



# Differences in experiences of discrimination: an investigation of personality and person based characteristics in a twin difference design

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## Abstract

Although discrimination experiences are widespread, experiences of discrimination are not equally distributed among potentially affected groups. Despite the fact that the empirical literature offers a broad variety of potential variables that are associated with discrimination experiences, these variables are seldom contrasted, and potential confounds are not conclusively controlled for. Especially for controlling confounds, twin difference designs constitute an advantageous approach. The aim of this study was to identify variables that lead to a higher probability to experience discrimination, and then model these variables in a twin difference design to test whether they exert quasi-causal effects. For this purpose, longitudinal data from the German Twin study *TwinLife* were analyzed using mixed logistic models with over 1,000 twin pairs. Migration history was the strongest predictor of discrimination experiences across all analyses. Lower self-esteem showed quasi-causal associations to discrimination experiences, underpinning the consequences discrimination experiences might have on self-evaluation. However, initial self-esteem can also function as a cognitive concept guiding future interpretations of potentially discriminating events. Although other personality based features also showed significant associations, this study casts doubt that personality factors can be conclusively regarded as antecedents of discrimination experiences.

**Keywords** Discrimination experiences · Twin difference design · Self-esteem · Migration

Discrimination is a widespread issue, as highlighted by various studies. The European Union Agency for Fundamental Rights (2019) found that nearly 40% of immigrants and ethnic minorities encountered discrimination over a five-year span.

Discrimination experiences do not occur at random but are tied to individual traits and social identities. Accordingly, being a member of an ethnic minority group tends to increase the risk of experiencing discrimination. For example, more than 20% of European residents originating in first or second generation from a non-western country reported feeling discriminated against as members of their specific minority group (Oudhof, 2007). In contrast, approximately 5% of native Europeans reported discrimination based on other characteristics such as religion, language, age, gender,

or sexuality. In addition to these between-group differences, the above percentages indicate that there is also variation within social groups: Not all members of a certain social group seem to experience discrimination to the same degree. In this study we focus on individual experiences of discrimination, defining experiences of discrimination as “when people are treated less favorably than other people are in a comparable situation only because they belong, or are perceived to belong to a certain group or category of people.” (Council of Europe, 2012, para. 2).

Discrimination experiences seem to be shaped by a complex interplay between individual characteristics and situational factors (Major & Dover, 2016). This notion highlights that while external circumstances play a significant role in discrimination experiences (Quillian et al., 2019), evidence shows that numerous individual traits are associated with experiences of discrimination as well (e.g., De Freitas et al., 2018). Understanding the role of individual characteristics can help shed more light on the complex phenomenon of discrimination experiences.

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On the one hand, there is an extensive body of evidence that ethnicity and ethnicity related physical features (e.g. Filut et al., 2020; Quillian et al., 2019), but also physical features independent of ethnicity play a role in discriminatory experiences, e.g. obesity (Spahlholz et al., 2016) or physical attractiveness (Kukkonen et al., 2023). For obesity, a meta-analysis of discrimination experience prevalence showed that roughly 20% of persons with mild obesity reported discrimination experiences and persons with severe obesity showed prevalence rates of 40% in contrast to 6% for persons with no obesity (Spahlholz et al., 2016). A recent systematic review revealed that individual differences in attractiveness can result in unequal treatment in the labor market, while higher attractiveness seems advantageous (Kukkonen et al., 2023). However, the effects were more complex for women, with a stronger context dependency of the effect. A more fine-grained study on victimization for discrimination experiences revealed that more attractiveness and a lighter skin tone were associated with a lower risk of being a victim of discrimination (Cawvey et al., 2017).

On the other hand, various personality traits seem to be associated with the experience of discrimination. Concerning Big Five personality traits, discrimination experiences were linked to lower scores in Agreeableness and higher scores in Neuroticism (McClendon et al., 2019). A cross-lagged design study on personality revealed that persons high in Neuroticism and low in Conscientiousness reported more experiences of discrimination, more chronic discrimination, or increases in the degree of perceived discrimination, whereas higher Extraversion was linked to lower discrimination rates (Sutin et al., 2016). Furthermore, longitudinal analyses indicated that Neuroticism increased, whereas Agreeableness and Conscientiousness decreased after experiencing discrimination. Cawvey et al., (2017) found similar patterns, where lower Conscientiousness, lower Agreeableness, and lower Emotional Stability scores were associated with discrimination experiences. However, the evidence for personality traits and their association to discrimination experiences appears to be underdeveloped and inconsistent, except for Neuroticism which consistently shows negative associations with discrimination experiences (Xiang et al., 2018).

Additionally, self-esteem seems to be one of the core trait-like aspects associated with social exclusion processes. In one study, Thijs and Piscoi (2016) examined how discrimination experiences and victimization in general were associated with self-esteem and emotional problems. Although victimization per se showed associations to lower self-esteem, the attribution of victimization to discrimination showed a self-protective moderation, weakening the effect on self-esteem. In contrast, there was an association

between peer victimization and emotional problems that was not moderated by the attribution made. As this study used cross-sectional data, it was not possible to distinguish, whether lower self-esteem and emotional problems were an antecedent or a consequence of victimization. The negative relationship between self-esteem and discrimination experiences was also shown in a meta-analysis (De Freitas et al., 2018).

Various studies have investigated the link of discrimination experiences and internalizing or externalizing symptoms (Bennett et al., 2020; Castro et al., 2022; De Freitas et al., 2018; Forster et al., 2022). Concerning internalizing symptoms, studies have shown that discrimination experiences were linked to symptoms of depression and anxiety (Forster et al., 2022). Using a longitudinal cross lagged design, Castro et al. (2022) showed that discrimination was associated to internalizing. More interestingly, they found a bidirectional relationship, i.e. internalizing was a predictor and a consequence of discrimination experiences. Discrimination as an antecedent of later internalizing and externalizing symptoms was also corroborated by Bennett et al. (2020), who found that discrimination experiences were predictive for higher internalizing and externalizing symptoms at a later time point. A meta-analysis underpinned the association between discrimination experiences and externalizing and internalizing symptoms (De Freitas et al., 2018).

There is a surprising lack of empirical studies on other personal characteristics potentially involved in discrimination experiences. Some research has targeted traits such as cognitive abilities or locus of control; however, results were mixed. In one study, it was found that higher intelligence was weakly associated with a lower rate of discrimination experiences (Kirkegaard, 2017). However, a study by Diehl and Liebau (2017) showed that groups of migrants with higher education tended to report more experiences with discrimination. On the one hand, higher cognitive skills may lead to the individual selection of a more academic environment, which could have an influence on the probability of experiencing discrimination. On the other hand, higher education and higher cognitive ability may raise the awareness of discrimination as a societal problem and thus raise the salience of attributions to discrimination. Concerning locus of control, an earlier study revealed that females with an internal locus of control tended to perceive a higher amount of sex discrimination (Lanier & Barnett, 1996).

Research indicates that experiences of discrimination may have a genetic influence to some extent (Das, 2019; Cuevas et al. 2021). So, when examining how certain traits relate to discrimination experiences, genetic factors can confound the observed associations. To address this, twin difference designs have emerged as a method to mitigate genetic confounding and isolate environmental

influences. Unlike traditional twin studies that estimate genetic and environmental components (see McAdams et al., 2021 for an overview on twin methods), twin difference designs focus on the within-twin pair variance, controlling for shared genetics and common environmental factors instead (Schwartz, 2017). The remaining within-twin pair variance captures unique, non-shared environmental influences. By correlating within-twin pair differences with an outcome, environmentally mediated effects, referred to as "quasi-causal" effects, can be revealed. These effects provide stronger indications of causality compared to traditional correlation coefficients. Twin difference models can also be extended to multivariate approaches, allowing researchers to study the relationships between multiple traits and an outcome simultaneously. Therefore, multivariate twin difference models provide a versatile framework for investigating multiple potentially quasi-causal relationships.

## Aim of the present study

Despite the fact that the empirical literature offers a broad variety of potential variables that can contribute to the experience of discrimination, these variables are seldom contrasted, and potential confounds are not conclusively controlled for. Especially for controlling confounds, twin designs are ideal: Twins are naturally matched for a number of variables, which potentially play a role in the experience of discrimination (monozygotic twins share: age, gender, social background and origin, as well as basic physical appearance; dizygotic twins share the aforementioned attributes but can vary in gender and typically show less similarities in basic physical appearance). In a co-twin difference design, differences in discrimination experiences can be analyzed against within-pair differences in psychological or physical variables. This may provide vital hints at quasi-causal relations in explaining discrimination experiences since latent confounders such as shared familial background or genetic influences can be controlled for.

In summary, the first aim of the study is to test, on an individual level, to what extent experiences of discrimination depend on physical features and individual personality-like constructs in a twin-based sample while taking multiple variables concerning demographics, physical appearance and personality-related variables into account. Drawing data from an extensive panel study featuring numerous variables enables us to capture shared proportions of variance and investigate the distinct impacts of specific variables that are seldom investigated jointly. The second aim of the study is to test to what extent differences in experiences of discrimination are associated with twins' differences in the

aforementioned variables, potentially hinting at quasi-causal associations with experiences of discrimination.

## Method

This study has been preregistered at the osf (<https://osf.io/hpuz2/>). Accordingly, changes regarding the preregistration are stated in the manuscript.

## Sample

The sample was taken from the ongoing longitudinal family-based twin study *TwinLife*, which incorporates approximately 4,100 German families (Hahn et al., 2016). *TwinLife* aims to investigate the development of individual differences in life chances by considering multiple dimensions of social inequality. Although primarily a twin study of same-sex mono- and dizygotic twin pairs, *TwinLife* conducts yearly interviews with all family members available in a household (parents, twins, siblings, step-parents, partner of twins), and therefore, the dataset can be utilized in many different ways. Twins were sampled so that they represent four age cohorts (5, 11, 17 and 23 mean age at the first assessment) spanning a developmental window from young childhood to early adulthood. At the time of the analyses, *TwinLife* data (Diewald et al., 2019) from the first two survey waves were available. It is accessible free of charge after signing a data use agreement.

For the analyses, adolescent and young adult twin data from the first (data assessment in 2014/15) and second wave (data assessment in 2016/17) of *TwinLife* were used, resulting in a sample of 2,001 twin pairs who provided data on experiences of discrimination (twins aged on average 17/19 or 23/25). For the longitudinal analyses, data from the second wave of *TwinLife* were used. A significant proportion of twin families participated again (roughly 2,730 families or 66%) in the second wave of *TwinLife*. However, the participation rates of the two oldest cohorts was slightly lower than in the younger cohorts in the second wave (likely due to higher mobility among young adults, leading to more non-contacts), resulting in a sample size for the longitudinal analyses of 962 twin pairs (48% of the initial sample). Nevertheless, the participation rates are comparable to other panel studies, which have reported similar participation rates in subsequent survey waves (e.g. SOEP; Gramlich, 2008).

## Measurement

Means, standard deviations and reliability coefficients for all constructs of interest are reported in Table 1. Further information on the items and scales (e.g., exact item wording) can be found elsewhere (see Klatzka et al., 2023).

**Table 1** Descriptive statistics on all variables, separately for mono- and dizygotic twins and for the total sample

Construct (coding)	Monozygotic		Dizygotic		Total		Mis	
	<i>N</i>		<i>N</i>		<i>N</i>			
Migration status	2040		2038		4078		0.1%	–
No first or second generation immigration history (0)	1524 (74.7%)		1630 (80.0%)		3154 (77.3%)			
One parent immigrated (1)	208 (10.2%)		160 (7.8%)		372 (9.1%)			
Both parents immigrated but children born in Germany (2)	234 (11.5%)		196 (9.6%)		430 (10.5%)			
Whole family immigration (3)	74 (3.6%)		52 (2.6%)		126 (3.1%)			
Sex (% females)	57.8%		57.5%		57.7%			
	<i>N</i>	<i>M (SD)</i>	<i>N</i>	<i>M (SD)</i>	<i>N</i>	<i>M (SD)</i>	Mis	$\alpha_{\text{Cron}}$
Age—Wave 1	2044	20.11 (3.09)	2040	19.71 (3.04)	4084	19.91 (3.08)	–	–
Age—Wave 2	1142	21.93 (3.07)	1156	21.51 (2.99)	2298	21.72 (3.04)	–	–
<b>Outcome</b>								
Discrimination experienced—yes (in Percent)—Wave 1	2021	11%	2018	10%	4039	11%	1.1%	–
Discrimination experienced—yes (in Percent)—Wave 2	1080	12%	1085	12%	2165	12%	47.0%	–
<b>Predictors</b>								
BMI—Wave 1	1836	22.17 (3.82)	1795	22.27 (3.97)	3631	22.22 (3.90)	11.1%	–
BMI—Wave 2	998	22.67 (4.28)	1007	22.92 (4.02)	2005	22.80 (4.15)	51.0%	–
Attractiveness—Wave 2 (-5 – 5)	1128	1.18 (1.45)	1164	1.08 (1.41)	2292	1.13 (1.43)	59.0%	0.48
Internalizing—Emotional Symptoms—Wave 1 (1–3)	2037	1.60 (0.46)	2037	1.61 (0.46)	4074	1.60 (0.46)	0.5%	0.72
Internalizing—Peer problems—Wave 1 (1–3)	2037	1.36 (0.38)	2037	1.42 (0.40)	4074	1.39 (0.39)	0.5%	0.46
Externalizing—Hyperactivity—Wave 1 (1–3)	2037	1.59 (0.44)	2037	1.63 (0.45)	4074	1.61 (0.44)	0.5%	0.64
Externalizing—Conduct Problems—Wave 1 (1–3)	2037	1.26 (0.25)	2036	1.28 (0.25)	4073	1.27 (0.25)	0.5%	0.38
Cognitive ability—Wave 1 (0- 56)	2027	40.33 (7.49)	2027	39.35 (8.39)	4054	39.84 (7.97)	2.3%	0.71
Openness—Wave 1 (1–7)	2037	4.99 (1.02)	2037	4.89 (1.07)	4074	4.94 (1.05)	0.3%	0.62
Conscientiousness—Wave 1 (1–7)	2037	5.27 (1.05)	2037	5.17 (1.08)	4074	5.22 (1.07)	0.3%	0.62
Extraversion—Wave 1 (1–7)	2037	4.86 (1.32)	2037	4.86 (1.33)	4074	4.86 (1.33)	0.3%	0.78
Agreeableness—Wave 1 (1–7)	2037	5.58 (0.94)	2037	5.47 (0.99)	4074	5.52 (0.97)	0.3%	0.48
Neuroticism—Wave 1 (1–7)	2037	4.20 (1.23)	2037	4.22 (1.24)	4074	4.21 (1.24)	0.3%	0.59
Self-Esteem—Wave 1 (1–5)	2035	3.88 (0.82)	2037	3.78 (0.83)	4072	3.83 (0.82)	0.3%	0.77
Self-Esteem—Wave 2 (1–5)	1017	3.94 (0.78)	1023	3.89 (0.78)	2040	3.92 (0.78)	50.4%	0.76
Locus of control—Internal Locus- Wave 2 (1–5)	1005	4.20 (0.55)	1016	4.19 (0.57)	2021	4.19 (0.56)	51.0%	0.36
Locus of control—External Locus- Wave 2 (1–5)	987	2.81 (0.69)	971	2.85 (0.70)	1958	2.83 (0.70)	51.5%	0.24

Note. (coding) = Possible value range of the construct, Mis. = Maximum missingness per item, M = Mean of the scale, SD = Standard deviation,  $\alpha_{\text{Cron}}$  = Cronbach's Alpha

## Discrimination experiences

In *Twinlife*, discrimination experiences were operationalized by a set of general questions. All participants aged 13 or older were asked the following: “In the past 12 months, have you been disadvantaged or been worse off in comparison to other people based on a personal feature (for instance based on your origin, gender, religion or ideology)?” If people answered yes, the reason for being disadvantaged were inquired (origin, gender, religion/ideology, age, sexual identity or handicap). Origin, religion and gender were the most common answers (T1: 42%, 27% and 22%, T2: 26%, 22% and 30%, respectively). Questions on discrimination experiences were part of the survey in both waves, so changes in experiences of discrimination can also be modelled.

Discrimination experiences were used as a binary criterion variable.

## Attractiveness

Self-perceived attractiveness (“How would you evaluate your physical attractiveness in comparison to other persons your own age or gender?”), evaluation on the co-twin's attractiveness (“How would you evaluate your twin's physical attractiveness in comparison to other persons your own age or gender?”) and the interviewer's evaluation (“Please evaluate the physical attractiveness of the twin in comparison to persons the same age and gender.”), answered on a 11-point-scale (ranging from “much more unattractive” to “much more attractive”), were included in the survey during

the second wave. The question originated from Lutz et al., (2013). A mean score across all three evaluations was calculated for all analyses.

### Migration status

As discussed previously, persons with a migration background appear to have a greater risk of experiences discrimination. Thus, information on migration background was used indicating whether participants had a) no migration status b) migrated to Germany themselves with their family or c) are children of one or d) two migrants, but born themselves in Germany.

### Body-Mass-Index (BMI)

Weight and height of the twins were provided via self-report in both wave one and two of the survey. These measures were used to calculate individual BMIs as an indicator for obesity.

### Personality

To assess the Big Five personality traits, the Big Five Inventory – Short Version (BFI-S, Gerlitz & Schupp, 2005) was used. Each of the five subscales comprised either four (for Openness) or three (for the remaining four dimensions) items. Participants provided answers on a 7-point-scale (ranging from “does not apply to me at all” to “applies to me perfectly”). Personality assessment was conducted as part of the survey in wave one.

### Cognitive ability

In the first wave of *Twinlife*, the Culture Fair Test (CFT-20-R, Weiß et al., 2006) was employed as a proxy for general cognitive ability. The CFT-20-R comprises four subtests (figural reasoning, figural classification, matrices and reasoning), each with 11 or 15 items, and was completed by all participants in a computer-based format. Overall sum scores were used in all analyses. Additional information on the validity and reliability of the measure, please refer to Gottschling et al. (2019).

### Self-esteem

Self-esteem was assessed using a shortened version of the Rosenberg Self-esteem Scale (Rosenberg, 1965). It consisted of three statements with a 5-point-scale (ranging from “strongly disagree” to “strongly agree”). This scale was part of the survey in waves one and two.

### Locus of control

Locus of control was assessed with an adapted version of the scales used in the SOEP study (Goebel et al., 2018). There were two subscales for internal vs. external locus, consisting each of two items with a 5-point-scale (ranging from “fully disagree” to “fully agree”). Locus of control assessment was in the survey during wave two.

### Internalizing/Externalizing

Internalizing and externalizing behavior were assessed using an adapted version of the Strengths and Difficulties Questionnaire (SDQ, Goodman et al., 1998). Internalizing behaviors consisted of two sub scales (problems with peers, emotional symptoms), and externalizing behaviors also consisted of two sub scales (hyperactivity, conduct problems). Every scale contained five items with a 3-point-scale (ranging from “not true” to “certainly true”).

### Other variables

**Zygosity** Zygosity was assessed with a similarity questionnaire (Oniszczenko et al., 1993), which had been completed by the twins during data collection in wave one. As indicated by Lenau et al. (2017), assessments of zygosity using this questionnaire yielded high accuracy when validated with a DNA-based test (92–96%). Zygosity was coded as 0 for monozygotic twins and 1 for dizygotic twins.

### Analyses

**Selection of variables** In a first set of analyses, all independent variables were used to predict whether a twin had experienced discrimination. We conducted multilevel logistic regression, with the twin pairs on level 2 and the individual twins on level 1, to account for the interdependencies among twins. Since gender and migration history are identical in the twin pairs, they were modelled as level 2 predictors. Explanatory variables were added all at once in a first step. Deviating from the preregistration, the backwards elimination algorithm was used as it was deemed more suitable given the large number of variables in our analyses. In this stepwise approach, the non-significant variable with the highest p-value is dropped and the model is recalculated without this variable. The procedure is repeated until only significant predictors remain. These analyses were conducted a) cross-sectionally at time point 1, b) cross-sectionally at time point 2 (as different variables were available at differing time points) and c) longitudinally with and



without control for prior discrimination experiences. Overall, four models are reported.

**Twin difference analyses** In the next step, we addressed the question, whether some of the effects identified in the prior analyses have quasi-causal quality using a twin difference design. The twin difference design minimizes the extent to which genetic and other shared influences may serve as cofounders of associations of interest (McAdams et al., 2021). More specifically, the twin difference design decomposes the variance of the independent variables into a between-pair (i.e., twins' mean) component and a within-pair component (i.e., twin's individual deviation of that mean, the twins' difference). A significant between-pair-effect can be interpreted similarly to a more traditional regression-based effect and still contains genetic and familial influences that are not controlled for by design. However, a significant within-pair effect indicates that twins having a different level in a specific predictor variable have different probabilities to experience discrimination. Since unobserved latent sources of influences that make twins more alike are controlled for, the twin difference effect only reflects unique environmental sources not shared by the twins, allowing for stronger indications of causality, so-called quasi-causal inferences (Schwartz, 2017).

Due to the nested data structure, we employed a multi-level approach, allowing for random intercepts. Deviating from the preregistration, we included interaction terms between the twin differences and zygosity, to investigate if within-cluster relationships differed across zygosity, which could be indicative of genetic confounding. Additionally, modelling zygosity allowed for a much larger sample size and increased power compared to separate analyses for monozygotic and dizygotic twins. Once again, all analyses were conducted cross-sectionally at time point 1 and 2, as well as longitudinally, with and without control for prior discrimination experiences.

**Statistical Analysis** Statistical analyses were conducted using Mplus Version 6.1 (Muthén and Muthén, 2011). Mean scores for all scales were calculated, unless otherwise indicated. Prior to analysis, all variables were standardized, so that 1-unit changes represent  $\pm 1$  standard deviation. Categorical predictors were dummy coded, and continuous variables were recoded to ensure that higher numerical values represented higher manifestations of a given trait. Missing data were handled using Full Information Maximum Likelihood estimation, and no outlier correction was applied.

## Results

Descriptive statistics.

For an overview of all relevant variables, please consult Table 1.

### Selection of variables

For a more detailed description of the results of the variable selection, please consult the supplementary material.

**Wave 1 – Cross-sectional** Significant predictors for discrimination experiences included migration history (one parent:  $\text{Exp}(b) = 2.20$ ,  $p < 0.001$ ; both parents:  $\text{Exp}(b) = 6.50$ ,  $p < 0.001$ ; family:  $\text{Exp}(b) = 5.52$ ,  $p < 0.001$ ), self-esteem ( $\text{Exp}(b) = 0.86$ ,  $p = 0.035$ ), emotional symptoms ( $\text{Exp}(b) = 1.30$ ,  $p = 0.045$ ), Openness ( $\text{Exp}(b) = 1.38$ ,  $p < 0.001$ ), Agreeableness ( $\text{Exp}(b) = 0.85$ ,  $p = 0.009$ ), and Extraversion ( $\text{Exp}(b) = 1.16$ ,  $p = 0.028$ ). Physical appearance, gender, cognitive abilities, externalizing behavior, Conscientiousness, and Neuroticism were not significant.

**Wave 2 – Cross-sectional** Significant predictors were gender (females:  $\text{Exp}(b) = 1.86$ ,  $p = 0.001$ ), migration history (one parent:  $\text{Exp}(b) = 2.33$ ,  $p = 0.010$ ; both parents:  $\text{Exp}(b) = 2.49$ ,  $p = 0.008$ ; family:  $\text{Exp}(b) = 5.69$ ,  $p < 0.001$ ), self-esteem ( $\text{Exp}(b) = 0.82$ ,  $p = 0.033$ ), and external locus of control ( $\text{Exp}(b) = 1.34$ ,  $p = 0.002$ ). Physical appearance did not play a significant role.

**Wave 2 – Longitudinal (uncontrolled)** Significant predictors included gender (females:  $\text{Exp}(b) = 2.01$ ,  $p < 0.001$ ), migration history (one parent:  $\text{Exp}(b) = 2.25$ ,  $p = 0.007$ ; both parents:  $\text{Exp}(b) = 2.16$ ,  $p = 0.011$ ; family:  $\text{Exp}(b) = 4.06$ ,  $p = 0.007$ ), cognitive abilities ( $\text{Exp}(b) = 0.80$ ,  $p = 0.021$ ), Openness ( $\text{Exp}(b) = 1.25$ ,  $p = 0.027$ ), Conscientiousness ( $\text{Exp}(b) = 0.77$ ,  $p = 0.002$ ), Extraversion ( $\text{Exp}(b) = 1.22$ ,  $p = 0.038$ ), peer problems ( $\text{Exp}(b) = 1.35$ ,  $p = 0.001$ ), and external locus of control ( $\text{Exp}(b) = 1.26$ ,  $p = 0.012$ ).

**Wave 2 – Longitudinal (controlled)** After controlling for prior discrimination experiences, migration history (one parent:  $\text{Exp}(b) = 1.80$ ,  $p = 0.016$ ; family:  $\text{Exp}(b) = 2.75$ ,  $p = 0.018$ ) remained significant, while cognitive abilities and Openness were no longer significant. Other effects remained consistent. No significance was found for physical appearance, internal locus of control, hyperactivity, or conduct problems.

## Twin Difference Models

### Wave 1 – Cross-sectional

For more detailed results, please consult Table 2. Consistent with the prior analyses, a migration background was a strong predictor for discrimination experiences in wave 1. In comparison to the no migration history group, having one parent with migration history ( $\text{Exp}(b) = 2.86, p < 0.001$ ), having two parents with a migration history ( $\text{Exp}(b) = 11.20, p < 0.001$ ) or having a migration history as a whole family ( $\text{Exp}(b) = 8.60, p < 0.001$ ) was associated with a higher risk of discrimination experiences.

Concerning twin means, higher Openness scores were linked to discrimination experiences ( $\text{Exp}(b) = 1.68, p < 0.001$ ). Higher Agreeableness scores were associated with a lower chance of discrimination ( $\text{Exp}(b) = 0.73, p = 0.003$ ). Concerning emotional symptoms, higher means were associated with a higher probability for discrimination experiences ( $\text{Exp}(b) = 1.48, p = 0.001$ ).

Regarding the twins' differences, the only twin difference variable that reached significance was self-esteem, indicating that the twin sibling with lower self-esteem was more likely to experience discrimination ( $\text{Exp}(b) = 0.59, p = 0.002$ ).

For emotional symptoms, there was evidence for genetic confounding, as the interaction term of *twin difference x zygosity* was significant ( $\text{Exp}(b) = 1.82, p = 0.027$ ). In DZ twins the association between emotional symptoms and discrimination experiences differed significantly from MZ twins, with an  $\text{Exp}(b)$  of 1.24 and 0.91, respectively.

### Wave 2 – Cross-sectional

Consistent with the prior analyses, being female was associated with a higher risk of discrimination experiences ( $\text{Exp}(b) = 1.63, p = 0.034$ ). Additionally, having a migration history was a significant predictor, but only in the comparison between individuals whose family have a migration history as a whole vs. individuals with no migration history ( $\text{Exp}(b) = 3.97, p = 0.010$ ).

### Wave 2 – Longitudinal

In the analyses without control of prior discrimination experiences, being female was a significant predictor ( $\text{Exp}(b) = 2.06, p = 0.002$ ). Additionally, migration history was a significant predictor of discrimination experiences, but only if one parent or the whole family had a migration history ( $\text{Exp}(b) = 2.68, p = 0.002$ ;  $\text{Exp}(b) = 3.67, p = 0.014$ , respectively). The twins' means of Openness ( $\text{Exp}(b) = 1.35, p = 0.034$ ), Conscientiousness ( $\text{Exp}(b) = 0.69, p = 0.008$ ),

Extraversion ( $\text{Exp}(b) = 1.47, p = 0.012$ ) and peer problems ( $\text{Exp}(b) = 1.43, p = 0.007$ ) predicted a higher likelihood of discrimination experiences, yet no within-twin-pair effects were apparent. Notably, for Openness, DZ twins showed a significantly different effect from MZ twins, with an  $\text{Exp}(b)$  of 1.66 and 0.71, respectively, indicating genetic confounding for these variables.

When controlling for prior discrimination experiences, once again, they were a strong predictor of discrimination experiences in wave 2 ( $\text{Exp}(b) = 7.92, p < 0.001$ ). After controlling for prior discrimination experiences, being female retained its association with a higher risk of experiencing discrimination ( $\text{Exp}(b) = 1.86, p = 0.007$ ). Having a migration background, on the other hand, was no longer a significant predictor. A higher twin mean of Extraversion was associated with a higher risk of discrimination experiences ( $\text{Exp}(b) = 1.58, p = 0.002$ ). Also reporting higher peer problems in wave 1, was associated with a higher risk of discrimination experiences later on ( $\text{Exp}(b) = 1.60, p = 0.001$ ). No twin difference score or interaction score reached significance.

## Additional analyses

### Selectivity analysis

To test for selective panel dropout, we conducted a series of t-tests comparing panel dropouts and individuals who continued to participate in the panel. Corrections for unequal variances were made where necessary. No differences between panel dropouts and individuals who continued to participate were found for sex, zygosity, discrimination experiences, emotional problems, peer problems, hyperactivity, Openness or Conscientiousness. Panel dropouts, however, showed a higher BMI ( $MD = 0.27, t(3633) = 2.09, p = 0.037$ , Cohen's  $d = 0.07$ ), higher conduct problems ( $MD = 0.05, t(3490.7) = 6.38, p > 0.001$ , Cohen's  $d = 0.21$ ), lower cognitive abilities ( $MD = -2.86, t(3512.18) = -11.86, p < 0.001$ , Cohen's  $d = -0.39$ ), higher Extraversion ( $MD = 0.17, t(4076) = 4.10, p < 0.001, d = 0.13$ ) and lower Agreeableness ( $MD = -0.08, t(4076) = -2.69, p = 0.007$ , Cohen's  $d = 0.09$ ). Additionally, the distribution of migration history differed between the two groups (38% with some form of migration status in drop-outs vs. 19% in persons who remained in the study,  $X^2(3) = 69.73, p < 0.001$ ).

## Discussion

The first aim of this study was to identify potential variables that contribute to discrimination experiences. Our analyses revealed that having a migration history was the strongest predictor for experiencing discrimination. This

**Table 2** Results of the twin difference models per time point with discrimination experiences as binary outcome

	T1 – Cross-sectional				T2 – Cross-sectional				T2—Longitudinal w/o control for prior discrimination				T2—Longitudinal controlled for prior discrimination			
	Mean <sub>Twin</sub> Exp(b) [CI-95]	Dev <sub>Twin MZ</sub> Exp(b) [CI-95]	Int <sub>Dz-MZ</sub> Exp(b) [CI-95]	Int <sub>Dz-MZ</sub>	Mean <sub>Twin</sub> Exp(b) [CI-95]	Dev <sub>Twin MZ</sub> Exp(b) [CI-95]	Int <sub>Dz-MZ</sub> Exp(b) [CI-95]	Int <sub>Dz-MZ</sub>	Mean <sub>Twin</sub> Exp(b) [CI-95]	Dev <sub>Twin MZ</sub> Exp(b) [CI-95]	Int <sub>Dz-MZ</sub> Exp(b) [CI-95]	Int <sub>Dz-MZ</sub>	Mean <sub>Twin</sub> Exp(b) [CI-95]	Dev <sub>Twin MZ</sub> Exp(b) [CI-95]	Int <sub>Dz-MZ</sub> Exp(b) [CI-95]	Int <sub>Dz-MZ</sub>
Discrimination T1	-	-	-	-	-	-	-	-	7.92*** [5.02; 12.4]	-	-	-	-	-	-	-
Zygosity (MZ as Reference)	0.92 [0.70; 1.19]	-	-	-	1.08 [0.76; 1.54]	-	-	-	1.01 [0.72; 1.43]	-	-	-	1.00 [0.71; 1.40]	-	-	-
Being Female	-	-	-	-	1.63* [1.11; 2.40]	-	-	-	2.06** [1.39; 3.05]	-	-	-	1.86** [1.27; 2.72]	-	-	-
Migration status	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
No Migration—Reference	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
One parent immigrated	2.86*** [1.87; 4.38]	-	-	-	1.79 [1.02; 3.14]	-	-	-	2.68** [1.58; 4.57]	-	-	-	1.61 [0.97; 2.68]	-	-	-
Both parents immigrated	11.20*** [7.62; 16.40]	-	-	-	2.00 [1.05; 3.81]	-	-	-	1.95 [1.05; 3.58]	-	-	-	0.87 [0.47; 1.62]	-	-	-
All family members immigrated	8.60*** [4.47; 16.50]	-	-	-	3.97* [1.65; 9.52]	-	-	-	3.67* [1.53; 8.81]	-	-	-	1.60 [0.73; 3.51]	-	-	-
Cognitive ability T1	-	-	-	-	-	-	-	-	0.77 [0.62; 0.96]	1.08 [0.64; 1.81]	0.59 [0.30; 1.15]	-	-	-	-	-
Openness T1	1.68*** [1.39; 2.02]	1.23 [0.93; 1.63]	0.98 [0.67; 1.42]	-	-	-	-	-	1.35* [1.07; 1.72]	0.71 [0.46; 1.10]	2.54** [1.44; 4.46]	-	-	-	-	-
Conscientiousness T1	-	-	-	-	-	-	-	-	0.69*** [0.56; 0.87]	1.08 [0.74; 1.58]	0.58 [0.36; 0.93]	0.82 [0.66; 1.01]	0.89 [0.60; 1.31]	0.83 [0.51; 1.37]	-	-
Extraversion T1	1.21 [1.01; 1.45]	0.96 [0.73; 1.26]	1.31 [0.90; 1.92]	-	-	-	-	-	1.47* [1.14; 1.89]	1.07 [0.72; 1.59]	0.89 [0.53; 1.50]	1.58** [1.23; 2.03]	1.04 [0.72; 1.50]	1.00 [0.61; 1.64]	-	-
Agreeableness T1	0.73** [0.61; 0.87]	0.90 [0.73; 1.12]	1.04 [0.76; 1.42]	-	-	-	-	-	-	-	-	-	-	-	-	-
Emotional symptoms T1	1.48*** [1.21; 1.81]	0.91 [0.66; 1.25]	1.82* [1.16; 2.84]	-	-	-	-	-	-	-	-	-	-	-	-	-
Peer Problems T1	-	-	-	-	-	-	-	-	1.43** [1.15; 1.79]	1.20 [0.83; 1.74]	1.02 [0.62; 1.68]	1.60** [1.27; 2.01]	1.14 [0.77; 1.68]	0.98 [0.58; 1.66]	-	-
Self-Esteem T1	0.93 [0.76; 1.15]	0.59** [0.44; 0.78]	1.37 [0.91; 2.05]	-	-	-	-	-	-	-	-	-	-	-	-	-
Self-Esteem T2	-	-	-	0.82 [0.65; 1.04]	0.79 [0.61; 1.03]	1.26 [0.82; 1.95]	-	-	-	-	-	-	-	-	-	-
External Locus T2	-	-	-	1.29 [1.00; 1.65]	1.34 [1.00; 1.80]	1.24 [0.77; 1.98]	1.25 [1.01; 1.55]	1.07 [0.66; 1.75]	1.40 [1.02; 1.92]	1.07 [0.66; 1.75]	1.30 [0.96; 1.77]	1.16 [0.73; 1.86]	1.30 [0.96; 1.77]	1.16 [0.73; 1.86]	-	-
N	4042			1614			1905					1680				
Cluster	2021			807			1102					840				

Note. Mean<sub>Twin</sub> = Between cluster effect of the twins' mean of a specific variable. Dev<sub>Twin MZ</sub> = Within cluster effect for the deviation of a twin of their twins' mean for monozygotic twins. Int<sub>Dz-MZ</sub> = Difference of within cluster effects for mono- and dizygotic twins. Exp(b) = Odds ratio, CI-95 = 95% confidence interval for the odds ratio \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$  (two-tailed)



finding aligns with other research, which indicates that having a migration history is one of the most significant drivers of discrimination experiences. Individuals with phenotypical differences such as an accent or a distinctive physical appearance, have a higher risk of discrimination than persons showing no obvious signs of a migration history (though this latter group still reports discrimination experiences; Forschungsbereich beim Sachverständigenrat deutscher Stiftungen für Integration und Migration [Research area at the Expert Council of German Foundations on Integration and Migration], 2018). Regarding other physical features, neither body composition (measured by Body-Mass-Index) nor rated attractiveness proved to be in a significant association with discrimination experiences. This suggests that they do not add predictive power over the other factors as a main effect in our models. This finding underscores that discrimination experiences appear to be primarily driven by prejudice and show little connection to other physical features investigated in this study.

In the pre-analyses, this study successfully replicated several correlational patterns that have already been reported in the literature. Specifically, being female (de la Torre-Pérez et al., 2022), higher Openness (Cawvey et al., 2017), higher emotional problems (which showed a high overlap to Neuroticism; Cawvey et al., 2017; McClendon et al., 2019), lower Agreeableness (Cawvey et al., 2017; McClendon et al., 2019; Sutin et al., 2016), lower Conscientiousness (Cawvey et al., 2017) higher scores in peer problems (a sub facet of externalizing behavior; de Freitas et al., 2018), lower self-esteem (see, for example, Thijs & Piscoi, 2016) and lower cognitive abilities (Kirkegaard, 2017) were all linked to a higher probability for discrimination experiences. Regarding the effect of cognitive abilities, persons high in cognitive abilities tend to be selected (or select themselves) more frequently into academic settings, which in turn could lower the probability to experience discrimination. However, conflicting findings exist, with some studies suggesting the contrary effect, linking higher cognitive abilities to experiencing discrimination (Diehl & Liebau, 2017). Our study highlights the possibility of moderating variables, potentially a context effect (given that most studies on discrimination are conducted in the United States). Nevertheless, research on this particular effect remains limited.

Contrary to other research, we found that higher Extraversion (Cawvey et al., 2017; Sutin et al., 2016) and having an external locus of control (Lanier & Barnett, 1996) was linked to a higher probability for discrimination experiences. Other factors that could have been related to discrimination experiences were not meaningful, at least in our models and sample. We did not find any effect for hyperactivity and internal locus of control.

However, it is worth noting that not all variables showed a consistent relationship at all-time points. It could be that the associations are influenced by other factors and third variables, leading to fluctuations in relationships between the predictors and the outcome over time. While this could pose challenges for interpretation, it highlights the importance of taking a longitudinal approach and considering multiple time points in order to gain a more comprehensive understanding of the relationship between person-related and personality-related characteristics and experiences of discrimination.

In our analyses, experiences of discrimination were consistently related to Extraversion, more precisely, higher scores in Extraversion were related to a higher probability to experience discrimination. One possible explanation might be a mediation process: More extraverted persons tend to expose themselves to more social situations than introverted persons and, hence, have a higher chance of experiencing negative events that potentially can qualify as discrimination experiences.

Also consistently across time-points, higher Openness served as a predictor to the probability to experience discrimination. Possibly, Openness is associated with cultural insights and a higher sensitivity to discrimination experiences and a greater awareness of social injustice issues, as suggested by studies showing a higher propensity to protest against political issues, when scoring higher on Openness (Brandstätter & Opp, 2013).

The second aim of the study was to test whether variations of discrimination experiences between twins will be mostly driven by twins' differences in personality variables. All predictors with no significance in the pre-analyses were omitted. Not surprisingly, migration history remained a strong predictor in the first set of analyses without prior control of discrimination experiences. However, when controlling for prior discrimination experiences in the longitudinal model, all migration indicators became insignificant. Gender also remained a significant predictor for both models using discrimination as outcome at wave 2.

The only quasi-causal relationship we identified involved self-esteem at wave 1: The twin lower in self-esteem had a higher risk of experiencing discrimination. It could be that lower self-esteem provides a cognitive framework, that guides the attribution and the assessment of future incidents. However, it is also possible that lower self-esteem follows from discrimination experiences. As monozygotic twins share family background and all the genetics, this association can be interpreted as “quasi-causal”. The role of self-esteem has been corroborated in the literature of discrimination before (e.g., Thijs & Piscoi, 2016). This is the first study to report this effect with a high control for genetic confounds and familial background. As additional data in *TwinLife* becomes available, more elaborate analyses on the

interplay between self-esteem and discrimination will be feasible.

The absence of quasi-causal effects in the twin difference analyses leave questions open regarding the origins of the phenotypic associations between discrimination and personality-based factors. One possible explanation could be that both discrimination experiences and certain personality factors share a genetic or environmental component, influencing the phenotypical relationship as a third variable. More research is needed to unravel the complex interplay between personal and situational factors in explaining the occurrence of discrimination experiences.

### Limitations and outlook

While the data used in this report are derived from short scales which have lower reliability by design, there exists a common trade-off in panel studies between extensive measurements and the need to keep the questionnaire as economical as possible to reach and motivate a broad sample. Furthermore, the *TwinLife* study aimed to incorporate measures highly parallel to other studies (Hahn et al., 2016), such as the SOEP (Gerlitz & Schupp, 2005), or established scales like the SDQ (Goodman et al., 1998), in order enhance comparability with existing research. This study's reliability scores were comparable in size to the originally reported reliability scores, and despite the lack of reliability for scales such as locus of control, Agreeableness, peer and conduct problems, significant effects were still observed. It is important to acknowledge that low reliability can introduce artifacts into statistical relationships, which could have influenced the results (Kanyongo et al., 2007). Therefore, while the study provides valuable insights and contributes to the existing literature, caution is necessary when interpreting the findings. Moving forward, future studies could consider incorporating more extensive measures of these scales to improve their reliability. Nonetheless, the current study serves as an important foundation for future research.

Furthermore, the question on discrimination experiences as used in *TwinLife* allows for a range of individual interpretations by the participants. This operationalization has its advantage, as it reflects all processes involved in the ultimate reports of discrimination experiences. Previous research suggests that reporting a discrimination experience may involve multiple processes a) attributing a treatment to social identity of group membership and b) judging that the treatment was unjust or undeserved (Major et al., 2002). Whether unjust treatment is attributed to discrimination appears to depend on two major categories of variables: situational and individual factors (Major & Dover, 2016). Person or personality characteristics

influence how situations are perceived and categorized, and they also play a crucial role in a person's reaction to a particular situation or stressor (e.g., Rigby & Huebner, 2004). Consequently, personality might also play a role in the attributional process concerning discrimination. However, with a relatively broad operationalization, these processes cannot be differentiated. Therefore, future studies should aim to disentangle these individual processes, examining each process individually and distinguishing between unfair and unjust treatment in general, while separating this assessment from the causal interpretation for this treatment. This approach would allow for a better understanding of the influences of personality on these separate processes.

Nonetheless, this study underscores the importance of person-based factors and emphasizes that not only situational factors are important in understanding the phenomenon of discrimination, but rather the complex interaction between situational and personality-based factors is important. To investigate this complex interplay further, future studies should incorporate both situational factors of discrimination experiences (e.g., the context in which the discrimination experience happened, factors of institutions that discriminated against the person, societal context) and person and personality-related traits of all individuals involved in the discrimination experiences (i.e., both victim and perpetrator).

Additionally, the analysis for selective attrition revealed differences between persons that participated also in the second wave of the panel and those who dropped out. While differences in personality scales were significant, effect sizes were rather small and could be seen as negligible. However, it is noteworthy that the proportion of individuals with migration history and those with lower cognitive ability scores decreased as the study progressed, which may have coincided with an overall increase in socioeconomic status in the *TwinLife* sample on average. While such trends are not uncommon in panel studies (see Soep, Siegers et al., 2021), the reduced variance in our sample could have led to an underestimation of effects.

### Conclusion

In summary, this study underscores that one of the most significant drivers of discrimination experiences is a migration history. In today's context, where prejudice and racial categorization remain common, immigrants are at a heightened risk of experiencing discrimination. Additionally, one quasi causal effect identified through twin difference models was the effect of self-esteem, highlighting the potential impact of discrimination experiences on self-evaluation.

However, initial self-esteem can also serve a cognitive concept guiding future interpretations of potentially discriminating events. Furthermore, the study raises questions about whether personality factors can conclusively be understood as antecedent of discrimination experiences. We hypothesize that genetic or environmental factors as a third variable could contribute to the frequently seen associations. Future research should explore this hypothesis further.

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**Data availability** The TwinLife data are available for the scientific community at the GESIS data catalogue: [https://search.gesis.org/research\\_data/ZA6701](https://search.gesis.org/research_data/ZA6701), <https://doi.org/https://doi.org/10.4232/1.13932>. Data access can be requested for scientific purposes and after signing a data use agreement.

## Declarations

**Ethics approval** Ethics approval for the TwinLife study was received from the German Psychological Society (Deutsche Gesellschaft für Psychologie; protocol number: RR 11.2009). In advance of the interview, participants were informed in writing about the scope and aim of the study, the data protection regulations and their right to refuse or withdraw from participation at any time. Informed consent was obtained from all participants and their legal guardians if they were under 14 years of age.

**Competing Interests** The authors declare no conflicts of interests.

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