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Introduction

Throughout the world, women terminate unwanted pregnancies for a range of reasons: when a woman feels she cannot care for a/another child, when a pregnancy will hurt opportunities for education or employment, when a pregnancy is the result of coerced sex, when a pregnancy is conceived at a point in a woman's life when it is socially unacceptable or stigmatizing to have sexual intercourse or bear a child. Abortion is common in most parts of the world. Generally speaking, abortion is safe where it is legal and unsafe where it is illegal, although there are contexts in which unsafe abortions are practiced even though abortion is legal. Globally, unsafe abortion results in significant morbidity and mortality (Woog and Pembe 2013; Grimes et al. 2006). In Tanzania, east Africa, abortion is only legal if the pregnancy is a threat to the woman's life (The World's Abortion Laws 2008), yet abortion is widely practiced.
The consequences of unsafe abortion are dire in Tanzania, where abortion accounts for an estimated 17-21% maternal mortality (Say 2014).

Most abortion research in east Africa is conducted among patients receiving post abortion care (PAC) (Rasch and Kipingili 2009; Sorensen et al. 2010). The prevalence of unsafe abortions among women who come to hospitals for PAC in Tanzania has been documented (Rasch and Kipingili 2009; Rasch et al. 2004; Rasch et al. 2000); up to 60% of women admitted to the hospital with 'miscarriage' have, in fact, induced abortion. Across Eastern Africa, more than 600,000 women were estimated to be hospitalized for induced abortion complications in 2005, corresponding to a rate of 10 per 1,000 women aged 15–44 (Woog and Pembe 2013). The true proportion of Tanzanian women who have had an unsafe abortion is unknown. On the one hand, abortions that lead to serious complications and hospitalizations are not likely to be representative of the majority of induced abortion attempts in sub-Saharan Africa because many women who attempt an unsafe abortion will be successful without complications, and will not obtain PAC (Justesen, Kapiga, and Asten 1992). On the other hand, some who need medical care after unsafe abortion may not or cannot seek it. In addition, while hospital-based data are limited in important ways, the stigmatized nature of abortion makes it challenging to obtain information about unsafe abortion from population-based survey data.

In Zanzibar, a semi-autonomous archipelago region of Tanzania, less than 12% of married reproductive-aged women use modern contraception (Tanzania DHS, 2010). Unplanned or unwanted pregnancy is correspondingly common. From studies on mainland Tanzania, we know that women use a wide variety of methods to terminate unwanted pregnancies, including ingesting (or inserting into the vagina) a variety of locally grown herbs, chloroquine, laundry detergent, and ashes (Plummer et al. 2008; Silberschmidt 2001). Complications in these settings include infection and fever, heavy vaginal bleeding, and cervical or uterine trauma (Mpangile, Leshabari, and Kihwele 1993). Despite the public health significance of abortion, while there are several published studies about abortion on mainland Tanzania, there are no studies about abortion in Zanzibar in the peer-reviewed literature. From communications with the Ministry of Health in Zanzibar and with physicians in Zanzibari public hospitals, we know that women in Zanzibar are having abortions, using a variety of methods. PAC for treatment of complications of induced and spontaneous abortion is legal in Zanzibar and well supported by the Zanzibar Ministry of Health. PAC is a leading cause for gynecological ward admission in the main public hospital in Zanzibar, although the hospital does not collect data about how many patients have experienced unsafe abortions.

As part of an exploratory, multi-method study about contraception and the consequences of unwanted pregnancies in Zanzibar in 2010, we sought to understand the experiences of a community-based sample of women who had terminated pregnancies and whether or not they needed PAC services afterward. Using the results of 44 interviews with women recruited via chain-referral sampling, we report the characteristics of women who have had abortions, the reasons they had abortions, and the methods they used to terminate their pregnancies.

Methods

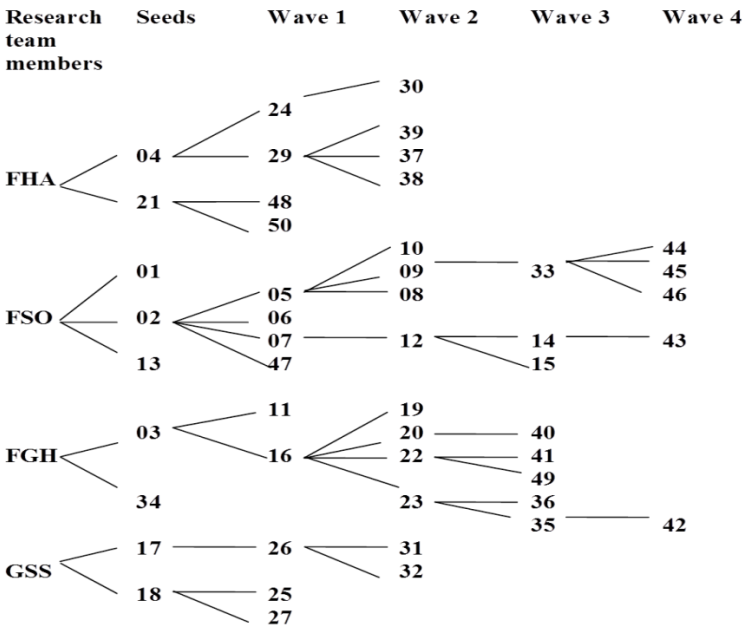
Recruitment

Because of the stigma surrounding abortion, women commonly fail to report abortion in interviews. Thus to interview women who had had abortions about their abortion experiences, we utilized a network-based sampling method known as chain-referral or snowball sampling to recruit women from the urban and peri-urban communities surrounding Zanzibar town who had terminated a pregnancy. Chain-referral sampling is a non-probability sampling technique that is particularly useful to reach

'hidden' populations with stigmatized or illegal behaviors because participants are recruited by acquaintances who themselves participated in the research (Heckathorn 1997, 2002). With the chain-referral method, the sample is initiated by the research team recruiting some known members of the target population (the 'seeds'). These seeds then recruit a small number of others in the population (who become the first 'wave'). Members of each wave in turn recruit other participants. We aimed for interviews with 30 women who had experienced at least one induced abortion, in order to achieve diversity of participant characteristics and abortion experiences.

Members of our research team invited acquaintances they knew had had abortions to be interviewed. Those who agreed to be interviewed were the nine seeds. Upon conclusion of their interview, each of the seeds, and then all participants up to the 40th participant (at which point new recruitment was closed), were asked if they were interested in inviting others to participate. Those who were willing were given recruitment cards to share with up to three other women known to them who had had an induced abortion. The cards indicated that we were researchers interested in talking with women about their experiences and thoughts about reproductive health, and included a number for women to call for more information. In practice, nearly all recruited women were brought directly to the interview site by the acquaintance who recruited them. The recruitment continued in this way extremely rapidly between May 15 and 31, 2010, for five waves. Of the 48 women we interviewed, 44 had had one or more induced abortion.

Figure 1: Participant recruitment via chain-referral sampling



Our participants recruited between zero and four new participants, with a mean of one (standard deviation 1.2).

Participants and procedures

To be included in the study, all participants had to be 15 years or older, able to give informed consent, able to participate in a Swahili language interview, were a resident of one of Zanzibar's islands, and had self-reported an induced abortion.

Verbal informed consent was obtained prior to the interviews. Interviews were conducted in Swahili by Zanzibari research assistants trained in empathic interviewing techniques, following a semi-structured interview guide. The interviews took place in private rooms within our study office, which was located adjacent to the main market in Zanzibar town, making it easy for women to visit without drawing attention. Some interviews were audio-recorded and transcribed. For participants who declined audio-recording, interviewers wrote notes during interviews to record participants' responses.
Each interview lasted approximately one hour. All interview participants were given 3,000 Tanzanian shillings (equivalent to US$2) for their time and transportation costs.

The interview included basic demographic questions, as well as questions about the details of

participants' induced abortion, age at abortion, relationship status at the time of the abortion, and reasons for termination. Each participant was asked about the steps she took and methods she used to terminate the pregnancy. Participants were asked whether they had visited a hospital for PAC following the induced abortion. The interviewers asked probing follow-up questions to elicit details, but participants were not prompted with lists.

Analysis

Responses were entered into spreadsheets for analysis. The qualitative data were hand coded for analytic categories; categorical information was tabulated, and frequencies were calculated. We present here a descriptive analysis of the data.

Ethical review

This study was approved by the Zanzibar Medical Research Ethics Committee and the Johns Hopkins School of Public Health Institutional Review Board.

Results

Participant characteristics

We interviewed 48 women. Four of these 48 reported spontaneous abortion instead of induced abortion. While we exclude these four women from the rest of this analysis, their participation demonstrates that people recruited via chain-referral may not necessarily have the characteristic of interest, and misclassification needs to be avoided. Four other women reported more than one abortion; two of these women gave in-depth information on both abortions. All other participants reported only one termination. In sum, we present information on 46 terminations from 44 women.

Participants reported varied abortion experiences and contexts. All participants were Muslim and nearly all (96%) had at least some secondary-level education. All resided in Zanzibar town or the peri-urban communities near to town. Participants' ages at the time of the interview ranged from 20 to 52 years (mean 32.8 years) (Table 1). At the time of interview, the participants had a minimum of one pregnancy (n=10, 23%) and a maximum of 8 pregnancies, with half of the women reporting four or more pregnancies (n=22, 50%), giving an overall mean of 3.4 pregnancies per participant.

At the time of pregnancy termination, the youngest age reported was 13 and the oldest was 38 (mean 24.2 years) (Table 2). When they had their abortion, 43% (n=20) of participants were single and had never been married, 43% (n=20) were married, and 13% (n=6) were divorced or widowed. Women terminated pregnancies at a variety of points in their reproductive lives. For over a third of participants, women terminated their first pregnancy (n=17, 37%). Twenty percent of terminated pregnancies were the second (n=9), and 15% (n=7) of terminated pregnancies were the third pregnancy. More than a quarter of terminated pregnancies were the woman's fourth pregnancy or higher (n=13, 28%).

Table 1. Participant characteristics at time of interview (n=44 participants)

		N	(%)
Age at interview (mean 32.8 years)			
	< 20 years	0	(0)
	20-29 years	24	(5)
	30-39 years	13	(30)
	>40 years	7	(16)
Relationship status at interview			
	Single, never married	10	(23)
	Married	30	(68)
	Divorced/widowed	4	(9)
# lifetime terminations			
	1	40	(91)
	2	4	(9)
	3+	0	(0)
# pregnancies at time of interview			
	1	10	(23)
	2	8	(18)
	3	4	(9)
	4+	22	(50)
	Range (mean)	1-8 (3.4)	
Ever contraception use (lifetime)			
	Never used contraception	7	(16)
	Calendar/rhythm method or withdrawal	12	
	Condom	9	
	Oral contraceptive pills	25	
	Depo injection	15	
	Hormonal implant or IUD	5	
	Tubal ligation/hysterectomy	1	

Table 2. Participant characteristics at time of abortion (n=46 abortions)

		N	(%)
Age at termination (mean 24.2 years)			
	< 20 years	11	(24)
	20--29 years	24	(52)
	30-39 years	8	(17)
	>40 years	0	(0)
	missing	3	(7)
Relationship status at termination			
	Single, never married	20	(43)
	Married	20	(43)
	Divorced/widowed	6	(13)
Primary reason(s) for termination *			
	Had young child	16	(35)
	Extramarital pregnancy	16	(35)
	Was student in school	14	(30)
	Shame: societal, parental	12	(26)
	Financial concerns	9	(19)
	Relationship concerns	5	(11)
	Housing concerns	4	(9)
	Had many children	3	(7)
	Health concerns	2	(4)
	Didn't want pregnancy at that time	2	(4)
# pregnancies at time of termination			
	1	17	(37)
	2	9	(20)
	3	7	(15)
	4+	13	(28)
	Range (mean)	1-8 (2.6)	
Using contraception at time of pregnancy			
	Not using contraception	28	(61)
	Calendar/rhythm method or withdrawal	11	(24)
	Condom	3	(7)
	Oral contraceptive pills	3	(7)
	Depo injection	1	(2)
	Hormonal implant or IUD	0	
	Tubal ligation/hysterectomy	0	

* Multiple responses allowed; total > 100%

Reason for terminating pregnancy

In discussing their abortions, participants described conditions under which continuing an unwanted pregnancy would threaten a successful future. Many women responded with multiple reasons why they terminated their pregnancies. The two most common reasons cited were 'having an infant' (n=16, 35%) and 'extramarital pregnancy' (n=16, 35%). Women who reported having an infant as a reason for termination worried about their inability to cope with the responsibility of a second infant. Also, those with infants were concerned about the social expectation that they should breastfeed the current infant for two full years, conflicting with another social norm that they should stop breastfeeding as soon as a new pregnancy was known.

Conceiving the pregnancy outside of marriage (including never married women, a portion of whom were students, divorced women, and one woman who was married and conceived the pregnancy with a man who was not her husband) was commonly cited as a reason to terminate a pregnancy (n=16, 35%). Shame of pregnancy was mentioned by many participants; including feeling ashamed of what the woman's parents would think, and feeling ashamed of what other people would think about her having a pregnancy at that time. While pregnancy among never married women is more stigmatized than pregnancy among divorced women, divorced or widowed women said they terminated to avoid the shame of having a child out of wedlock. For one married woman, a pregnancy was shameful proof of sexual intercourse outside of her marriage.

In Zanzibar, the stereotypical view of abortion is that young unmarried students seek it (Brown 2013), and indeed 30% (n=14) explained that they decided to have an abortion because they were students at the time. For students, pregnancy reveals that they have had socially unsanctioned sexual intercourse. In addition to the social stigma, bearing a child may preclude successful completion of schooling. Some of the students gave additional reasons for termination that included being unmarried and feeling shame about the pregnancy.

Participants described concerns about financial well-being and/or housing, including an explanation that 'life is hard,' that the woman's residence was not big enough for a new baby, or that the woman lived with her parents who would not welcome an infant. Women who were not married feared dissolution of their unions and expulsion from their natal homes. For a few participants, health concerns (previous

difficult labor, older maternal age) and relationship concerns (abusive husband, separated from partner) were reasons for terminating pregnancies.

Methods of pregnancy termination

The majority of reported terminations (38 of 46, 82%) were successful on the first termination attempt, which often involved a combination of methods (Table 3). The most effective first method was a termination at a hospital, either public or private (n=14, 30% of 1st attempts). Other methods used initially included assistance from a medical worker but not at a health care facility (n=4, 9%); the medical qualifications of these providers was not well described. Eight of the 46 attempts had to use a second method to terminate their pregnancies. Ultimately half the sample had a successful abortion with a clinician (41% (n=19) in a hospital setting and 11% (n=5) in a medical provider's house); we do not know specifics about which methods the clinicians used in either of those settings. A significant proportion (n=21, 46%) successfully terminated a pregnancy using herbs. A known abortifacient, henna plant root, was used successfully alone or in combination for 22% of abortions (n=10). Other reported methods used in combinations included drinking strong tea (n=12, 26%), taking other traditional medicine (n=12, 26%) and overdosing of medications (n=3, 6%).

Many participants described using 'hospital' or 'medical worker's house' as the place for obtaining the abortion, and some of the care they received in those settings overlaps with the care that would be given for PAC. We do not characterize these women as having received PAC because the woman went for an abortion, not PAC. Three participants utilized PAC; two for complications after self-induction efforts and one for reassurance. The rest had successful abortions at home or in clinics.

Table 3: Methods participants used to abort pregnancies (n=46)

	First method*		Final method**	
Method of termination	N	(%)	N	(%)
Hospital	14	(30)	19	(41)
Medical worker's house	4	(9)	5	(11)
Henna root alone	5	(11)	5	(11)
Strong black tea alone	2	(4)	1	(2)
Tetracycline alone	1	(2)	1	(2)
Combo: Henna root, strong black tea	4	(9)	1	(2)
Combo: Henna root, strong black tea, traditional medicine	3	(7)	3	(7)
Combo: Henna root, strong black tea, tetracycline	1	(2)	1	(2)
Combo: strong black tea, chloroquine	1	(2)	1	(2)
Combo: traditional medicine, strong black tea	5	(11)	5	(11)
Traditional medicine***	6	(13)	4	(9)

*first method includes participants for whom this method succeeded or failed.
** final method count excludes participants who used this method but were not successful with it; final method count includes participants who used this method successfully after failing a different first method.
*** including a variety of herb and plants, for example: *Plectranthus* spp, papaya tree root, cassava plant leaves, mango tree seeds, garlic, ground chalk, and lime tree root

Discussion

Women in Zanzibar terminate pregnancies that are unwanted for a range of reasons, at various points in their reproductive lives, using multiple methods, and usually without complications requiring PAC. While facility-based methods were the most effective, nearly half of our participants reported success using non-facility methods. The broad variation of experiences is noteworthy in light of our non-random sampling method.

In this exploratory study, we demonstrate that chain-referral sampling is an effective method to gather abortion experiences from a community-based population. In addition to the efficiency that chain-referral sampling offered (in identifying people with a particular characteristic), the method also had the benefit that participants came in with trust, having been recruited by someone they knew. Further, participants were recruited knowing that the purpose of their participation was to talk about their

induced abortion, reducing the chance of misclassification. In comparison, in the post-abortion care setting, misclassification error is common due to women's reluctance to self-report induced abortion in the hospital while receiving care (Rasch 2000). While abortion is not thought to be rare among Zanzibari women, it goes largely unreported, so chain-referral sampling facilitated the successful exploration of an otherwise hidden experience. We note that women do talk with their social contacts about abortion, and thus can refer each other via chain-referral sampling, despite the stigma of abortion. Though the method uses non-probability sampling, if we were to have continued recruitment and had long chains of participants, the sample could have reached a point at which the final sample would not be biased by the purposeful selection of the initial seeds (citation). Our small sample size precluded use of any statistical adjustments to produce generalizable samples, but if the sample were large and the population socially networked (citation), chain-referral sampling could produce generalizable results and be a strategic method for abortion studies.

Our study benefited from the chain-referral method to reach, in an efficient way, a hidden behavior among women in Zanzibar. However, our methodology favored participation from women who lived close to, or were willing to travel to, the urban center where the research study was based. Additionally, it is possible that the method was more likely to capture women who had recent abortions and/or more complicated abortions, as these may have been remembered more by their acquaintances. On the other hand, women with complicated abortions may have been less likely to want to participate. Overall, we cannot describe the population from which our study sample was drawn. Because we recruited only women who did terminate a pregnancy, our study design also excludes women who tried but failed to terminate a pregnancy. This may be a large number of women, and represents a dual public health problem: the continuation of unwanted pregnancy *and* the potential sequelae from ineffective abortion attempts. In addition, some of our participants were describing abortions that had happened years in the past, which may lead to recall bias. On the other hand, having more distance from their induced abortion experience will allow these participants to reflect on the entire event and consider how the abortion fit into the arc of their lives. We are also unable to capture data on women who died in their attempt to terminate a pregnancy.

Most women in our study terminated pregnancies without the complications that lead to hospitalizations. Thus, even in settings where abortion is illegal, some women experience what we might call 'safer' abortions; these kinds of abortion experiences are missed in studies conducted among

women seeking PAC in hospitals. Most data about abortion in context where it is illegal are extrapolated from PAC data (Sedge 2007). Our data highlight the extent to which such studies in PAC contexts may underestimate the number of abortions that take place in a community, while simultaneously overestimating the morbidity and mortality of the abortions that do occur. Participants described that they keep their abortions secret; perhaps many of these abortions would not have been reported in household surveys like Demographic and Health Surveillance surveys.

Our findings about the methods used to terminate pregnancies come from the participants themselves, and so often lack clinical specificity. We assume that participants who had their abortions in hospitals, clinics, or 'the doctor's house' had procedures that include dilation and curettage and manual vacuum aspiration. We found that misoprostol as a method for abortion was not widely known in Zanzibar at the time of our study. Many women in our study obtained successful abortions from clinicians, demonstrating that some providers in Zanzibar give abortion care, even in a legally restricted environment.

Nearly a quarter of participants specified using the root of the henna plant (*Lawsonia inermis*), alone or in combination. Henna is a known abortifacient (Gagandeep Chaudhary 2010; Rasch 2009). In the category of 'traditional medicine,' we were capturing a combination of plant products, including *Plectranthus* species, papaya tree root, cassava plant leaves, mango tree seeds, garlic, ground chalk, and lime tree root, some of which may have been abortifacients, and others of which may not have been. Across sub Saharan Africa, many local plants are boiled down to a concentrated tea and used to induce abortions. Several species (e.g., *Bidens pilosa, Commelina africana, Desmodium barbatum, Manihot esculenta, Ocimum suave, Oldenlandia corymbosa and Sphaerogyne latifolia*) have been shown to have uterine contractile activity (Nikolajsen et al. 2011). Beyond henna, we do not know exactly what plants our participants may have been exposed to. In mainland Tanzania and Zanzibar women prefer to turn to traditional birth attendants and pharmaceutical retailers for help with abortions, as they offer greater convenience, privacy, and lower costs than physicians (Marchant et al. 2004. Brown et al. 2013). Drawbacks to these methods include the inability of the tea-maker to control dose of pharmicoactive agent, the possibility of side-effects, and lack of data about efficacy and safety. For other medical treatments, many Tanzanians will try traditional medications first and turn to biomedical treatments only if the first treatment fails.

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Many participants used 'strong black tea' (boiling a kilogram of tea leaves down to a single cup of tea) as part of their abortion methods. We hypothesize that this leads to a very high caffeine content in the tea, and that could theoretically cause abortion. Epidemiological studies investigating the association between high caffeine consumption and spontaneous abortion have found conflicting results. While animal studies have not supported the concept that caffeine is an abortifacient for the wide range of human caffeine exposures (Brent, Christian, and Diener 2011), a meta-analysis of 43,000 pregnancies found a small but statistically significant [OR 1.36 (1.29-1.45)] increase in the spontaneous abortion among women consuming more than 150 mg caffeine per day. In other work, Klebanoff et al., assessed serum levels of paraxanthine, a metabolite of caffeine, to estimate the dose of caffeine at matched time points in women who did and did not have spontaneous abortions. Only extremely high serum paraxanthine concentration levels were associated with spontaneous abortion (Klebanoff et al. 1999). Perhaps the method of concentrating black tea used by our participants contains a high enough level of caffeine to induce abortions.

While we cannot preclude the possibility that some women may have used ineffective methods to attempt induced abortion, and may instead have had spontaneous abortions or delayed menses, we have demonstrated that multiple methods of abortion are known and used with the intent of terminating unwanted pregnancies in Zanzibar. Importantly, several methods—including soap and inserting objects into the vagina or uterus—described in other studies—were not mentioned by our participants. (Kidula 1992, IPPF, 1994; Doclub, 1980, Yoseph, et al., 1993, Marchant et al. 2004) These more dangerous methods are used in Zanzibar, we know, because of stories from PAC providers in public hospitals. No participants described self-induction with misoprostol.

The surest way to prevent unsafe abortion is to prevent unwanted pregnancies. In our study, 16% of women were using contraception at the time they became pregnant. Given the life circumstances described as the reasons for the abortion, it is evident that there is the need to promote contraceptive use. While increasing contraceptive use will not eliminate the need for abortion, it will likely result in fewer abortions in the long run. At the same time, social norms about abortion's immorality, abortion's illegal status, and widespread beliefs about abortion's health risks present particular challenges for improving abortion care in Zanzibar. Insofar as women believe that abortion is necessary for some

reasons, this rationale may serve as an entry point for lawmakers to advocate for changed laws, and for health care workers to provide abortions in cases permitted by law.

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