Title: Exploring the feasibility and validity of proxy pregnancy histories generated via a mobile phone survey in Malawi.

Short Abstract

Background: Proxy Pregnancy History (PPH) is a tool to collect pregnancy histories through proxy reporting. PPH can increase the effective sample size for estimating rates of child mortality and reproductive outcomes and allows data collection irrespective of the mother's survival status. However, the validity of PPH is poorly understood.

Methods: We conducted phone interviews with 500 index women and a nominated sister as proxies about the index's pregnancy histories. We compare individual reports and aggregated mortality rates.

Results: Proxies were older, more likely to own phones, and more educated than index women. 80.4% and 86.5% reported the same number of births and child deaths respectively as the index. Among matched pregnancies (n=1160), 95%, 91%, and over 95% had the same pregnancy outcome, and sex and vital status of children respectively. Most mortality probabilities were marginally higher for the index.

Conclusions: We observe high correspondence in pregnancy history reporting between index and proxies, suggesting PPH may be a promising methodology.

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Extended Abstract

Title: Exploring the feasibility and validity of proxy pregnancy histories generated via a mobile phone survey in Malawi.

Introduction

Proxy pregnancy (sometimes *birth*) histories (PPH) is a tool to collect pregnancy (or birth) histories through proxy reporting where women of reproductive ages (WRA) report on pregnancy histories of WRA they are close to, such as sisters or close friends. Women are asked to report on either all lifetime pregnancies or focus on pregnancy reporting within a specific timeframe. PPH involves questions relating to the outcome of each pregnancy, current survival status, age, sex, and age at death among others. By using PPH, we can potentially increase the sample size (in cases where interviewed women also provide their own histories), and reduce survey costs. Given that the interviewed woman (proxy) can also report on pregnancies of her deceased sisters/friends, we can also reduce biases in mortality estimates that arise due to potential correlation between child and mother survival.

Despite being a promising methodology, not many validation studies have been done to assess its feasibility and validity. The only known validation study to date conducted in 1995 in Tanzania showed that comparable mortality rates were obtained for less than 5 years before the survey, but markedly different for earlier periods (Bicego et al. 1997). In this study, we attempt to validate the quality of reports by proxies to index reports both generated via phone interviews.

Methods

As part of Rapid Mortality Mobile Phone Surveys (RaMMPS), we randomly administered Full Pregnancy History (FPH) and Truncated Pregnancy History (TPH) questionnaire modules to women of reproductive ages (18-49) and their referred biological sisters as proxies (aged 18-49) via mobile phone interviews. For FPH we adapted the VIII Demographic Health Survey (DHS) questionnaire to capture all lifetime pregnancies experienced by the index, starting with the earliest pregnancy (Akuze et al. 2021). The TPH questionnaire sought to collect information on pregnancies in the 7 years before the survey starting with the most recent as used in Malaria Indicator Surveys (MIS). We also collected detailed summary birth histories (SBH) for all women. All index women were members of the Karonga Health and Demographic Surveillance Site (HDSS) at the time of sampling (Crampin et al. 2012; Jahn et al. 2007). We oversampled women who had experienced events of interest in the years preceding the survey, as such our mortality indicators may be higher than normal.

A team of 5 interviewers (2 male and 3 female) with experience in conducting both in-person and telephone interviews (including on mortality and fertility) conducted interviews from their homes. Each index-proxy pair was interviewed by the same enumerator. With consent from participants, all interviews were audio recorded using SurveyCTO built-in audio-audit tool. All women were informed that they had a choice to choose to be interviewed by a female interviewer but none chose to use this option.

This analysis focuses on comparing reports made by the index and their proxy. We look at levels of agreement in 1) summary birth histories 2) pregnancy outcomes 3) Accuracy of reports of child/fetus survival status, dates of events, and ages. Our analysis assesses both matched and unmatched pregnancies. The pregnancy and child matching processes are outlined in Appendix A. In our analyses, we refer to the index woman's report as the reference dataset and consider it as the most accurate record. We also assume that the proxy was indeed reporting on the identified index.

Results

Out of 1,048 WRA interviewed in the main validation, 647 (61.7%) provided phone numbers of their sisters, 500 (77.3%) of whom were eventually interviewed (Figure 1). Compared to index women, proxies were likely to be older (p=0.04), more likely to own the phone we used in the interview (p <0.001), and more educated (p=0.04). There was no evidence of differences in marital status and place of call (Table 1).

Results from questions on children ever born (summary birth histories) showed that 80.4% of proxies were reported accurately, and 96.2% reported children ever born within 1 child of the index's report (Table 2). The proportion reporting the same number were higher for children currently alive (89.7%) and children born alive but later died (86.5%). Proportion of proxy women over reporting on different categories ranged from 47.9% to 53.9%, suggesting no inherent bias for proxies to over-report or under-report any of the categories.

Can proxy respondents answer questions about their sisters' pregnancies?

All index women provided a year of birth versus 96.2% of proxy respondents. However, reports of "don't know" were much higher for months than years of birth (58% vs <1% for index). As Figure 2 shows, seasonal patterns of births were different between the proxy and index. "Don't know's" were also more prevalent for the year (6/86, 7%) and month (68%) of abortions and miscarriages for proxy versus 0, and <1% respectively for the index. Similarly, the quality of age data was mostly similar between proxy and index participants, despite few observed differences (Figure 3).

Among unmatched pregnancies, there were more pregnancies reported by index (835) than proxy (816) via FPH, and marginally more pregnancies reported by proxy (440) than index (437) via TPH. Overall, index women reported more stillbirths, miscarriages, and abortions than proxies in FPH. Proxies on the other hand reported more miscarriages under TPH (Figure 4).

We successfully matched 1,160 out of possible 1,315 (88.2%) pregnancy pairs. Among these, we observed 95% pregnancy pairs (94.7% for FPH and 95.9% for TPH) with the same pregnancy outcome across the 2 reports (Figure 5). For those who were born alive, 91% of indexes and their nominated proxies reported the same sex of the child (Figure 6) and over 95% reported the same vital status on the day of the interview (Figure 7).

Table 3 presents probabilities of dying before the age of 5, before 29 days, and experiencing stillbirths and miscarriages between 2014 and 2022 under both FPH and TPH questionnaires,

before and after matching. Amongst unmatched data, proxy participants largely underestimated stillbirths, and miscarriages and FPH and overestimated miscarriages under TPH. For matched data, proxies underestimated stillbirths for FPH and overestimated miscarriages for both FPH and TPH. Other probabilities were generally higher for index participants.

Discussion

This paper presents early results from our analysis of proxy pregnancy histories reported by nominated sisters of HDSS sampled index women. Results show relatively high correspondence on several key areas such as pregnancy outcomes, sex of baby, and vital status on the day of the interview. Further, our results from summary birth histories are also promising.

Despite showing promising results, we also note that a high proportion of proxy respondents were unable to provide exact dates of events, for example, 58% of live births had no exact month of birth. This is similar to what has been observed in a similar RaMMPS study in Bangladesh where close confidants were interviewed (Kan et al. 2024). Unlike Bangladesh where over 30% of index participants also reported “Don’t know”, index participants in Malawi were able to provide months for over 90% of births. Given that our proxy participants were more educated than index women, it is unlikely that this is due to differences in education, but rather it may be attributed to the lack of interest or recall challenges.

Our summary birth history data in particular performs much better than the 1995 Tanzania proxy reporting validation where discrepancy percentages between children born, living children, and dead children were between 18.8 and 32.3 (Bicego et al. 1997). We hypothesize that our better results may be due to improvements in education, and the usage of technology that allows people to be easily updated with what is happening with their close friends and siblings.

Despite our efforts to reach as many proxy respondents as possible, the overall proportion of respondents actually interviewed is quite low. Further, the number of deaths recorded are quite low, which may eventually affect the mortality probabilities we calculate in this paper. Our third limitation relates to our untested matching process as our results may change as we improve the matching of proxy to index respondents. Finally, we also acknowledge that all the index participants, and most of the proxy respondents have in the past been involved in different (mostly face- to-face) MEIRU studies, as such the questions may be relatively easier to them and less likely to respond negatively to this study.

Conclusion

Our study shows that proxy reporting methods are currently much better than the 1995 Tanzania study indicates. Generally, it shows high correspondence between proxy and index reports on different metrics. However, it is important that other validation studies be implemented elsewhere.

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Tables and Figures

Table 1: Background characteristics: Index vs Proxy

		Index		Proxy		p-value
Age	18-24	113	22.6%	82	16.4%	0.044
	25-34	173	34.7%	192	38.5%	
	35-49	213	42.7%	225	45.1%	
Place of call	Home	398	79.8%	366	73.3%	0.19
	Workplace	39	7.8%	52	10.4%	
	Road	27	5.4%	39	7.8%	
	Market	8	1.6%	11	2.2%	
	Other	27	5.4%	31	6.2%	
Marital status	Married	279	55.9%	293	58.7%	0.62
	Cohabiting	28	5.6%	25	5.0%	
	Not in Union	191	38.3%	181	36.3%	
	Refuse	1	0.2%	0	0.0%	
Phone ownership	Owns phone	314	62.9%	386	77.4%	<0.001
	Someone else	185	37.1%	113	22.6%	
Education	None	6	1.2%	0	0.0%	0.044
	Primary	257	51.5%	254	51.0%	
	Secondary	207	41.5%	203	40.8%	
	Higher	29	5.8%	41	8.2%	

Table 2: Agreement between index and proxy reports: SBH

Fertility/mortality variable	% agreement	% agreement within 1 event	% of discrepant where proxy > index
Ever had children	98.6	-	-
Number of children born	80.4	96.2	51.5
Number of daughters born	84.7	96.0	53.9
Number of sons born	85.3	97.0	47.9
Number of living children	89.7	97.6	50.9
Number of dead children	86.5	98.6	49.2

Table 3: Probabilities of dying and experiencing adverse outcomes between 2014 and 2022, per 1000 pregnancies/live births

		Index	Proxy	Ratio (Index/Proxy)
Unmatched	Neonatal - FPH	18/212 = 84.9	17/211 = 80.5	1.05
	Neonatal - TPH	15/224 = 66.9	13/215 = 60.4	1.11
	Stillbirth- FPH	11/223 = 49.3	7/218 = 32.1	1.54
	Stillbirth- TPH	11/235 = 46.8	9/223 = 40.4	1.16
	Miscarriage- FPH	33/256 = 128.9	18/236 = 76.3	1.69
	Miscarriage- TPH	14/249 = 56.2	16/239 = 66.9	0.84
	Under 5 - FPH	23/212 = 108.5	23/211 = 109.0	0.99
	Under 5 - TPH	26/224 = 116.1	21/215 = 97.7	1.19
Matched	Neonatal - FPH	17/204 = 83.3	16/205 = 78.0	1.07
	Neonatal - TPH	13/210 = 61.2	11/205 = 53.7	1.15
	Stillbirth- FPH	7/214 = 32.7	4/211 = 19.0	1.73
	Stillbirth- TPH	7/213 = 32.9	6/212 = 28.3	1.16
	Miscarriage- FPH	13/237 = 54.9	16/227 = 70.5	0.78
	Miscarriage- TPH	4/217 = 18.4	5/217 = 23.0	0.80
	Under 5 - FPH	22/204 = 107.8	21/205 = 102.4	1.05
	Under 5 - TPH	22/210 = 104.8	19/205 = 92.7	1.13

Figure 1: Participation flowchart

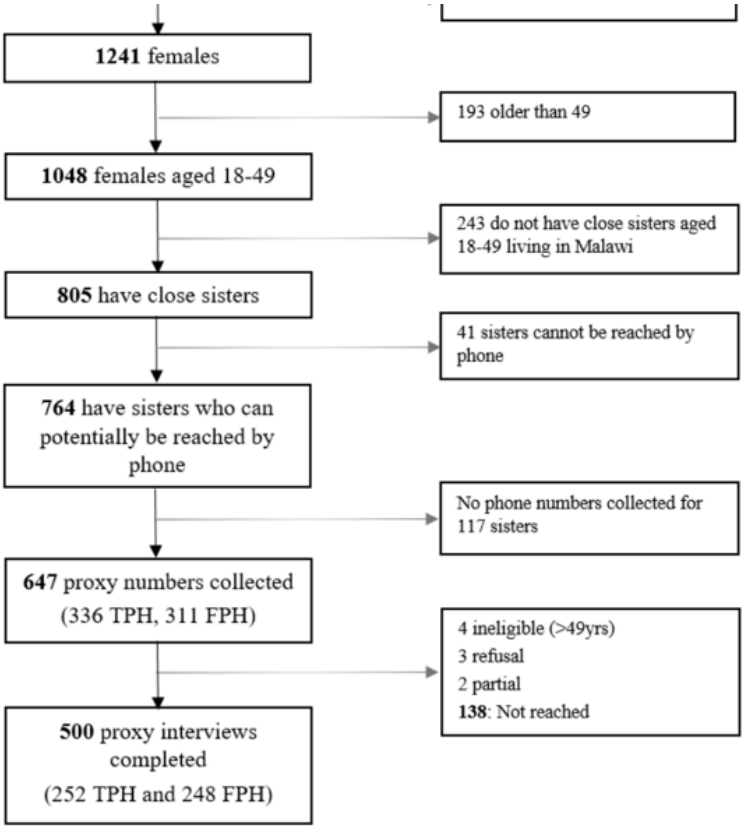


Figure 2: Seasonality of births, Index vs Proxy

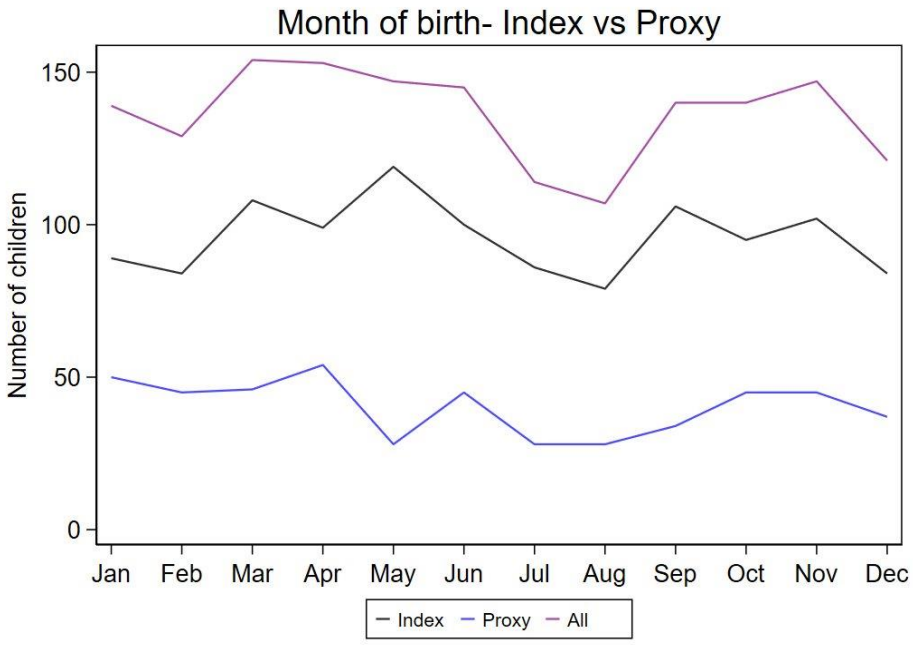
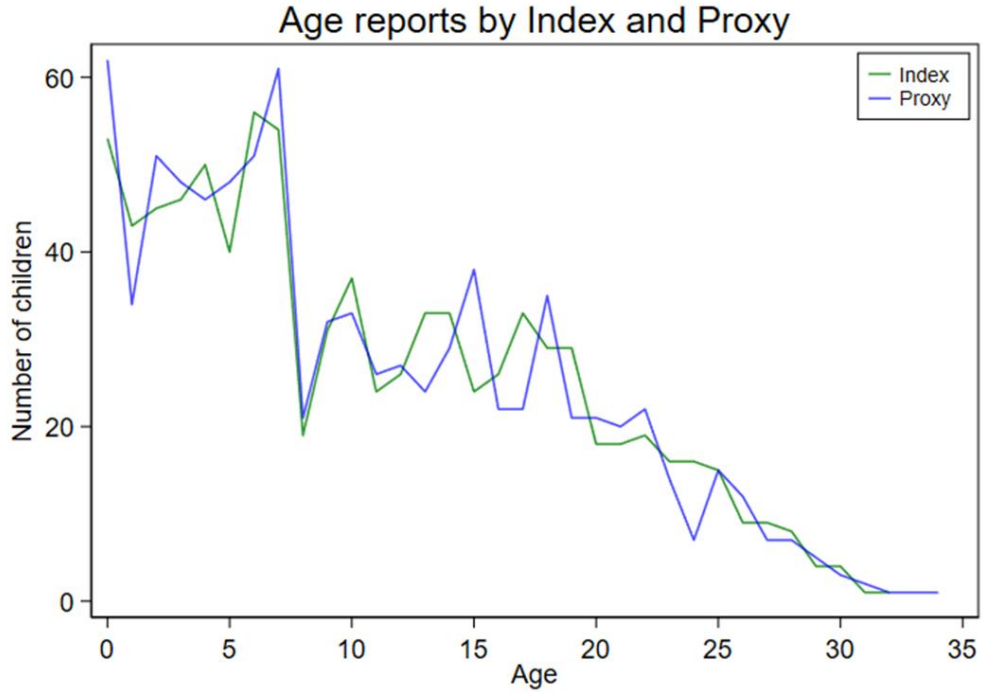


Figure 3: Quality of age reports: Index versus Proxy (unmatched)



Note: *Graph shows number of children by age. There are more children for ages 0-7 years, because it combines both TPH and FPH. Only FPH for >7 years*

Figure 4: Pregnancy outcomes amongst unmatched pregnancies

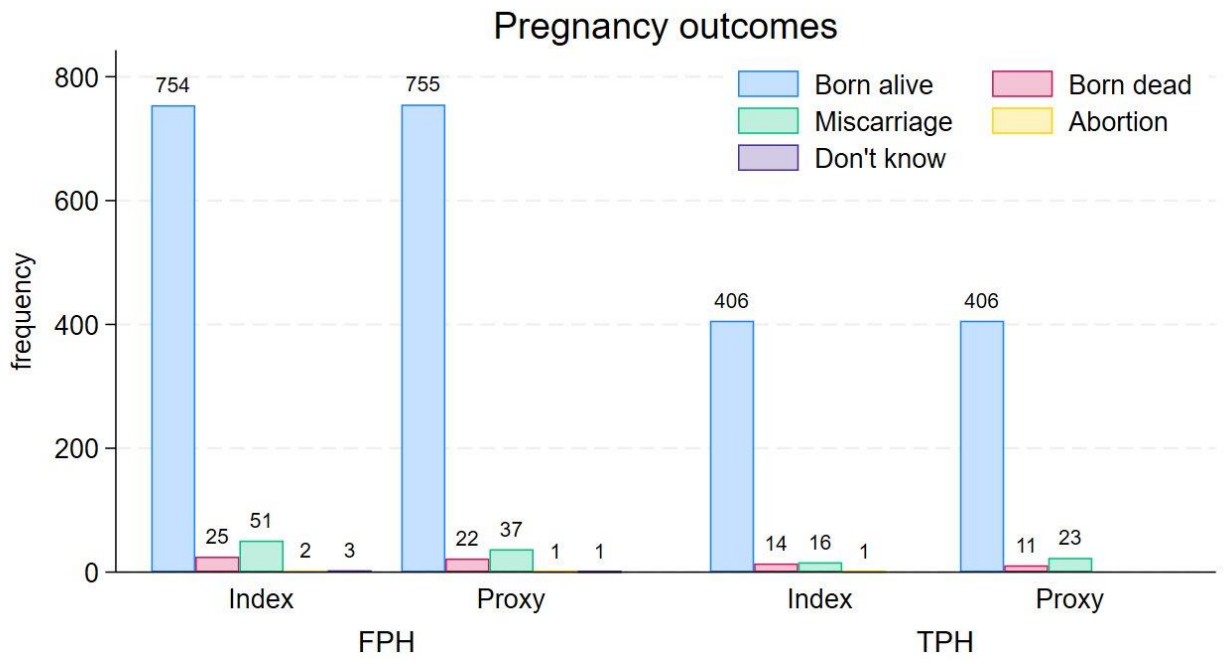


Figure 5: Pregnancy outcomes amongst matched pregnancies

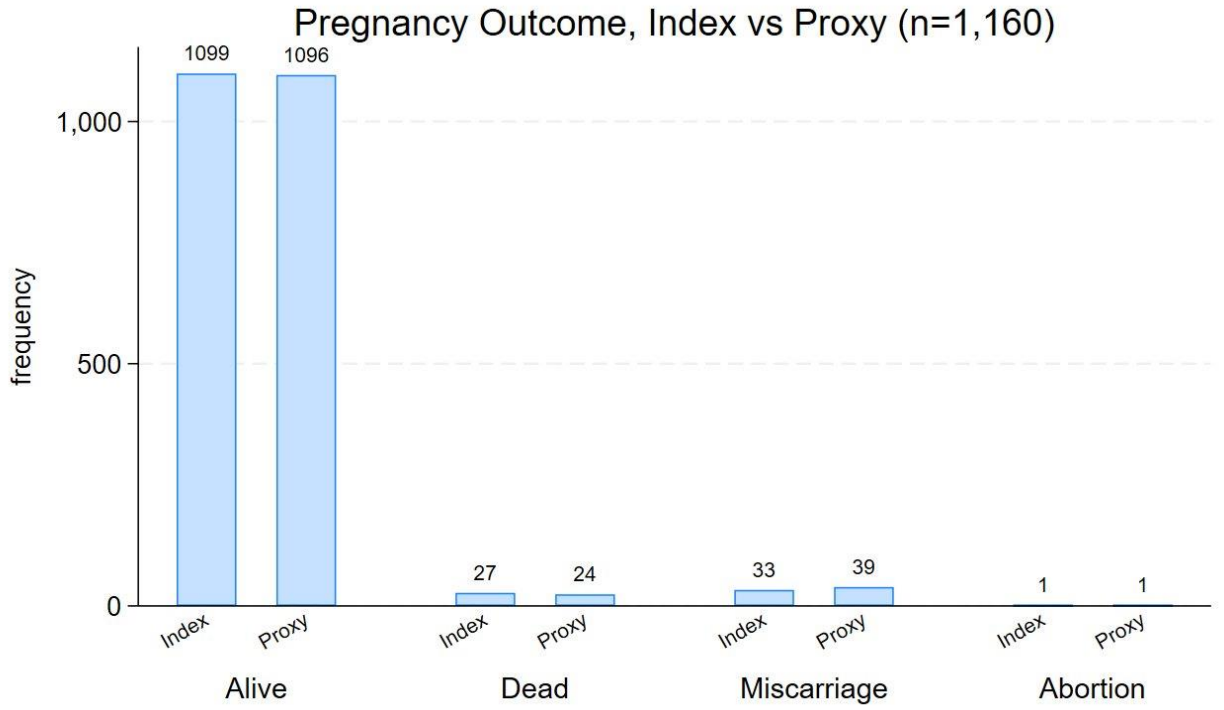


Figure 6: Sex of baby amongst matched pregnancies

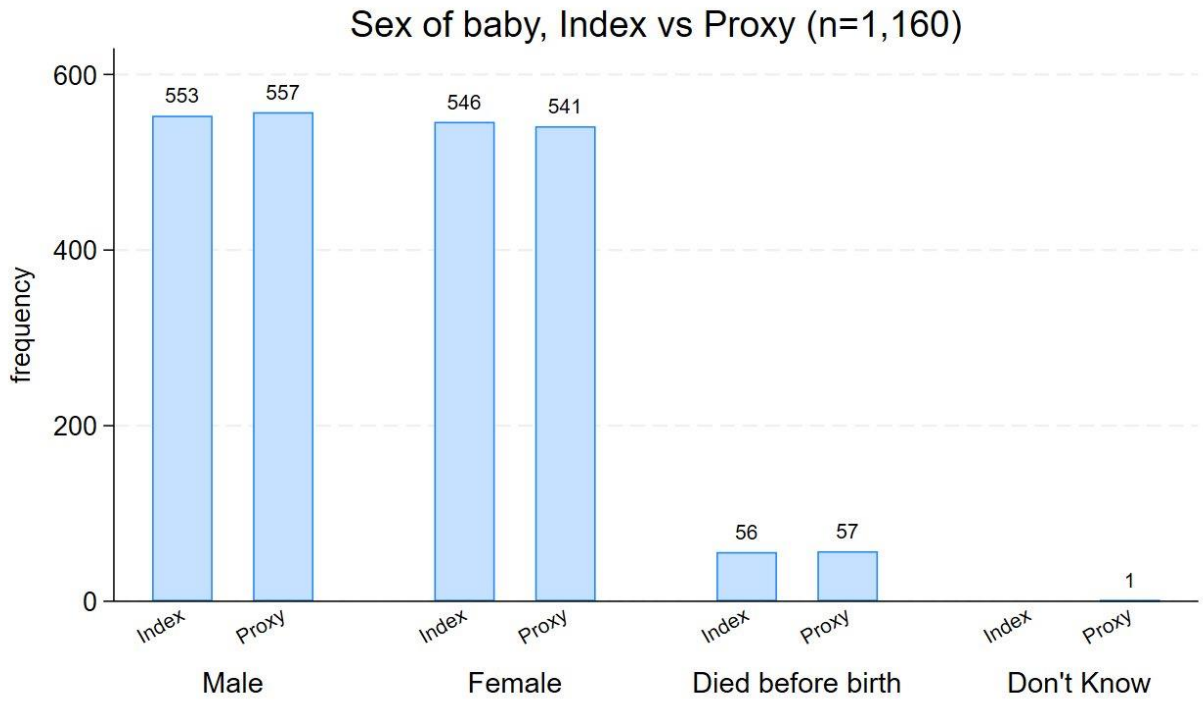
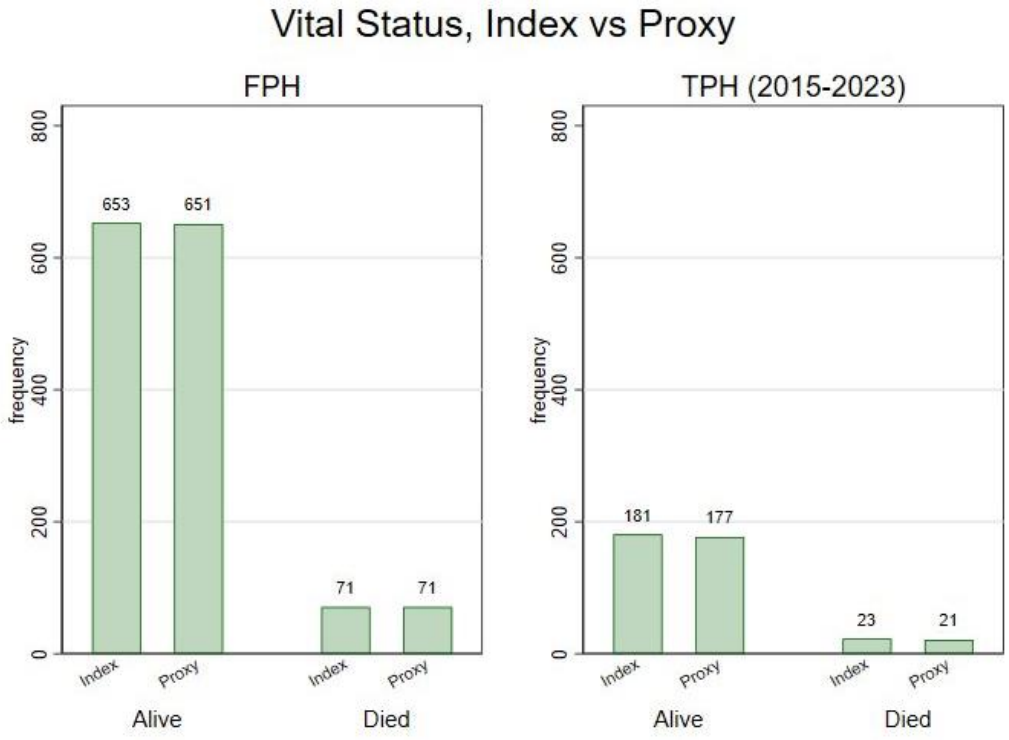


Figure 7: Vital status amongst matched pregnancies



Appendix A: Index- Proxy pregnancy/child matching process.

The following stages of matching were followed. If step 1, didn't result in a match, the unmatched pregnancies were retried with subsequent stages.

1. Mother unique identifier, Number of pregnancies, Pregnancy/birth order and Outcome year, Outcome month match: 97 matched
2. Mother unique identifier, Number of pregnancies, Pregnancy/birth order and Outcome year match: 268 matched
3. Mother unique identifier, Number of pregnancies and Pregnancy/birth order match: 470 matched
4. Mother unique identifier, Pregnancy/birth order, Outcome year and Outcome month match: 60 matched
5. Mother unique identifier, Outcome year and Outcome month match: 73 matched
6. Mother unique identifier and first name match: 118 matched
7. Mother unique identifier + manual matching: 74 matched

Result:
1,160 pregnancy pairs matched (1,104/1195 singleton pregnancies + 56/120 multiple births)