DNA PATERNITY TESTING IN ZIMBABWE - EMERGING PATERNAL DISCREPANCY TRENDS AND DEMOGRAPHIC PATTERNS

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Abstract

Paternal discrepancy is a major cause of marital and legal challenges in society. Data on its prevalence in most countries is however limited. This study reviews 851 DNA paternity tests conducted from 2014 to 2019 using 16 and 21 STR marker kits on the Thermo Fisher platform in Zimbabwe. The average paternal discrepancy was 32.8 %, and of these cases 83.21 % were revealed through peace of mind tests whilst 16.79 % were court ordered tests. Of the 851 tests, 66.22 % were male children, suggesting stronger interest by social fathers in ascertaining paternity of males compared to females. The 31-44 years age group had the highest number of tested putative fathers. The age difference between the fathers and mothers was within the population average of 12.2 years. Trends observed provide baseline design data for research on the scientific, cultural, ethical and legal issues relating to paternity testing in Zimbabwe.

Keywords: DNA test, paternity discrepancy, low paternity confidence

Introduction

Paternal discrepancy (PD) occurs when a child is identified as being biologically fathered by someone other than the man who believes or is claimed to be the father. Interest in ascertaining the paternity of children is as old as the family institution itself (Milanich, 2019). The primary driving factor being rights to property (its use and inheritance) and secondary drivers being an assortment of cultural and moral factors that society has constructed around family structures (Prall & Scelza, 2020). Methods of establishing the paternity of children have evolved over the years from use of spiritual methods (Gritt, n.d.; *Psychic Wrongly Predicts She Is Dali's Child in Surreal Paternity Claim | Entertainment | English Edition | Agencia EFE*, n.d.), physical features (Dolinska, 2019), blood group typing (Gilding, 2005), and now DNA profiling (Mousa et al., 2020; Patidar et al., 2015; Tam et al., 2020).

DNA testing to establish paternity of offspring was introduced in 1988 (Adams, 2008). Since then many reports have been published on the prevalence of discorded paternity (i.e. children found not to have been fathered by the said man) to range from 0.8-30% (Aryes, 2017; Bellis et al., 2005). Efforts to separate the frequencies of discorded paternity in the general population and in populations seeking to establish paternity are pointing to the general population being 1-3.% whereas among those seeking the test triggered by whatever reason to be around 29% (Kermyt G. Anderson, 2006). Other studies have explored cultural and legal implications of discorded paternity test and reported observations that could help us better understand human cultural and biological evolution (Prall & Scelza, 2020; Scelza et al., 2020).

The consequence of a child being found not to be that of the said father range in severity depending on the cultural setting this happens. Among the list of things that can happen include withdrawal of financial support and disinheritance of the child (Draper, 2007), collapse of the marriage (K.G Anderson, 2012), violence involving concerned parties (Davis, 2007; Mandava et al., 2015). On the other hand, efforts to reduce the risk of offspring conceived in marriage or co-habitation not being theirs has driven man to try interventions that range from traditional medicine/interventions (M. E. Baloyi, 2016), rules & regulations of family function (Amadiume, 2006), to legal instruments (Miller, n.d.; Wimalasena, 2016) around this issue. It is therefore not surprising that the topic of paternity testing gets society all worked up as facts and fiction fuel the arising discourse.

Access to DNA testing in Zimbabwe greatly improved with the establishment of the first DNA testing laboratory in 2013 (*Zim's First DNA Testing Centre Registered | The Herald*, n.d.). This study aims at analyzing paternity data collected over the past 6 years for paternity discrepancy trends and any demographic patterns associated with those seeking for these services.

Materials and Methods

Sample population

The 851 DNA test results cases spanning the 2014-2019 period. The involved fathers belonged to the low paternity confidence group since they all sort to determine if they were the fathers to the children in question. According to Anderson (2006), classification paternity test results can be categorised as *High paternity confidence* (man who have no reason to doubt their fatherhood) and *low paternity confidence* group (these include man who are sufficiently doubtful that they seek paternity to determine if they are the fathers of their putative children).

The cases were also classified as 'peace of mind' tests if they were requested based on the concerned parties' need to know but outside the legal dispute or requirement. The second group was that of court disputed paternity, where the concerned parties where ordered by the civil court to have a paternity test done. For the peace-of-mind tests, participation of the mother was voluntary and man where not required to bring involved women as long as they could prove guardianship over the child. As a result, this group had a mixture of duo (child and presumed father) and trio (child, mother and presumed father). The court cases however required the man, the woman and the disputed child to participate in the test, hence such cases always being trio.

The concerned parties (including the child if over 18 years) underwent a 15-20 minutes pre-test counselling session during which they were made aware of the technical aspect of the test and potential implication of the results. If still determined to undergo the test, they would sign their consent. Tested parties also underwent post-test counselling session of 20-30 minutes during which results were disclosed and further explained.

Samples for DNA analysis

Swabs (4 ng floq) from Copan Flock Technologies were used for sample collection. Two samples of buccal swabs were each collected from the alleged father and child in question. Collection of samples from the mother was optional. Samples were stored between $-20^{o}C$ until analysis.

Sample Processing

DNA extraction.

DNA from buccal swabs was extracted using Prep-n-Go ^{TM} Buffer (Applied Biosystems by Life Technologies, UK). Only one sample per individual was used. Method used to extract DNA from buccal swab was as per GlobalFiler™ Express PCR Amplification Kit User Guide. This involved adding 400μl of Prep-n-go TM buffer to buccal swab head vortexing for 10 seconds. Sample was then left to lysate at room temperature for 20 minutes. The lysate was then transferred into a 1.5ml tube.

PCR amplification

The Applied Biosystems™ GlobalFiler™ Express PCR Amplification Kit was used.

The kit amplifies 21 autosomal STR loci (D3S1358, vWA, D16S539, CSF1PO, TPOX, D8S1179, D21S11, D18S51, D2S441, D19S433, TH01, FGA, D22S1045, D5S818, D13S317, D7S820, SE33, D10S1248, D1S1656, D12S391, D2S1338), 1 Y-STR (DYS391), 1 insertion/deletion polymorphic marker on the Y chromosome (Y indel) and Amelogenin (sex determining marker). Method of extraction was as per GlobalFiler™ Express PCR Amplification Kit User Guide. Each PCR reaction comprised of 6μl master set, 6 μl primer set and 3 μl DNA sample and amplification was done using the Veriti^{TM} 96 well Thermal Cycler (Applied Biosystem).

Capillary electrophoresis.

The PCR product was separated by capillary electrophoresis on the Genetic analyser 3500 Data Collection v2 Software (Applied Biosystems). Alleles were determined using GeneMapper® ID-X v1.4 software (Applied Biosystems™).

Data analysis

Paternal index analysis

The Genecodes Forensic Corporation Software M-FISys (USA) was used to calculate the statistical values for DNA profiles match for specific biological relationships using likelihood ratios. Cases with a combined paternal index equivalent to a minimum probability of paternity of 99.999 % were accepted as matches supporting the alleged relationship. the probability of paternity was calculated by comparing to an untested, unrelated, random individual in the test population. The test assumed prior probability equals 0.5. Based on the International Forensic DNA testing guidelines, a probability value equal or

greater than 99.999 % is considered sufficient to conclude that the alleged man is the biological father of the child.

Clients summary and demographics

The total number of tests was collected from our database in M-FISys (Gene Codes Corporation (Ann Arbor, Michigan, USA). From these tests the number of peace of mind tests and court ordered tests as well as the results of the test was documented. Other data collected from the database included the number of trio and duo cases, as well as the ages of the test participants at the time of testing. A single tailed, nonparametric t-test analysis to compare the age groups of putative fathers and tested mothers was carried out using GraphPad Prism 8 software.

Results

Paternity tests for a total of 851 over a 6-year period where analyzed in this report. The table 1 summarizes the number of peace-of-mind and court cases, the number of discrepancy cases, age rages of males and females involved, and those of the disputed children over the 2014 to 2019-year period. The total number of tests and number of discrepant paternity (PD) cases are graphically depicted in Fig 2. The mean PD per year is 32.8%. Percent discrepancy ranged between 27.34 %-40.16 % with 2019 showing the highest percent discrepancy. The age range of man seeking DNA paternity testing most was 31-44yr (Fig 3). The 12-18yr old age group had the least number of putative fathers with only two males taking a paternity test whilst the 31-44yr old age group had the highest number of participants compromising of more than fifty percent of all putative fathers tested within the six-year period. For each year, it is consistently shown that the women are on average 12.2 years younger than the man. Tested mothers were signifcantly younger than putative fathers (p value = 0.002). Tested mothers were almost always younger than tested fathers with the first quartile ages of the putative fathers tested each year being greater than the median ages of the mothers. The mean median age of persons tested in disputed paternity was 4-years.

Table 1. Summary of demographics of paternity test participants and paternity test results conducted over a six-year period from 2014 to 2019.

| Year	2014	2015	2016	2017	2018	2019
Total number of tests	105	160	128	135	201	122
No. of Peace of mind tests	98	152	119	116	147	101
No. of Court ordered tests	7	8	9	19	54	21
Discrepancies	33	48	35	42	74	49
Legitimate	72	112	93	93	127	73
Trio cases	63	95	64	75	25	0
Duo cases	42	65	64	60	176	122
No. of female children tested	47	47	43	57	84	52
No. of male children tested	58	113	85	78	117	70
Ages of the tested children	Med. 2 (6d-43y)	Med. 3 (2wks-31y)	Med. 4 (4d-38y)	Med. 4 (2wks-47y)	Med. 4 (3d-39y)	Med. 5 (2wks-45y)
Ages of the tested fathers	Med. 40 (22-76y)	Med. 38 (22-71y)	Med. 41 (20-77y)	Med. 40 (18-80y)	Med. 40 (16-67y)	Med. 39 (16-80y)
Ages of the tested mothers*	Med. 30 (14-62y)	Med. 21 (18-47y)	Med. 27 (19-46y)	Med. 27 (11-59y)	Med. 28 (19-52y)	Med. 32 (19-59y)
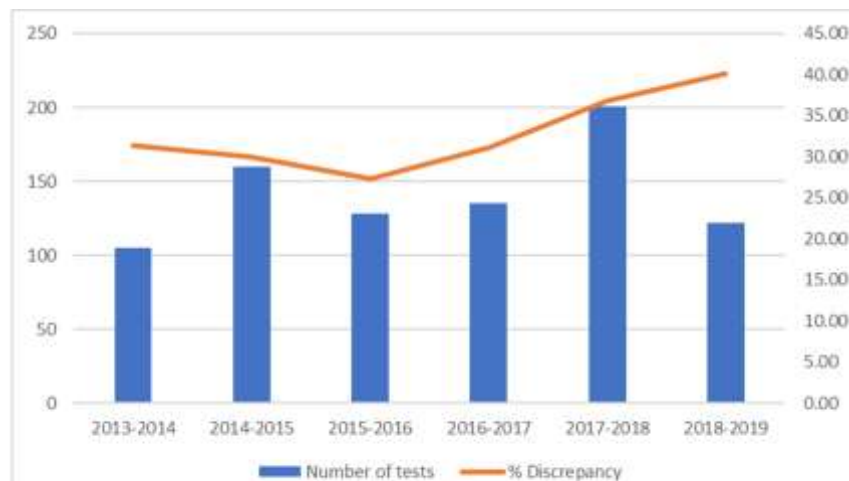
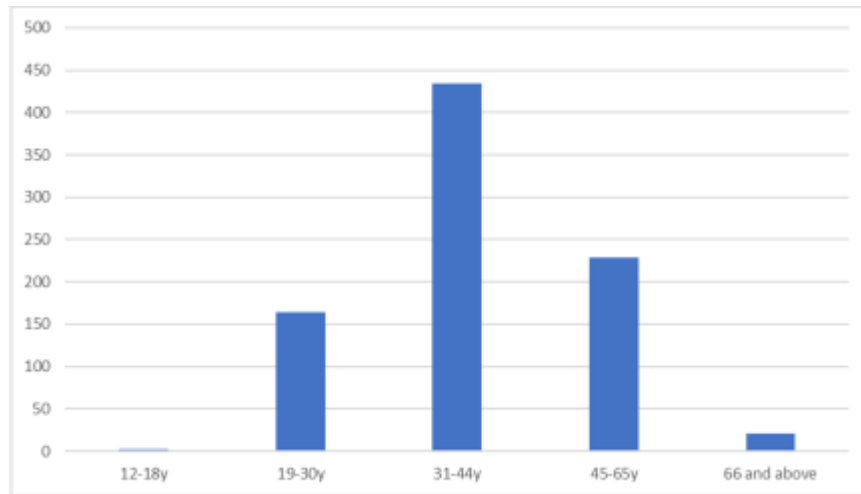Figure 1. Total cases and percent discrepancy recorded over a six-year
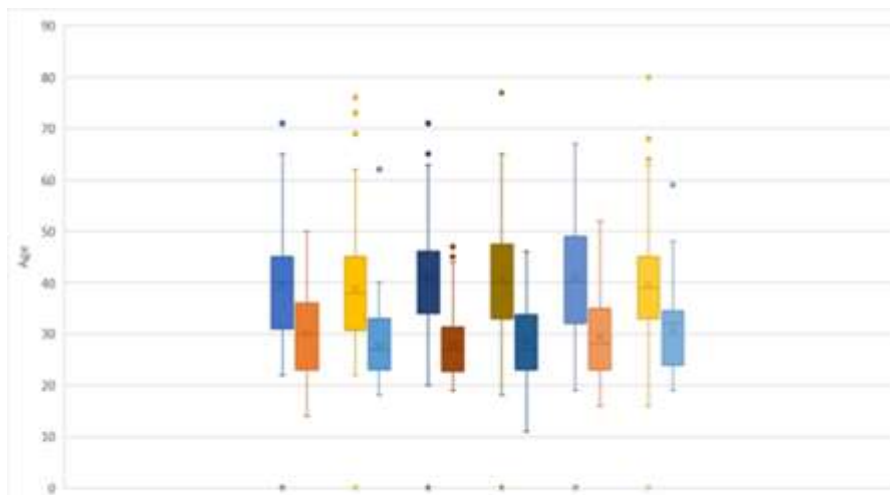
Figure 1. **Age distribution of putative fathers tested..**

Figure 3. Age distribution of putative fathers and mothers.

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Discussion and Conclusion

To our knowledge, this is the first scientific publication on the prevalence of paternity discrepancy in Zimbabwe. Analysis of 851 paternity tests done over a six-year period, 2014 -2019, showed the average paternity discrepancy to be 32.8 %. This value is comparable to data collected in a study by Bellis, et al 2005, where the rates of non-paternity varied from 0.8-30 % (median 3.7% n-17). It is also comparable to data for non-paternity in cases of low paternity confidence where the median was 29.8 % (n = 31) (Kermyt G. Anderson, 2006). These findings point to likely similar PD trends in Zimbabwe compared to other parts of the world where PD is high among those seeking to ascertain the paternity of their supposed children. This sets the ground for further studies to understand social behavioral patterns in the Zimbabwean communities that drive this high level of PD. The level of PD in high paternity confidence group (i.e. the general population with no reason to doubt the paternity of their children) still needs to be investigated and compared to the observed 1-3% in other world populations (Kermyt G. Anderson, 2006).

The male to female ratio at child birth is 1.02 and this ratio declines with age indicating that, save for newborns, in any age group there are more females than males. Our results indicate that of the total tests conducted 66.22 % were male children whilst female children made up for only 33.78 %. These results indicate a stronger interest by social fathers in ascertaining paternity of male children as compared to female children. Zimbabwe is a patrilineal society meaning descent is traced through the male line. It could be that fathers are more interested in ascertaining the paternity of male children to ensure the continuity of the family legacy and name through the male child (Magezi E. Baloyi & Manala, 2019).

The number of court ordered paternity tests increased over the years. Of the 851 tests conducted 120 (14 %) were court ordered tests and of those 120 court ordered tests, 47 were cases of misattributed paternity. The increase in court ordered tests could be an indication of the increased awareness of paternity testing and its importance in legal proceedings such as child support claims. The media has played an important role in the increased awareness and interest in paternity testing (Turney & Wood, 2007), especially raising awareness on paternity fraud. Paternity fraud occurs when a woman secretly but knowingly misattributes paternity or points out a man as being the father of the child whilst having doubts about who the actual father is. Recently in Zimbabwe, a Gweru woman made the headlines after an arrest warrant was put out against her for two charges of fraud as she had been claiming child support payments from two men, for a period of no less than three years. Court ordered paternity

testing showed that neither of the two men was the biological father of the child (*Two Men Pay Maintenance for One Child, DNA Tests Prove None Is the Father - Zimbabwe Voice*, n.d.). The extent of paternity fraud remains under speculation as no studies have been done to investigate how frequently paternity fraud is occurring in Zimbabwe. Zimbabwe Maintenance Act (Chapter 5:09) requires one to pay monthly installments of child support for the upbringing of their child if the parents are divorced or separated. Currently in Zimbabwe it is not mandatory to get a paternity DNA test before child support payments are officialized by the courts unless the father or mother requests one. However, with high rates of misattributed paternity observed in this study it may be advisable to put legal frameworks which make it mandatory for paternity testing in order to reduce the risk of paternity fraud.

Results obtained show that of the total tests involving misattributed paternity, 83.21 % were revealed in peace of mind tests whilst 16.79 % were revealed in court ordered tests. Further research is required to understand the reason for the observed difference in PD between these groups which are both classified as low paternity confidence.

Comparative analysis of the age groups of the fathers and mothers showed that the mothers are significantly younger than the putative fathers by an average of 12.2 years. This age disparity can be explained by the study by (Lee & Mckinnish, 2018), which showed that men are more drawn to and satisfied by younger wives. Similar mating trends where on average the women are younger than their sexual partners have been across the world with sub-Saharan Africa showing the largest age disparity.(Barbieri et al., 2005; *Where Are the Largest Marriage Age Gaps in the World? | World Economic Forum*, n.d.). These studies have also explained the age disparity as being attributed to the need for economic growth and success for men and women being more attracted to successful men. This literature may also explain why the 31-44-year-old age group had the highest number of tested putative fathers as this age group is more economically productive and stable.

Although DNA testing has gained popularity over the years, the number of tests carried out each year is insignificant when compared to tests done in other countries. Further research on access and affordability of paternity testing needs to be done in Zimbabwe. The legal framework for DNA testing and its application also needs to be developed.

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