitude	0.14	7.12	<0.001***	1.00	[0.73, 1.28]	0.60	[0.49, 0.71]
IS→ science denial →anti-vaccination attitude	0.09	−4.94	<0.001***	−0.45	[−0.63, −0.27]	−0.27	[−0.36, −0.18]
CN→ science denial →climate change denial	0.09	6.64	<0.001***	0.61	[0.43, 0.79]	0.44	[0.34, 0.53]
IS→ science denial →anti-vaccination attitude	0.06	−4.86	<0.001***	−0.28	[−0.39, −0.16]	−0.20	[−0.27, −0.13]
CN→ science denial →belief in binary gender	0.04	1.16	0.247	0.05	[−0.03, 0.13]	0.05	[−0.03, 0.13]
IS→ science denial →belief in binary gender	0.02	−1.16	0.247	−0.02	[−0.06, 0.02]	−0.02	[−0.06, 0.01]
CN→ science denial →natural medicine	0.10	5.53	<0.001***	0.56	[0.36, 0.75]	0.44	[0.32, 0.55]
IS→ science denial →natural medicine	0.06	−4.35	<0.001***	−0.25	[−0.37, −0.14]	−0.20	[−0.27, −0.12]

Abbreviations: CN, collective narcissism; IS, ingroup satisfaction.

ways also contribute significantly, particularly regarding attitudes toward climate change and beliefs about gender. This highlights the multifaceted ways in which collective narcissism and ingroup satisfaction influence distinct societal and ideological outcomes.

6 | General Discussion

In times marked by historically low societal trust in science, four cross-sectional studies consistently demonstrated that national narcissism is positively, while national ingroup satisfaction is negatively, associated with generic science denial. Across all studies, national narcissism emerged as the strongest predictor of generic science denial, surpassing the contributions of (in order of strength): vulnerable narcissism, political conservatism, and low education. These findings replicated across two countries with notable right-wing populist movements—Poland and the United States—and remained consistent across diverse assessments of generic science denial, narcissistic personality and political conservatism. The results suggest that the undermining of scientific authority is driven more by a sense of personal and collective narcissistic grievance and entitlement than by conservative political ideology or educational background. The results highlight also the significant role of ingroup evaluation in generic science denial. Logic and scientific consensus are predominantly rejected by collective narcissists who consider their nation superior and wronged, but endorsed by people who feel proud and satisfied with belonging to a valued national group.

The studies further revealed that national narcissism and ingroup satisfaction were indirectly linked through generic science denial to adverse outcomes during the COVID-19 pandemic. National narcissism was associated with a negative attitude toward health regulations, reduced compliance with those regulations, and lower vaccination rates as of January 2023 (Study 3). In contrast, ingroup satisfaction was linked to positive pandemic outcomes, including adherence to health regulations and vaccination uptake. The indirect, opposite associations of collective narcissism and ingroup satisfaction with a general anti-vaccination stance through generic science denial were also indicated by the results of Study 4. Additionally, the findings of Study 4 demonstrated that national narcissism (positively) and ingroup satisfaction (negatively) are indirectly associated, via generic science denial, with broader societal and ideological outcomes such as climate change denial, and preference for unregulated access to "alternative" medicine. Unexpectedly, the results also identified a direct positive association between national narcissism and the belief that gender is only binary. This association was not mediated by generic science denial, indicating that beliefs about gender in Poland are more closely tied to national narcissism than to understanding of the state of scientific knowledge and consensus regarding gender. This aligns with previous research showing that national narcissism directly fuels beliefs about gender, that perpetuate prejudice and gender inequality (Golec de Zavala and Bierwiaczonek 2021; Mole et al. 2021; Szczepańska et al. 2022).

6.1 | Collective Narcissism of Science Denial

The present findings expand upon earlier research that linked national narcissism to distrust in specific scientific domains, such as climate (Bertin et al. 2021), vaccination (Cislak et al. 2022; Górska et al. 2022; Marchlewska et al. 2022), and COVID-19 science (Sternisko et al. 2023). The present findings suggests that distrust in science in these specific areas is driven by a generic science denial associated with collective narcissism. This is especially true for anti-vaccination stance and rejection of regulations by health authorities, as the association between collective narcissism and generic science denial fully accounted for the associations between collective narcissism and those specific outcomes. Similarly, national ingroup satisfaction was only indirectly negatively associated with those outcomes through generic science denial. The opposite associations of collective narcissism and ingroup satisfaction with generic science denial also provide a unifying explanation for the diverse opposite correlates of collective narcissism and ingroup satisfaction, including anti-environmental attitudes, climate change denial (Bertin et al. 2021; Cislak et al. 2018, 2021, 2023, 2024), and insufficient responses to public health emergencies (Gronfeldt et al. 2023; Nowak et al. 2020).

The present findings align with and extend previous results showing that collective narcissism is associated with endorsement of conspiracy theories that forfeit facts or logic to fulfil psychological needs (Golec de Zavala et al. 2022). The present results suggest that the collective narcissistic need to have the nation recognized as better than others biases information processing "to the

point of irrationality" (Fromm 1973, 357). Collective narcissistic generalized irrationality underlies the endorsement of specific conspiracy theories and other shared delusions. The existing findings linking collective narcissism to the need for chaos—the vengeful destructive desire to "see the world burn"' because it does not fulfil their desire for recognition (Federico et al. 2025; Golec de Zavala 2023)—suggest just how dangerous the narcissistic rejection of rationality may be for the ingroup, the outgroup, and the whole planet (see also Alam and Vitriol, 2025).

6.2 | The Role of Non-Narcissistic Ingroup Satisfaction

The present findings highlight the importance of nuanced differentiation between distinct dimensions of ingroup identification to better understand their unique roles in shaping behaviors in intergroup contexts (Ashmore et al. 2004; Cameron 2004; Jackson and Smith 1999; Leach et al. 2008; Roccas et al. 2006). By disentangling aspects such as national narcissism, national ingroup satisfaction, and national ingroup centrality, this research reveals their specific contributions to generic science denial: strong and positive of national narcissism, weaker and negative of ingroup satisfaction and positive but negligible of ingroup centrality. In contrast to both national narcissism and national ingroup centrality, national ingroup satisfaction is uniquely negatively associated with science denial. Unlike collective narcissism or ingroup centrality, ingroup satisfaction is rooted in a positive but unexaggerated evaluation of the ingroup, fostering openness to logic and rationality. This suggests that national satisfaction can serve as a protective factor against generic science denial and may play a pivotal role in countering distrust in science.

6.3 | Limitations

While interpreting the present findings, it is important to remember that they are based on cross-sectional data. The present findings are correlational and no statements regarding causality or directionality of the examined relationships can reliably be made. It is proposed here that evaluative beliefs about national identity (collective narcissism and ingroup satisfaction) constraints beliefs about science, but beliefs about the nation may be also used post-facto, to justify generic science denial. Nevertheless, the present research extends our knowledge about science denial by focusing on previously untested involvement of national narcissism and narcissistic personality traits in generic science denial.

6.4 | Practical Implications

Narcissistic personality traits and national narcissism emerged as the strongest predictors of generic science denial in the present studies, highlighting the importance of identifying conditions that mitigate public expressions of narcissism. Such results suggest that educational curricula and public policies should be revised not only to improve how science is taught (see Cleary and Robinson, 2025), but also to carefully consider the content being taught. Research suggests that narcissistic tendencies are curbed in contexts emphasizing interdependence and communal responsibility, particularly during periods of collective challenge, such as economic hardship (Bianchi 2015; Piff 2014; Vater et al. 2018). These findings point to the potential of fostering values of cooperation, mutual concern, and shared accountability in education and public discourse as a means of addressing science denial.

Additionally, the present results point to the importance of fostering national satisfaction over national narcissism or excessive self-investment in national identity. National narcissism, as a shared belief about group identity, is more malleable than individual narcissistic personality traits. Moreover, it coexists with ingroup satisfaction within persons and within groups. Group members constantly negotiate which of those approaches should become dominant and normative for the group to binds group members and coordinate their attitudes and actions. When national narcissism becomes the dominant normative belief about the national group, science skepticism and denial may gain greater prominence in public discourse. Interventions aimed at addressing science denial should, thus, focus on promoting a balanced and non-contingent pride in the national group.

Therefore, educational programs and public discourse should actively challenge the notion that individual or group worth is contingent on external recognition of superiority. Instead, curricula should promote reciprocal respect and collective well-being among citizens, moving away from nostalgic narratives of national greatness. Emphasizing the contributions of diverse social groups to the national fabric can help mitigate ethnocentric projections of the dominant group's interests onto the entire nation (Golec de Zavala and Keenan 2023, 2024). Additionally, a realistic and contextual understanding of national achievements—highlighting science, rationality, and democracy as sources of pride—should replace idealized depictions of the national past.

Finally, since the negative consequences of collective narcissism can be mitigated by equipping individuals with tools to manage negative emotions (Golec de Zavala et al. 2024), it is essential to expand access to mental health services. Integrating these services into education and workplace systems can help individuals develop emotional resilience, which may, in turn, reduce the appeal and influence of collective narcissism in shaping public attitudes and behaviors.

Ethics Statement

All studies were approved by the Ethics Committee, Department of Psychology, Goldsmiths, University of London. All participants gave informed consent to participate in the studies.

Conflicts of Interest

The author declares no conflict of interest.

Data Availability Statement

All datasets and codes for analyses can be found at: https://osf.io/2mtdw/?view_only=4cc18cc60c26472cadfe183e53cf1208

Endnotes

[1]Please note that three hypotheses were originally pre-registered. H1 expected collective narcissism to predict science denial over and above

demographic variables, individual narcissism, and predictors identified by extant literature: political conservatism and low education. H2 expected ingroup satisfaction to be negatively related to science denial after its positive overlap with collective narcissism was controlled for. H3 (annotated as a second H2 due to a clerical error) predicted opposite unique (after their common variance was controlled) indirect associations of collective narcissism and ingroup satisfaction with outcome variables. For the sake of focus and simplicity in this paper H1 and H2 are collapsed into one H1 and previous H3 is tested as H2a and H2b with different outcome variables in Studies 3 and 4.

References

Alam, R., and J. Vitriol. 2025. "Reveling in Mayhem: The Need for Chaos in Pandemic Psychology." *Journal of Social Issues*.

Ashmore, R. D., K. Deaux, and T. McLaughlin-Volpe. 2004. "An Organizing Framework for Collective Identity: Articulation and Significance of Multidimensionality." *Psychological Bulletin* 130, no. 1: 80–114. https://doi.org/10.1037/0033-2909.130.1.80.

Azevedo, F., and J. T. Jost. 2021. "The Ideological Basis of Antiscientific Attitudes: Effects of Authoritarianism, Conservatism, Religiosity, Social Dominance, and System Justification." *Group Processes & Intergroup Relations* 24, no. 4: 518–549. https://doi.org/10.1177/1368430221990104.

Back, M. D., A. C. P. Küfner, M. Dufner, T. M. Gerlach, J. F. Rauthmann, and J. J. A. Denissen. 2013. "Narcissistic Admiration and Rivalry: Disentangling the Bright and Dark Sides of Narcissism." *Journal of Personality and Social Psychology* 105, no. 6: 1013–1037. https://doi.org/10.1037/a0034431.

Bertin, P., K. Nera, K. Hame, I. Uhl-Haedicke, and S. Delouvée. 2021. "Stand Out of My Sunlight: The Mediating Role of Climate Change Conspiracy Beliefs in the Relationship Between National Collective Narcissism and Acceptance of Climate Science." *Group Processes & Intergroup Relations* 24, no. 5: 738–758. https://doi.org/10.1177/1368430221992114.

Bianchi, E. C. 2015. "Assessing the Robustness of the Relationship Between Entering Adulthood in a Recession and Narcissism." *Psychological Science* 26: 537–538. https://doi.org/10.1177/0956797614568157.

Bizumic, B., and J. Duckitt. 2018. "Investigating Right Wing Authoritarianism with a Very Short Authoritarianism Scale." *Journal of Social and Political Psychology* 6, no. 1: 129–150. https://doi.org/10.5964/jspp.v6i1.835.

Breiman, L. 2001. "Random Forests." *Machine Learning* 45: 5–32. https://doi.org/10.1023/A:1010933404324.

Cameron, J. E. 2004. "A Three-Factor Model of Social Identity." *Self and Identity* 3: 239–262. https://doi.org/10.1080/13576500444000047.

Cichocka, A., K. Bocian, M. Winiewski, and F. Azevedo. 2022. ""Not Racist, but…": Beliefs About Immigration Restrictions, Collective Narcissism, and Justification of Ethnic Extremism." *Political Psychology* 43, no. 6: 1217–1234. https://doi.org/10.1111/pops.12813.

Cichocka, A., M. Marchlewska, and A. Golec de Zavala. 2016. "Does Self-Love or Self-Hate Predict Conspiracy Beliefs? Narcissism, Self-Esteem and the Endorsement of Conspiracy Theories." *Social Psychological and Personality Science* 7: 157–166. https://doi.org/10.1177/1948550615616170.

Cichocka, A., M. Marchlewska, A. Golec de Zavala, and M. Olechowski. 2015. "'They Will Not Control Us': In-Group Positivity and Belief in Intergroup Conspiracies." *British Journal of Psychology* 107, 556–576. https://doi.org/10.1111/bjop.12158.

Cislak, A., A. Cichocka, A. D. Wojcik, and T. L. Milfont. 2021. "Words Not Deeds: National Narcissism, National Identification, and Support for Greenwashing Versus Genuine Proenvironmental Campaigns." *Journal of Environmental Psychology* 74: 101576. https://doi.org/10.1016/j.jenvp.2021.101576.

Cislak, A., M. Marchlewska, A. D. Wojcik, et al. 2022. "National Narcissism and Support for Voluntary Vaccination Policy: The Mediating Role of Vaccination Conspiracy Beliefs." *Group Processes & Intergroup Relations* 24, no. 5: 701–719. https://doi.org/10.1177/1368430220959451.

Cislak, A., A. D. Wójcik, J. Borkowska, and T. L. Milfont. 2023. "Secure and Defensive Forms of National Identity and Public Support for Climate Policies." *PLOS Climate* 2, no. 6: e0000146. https://doi.org/10.1371/journal.pclm.0000146.

Cislak, A., A. D. Wojcik, and A. Cichocka. 2018. "Cutting the Forest Down to Save Your Face: Narcissistic National Identification Predicts Support for Anti-Conservation Policies." *Journal of Environmental Psychology* 59: 65–73. https://doi.org/10.1016/j.jenvp.2018.08.009.

Cislak, A., A. D. Wojcik, A. Cichocka, and T. L. Milfont. 2024. "National Identity and Environmentalism: Why National Narcissism Might Undermine Pro-Environmental Efforts." *Frontiers in Social Psychology* 2: 1305150. https://doi.org/10.3389/frsps.2024.1305150.

Cleary, A., and D. Robinson. 2025. "Institutionalized Misinformation in US Education: Combatting the Overselling of Learning Styles and Underselling of Spaced Effort." *Journal of Social Issues*.

Cohen, J. 1992. "Statistical Power Analysis." *Current Directions in Psychological Science* 1, no. 3: 98–101. https://doi.org/10.1111/1467-8721.ep10768783.

Crocker, J., and R. Luhtanen. 1990. "Collective Self-Esteem and Ingroup Bias." *Journal of Personality and Social Psychology* 58, no. 1: 60–67. https://doi.org/10.1037/0022-3514.58.1.60.

Duckitt, J. 2001. "A Dual Process Cognitive-Motivational Theory of Ideology and Prejudice." *Advances in Experimental Social Psychology* 22: 41–113. Academic Press, San Diego.

Federico, C. M., A. Golec de Zavala, and T. Baran. 2021. "Collective Narcissism, Ingroup Satisfaction, and Solidarity in the Face of COVID-19." *Social Psychology and Personality Science*. 12, no. 6: 1071–1081. https://doi.org/10.1177/2F1948550620963655.

Federico, C. M., A. Golec de Zavala, and T. Baran. 2025. Rebels Without a Cause: Collective Narcissism and Political Contrarianism. https://osf.io/preprints/psyarxiv/qm6j8_v1

Federico, C. M., A. Golec De Zavala, and W. Bu. 2022. "Collective Narcissism as a Basis for Nationalism." *Political Psychology* 44: 177–196. https://doi.org/10.1111/pops.12833.

Ferkany, M. 2015. "Is It Arrogant to Deny Climate Change or Is It Arrogant to Say It Is Arrogant? Understanding Arrogance and Cultivating Humility in Climate Change Discourse and Education." *Environmental Values* 24, no. 6: 705–724. https://doi.org/10.3197/096327115X14420732702572.

Fromm, E. 1973. *The Anatomy of Human Destructiveness*. Holt, Rinehart and Winston.

Gentile, B., J. D. Miller, B. J. Hoffman, D. E. Reidy, A. Zeichner, and W. K. Campbell. 2013. "A Test of Two Brief Measures of Grandiose Narcissism: the Narcissistic Personality Inventory–13 and the Narcissistic Personality Inventory-16." *Psychological Assessment* 25, no. 4: 1120–1136. https://doi.org/10.1037/a0033192.

Gligorić, V., C. Reinhardt, E. Nieuwenhuijzen et al. 2025. "The Role of Worldviews, Radicalization Risk Factors, and Personality in Harassment of Scientists." *Scientific Reports* 15: 1261. https://doi.org/10.1038/s41598-025-85208-7.

Golec de Zavala, A. 2011. "Collective Narcissism and Intergroup Hostility: The Dark Side of 'in-Group Love'.". *Social and Personality Psychology Compass* 5, no. 6: 309–320. https://doi.org/10.1111/j.1751-9004.2011.00351.x.

Golec de Zavala, A. 2018. "Collective Narcissism: Antecedents and Consequences of Exaggeration of the In-Group image." In *The Handbook of Trait Narcissism: Key Advances, Research Methods, and Controversies*, edited by A. Hermann, A. Brunell, and J. Foster, 79–89. Springer.

Golec de Zavala, A. 2019. "Collective Narcissism and in-group Satisfaction Are Associated With Different Emotional Profiles and Psychological Wellbeing." *Frontiers in Psychology, 10*. https://doi.org/10.3389/fpsyg.2019.00203.

Golec de Zavala, A. 2020. "Why Is Populism So Robustly Associated With Conspiratorial Thinking? Collective Narcissism and the Meaning Maintenance Model." In *The Psychology of Political Behavior in a Time*

of Change: Identity in a Changing World, edited by J. Sinnott, and J. Rabin, 277–290. Springer International Publishing ISBN 9783030382698.

Golec de Zavala, A. 2022. "Conditional Parochial Vicarious Ostracism: Gender Collective Narcissism Predicts Distress at the Exclusion of the Gender Ingroup in Women and Men." *Sex Roles* 87: 267–288. https://doi.org/10.1007/s11199-022-01315-z.

Golec de Zavala, A. 2023. *The Psychology of Collective Narcissism*. Routledge.

Golec de Zavala, A. 2024. "Authoritarians and 'Revolutionaries in Reverse': Why Collective Narcissism Threatens Democracy." *Group Processes & Intergroup Relations* 27, no. 5: 1027–1049. https://doi.org/10.1177/13684302241240689.

Golec de Zavala, A. 2025. Collective narcissism and a group-level antagonistic pursuit of recognition. Advances in Experimental Social Psychology.

Golec de Zavala, A., and K. Bierwiaczonek. 2021. "Male, Religious and National Narcissism Predicts Sexism in Poland." *Sex Roles* 84: 680–700. https://doi.org/10.1007/s11199-020-01193-3.

Golec de Zavala, A., K. Bierwiaczonek, and P. Ciesielski. 2022. "An Interpretation of Meta-Analytical Evidence for the Link Between Collective Narcissism and Conspiracy Theories." *Current Opinion in Psychology* 47. https://doi.org/10.1016/j.copsyc.2022.101360.

Golec de Zavala, A., A. Cichocka, R. Eidelson, and N. Jayawickreme. 2009. "Collective Narcissism and Its Social Consequences." *Journal of Personality and Social Psychology* 97: 1074–1096. https://doi.org/10.1037/a0016904.

Golec de Zavala, A., A. Cichocka, and I. Iskra-Golec. 2013. "Collective Narcissism Moderates the Effect of in-group Image Threat on Intergroup Hostility." *Journal of Personality and Social Psychology* 104: 1019–1039. https://doi.org/10.1037/a0032215.

Golec de Zavala, A., and C. Federico. 2018. "Collective Narcissism and the Growth of Conspiratorial Thinking over the Course of the 2016 United States Presidential Election: ALongitudinal Analysis." *European Journal of Social Psychology* 48: 1011–1018.

Golec de Zavala, A., K. Dyduch-Hazar, and D. Lantos. 2019. "Collective Narcissism: Political Consequences of Investing Self-worth in the Ingroup's Image." *Political Psychology* 40: 37–74. https://doi.org/10.1111/pops.12569.

Golec de Zavala, A., and C. Federico. 2024. "The Fathers Love. Collective Narcissism and Defensive Reactions to Allegations Against John Paul II." *Public Opinion Quarterly* 88, no. 2: 291–314. https://doi.org/10.1093/poq/nfae008bib>

Golec de Zavala, A., C. M. Federico, and T. Baran. 2025. *Collective Narcissism and Authoritarianism on the Right and the Left*. https://doi.org/10.13140/RG.2.2.23356.76167.

Golec de Zavala, A., C. M. Federico, C. Sedikides, et al. 2020. "Low Self-Esteem Predicts Out-Group Derogation via Collective Narcissism, but This Relationship Is Obscured by In-Group Satisfaction." *Journal of Personality and Social Psychology* 119, no. 3: 741–764. https://doi.org/10.1037/pspp0000260.

Golec de Zavala, A., and O. Keean. 2023. "Collective Narcissism in Advantaged and Disadvantaged groups." In *The Psychology of Politically Unstable Societies. Current Issues in Political Psychology*, edited by A. Kende, and B. Lášticová, 119–136. Routledge.

Golec de Zavala, A., and O. Keenan. 2021. "Collective Narcissism as a Framework for Understanding Populism." *Journal of Theoretical Social Psychology* 5, no. 2: 54–64. https://doi.org/10.1002/jts5.69.

Golec de Zavala, A., and O. Keenan. 2024. "National and Gender Collective Narcissism and Pursuit of Gender Equality." *Sex Roles*, 90: 565–586. https://doi.org/10.1007/s11199-024-01443-8.

Golec de Zavala, A., O. Keenan, M. Ziegler, et al. 2024. "Mindful-Gratitude Practice Reduces Prejudice at High Levels of Collective Narcissism." *Psychological Science* 35, no. 2: 137–149. https://doi.org/10.1177/09567976231220902.

Golec de Zavala, A., and D. Lantos. 2020. "Collective Narcissism and Its Social Consequences: The Bad and the Ugly." *Current Directions in Psychological Science* 29, no. 3: 273–278. https://doi.org/10.1177/0963721420917703.

Gordon, D., and M. Birney. 2025. "Science Denial as an Expression of Spite: An Exploration Into the Role of Spite in Conspiracy Theory Beliefs." *Journal of Social Issues*.

Górska, P., M. Marchlewska, D. Szczepańska, Z. Molenda, P. Michalski, and A. Furman. 2022. "A Vicious Circle? Longitudinal Relationships Between Different Modes of In-Group Identity and COVID-19 Conspiracy Thinking." *Journal of Social Psychology* 163, no. 6: 877–894. https://doi.org/10.1080/00224545.2022.2111250.

Gronfeldt, B., A. Cislak, A. Sternisko, I. Eker, and A. Cichocka. 2023. "A Small Price to Pay: National Narcissism Predicts Readiness to Sacrifice In-Group Members to Defend the In-Group's Image." *Personality and Social Psychology Bulletin* 49, no. 4: 612–626. https://doi.org/10.1177/01461672221074790.

Hayes, A. 2022. *Introduction to Mediation, Moderation, and Conditional Process Analysis. Third Edition. A Regression-Based Approach*. Guilford Press.

Hendin, H. M., and J. M. Cheek. 1997. "Assessing Hypersensitive Narcissism: A Reexamination of Murray's Narcism Scale." *Journal of Research in Personality* 31, no. 4: 588–599. https://doi.org/10.1006/jrpe.1997.2204.

Ho, A. K., J. Sidanius, N. Kteily, et al. 2015. "The Nature of Social Dominance Orientation: Theorizing and Measuring Preferences for Intergroup Inequality Using the New SDO7 Scale." *Journal of Personality and Social Psychology* 109, no. 6: 1003–1028. https://doi.org/10.1037/pspi0000033.

Ishwaran, H., and U. B. Kogalur. 2019. "Fast Unified Random Forests for Survival, Regression, and Classification (RF-SRC)." *R Package Version* 2, no. 1:.

Jackson, J. W., and E. R. Smith. 1999. "Conceptualizing Social Identity: A New Framework and Evidence for the Impact of Different Dimensions." *Personality and Social Psychology Bulletin* 25, no. 1: 120–135. https://doi.org/10.1177/0146167299025001010.

Keenan O., and A. Golec deZavala. 2021. "Collective Narcissism and Weakening of American Democracy." *Analyses of Social Issues and Public Policy* 21: 237–258. https://doi.org/10.1111/asap.12274.

Keenan, O., and A. Golec de Zavala. 2024. *Collective Narcissism, White Supremacy and Minorities Resistance*. PsyArXiv, https://osf.io/preprints/psyarxiv/f8rkz.

Kerr, J. R., and M. S. Wilson. 2021. "Right-Wing Authoritarianism and Social Dominance Orientation Predict Rejection of Science and Scientists." *Group Processes & Intergroup Relations* 24, no. 4: 550–567. https://doi.org/10.1177/1368430221992126.

Krizan, Z., and A. D. Herlache. 2018. "The Narcissism Spectrum Model: A Synthetic View of Narcissistic Personality." *Personality and Social Psychology Review* 22: 3–31. https://doi.org/10.1177/1088868316685018.

Kruglanski, A. W., A. Pierro, L. Mannetti, and E. De Grada. 2006. "Groups as Epistemic Providers: Need for Closure and the Unfolding of Group-centrism." *Psychological Review* 113, no. 1: 84–100. https://doi.org/10.1037/0033-295X.113.1.84.

Kruglanski, A. W., and D. M. Webster. 1996. "Motivated Closing of the Mind: "Seizing" and "Freezing." *Psychological Review* 103, no. 2: 263–283. https://doi.org/10.1037/0033-295X.103.2.263.

Kunda, Z. 1990. "The Case for Motivated Reasoning." *Psychological Bulletin* 108, no. 3: 480–498. https://doi.org/10.1037/0033-2909.108.3.480.

Lantos, D., R. C. M. Mole, and A. Golec de Zavala. 2024. "Born this Way? National Collective Narcissism, Implicit Homophobia, and Homosexual Essentialism in Populist Poland." *Archives of Sexual Behavior* 53: 3907–3924 https://doi.org/10.1007/s10508-024-02952-z.

Lasco, G. 2020. "Medical Populism and the COVID-19 Pandemic." *Global Public Health* 15, no. 10: 1417–1429. https://doi.org/10.1080/17441692.2020.1807581.

Leach, C. W., M. van Zomeren, S. Zebel, et al. 2008. "Group-Level Self-Definition and Self-Investment: A Hierarchical (Multicomponent) Model of In-Group Identification." *Journal of Personality and Social Psychology* 95, no. 1: 144–165. https://doi.org/10.1037/0022-3514.95.1.144.

Levy, S., C. Monahan, A. Araiza, L. Ramirez, and X. Palacios-Espinosa. 2025. "Reducing Climate Change Denial and Increasing Support for Climate-Friendly Policies: The Role of Climate Change Education." *Journal of Social Issues*.

Lewandowsky, S., U. K. H. Ecker, C. Seifert, N. Schwarz, and J. Cook. 2012. "Misinformation and Its Correction: Continued Influence and Successful Debiasing." *Psychological Science in the Public Interest* 13: 106–131.

Lewandowsky, S., M. E. Mann, N. J. L. Brown, and H. Friedman. 2016. "Science and the Public: Debate, Denial, and Skepticism." *Journal of Social and Political Psychology* 4, no. 2: 537–553. https://doi.org/10.1177/1529100612451018.

Lewandowsky, S., K. Oberauer, and G. E. Gignac. 2013. "NASA Faked the Moon Landing—Therefore, (Climate) Science Is a Hoax: An Anatomy of the Motivated Rejection of Science." *Psychological Science* 24, no. 5: 622–633. https://doi.org/10.1177/0956797612457686.

Liu, D. W. C. 2012. "Science Denial and the Science Classroom." *CBE-Life Sciences Education* 11: 129–134.

Lynam, D. R., R. H. Hoyle, and J. P. Newman. 2006. "The Perils of Partialling: Cautionary Tales From Aggression and Psychopathy." *Assessment* 13, no. 3: 328–341. https://doi.org/10.1177/1073191106290562.

MacKinnon, D., J. L. Krull, and C. M. Lockwood. 2000. "Equivalence of the Mediation, Confounding and Suppression Effect." *Prevention Science* 1, no. 4: 173–181. https://doi.org/10.1023/A:1026595011371.

Marchlewska, M., K. Hamer, M. Baran, P. Górska, and K. Kaniasty. 2022. "COVID-19: Why Do People Refuse Vaccination? The Role of Social Identities and Conspiracy Beliefs: Evidence From Nationwide Samples of Polish Adults." *Vaccines*. 10, no. 2: 268. https://doi.org/10.3390/vaccines10020268.

Meyer, Y., and N. Kramer. 2022. *General Science Skepticism: Development and Validation of a New Scale, PsyArX*. https://doi.org/10.31234/osf.io/x9jng.

Michalski, P., M. Marchlewska, P. Górska, M. Rogoza, Z. Molenda, and D. Szczepańska. 2023. "When the Sun Goes Down: Low Political Knowledge and High National Narcissism Predict Climate Change Conspiracy Beliefs." *Journal of Social Psychology* 164, no. 6: 1042–1058. https://doi.org/10.1080/00224545.2023.2237176.

Miller, J. D., M. D. Back, D. R. Lynam, and A. G. C. Wright. 2021. "Narcissism Today: What We Know and What We Need to Learn." *Current Directions in Psychological Science* 30, no. 6: 519–525. https://doi.org/10.1177/09637214211044109.

Miller, J. D., D. R. Lynam, C. S. Hyatt, and W. K. Campbell. 2017. "Controversies in Narcissism." *Annual Review of Clinical Psychology* 13: 291–315. https://doi.org/10.1146/annurev-clinpsy-032816-045244.

Mole, R. C., A. Golec de Zavala, and M. M. Ardag. 2021. "Homophobia and National Collective Narcissism in Populist Poland." *European Journal of Sociology/Archives Européennes De Sociologie* 62, no. 1: 37–70.

Morgan, J., J. A. Wagoner, and T. Pyszczynski. 2023. "Psychosocial Determinants of COVID-19 Vaccine Hesitancy and the Mediating Role of Various Attitudes Towards Science." *Vaccines* 11, no. 8: 1310. https://doi.org/10.3390/vaccines11081310.

Morgan, M., W. B. Collins, G. G. Sparks, and J. R. Welch. 2018. "Identifying Relevant Anti-Science Perceptions to Improve Science-Based Communication: The Negative Perceptions of Science Scale." *Social Sciences* 7, no. 4: 64. https://doi.org/10.3390/socsci7040064.

Nowak, B., P. Brzóska, J. iotrowski, C. Sedikides, M. Żemojtel-Piotrowska, and P. Jonason. 2020. "Adaptive and Maladaptive Behavior During the COVID-19 Pandemic: The Roles of Dark Triad Traits, Collective Narcissism, and Health Beliefs." *Personality and Individual Differences* 167: 110232. https://doi.org/10.1016/j.paid.2020.110232.

Orth, U., S. Krauss, and M. D. Back. 2024. "Development of Narcissism Across the Life Span: A Meta-Analytic Review of Longitudinal Studies." *Psychological Bulletin* 150, no. 6: 643–665. https://doi.org/10.1037/bul0000436.

Pennycook, G., and D. Rand. 2020. "Who Falls for Fake News? The Roles of Bullshit Receptivity, Overclaiming, Familiarity, and Analytic Thinking." *Journal of Personality* 88: 185–200. 10.1111/jopy.12476.

Piff, P. K. 2014. "Wealth and the Inflated Self Class, Entitlement, and Narcissism." *Personality and Social Psychology Bulletin* 40: 34–43. https://doi.org/10.1177/0146167213501699.

Qin, X. 2024. "Sample Size and Power Calculations for Causal Mediation Analysis: A Tutorial and Shiny App." *Behavioral Research* 56: 1738–1769. https://doi.org/10.3758/s13428-023-02118-0.

Reif, A., M. Taddicken, L. Guenther, J. T. Schröder, and P. Weingart. 2024. "The Public Trust in Science Scale: A Multilevel and Multidimensional Approach." *Science Communication, 0(0)*. https://doi.org/10.1177/10755470241302758.

Roccas, S., Y. Klar, and I. Liviatan. 2006. "The Paradox of Group-Based Guilt: Modes of National Identification, Conflict Vehemence, and Reactions to the In-Group's Moral Violations." *Journal of Personality and Social Psychology* 91, no. 4: 698–711. https://doi.org/10.1037/0022-3514.91.4.698.

Rosseel, Y. 2012. "lavaan: an R Package for Structural Equation Modeling." *Journal of Statistical Software* 48, no. 2: 1–36. http://www.jstatsoft.org/v48/i02/.

Rutjens, B. T., R. M. Sutton, and R. van der Lee. 2018. "Not all Skepticism Is Equal: Exploring the Ideological Antecedents of Science Acceptance and Rejection." *Personality and Social Psychology Bulletin* 44, no. 3: 384–405. https://doi.org/10.1177/0146167217741314.

Seddig, D., D. Maskileyson, E. Davidov, I. Ajzen, and P. Schmidt. 2022. "Correlates of COVID-19 Vaccination Intentions: Attitudes, Institutional Trust, Fear, Conspiracy Beliefs, and Vaccine Skepticism." *Social Science & Medicine* 302: 114981.

Sedikides, C. 2021. "In Search of Narcissus." *Trends in Cognitive Sciences* 25, no. 1: 67–80. https://doi.org/10.1016/j.tics.2020.10.010.

Simmons, J. P., L. D. Nelson, and U. Simonsohn. 2011. "False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant." *Psychological Science* 22, no. 11: 1359–1366. https://doi.org/10.1177/0956797611417632.

Sinatra, G. M., D. Kienhues, and B. K. Hofer. 2014. "Addressing Challenges to Public Understanding of Science: Epistemic Cognition, Motivated Reasoning, and Conceptual Change." *Educational Psychologist* 49, no. 2: 123–138.

Sternisko, A., A. Cichocka, A. Cislak, and J. J. Van Bavel. 2023. "National Narcissism Predicts the Belief in and the Dissemination of Conspiracy Theories During the COVID-19 Pandemic: Evidence From 56 Countries." *Personality and Social Psychology Bulletin* 49, no. 1: 48–65. https://doi.org/10.1177/01461672211054947.

Szczepańska, D., M. Marchlewska, A. Karakula, Z. Molenda, P. Górska, and M. Rogoza. 2022. "Dedicated to Nation but against Women? National Narcissism Predicts Support for Anti-Abortion Laws in Poland." *Sex Roles* 87: 99–115.

Turner, J. C., M. A. Hogg, P. J. Oakes, S. D. Reicher, and M. S. Wetherell. 1987. *Rediscovering the Social Group: A Self-Categorization Theory*. Basil Blackwell.

Uscinski, J. E., A. M. Enders, M. I. Seelig, et al. 2021. "American Politics in Two Dimensions: Partisan and Ideological Identities Versus Anti-

Establishment Orientations." *American Journal of Political Science* 65: 877–895. 10.1111/ajps.12616.

Uscinski, J. E., S. Littrell, M. Seelig, et al. 2025. "Belief in Science-Related Conspiracy Theories." *Journal of Social Issues*.

Vaal, S., M. B. Schofield, I. S. Baker et al. 2023. "Narcissism, National Narcissism, COVID-19 Conspiracy Belief, and Social media Use as Predictors of Compliance With COVID-19 Public Health Guidelines." *Current Psychology* 42: 26868–26875. https://doi.org/10.1007/s12144-022-03715-6.

van Bavel, J. J., A. Cichocka, V. Capraro et al. 2022. "National Identity Predicts Public Health Support During a Global Pandemic." *Nature Communications* 13: 517. https://doi.org/10.1038/s41467-021-27668-9.

Vater, A., S. Moritz, and S. Roepke. 2018. "Does a Narcissism Epidemic Exist in Modern Western Societies? Comparing Narcissism and Self-Esteem in East and West Germany." *PLOS ONE* 13, no. 1: e0188287. https://doi.org/10.1371/journal.pone.0188287.

Washburn, A. N., and L. J. Skitka. 2018. "Science Denial Across the Political Divide: Liberals and Conservatives Are Similarly Motivated to Deny Attitude-Inconsistent Science." *Social Psychological and Personality Science* 9, no. 8: 972–980. https://doi.org/10.1177/1948550617731500.

Webster, D. M., and A. W. Kruglanski. 1994. "Individual Differences in Need for Cognitive Closure." *Journal of Personality and Social Psychology* 67, no. 6: 1049–1062. https://doi.org/10.1037/0022-3514.67.6.1049.

Weintrobe, S. 2021. *Psychological Roots of the Climate Crisis: Neoliberal Exceptionalism and the Culture of Uncare*. Bloomsbury Academic.

Wolf, E. J., K. M. Harrington, S. L. Clark, and M. W. Miller. 2013. "Sample Size Requirements for Structural Equation Models: An Evaluation of Power, Bias, and Solution Propriety." *Educational and Psychological Measurement* 76, no. 6: 913–934. https://doi.org/10.1177/0013164413495237.

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