Psychiatry Research 323 (2023) 115142

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Discovering your presumed father is not your biological father: Psychiatric ramifications of independently uncovered non-paternity events resulting from direct-to-consumer DNA testing

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ARTICLE INFO

Keywords:
Misattributed paternity
NPE
Non-paternity event
Not paternity expected
Direct-to-consumer DNA test

ABSTRACT

Direct-to-consumer DNA tests provide information on ancestry and family relations. Their increased use in recent years has led many to discover that their presumed father is not their biological father, a non-paternity event (NPE). We aimed to explore and quantify the psychiatric effects of discovering one's father's identity was misattributed. We distributed questionnaires in a private online community of individuals who learned they were NPEs. Questionnaires included clinical scales assessing depressive, anxiety, and panic symptomatology as well as background and personal details regarding participants' NPE discovery and demography. A total of 731 people participated. Results demonstrated increased levels of depression, anxiety, and panic symptoms relative to controls. Multiple factors influenced such effects, including demographics, background information, family members' reactions, and personal reactions. We identified a worsening relationship or attitude toward the mother as a risk factor for worse mental health. The ability to openly discuss the discovery and acceptance of it were identified as protective factors. This is the first paper to explore the psychiatric sequelae of discovering misattributed paternity in a large cohort. This unique psychosocial stressor is likely to become more common as direct-to-consumer DNA tests gain popularity, requiring the attention of mental health professionals.

1. Introduction

The past three decades have seen a rise in the popularity of commercial direct-to-consumer (DTC) DNA test kits (e.g., Ancestry, 23andme, MyHeritage). An estimated 30 million people worldwide have taken such tests in a recreational setting as of 2020 (Georgiadis, 2020).

These DNA test kits offer consumers information relating to their health and ancestry. Furthermore, these tests provide an option to find relatives by genetic markers from the pool of other consumers who tested their DNA.

In recent years, many stories have emerged in popular media about consumers who learned that the man they presumed to be their father was not, in fact, their biological parent as a result of the DNA analysis (e.g., Ash 2018, Davis 2007). Recently, research has begun to emerge regarding these consumers and their subsequent experiences (Grethel et al., 2022; Guerrini et al., 2022).

The uncovering of misattributed paternity, also called NPE in genealogy (non-paternity events or not parent expected), can occur in a multitude of ways, such as by identifying previously unknown first-degree relatives, learning that siblings are genetically half-siblings, discovering an unexpected ethnicity and more.

Many studies have attempted to determine the prevalence of NPEs in present-day populations and throughout history. Estimates range from less than 1% to over 10% (International Society of Genetic Genealogy, 2022). Recently, Guerrini et al. surveyed 23,196 people who used the DTC service FamilyTreeDNA and found that 5% of participants discovered an unexpected biological parent of any gender (Guerrini et al., 2022). While this number represents misattributed paternity of both mothers and fathers, it suggests 5% as an upper limit to the number of paternal NPEs among DTC DNA test users. This number may also represent the upper limit in the general population, as those suspicious about their paternity may be more inclined to use the tests.

Anecdotal tales of NPEs have circulated throughout history, yet it has never been so easy for a person to discover a misattributed paternity or

Abbreviations: NPE, Non-paternity event; DTC, Direct-to-consumer.

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https://doi.org/10.1016/j.psychres.2023.115142
Received 4 December 2022; Received in revised form 19 February 2023; Accepted 1 March 2023
Available online 4 March 2023

establish it with such certainty. Furthermore, social media has allowed thousands of individuals who have discovered their NPE status to form groups discreetly for the first time in history. These individuals use the privacy provided by online groups to discuss their discovery and its effect on their lives in an understanding environment (Teitell, 2019; Zhang, 2018). A recent study by Grethel et al. performed a qualitative study of 27 NPEs. In their study, NPEs often reported a profound sense of grief and loss and an unstable sense of who they were in their family context. They reported feelings of shock, denial, anger, fear, confusion, isolation, extreme emotional responses, and bodily sensations such as feeling frozen, dazed, and dysregulated. Though the situation is of no fault of their own, many felt the discovery brought about shame and a desire for secrecy. Those who chose to reveal their findings often experienced their difficulties were invalidated by friends and family (Grethel et al., 2022).

Recognizing these recent developments, DNA testing companies have offered *some* guidance to their customers, but their ability to offer support is limited at best (Brown, 2018). A leading group on Facebook named "DNA NPE Friends", visible to group members only, led to the establishment of the non-profit "NPE Friends Fellowship" in 2018, intending to provide community support and education to those affected by an NPE discovery. As of February 2023, 8900 members are part of the "DNA NPE Friends" Facebook group.

Previous medical literature examined the moral and social implications of disclosing incidentally-found misattributed paternity in medical settings (Hercher and Jamal, 2016; Palmor and Fiester, 2014). However, to our knowledge, this is the first study to explore, describe and quantify the psychiatric sequela of a large cohort of individuals who discovered their unexpected paternity on their own.

We surveyed NPEs under the hypothesis that the independent discovery of a misattributed father in adult life would lead to various psychiatric symptoms. Furthermore, we assumed factors related to the discovery, demographics, subsequent encounters with family members, and personal reactions influence these symptoms.

2. Methods

The study was approved by the institutional review boards and was conducted in accordance with the International Conference on Harmonisation guidelines and ethical principles of the Declaration of Helsinki.

Participants recruited for the study were all members of the Facebook group *"DNA NPE Friends"*. At the time of data collection, the group consisted of 6500 members, most of whom had unexpected paternity. Others had unexpected maternity or both, such as in cases of adoptees or double gamete donation. In our study, we focused on individuals who discovered that their biological father's identity differed from their assumed father's identity through DTC DNA tests. We excluded cases of adoption. We asked participants to complete a set of questionnaires containing demographic data, questions about their NPE discovery emphasizing personal consequences (e.g., effect on family ties, outcomes of NPE-related conversations with family members, feeling a need to keep the discovery a secret, acceptance of the new truth), as well as depression and anxiety clinical scales. We also asked participants to write free text to elaborate on their experiences.

We used QuestionPro.com to create the questionnaires, and the group administrators disseminated them. The clinical instruments used in this study were the Patient Health Questionnaire (PHQ-9)(Kroenke et al., 2001), which assesses the presence and severity of depressive symptoms (sensitivity = 0.88, specificity = 0.88, Cronbach's α = 0.89), and the Generalized Anxiety Disorder screener (GAD-7) (Löwe et al., 2008), which evaluates anxiety symptoms (sensitivity = 0.89 and specificity = 0.82, Cronbach's α=0.89). Finally, we included a selection of questions about panic disorder from the PHQ-PD questionnaire, a module of the complete PHQ questionnaire (sensitivity = 0.71 and specificity = 0.83) (Wittkampf et al., 2011).

Data collection was conducted between November 2019 and February 2020 and was terminated prematurely due to the outbreak of the COVID-19 pandemic. We decided on this course of action to avoid probable confounders as mental health was expected to be affected worldwide. For the same reason, we also chose to use historical controls as comparison groups, as the NPE participants' data were collected prior to the COVID-19 pandemic since, at the time of the pandemic's outbreak, a control group was yet to be sufficiently collected.

3. Results

3.1. Characteristics of the sample

The sample consisted of $N = 731$ participants who discovered their unexpected paternity on their own. The sample characteristics are detailed in Table 1. Participants were predominantly located in the USA (91.5%). The mean age was 51.7 ± 10.9. A majority of participants were

Table 1
Characteristics of study participants.

Participants	$N = 731$
Age [mean±SD (range)]	51.7 ± 10.9 (20-84)
Gender - Female	652 (89%)
Country	
North America	693 (95%)
Europe	29 (4%)
Oceania	9 (1%)
Marital status	
Married / common law	538 (74%)
Separated/divorced	91 (12%)
In a relationship	43 (6%)
Single	40 (5%)
Widowed	19 (3%)
Has children	602 (82%)
Employment	
Employed	509 (70%)
Retired	124 (17%)
Homemaker	65 (9%)
Unemployed	16 (2%)
Disabled	9 (1%)
Student	8 (1%)
Motivation to perform DNA Test	
Genealogical research	309 (42%)
Recreational reasons	217 (30%)
Suspicions about own paternity	132 (18%)
Received kit as a gift	105 (14%)
Health research	22 (3%)
Took test on others' behalf	20 (3%)
Looking for relatives	15 (2%)
Ethnicity study	7 (1%)
Mental health diagnosis prior to the discovery	262 (36%)
Given diagnoses prior to discovery [a]	
Anxiety	135 (51%)
Depression	92 (35%)
Post-traumatic stress disorder	78 (30%)
Panic	26(10%)
Adjustment disorder	14 (5%)
Obsessive-compulsive disorder	14 (5%)
Bipolar disorder	8 (3%)
Borderline personality disorder	4 (1%)
Schizophrenia	1 (<1%)
Other	11 (4%)
Nature of biological parents' relationship	
Short affair	227 (31%)
Unknown	166 (23%)
Prolonged affair	129 (18%)
Romantic relationship prior to the relationship with the formal father	79 (11%)
Romantic relationship of unknown nature	71 (10%)
Sexual assault/prostitution	24 (3%)
Sperm donation	17(2%)
Single sexual encounter	15(2%)
Other	3 (<1%)

[a] Percent is from the total of participants with a prior mental health diagnosis.

women (89%), in a relationship (80%), had children (82%), and were employed at the time of the study (70%). Of the study participants, $N = 262$ (36%) had a diagnosis of mental health prior to the discovery of being an NPE, mostly anxiety (18.5% of the entire sample), depression (12.6%), and PTSD (10.7%). Most participants had no previous suspicion of their NPE status (82%).

3.2. Level of distress compared to historical cohorts

We compared participants' PHQ-9 depression scores to the normative data from the National Health and Nutrition Examination Survey (NHANES) data of 2017-2018(Centers for Disease Control and Prevention (CDC), 2019), which includes a representative sample of non-institutionalized US citizens. GAD-7 anxiety scores were compared to normative data scores published by Löwe et al. (2008). Panic disorder prevalence was compared to the prevalence from the population data from 15 US primary care clinics from Kroenke et al. (2007). Historic cohorts were compared using either an independent samples t-test (PHQ-9 and GAD-7) or a chi-square test (panic disorder) for each gender separately. The results are presented in Tables 2 and 3.

Participants had significantly higher mean depression and anxiety scores than historical cohorts. Moreover, the study group had a higher proportion of moderately-severe or severe depression than the controls (16.1% and 3.3%, respectively, $p < 0.001$). Suicidal ideation (i.e., the thought that it is better to be dead or to have thoughts of hurting oneself) was reported on the PHQ-9 questionnaire in higher proportions in the study group (13.3%) as compared to controls (3.8%, $p < 0.001$; $\chi^2_{(1)} = 119.4$). Frequent suicidal ideation (daily or nearly daily) was twice as common in the study group as compared to controls (1.1% vs. 0.5%, respectively), but this result only bordered on statistical significance ($p = 0.051$). For panic disorder, women study participants had a higher proportion of panic disorder compared to the historical cohort, but comparable results were only marginally statistically significant for men.

3.3. Prediction of psychiatric symptoms using factors related to NPE-status discovery

We analyzed the data further to elucidate the demographic, psychological, and social factors influencing the association between NPE status and psychiatric variables. A correlation analysis was performed before regression analyses to estimate the contribution of different factors to the clinical variables (see supplemental data). We converted categorical variables into dummy variables before correlating them with outcome variables to facilitate consideration in the following regression analysis.

A set of two hierarchical linear regression models (predicting PHQ-9 and GAD-7 scores) and a hierarchical logistic regression model (predicting panic disorder) were fitted, with demographic variables in the 1st step, clinical variables in the 2nd step, NPE-related variables in the 3rd step, and personal reaction to discovery (acceptance and the need to keep the discovery a secret) in the 4th step. All the steps in the different models were significant, and all steps in the different regression analyses significantly added to one another.

Of the demographic variables, older age and being in a relationship were significant predictors of better clinical outcomes across all dependent variables. Previous mental illness was a significant predictor of worse outcomes. Regarding NPE-status related variables, subjects showed a trend of faring better as time passed with the trend achieving statistical significance after two years had passed since discovery. Higher acceptance levels were related to decreased depression and anxiety scores and reduced risk for panic disorder. Finally, being less concerned about secrecy following the revelation correlated with reduced depressive and anxiety symptoms. Results are presented in Figs.1-4.

Eleven participants who answered their biological parents had coercive/exploitative relations (i.e., rape and prostitution) had a marginally statistically significant higher incidence of previous mental illness compared to participants with other contexts of parental ties (55% and 35%, respectively, $\chi 2_{(1)} = 2.6$, $p = 0.1$).

Table 2
Independent samples t-tests comparing study sample and historic cohorts on depression and anxiety measures.

	Mean (SD) Study Participants	Historical control[a]	test statistic	*p value*	Difference (95%CI)
Depression (PHQ-9)					
Women	7.43 (6.48)	3.71 (4.45)	$t_{(2521)} = 16.19$	<.001 *	3.72 (3.27–4.17)
Men	5.49 (5.76)	2.79 (4.05)	$t_{(2055)} = 5.63$	<.001 *	2.7 (1.76–3.64)
Anxiety (GAD-7)					
Women	6.34 (5.69)	3.2 (3.52)	$t_{(3348)} = 17.84$	<.001 *	3.14 (2.8–3.49)
Men	4.69 (5.11)	2.66 (3.24)	$t_{(2407)} = 5.29$	<.001 *	2.03 (1.28–2.78)

[a] National Health and Nutrition Examination Survey (NHANES) data of 2017-2018 (Centers for Disease Control and Prevention (CDC), 2019) was used for PHQ-9 normative depression scores; Normative data scores published by Löwe et al. (2008) for GAD-7 normative anxiety scores.
* $p < .001$.

Table 3
Chi-square test comparing study sample and historic cohorts on panic disorder measure.

	Number of participants (%) Study Participants	Historical control[a]	test statistic	*p value*
Panic disorder (PHQ-PD)				
Women	124 (19.01%)	55 (8.25%)	$\chi^2_{(1)} = 99.639$	<.001 *
Men	6 (7.79%)	11 (3.67%)	$\chi^2_{(1)} = 3.676$	0.055

[a] Prevalence of panic disorder as published by Kroenke et al. (2007).
* $p < .001$.

4. Discussion

The present study is the first to quantify the psychiatric ramifications of an NPE discovery on offspring. Our cohort consisted of members of a Facebook support group for individuals who discovered, as adults, using a DTC DNA kit, that their presumed father is not their biological father. Participants were primarily American women aged about 50 years old, resembling the sampled Facebook group's demographic. Analysis of participants' demographic characteristics showed that most were functioning members of society: in a current relationship, working or retired, and parents themselves. About a third had a mental health diagnosis prior to their discovery of being NPEs, similar to the estimated lifetime prevalence of psychiatric diagnosis in the general population of this relatively older population (Pedersen et al., 2014). Less than one-fifth suspected that their father's identity was misattributed.

Our findings documented increased levels of depression, anxiety, and panic disorder in the study participants compared to historical controls, as measured by clinical scales. The findings are compatible with Grethel et. al which reported intense negative and distressing feelings (Grethel et al., 2022), and with Guerrini et al. findings that those who had misattributed the identity of a parent report increased regret about performing a DNA test and more negative consequences to themselves (Guerrini et al., 2022).

In line with our initial hypotheses, multiple factors influenced

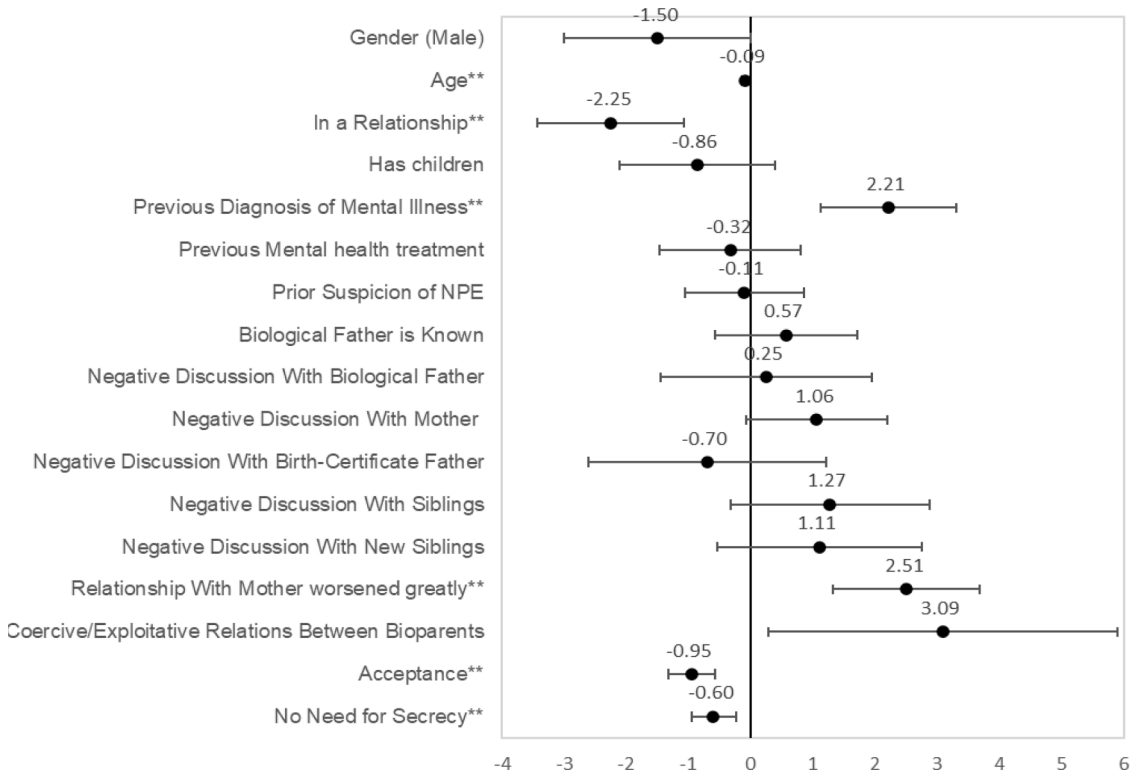

Fig. 1. Binary logistic regression for predictors of depression scores (PHQ-9)
Values are OR for the clinical scale PHQ-9; * denotes $p < 0.05$;** denotes $p < 0.01$; "Negative" is defined subjectively by participants as feeling rejected or that the other party to the discussion was not forthcoming.

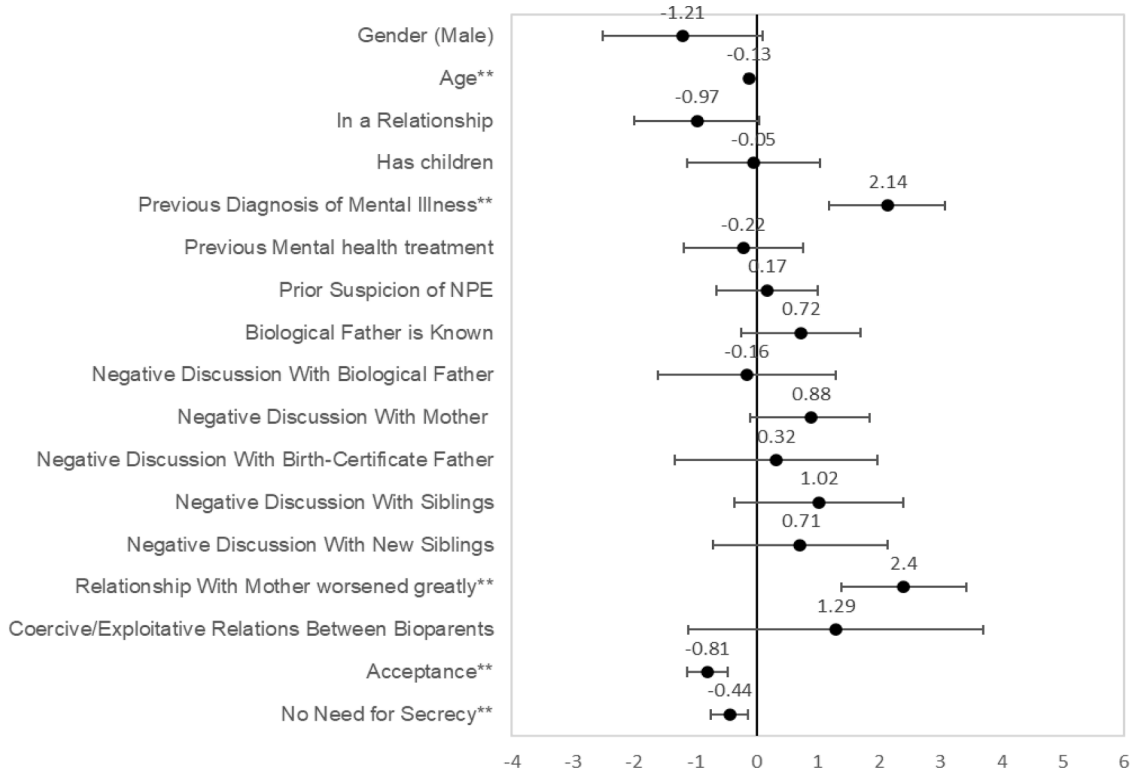

Fig. 2. Binary logistic regression for predictors of anxiety scores (GAD-7)
Values are OR for the clinical scale GAD-7; * denotes $p < 0.05$;** denotes $p < 0.01$; "Negative" is defined subjectively by participants as feeling rejected or that the other party to the discussion was not forthcoming.

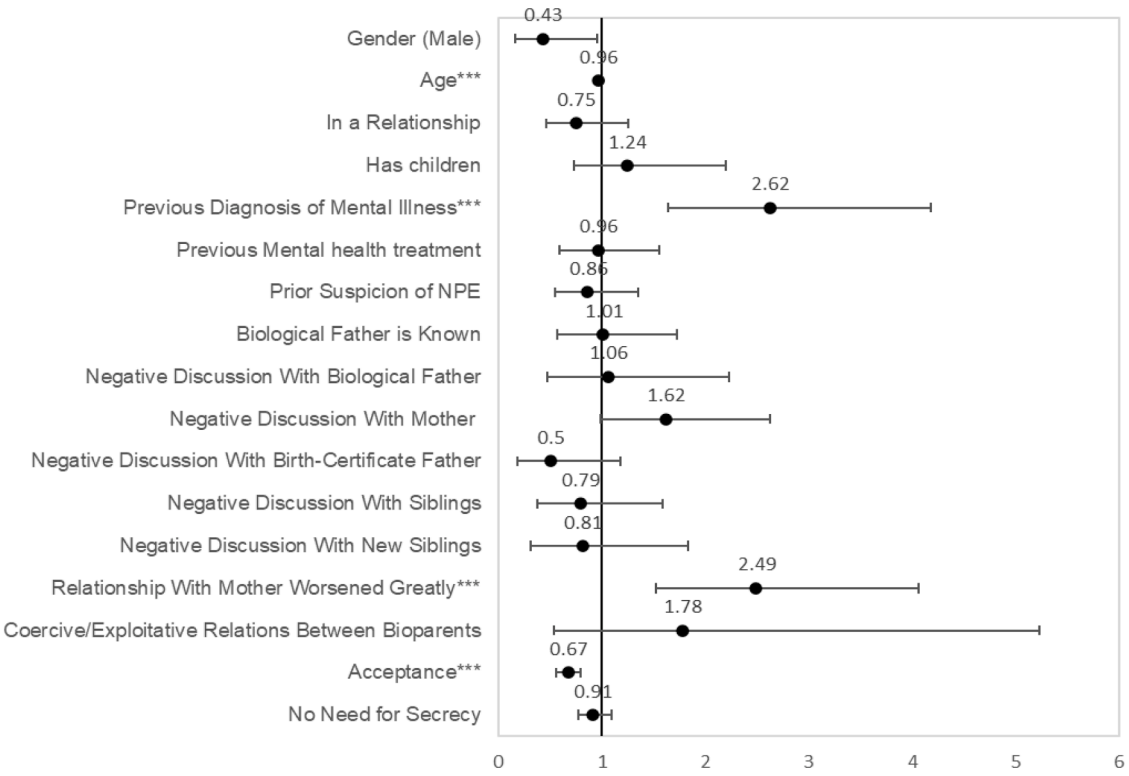

Fig. 3. Multiple linear regression for predictors of panic disorder scores
Values are regression coefficient b for panic disorder; *** denotes $p < .001$; "Negative" is defined subjectively by participants as feeling rejected or that the other party to the discussion was not forthcoming.

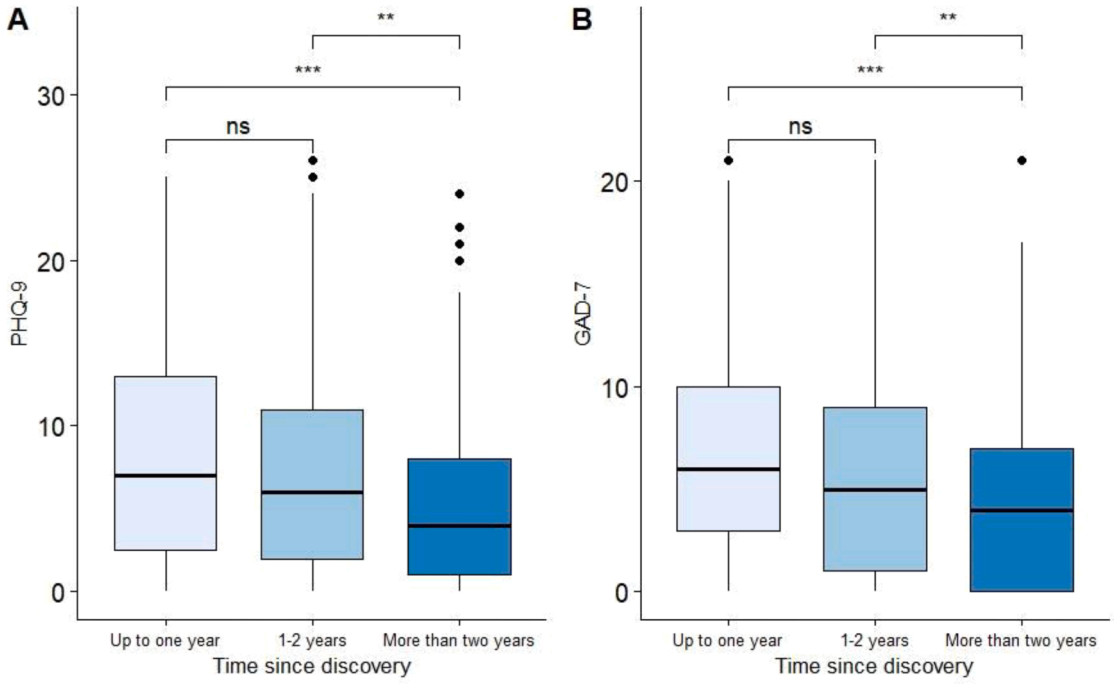

Fig. 4. Clinical scales vs. time since the discovery
275 participants discovered their NPE status up to one year prior to participating in the study, 295 participants discovered it between 1 and 2 years prior, and 161 participants discovered it more than 2 years ago. Both ANOVAs were significant, with significant pairs (After Tukey HSD adjustment) between the group discovered more than two years ago and the other two groups (up to one year and 1-2 years). ** $p < 0.01$ *** $p < 0.001$.

mental health consequences, including demographics, background information, family members' reactions to discovery, and personal reaction to discovery (i.e., the ability to accept it and to be open about it with others). In addition, NPE-status-related variables (such as the nature of the relationship between biological parents, time since the discovery, and a worsening relationship with the mother) were also predictors of

worsened mental health, over and above both known demographic variables and previous mental health.

Protective factors for mental health were the ability to openly discuss the situation with one's social circle (as opposed to keeping it a secret) and acceptance of the discovery. Previous suspicions of non-paternity did not influence the psychological end result. Unsurprisingly, having a prior mental health diagnosis was associated with worse mental health on all scales. Notably, a few participants spontaneously reported feelings of joy and relief following the discovery. Some of these participants described negative relationships with their non-biological fathers in the optional free text field, a finding which may warrant further study.

Though our subject seemingly revolves around paternity, the relationship between child and mother is a critical factor in post-discovery mental health. Participants who reported that the relationship with their mother, or how they viewed her, took a significant turn for the worst were worse off on all clinical scales than those whose relationships did not change, improve, or worsened less. The fathers' reaction was clinically negligent. The reaction of known and newly found half-siblings did not affect clinical outcomes either. One can speculate a multitude of reasons why the mother is such a significant factor besides her being the obvious common denominator. For example, it is established that as a primary caregiver, and the person with whom the child usually has the closest relationship with, mothers have a key role in shaping the child's sense of trust and security (Campbell and Stanton, 2019). As such, hiding a misattributed identity by a mother may be considered a severe violation of trust which may also be interpreted as having been motivated by personal reasons that did not consider the child's needs and rights. This may lead to feelings of betrayal, anger, frustration, and loss. Some insight about some of reasons may be gained from NPE narratives published in Grethel et al. reporting that many mothers responded unapologetically, even angrily, about the uncovering of secrets and that responders subsequently felt the need to distance themselves from their mothers. This may also be hinted in the relatively strong correlation between negative conversations with the mother and a worsening relationship (see supplemental data).

The nature of the relationship between the mother and the biological father played a pivotal role; Children conceived by romantic circumstances and those conceived with the help of a sperm donor had better outcomes for mental health than those conceived of coercive impregnation such as rape or prostitution. There may be several explanations for this pattern: one might assume mothers exposed to such situations suffered from various difficulties that influenced the rearing of their children and their children's mental health. However, data showed only a marginally statistically significant increase in the incidence of previous mental health difficulties in this small subgroup. An alternative explanation of this result may be attributed to the pain of learning that one's mother was a victim of abuse and that one's biological father was an abuser. Finally, it may also imply that people prefer certain narratives of how they were brought into the world. It is fair to assume that people prefer to have originated from a wanted pregnancy, maybe even one produced out of love, rather than to have the beginning of their life start from being unwanted or brought upon by violence or exploitation. Assuming importance to one's conception story's valance is congruent with a recent qualitative study which found that how people perceive and receive stories about conception can significantly impact their self-perception, family relationships, and their sense of parenthood (Ogden and Syder, 2022).

Adoptees and those conceived using gamete donation, intentional and socially acceptable departures from biological parenthood, are the most natural comparison group to our participants (a minority of which were conceived using sperm donation though unknown to them until the use of a DNA test). The literature on the mental health of these groups shows that adopted adults and the donation-conceived have higher rates of mental health problems. (Adams et al., 2021b, 2021a; Behle and Pinquart, 2016; Juffer and van Ijzendoorn, 2005; Lehto et al., 2020; Melero and Sánchez-Sandoval, 2017) In both of these types of non-paternity, difficulties may not be due to the revelation of misattributed paternity but to early-life adversity and genetics for the adopted and poorer birth outcomes associated with assisted reproduction for the donor-conceived. In our sample, early-life adversity is not expected to be higher than in the general population, and an increased prevalence of prior mental illness is not present. However, differences from our sample do not imply that studies on adoptees and donor-conceived do not contribute to understanding the NPE condition. Most importantly, for the adopted and the donor-conceived alike, disclosing their biological origins at a young age is almost universally recommended to parents. Studies indicate that disclosure at later ages may lead to adverse psychological consequences and particularly to a negative attitude towards their mothers (Baden et al., 2019; Golombok et al., 2011; Ilioi et al., 2017; Jadva et al., 2009). This finding is congruent with our aforementioned findings, as all of our participants discovered their NPE status as adults, with many suffering from psychological difficulties and a worsening attitude towards their mothers.

Regarding disclosure, the situation is more complex in the case of NPEs. Unlike adoption and donor-conception, many mothers of NPEs may be unsure of the biological father's identity due to parallel relations. Others may have conceived under unwanted and dire circumstances. Therefore, they would likely be more reluctant to disclose information, especially if the situation is not in line with social norms (e.g., impregnation by previous, extramarital, or unwanted relations). Maternal reluctance to reveal certain or suspected misattributed paternity may be expected when considering such revelations may lead to personal, marital, and social consequences. In many societies, women who have a child outside of marriage and their offspring are ostracized as adulterous and illegitimate, respectively (Brandt, 2013). [1]

In the clinical setting of genetic counseling, organ donation, and pediatrics, there is also a dilemma in disclosing information about incidentally discovered misattributed paternity (Galetto-Lacour et al., 2003; Hercher and Jamal, 2016; Klitzman et al., 2013; Young et al., 2009). In contrast to the recommendation to parents to disclose adoption and donor-conceived status at an early age, there is no consensus on the clinician's most appropriate course of action in this scenario, but many lean towards universal non-disclosure (Hercher and Jamal, 2016; Palmor and Fiester, 2014). However, present discussions on clinical ethics are not based on mental health data, with our study shedding some light on the possible repercussions of non-disclosure in the age of commercially available DNA testing.

Our study highlights the possible adverse effects of informing patients of their misattributed paternity status. Nevertheless, it is crucial to acknowledge that with the increasing popularity of direct-to-consumer DNA testing kits, this information may still become known to the patients. As rates of incidental NPE discovery are expected to increase, we join others (Hercher and Jamal, 2016) in urging clinicians to at least consider carefully planned disclosure. One should not ignore the advantages of careful disclosure with immediate psychological support, as opposed to the growing possibility of future independent discovery without such support, along with averting years of living under a false premise. At the very least, it may be ethically sound to advise the mother about the negative impact concealing a misattributed paternity could have on her child and their relationship, should it be independently discovered in the future.

Our study has several limitations. First, the study group comprised only 11% of the Facebook group of origin, "NPE DNA Friends". That online community may naturally function as a support group for some members, implying it may include individuals particularly prone to have

[1] e.g., In traditional Jewish law, a *mamzer* ("illegitimate child") and their descendants are not allowed to marry a non-*mamzer* Jewish spouse for no less than ten generations , resulting in a conservative policy of the use of genetic tests in Israeli law to discourage NPE discoveries from being made (The Knesset, 2008).

suffered distress following their discovery. Moreover, individuals who use direct-to-consumer DNA kits may be more likely to see biological history as more important and subsequently suffer more due to having their biological history upended or unavailable. This does not negate the psychological consequences of the discovery, though it may inflate the proportion of the negatively affected individuals and perhaps limit the generalizability of our conclusions. Another limitation is the overwhelmingly female sample (89%), with no definitive answer as to why most of the original Facebook group is female. The gender difference was controlled statistically regarding clinical scales, with differences only found regarding symptoms of panic. Further exploratory analysis suggests that gender may moderate some relationships between study variables and psychopathology. Due to the limited number of men in our study, we were unable to adequately test significant gender interactions, highlighting the need for future research to include more male participants to understand gender-specific patterns better. Finally, a significant limitation is our use of historical controls, potentially introducing uncontrollable confounders. This was done in light of the COVID-19 pandemic, which broke out immediately following the collection of our study group's data, influencing mental health worldwide and eliminating any chance of collecting an unaffected baseline of controls in the foreseeable future.

In conclusion, the discovery of non-paternity is a complex and often difficult experience with wide-ranging implications for mental health and familial relationships. Such discoveries may also affect self-image, identity, and feelings of belonging as they upend a person's position in the family and personal narrative, as shown by a previous study (Grethel et al., 2022). According to estimates, at least 30 million people have already conducted DTC DNA tests (Georgiadis, 2020), and by other estimates, about 1%–5% of the general population have misattributed paternity (Guerrini et al., 2022; International Society of Genetic Genealogy, 2022). These estimates may imply that hundreds of thousands of people worldwide face a unique risk to their mental health following discovering a misattributed paternity. With direct-to-consumer DNA testing being both commercially available and affordable, the problem of independently discovered non-paternity is expected to become more prevalent. Therefore, more research must be conducted to elucidate the many facets of NPE discovery and explore the appropriate treatment options for this population.

CRediT authorship contribution statement

Chen Avni: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **Dana Sinai:** Data curation, Formal analysis, Methodology, Software, Validation, Visualization, Writing – review & editing. **Uri Blasbalg:** Data curation, Formal analysis, Software, Writing – review & editing. **Paz Toren:** Conceptualization, Investigation, Methodology, Project administration, Resources, Supervision, Writing – review & editing.

Declaration of Competing Interest

Authors declare no competing interests.

Acknowledgments

We would like to thank Catherine St. Clair and Rebekah Drumsta from "NPE Friends Fellowship" for their assistance with this study.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2023.115142.

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