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Children and pesticides: Does having a young child in the household reduce pesticide use?

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Nicola Wills is a Masters student in the School of Economics, University of Cape Town. This paper is based on her Economics honours dissertation.

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Abstract

Rodent infestation is a growing problem in many informal settlements within South Africa. This paper looks specifically at Khayelitsha Site C, where overcrowding and inefficient waste removal encourages rodent infestation, and many people resort to the use of 'street pesticides' in order to try to improve their circumstances. The majority of these pesticides come from vendors in the townships and are highly toxic. This poses a risk to the children of the community who may accidentally consume these poisonous substances. This paper uses survey data from the Khayelitsha Rodent Study (KRS) 2017-2018 to investigate whether the presence of a child younger than the school-going age decreases the likelihood of a household purchasing rodenticides. In attempting to answer this question, the analysis is presented in the form of a comprehensive review of the literature, probit regression models, and information provided by holding a focus group consisting of four women who participated in the KRS survey. The findings suggest that the presence of a young child does in fact decrease the probability that a household will purchase poison and that this finding remains robust to the inclusion of other potential determinants of rodenticide demand, including concerns about the connection between rats and witchcraft.

1. Introduction

In 1900 the shipment of fodder for British horses during the South African war brought bubonic plague, carried via fleas on rats within the fodder, to Cape Town (Swanson, 1977). Rats were seen dying in great numbers on the docks, but the military officers in charge did not report this to the health officers and it was only when dock workers started dying in early 1901 that the alarm was raised. During this period, the authorities associated the plague crisis with the African populace living in slum conditions in Cape Town. This led to the mass relocation of Africans - despite the fact that fewer Africans had contracted the plague than white or coloured people (Swanson, 1977). Rodent control thus functioned as an ideological tool to justify racial segregation.

Rats, when established in urban areas, are very difficult to eradicate, especially in low income areas where dilapidated structures, overcrowding and inefficient waste removal provide food and harbourage (Himsworth et al., 2013; Jassat et al., 2013). Cape Town, as is the case with most global cities, combats rodent infestation with rodenticides (rat poison). This is especially evident in Khayelitsha, Cape Town's largest township (Nattrass et al., 2019). Khayelitsha was built during the early 1980s and is the second largest township in South Africa (Beyond Our Borders, n.d.). According to the 2011 census, 55% of Khayelitsha households are in informal areas (Statistics South Africa, 2013:3) where waste removal is erratic and inadequate, causing problems with rodent infestation (Green, 2018). Most people have learnt to associate rat extermination techniques with the use of poison, including both legal and illegal street pesticides (Roomaney et al., 2012).

In 2014/15 the local government department of Environmental Health (EH) launched a job creation program in Khayelitsha whereby unemployed individuals were given jobs, which comprised of setting cage traps in people's homes. The rats were caught and thereafter drowned, in an attempt to curb the rodent infestation in a way that avoided any use of poison (Nattrass et al., 2019). However, the South African National Council for Societies for the Prevention of Cruelty to Animals (NSPCA) ended this program when they threatened legal action unless the drowning of rats was put to a stop. The EH was then forced to go back to the former method of offering poisoned bait to households with rat problems, despite the fact that most people living in Khayelitsha site C supported the method of cage-trapping and drowning (Nattrass et al., 2019).

Pesticides, including rodenticides, pose a serious threat to wildlife and domestic animals (through secondary poisoning), but more troublingly they can pose a serious health hazard to young children (Tolosana et al., 2009). This is especially the case with regard to the illegal use of agricultural chemicals (often sold as street pesticides) as a means of controlling household pests (Rother, 2010). Khayelitsha EH officials were hoping not only to reduce the harm caused by their own rodenticides, but to encourage households to shift away from use of the entire range of legal and illegal poison (Nattrass et al., 2019).

This paper seeks to delve deeper into the demand for poison, both legal and illegal, in Khayelitsha, and to explore whether the presence of young children in the household affects demand. More specifically, the objective is to investigate whether the presence of a child younger than the school-going age decreases the likelihood of the household purchasing poison for rodent control. The hypothesis is that despite people being desperate to get rid of the rats, they are aware of the health risks imposed by using these poisons. If so, then having a

young child in a household will decrease the likelihood of purchasing poison for rodent control. I would then expect this finding to remain robust to the inclusion of other potential determinants of the demand for poison, including socio-economic status, the degree of rodent infestation, attitudes towards rats, and the dangers of poison to wildlife and pets.

2. Risks imposed on children

Poison use in the form of pesticides can pose a serious health risk to people who come in contact with them (Mngadi, 2016). Studies suggest that pesticide exposure may be related to an increased susceptibility to many diseases such as cancer, leukemia, Parkinson's disease, diabetes and asthma (Kim et al., 2016:530). Additionally, the effects of pesticide exposure are more prominent in particular categories of people, notably children, pregnant women and the elderly (Kim et al., 2016:530). There are several factors that make children especially vulnerable, namely their immature physiology and hand-to-mouth behavior (Tolosana et al., 2009:180). The ingestion of contaminated food, inhalation of low-lying contaminated layers of air, and skin exposure followed by absorption, are the main vectors for childhood poisoning. Additionally, in utero and early childhood exposure may cause low birthweight in newborns, as well as impairments in their reproductive development and cognitive progression (Tolosana et al., 2009:180,184). In 2001, the United States Environmental Protection Agency (EPA) banned the residential use of most toxic rat poisons because of the public health concern of accidental exposure (Roomaney et al., 2012). In South Africa, there is growing awareness of the problem of pediatric pesticide exposure and poisoning; however, this kind of legislative action has not as yet been taken (Balme et al., 2010).

Many people in Khayelitsha live in poor circumstances which include a lack of adequate housing, overcrowding, ineffective waste removal and poor sanitation, which, as noted above, are perfect conditions for the proliferation of rats. Residents turn to cheap and easy solutions which often take the form of illegal street pesticides. The majority of these pesticides come from vendors in the townships, trains and railway stations, and are highly toxic (Roomaney et al., 2012; Rother, 2016). The vulnerability of children and the ease of access to these illegal pesticides has resulted in a high number of acute pesticide poisoning cases presented at the Red Cross War Memorial Children's Hospital (RCWMCH) from 2003 to 2008 (Balme et al., 2010:928). Tolosana et al. (2009) found that 89% (n=61) of South African children living in informal settlements had been exposed to pesticides. This problem has largely been hidden by inadequate reporting to the relevant health authorities (Balme et al., 2010).

Street pesticides that are commonly used in South Africa include both legal agricultural pesticides that are decanted by informal vendors into unlabeled containers (with no instructions and no health and safety warnings) which are then sold for pest control, as well as illegal pesticides sold to be used in the household (Rother, 2016). Some street pesticides used in Cape Town's townships have been tested in laboratories and found to include carbamates (e.g. aldicarb known as 'two step' or 'sticks') and organophosphates (e.g. chlorpyrifos and methamidophos) which are highly toxic (Swartz et al., 2018). Aldicarb has been banned in South Africa for almost a decade (information provided by an agricultural wholesaler) and chlorpyrifos is illegal if sold as a domestic product (Swartz et al., 2018). However, there is limited control of the illegal/informal sale of agricultural poisons for household use, as vendors can access them through agricultural wholesalers or from stocks of aldicarb released into the informal market after the product was banned. Moreover, there is limited control at borders so illegal products such as aldicarb may be brought into the country hidden in luggage (Swartz et al., 2018).

Supply-side issues also drive poison sales as street vendors can earn a living from selling them (Rother, 2016). A study of pesticide vendors in Cape Town reported how an informal vendor was able to buy a bottle of agricultural pesticide for R71 and by decanting, repackaging and selling to people in the township, was able to earn R425 profit (Rother, 2010). Fieldwork, conducted by Rossouw in 2017, found that the price of street pesticides ranged anywhere from R2 to R15, with aldicarb being the cheapest at a cost of R2 and glue traps being sold at between R10 and R15 (Rossouw, 2017). These low prices, coupled with the opportunity for profits by street vendors, exacerbates the availability and proliferation of these highly toxic substances throughout Khayelitsha.

3. Data and the determinants of purchasing poison

3.1. Data Description

In this research paper, data is used from the Khayelitsha Rodent Study (KRS), which was conducted by the Centre for Social Science Research (CSSR) at the University of Cape Town during 2017/2018. The questionnaire was administered in isiXhosa by Fezeka Lephaila and Thobani Ncapai, who not only captured data by means of the KRS questionnaire, but were also able to make extensive notes on additional information given by respondents.

In addition, a focus group (facilitated by Thobani Ncapai) was held for the purposes of this study on 13 July 2019. Four women, who have young children and had been interviewed as part of the KRS survey, were invited to discuss their experiences with rodents and rodenticides, and to reflect on the negative relationship evident in the preliminary data analysis between the presence of small children and the purchasing of rat poison (ethics clearance granted 2019/hons/03).

The KRS data comprises a two-stage (by household), stratified random sample of 222 households (formal and informal) from Khayelitsha Site C – also known as Ikwezi Park. According to the 2011 population census, 391,749 people live in Khayelitsha, 98.6% of whom are black Africans. Khayelitsha comprises 28 'sub-places' or 'sections' of which Site C, is the closest to Cape Town and the biggest (with 52,184 people). The households were randomly drawn from 11 'small areas' as demarcated in the 2011 South African census (Nattrass et al., 2018). Post-stratified probability weights were used to adjust the analysis to obtain unbiased estimates for this subpopulation. Using these design weights (the inverse of the probability of each respondent being in the sample), the estimation sample size was 46,666 (which is close to the census total). Ethics approval for the survey was obtained through the University of Cape Town's Research Ethics Committee (REC/2017/03/001 and REC/2018/02/006).

This paper uses the KRS data to run probit regressions on a binary variable that indicates whether the respondent had bought poison over the past year. This was coded as 1 for the 94 people who answered 'yes' to the question 'Have you purchased any of these poisons in the past year?' and 0 for the 124 that answered 'no'. Following Williams (2012), I calculate and present average marginal effects rather than marginal effects at the mean. Wald tests and k=5 Crossfold estimates of the out of sample error are provided. Following Benjamin et al. (2018) results are reported to be statistically significant if the p-value is at or below the 0.01 level and results are statistically suggestive for p-values at or below 0.05.

3.2. Modelling the determinants of purchasing poison

The demand for poison could be influenced by a range of considerations besides the presence of small children in the household, including the overall damage experienced by the household from rodents; being aware of the dangers posed to non-target animals by rodenticides; the presence of a cat that is actively cared for; beliefs surrounding witchcraft and rats; and potentially also indicators of

socio-economic status such as employment, household assets and education level of the respondent. I hypothesized that experienced damage is likely to be a very important determinant of purchasing poison because rodents can cause extensive damage by contaminating and destroying food and possessions, damaging infrastructure, carrying disease, and biting children (Swartz et al., 2018:247). It seems plausible that households that experienced such damage over the past year would be more likely to report having bought legal or illegal pesticides.

I also hypothesized that people are less likely to buy poison if there is a young person in the house because of the dangers posed to small children by poison, and in light of attempts by EH officials in Khayelitsha to educate people about the dangers of rodenticide use. Conversely, they may be motivated to buy the poison in an attempt to protect the small children in their household from being bitten by rats – hence the direction of the relationship between purchasing poison and the presence of small children could be unclear. Given that street pesticides do not carry any warnings, it is possible that some people remain unaware of the dangers. Even so, the women in the focus group were adamant that people in Khayelitsha are aware of the dangers posed by rodenticides because city council workers place poison (so called 'blue squares', or poison wax bait) in and around houses using gloves, and they tell people of the danger thereof. The workers explained that children could mistake the poison for sweets and consume the toxic poisons. The women also said that stories about children being poisoned by rodenticides circulate over social media. Hence, I expected the overall direction in the relationship between rodenticide purchases and the presence of small children to be negative.

Rodenticide use poses threats to other animals directly (if they consume the poison) and indirectly through secondary poisoning (eating a poisoned rat) (Brakes & Smith, 2005). According to the KRS, 83.5% of the estimation sample indicated that they were concerned that rat poison could kill other animals like cats and owls. I hypothesized that people who are worried about the secondary poisoning of animals will be less likely to use poison for rodent control.

Those with a cat living in their house or coming into their yard that they actively care for (a house pet) are probably also less likely to purchase poison – either out of concern for the cat, or because the cat has reduced the rodent problem, thereby reducing the need for poison. A study conducted by Jassat et al. (2013) in five settlements across Johannesburg found that there was a 60% lower chance of reporting rats in households that kept cats. However, cats are often linked to concerns about witchcraft, including in Khayelitsha (Mngadi, 2016). According to the focus group, people are often reluctant to allow a cat into the

home in case the cat is used by malevolent others for witchcraft. Thus, having a cat that comes into the house or yard does not necessarily mean that people would stay away from using poison. It may even increase their propensity to use poison to get rid of both rats and cats.

Some people believe that rat infestation has a supernatural cause – either God is punishing them, or the rats are coming into their homes as a result of witchcraft (Mngadi, 2016). The belief in witchcraft, that is the use of magic to harm enemies or gain advantage over others - is 'strong, common and widespread in Africa' (Cohan, 2011:807). According to an empirical study conducted by Gershman (2015), in nineteen Sub-Saharan countries there was a negative correlation between witchcraft beliefs and national trust levels. Thus, witchcraft beliefs and the degradation of social capital were found to be reinforcing factors. Due to the unemployment, poverty and inequality in townships such as Khayelitsha, people may worry about envy and resentment – and hence about witchcraft attacks. These supernatural powers can also be understood as assumed supernatural 'forces impinging on people's lives that make them feel unsafe' (Ashforth, 2005:16). This is supported by Hampton (2018) who used KRS data to show that witchcraft beliefs in Khayelitsha were inherently linked to perceived powerlessness and distrust of others. According to the focus group, an envious person could consult a witchdoctor in order to try to ensure that bad things happen to the person who is the object of their jealousy.

According to the focus group respondents, cats, owls and rats are all believed to be used by witchdoctors in an attempt to cause harm to others. An example of this is a story told by one of the women, whereby there were two crèches – one successful and the other not. The successful crèche suddenly became infested by rats and the staff started killing them, including pouring boiling water over some rats. When this happened, the owner of the struggling crèche became noticeably distressed and started crying. The supposition was that she had been responsible for sending the rats to the other crèche and was suffering along with them. This narrative highlights how in a community such as Khayelitsha, where crime and violence are prevalent, social ties may become weaker, and powerlessness could become a common feeling amongst residents (Geis & Ross, 1998). It accords also with theories of witchcraft as a form of paranoia driven by distrust within the community at large (Mirowsky & Ross, 1983). These examples suggest that people who worry that rats might be linked to witchcraft, will be very keen to get rid of them and thus more likely to use poison.

Another factor that needs to be considered when thinking about factors likely to affect the demand for poison, is whether or not the person is employed, and their overall socio-economic status (measured in the KRS by a household asset

index). According to Roussow (2017) and the women in the focus group, poison is mainly purchased on the trains or at the stations. Many employed people in Khayelitsha commute to work by train and thus will have both the means and opportunity to purchase these street pesticides. However, employed people are also more likely to be able to protect their homes in other ways too, such as ensuring there are no holes in the walls or the floor. Poor quality housing is a risk factor for rodent infestation (Jassat et al., 2013) and people with a steady income or living in a household with a higher level of wealth would presumably have better quality housing. The relationship between both employment and socio-economic status with the decision to purchase poison is thus likely to be unclear.

Level of education may influence whether an individual uses poison to try to solve their rodent problem. People with higher levels of education and people that have relatively high incomes have been found to place more value on health control measures (Mngadi, 2016). If these people see poison use as an essential means to get rid of a health risk (rats) then purchasing poison will be positively linked to education. However, it is also possible that educated people may be more aware of the dangers of poison and/or live in houses that are less dilapidated than those of less educated people and hence have less need to purchase poison. Poorer and less educated people might want to purchase poison, but lack the means, or they might allocate their scarce resources to purchasing poison because of a particularly severe rodent problem, or they may feel too demoralized to do anything. I thus have no clear expectation about the direction of the relationship between education and purchasing poison.

3.3. Preliminary Data Work

While the purpose of this paper is to determine whether the presence of young children affects the decision to purchase poison, a first approach was to ascertain if there is in fact a difference in the number of households purchasing poison and not purchasing poison.

Table 1: Tabulation of the decision to purchase poison based on if there is a young child in the household or not

		Young child present in household		
		No	Yes	*Total*
Rat poison purchased in the last year	No	0.4966 0.5256	0.5034 0.6632	1 0.5869
	Yes	0.6369 0.4744	0.3631 0.3368	1 0.4131
	Total	0.5545 1	0.4455 1	1 1

Pearson: uncorrected chi2 (1) = 4.2088; design-based F(1,9) = 6.7235. P = 0.0291.

As Table 1 shows, 41.3% of the respondents reported that they had purchased one or more type of rat poisons in the previous year – the percentage was lower for households with young children (33.7%) and higher (47.4%) for households without young children (a difference that is statistically suggestive at the 5% level). As this result could be driven by factors other than the presence of children, I developed a multi-variate model that controls for other factors that might be driving the demand for poison. If the negative relationship between purchasing rat poison and the presence of small children remains statistically significant controlling for these factors, I can be surer that the presence of small children is indeed a statistically significant driver of the demand for poison.

Table 2 (an initial correlation exploration) compares the proportion of respondents that purchase poison and those who do not by our other key hypothesized independent dummy variables. The multiple regression also controls for two continuous variables not reported in Table 2: an index of household assets, and an index of rodent damage in the last year ranging from 0 to 4 (a score of one being allocated to each of the following: rats having eaten food in the household, having damaged household possessions, bitten any household members, or been seen in the rubbish). Table 2 provides a binary proxy for the rodent damage index (taking a value of one if the household experienced any damage, and 0 if none). As a proxy for education, Table 2 presents the results for a binary variable ‘matric’ which takes the value 0 if the respondent does not have a school leaving certificate, and 1 if the respondent does. The wealth index was not included in the analysis in Table 2 because it is a continuous variable.

Table 2: Percentage that purchased poison by each binary independent variable

Variable	All	Rat poison purchased	Rat poison not purchased	Significance	P - value
1= There is a child too young to go to school in household	0.4455	0.3368	0.6632	**	0.0291
1= Respondent has experienced rodent damage	0.8573	0.4724	0.5276	***	0.0000
1= Respondent is wage- or self-employed	0 .4391	0.4892	0 .5108	***	0.0080
1= Respondent has a school-leaving certificate	0.318	0.3986	0.6014		0.8455
1= Respondent worries about secondary poisoning of non-target animals	0.8349	0.3722	0.6278	**	0.0299
1= Respondent has a cat that is actively cared for (a pet)	0.165	0 .1942	0 .8058	***	0.0041
1= Respondent agrees strongly that they worry about witchcraft	0.0538	0.7533	0.2467	***	0.0013
N individual	218	94	124		

Two-sample t-test of the difference between the proportion of people who purchase poison and who do not by the independent variable of choice.
Pr (|T| > |t|) is the two-tailed p-value calculated using the t distribution. It is the probability of observing a greater absolute value of t under the null hypothesis that the proportions are equal.
**** p<0.01, ** p<0.05, * p<0.1*

Table 2 shows a number of statistically significant differences between the proportion of respondents who had purchased poison in the last year and those who had not. All the variables (except for the educational level proxy) show statistically significant differences across the decision to purchase poison, at varying significance levels. (There was also no statistically significant correlation between years of education and whether poison was purchased.) Table 2 indicates that people who were worried about witchcraft were more likely to purchase poison. In contrast, people who had young children in their

household, who were employed, people who worried about the secondary poisoning of other animals, and those with a cat that they actively cared for, were found to be more likely not to purchase poison.

4. Regression analysis

A Probit model was used to run regressions on the binary dependent variable indicating whether or not the respondent's household had purchased poison in the last year (see Appendix). The average marginal effects for each of the five probit regressions were then calculated and represented in Table 3. The first regression is a simple, univariate model that included only the binary variable indicating whether or not there were children younger than school-going age present in the household. The second regression controlled also for the degree of rodent damage, and the third controlled also for the household asset index. Note that adding household assets increased the out of sample predictive error, so it was dropped for the rest of the regressions.

The fourth multiple regression added further controls for personal characteristics and attitudes of the respondent that might matter. However, note that the question about purchasing poison was a household variable, not an individual variable. Thus, adding these individual-level variables was not necessarily useful because I could not be sure that the respondent's attitudes and characteristics were necessarily good proxies for those of the household. I did not include educational level, as the initial correlation explorations proved statistically insignificant (Table 2).

The variable created for whether the respondent had a pet cat or not was a complicated one but insight from the focus group held for the purposes of this research helped in understanding how to code it in Stata. If the respondent indicated that there was a cat that came into their yard or lived in their house, they were then asked questions about the cat. Out of the 136 people that had a cat present, 130 people answered 'yes' to the question 'Is the cat a household pet?'. When further analysed, many of these people had also answered that they did not in fact like cats or feed the cat or let the cat in their house. This did not quite fit with the definition of what a pet is and so a more rounded approach had to be taken. The binary variable took on the value 1 if the respondent with a cat present answered 'yes' to the question 'Do you like cats?' and answered 'yes' to either the question 'Do you feed the cat?' or 'Do you let the cat into your house?'. Only 33 people fitted this criterion which is more in line with what would be expected, as for the most part people avoid having cats perhaps due to the widespread association with witchcraft.

For the fifth and final multiple regression, I dropped the two statistically insignificant variables – being worried about secondary poison and the employed variable. Our final regression thus included four independent variables which were consistent with the factors that the focus group deemed the most important when deciding whether or not they would purchase poison. These are: the binary variable indicating whether the respondent had children younger than school going age present in their household; an index of rodent damage; whether or not the respondent has a cat that is actively cared for; and having strongly agreed that they are worried about rodents being linked to witchcraft.

Table 3 includes Wald tests and k=5 Crossfold estimates of the out of sample error. The Crossfold estimate is known as the Brier score for binary outcomes and a lower score is indicative of a stronger model.

5. Empirical results

The empirical strategy presented below tests to see whether the negative relationship, between the presence of young children in a household and whether the household purchased rat poison, remains statistically significant, after controlling for other potential determinants of the demand for rat poison. Table 3 presents the 5 regressions described above. The F-tests for all of them reject the null hypothesis that all the coefficients are equal to zero.

I make use of the average of five Crossfold Root Mean Squared Errors (RMSE) estimates in order to analyse the predictive power of each regression. A lower Crossfold score is indicative of a lower out of sample predictive error of the model, and thus a stronger extrapolative model. As Table 3 indicates, regression 2 is the strongest model with a RSME estimate of 0.48162. Thus, the best predictive model of purchasing poison is the one that controls for whether or not the respondent had children younger than school-going age present in the household, as well as the household rodent damage index value. Moving to the third regression where I add the variable for household assets, the out of sample predictive error increases to 0.48531 and the added variable is not statistically significant or suggestive. I thus do not make use of this explanatory variable for the fourth and fifth regressions. The RMSE estimate increases to 0.48908 in the fourth regression, but two of the three independent variables added are statistically suggestive, so I include them in the fifth regression.

Table 3 (dY/dx): Average Marginal Effects (AME) predicting the probability of answering 'yes' to the question 'Have you purchased any of these poisons in the past year?'

Regressors	**1**	**2**	**3**	**4**	**5**
1= Young children in household 0 = No young children present	-0.138** (0.053) p=0.029	-0.139** (0.049) p=0.020	-0.126** (0.050) p=0.034	-0.150** (0.062) p = 0.039	-0.165** (0.051) p = 0.010
Index of rodent problem past year 0-4		0.152*** (0.014) p=0.000	0.149*** (0.013) p=0.000	0.142*** (0.022) p=0.000	0.147*** (0.020) p = 0.000
Household asset index (weighted by average price and scaled from 0 to 100			-0.001 (0.002) 0.551		
1= Employed 0= Unemployed				0.079 (0.046) p=0.118	
1= Worried about secondary poisoning 0 = Do not worry about secondary poisoning				-0.089 (0.132) p=0.517	
1= Cat that is actively cared for 0 = No cat that is actively cared for				-0.210** (0.064) p=0.010	-0.230*** (0.069) p=0.009
1= Agrees strongly that they worry about witchcraft 0 = Does not agree				0.246* (0.133) p=0.096	0.310** (0.105) p=0.016
Observations	218	216	216	193	193
Wald Test for Probit Model	F(1,9)=6.7 p= 0.0295	F(2,9)=42.5 p= 0.0000	F(3,9)= 32.1 p= 0.0000	F(6,9)= 100.3 p= 0.0000	F(4,9)= 41.0 p= 0.0000
Average of 5 Crossfold Root Mean Squared Error (RMSE) estimates	0.50437	0.48162	0.48531	0.48908	0.48668

*Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*

5.1. Multiple regression results

The RSME estimate for regression 5 is only marginally higher than for regression 3, with all independent variables being statistically suggestive or significant. Despite a higher RSME estimate, based on the discussions that took place in the focus group, the fifth regression will be relied as the most meaningful analysis of the decision to purchase poison. This is due to the fact that according to the four women in our focus group, witchcraft plays an important role within the culture of the people living in Khayelitsha - with jealousy being the main propagator. In addition, cats are inherently linked to witchcraft, but at the same time they instinctively kill rats so having a household pet cat would decrease the need for measures to prevent rat infestation. Furthermore, if the cat is in fact actively cared for (33 respondents fit this criteria) and the owner is not worried about the link to witchcraft, the owner may not want to run the risk of accidently poisoning their cat.

The models in Table 3 show that the presence of young children in the household reduced the average marginal probability of purchasing poison by between 14 and 17 percentage points depending on model specification. All were statistically suggestive (statistically significant at the 5% level).

In all of the models, the rodent damage index was found to be the most statistically significant predictor of purchasing poison (significant at the 1% level), ceteris paribus. Looking at regressions 2 and 5, which had the strongest predictive models, a one unit increase in the rodent damage index value increases the average marginal propensity of purchasing poison by between 14.7 to 15.2 percentage points, ceteris paribus.

The variable indicating whether or not the respondent had a cat that was actively cared for (household pet), was statistically significant at the 1% level in the fifth regression. When a respondent answered that they had a pet cat, the average marginal probability of the household purchasing poison decreased by 23 percentage points, ceteris paribus. Some explanations for this include the fact that cats instinctually hunt and kill rats, which may mean that these households could be using a cat as a rat deterrent instead of poison. In addition, these households may not want to use poison in case the cat is accidently poisoned and gets ill or dies. This variable is less significant in the fourth regression because model 4 suffers from over specification bias, which has both decreased the average marginal effect that the variable has on the decision to purchase poison, as well as making the variable less statistically significant. However, there is a clear negative relationship seen in both regression 4 and 5.

In regression 5, the variable indicating whether or not the respondent agreed strongly that they worry about rodents being linked to witchcraft was statistically suggestive at the 5% level. If the respondent agreed strongly, the average marginal probability of purchasing poison increased by 31 percentage points, ceteris paribus. Regression 4 shows this variable as being less statistically significant, which I can again attribute to the over specification of this model. However, the coefficient is positive in both regression 4 and 5. This is consistent with the literature suggesting that people are concerned about witchcraft and the role that rats might be playing in this regard (Mngadi, 2016). In addition, according to Ciekawy & Geschiere (1998:1), 'the influence of witchcraft discourse has become increasingly manifest, precisely in modern sectors of society including politics, sports, new forms of entrepreneurship, and institutions of formal education'. This may well increase the desperation of people to get rid of the rats in their homes. Subsequently, despite knowing the dangers of poison, people may still use it as, to them, witchcraft associated with rodents could be regarded as a bigger problem.

5.2. Young children as a determinant

The models in Table 3 show that even after controlling for rodent infestation, concerns about rodents, concerns about witchcraft, the presence of a pet cat and indicators of socio-economic status (employment of the respondent and the household asset index), having young children in the household reduced the average marginal probability of purchasing poison by between 12.6 and 16.5 percentage points This is a welcome result given the research on childhood poisoning and street pesticide use in Cape Town by Swartz et al. (2018), and the problem of paediatric poisoning in Cape Town (Balme et al., 2010). It suggests that there probably is significant awareness in Khayelitsha, Site C of the risks posed by rodenticides for young children. Thus, although some households might have wanted to use poison to protect the children from being bitten by rats (or exposed to other health risks) the results are consistent with there being greater concern about the risks posed by the poison for children. It suggests that for a significant number of households, the danger to children outweighs the benefits of rat control that the poison may provide. This, however, is speculative. More qualitative research is required to interrogate this.

The main limitation in the above quantitative analysis is that purchasing poison was a household variable, not an individual variable. Thus, even though some personal attitudes and characteristics were statistically significant or suggestive determinants of whether the household bought poison, the connection was inevitably loose as household members differ in their characteristics and

opinions. Unfortunately, the KRS survey did not collect data on other household members. Another limitation worth mentioning is that the KRS questionnaire was developed in English but was translated into isiXhosa when the survey was conducted. In this translation process the direct meaning of certain questions may have been changed, which could affect our results.

6. Focus group qualitative research regarding results

Due to the nature of this research, the focus group held was fundamental in understanding what the data seemed to be telling us. The four women, drawn from KRS respondents, were extremely enthusiastic and willing to share their struggles with rodent infestation and control. One of the women told us how one night she heard her child, who was a few months old at the time, crying loudly. She investigated and found that a rat had bitten her child on the finger and drawn quite a bit of blood, and she ended up taking her child to the clinic for medical attention. For any caregiver this experience is traumatic and would inevitably lead to desperate attempts to get rid of the rats in their households. A recent mixed-methods study of childhood poisoning in Cape Town (Swartz et al., 2018) emphasised the anxiety mothers can feel about rats harming their children, and how this can lead to the purchase of street pesticides that harm them even more. Yet the regression analysis presented in Table 3 indicates that households with small children were nevertheless less likely to purchase poison. The focus group provided further support and context for this finding.

For the women in the focus group, their everyday reality is one of living amongst rats. They try to keep their houses tidy and remove any rubbish, but rats seem to infiltrate despite their best efforts. All these women seemed afraid of rats and desperate to get rid of them, even asking us if we had the answers to best deal with rats. However, as desperate as they may be none of them said they had bought street pesticides, the reason being that it is not safe for their young children. The women told us that workers from the city council come into the houses in Khayelitsha and place poison bait in blue plastic boxes (‘Steemic’) under cupboards. These workers use gloves and give strict warnings about how toxic the poison bait is, and to be careful as children may mistake the poison for sweets and try to eat it. Additionally, the women said that information from social media has made them aware of the dangers that poison use poses to their children.

We then asked the women how they make sure that the children do not accidentally consume the poisonous bait. They told us that the bait is placed out

of their reach and that they try their best to explain to the children not to go near it. Some said they prefer to use glue traps because when rats die from poisoning it is not immediate, so a rat may die somewhere in your house without you knowing until you start smelling something dead. You then have to go and try to find the dead rat, whereas with a glue trap you can let the rat die and then throw it down the toilet or in the bin. However, even glue traps are not always effective as the bigger rats are strong enough not to get stuck by the glue, and it is postulated that the smaller rats have learnt to jump over the traps entirely.

An important piece of information that the women were able to provide was that the illegal poison aldicarb is now extremely hard to come by. This poison is the most toxic of all the street pesticides, thus having it off the informal market is good news for the safety of young children living in Khayelitsha. Despite this fact, the women said that even when aldicarb had been widely available they had never purchased or used it.

The women in the focus group talked a great deal about witchcraft. This concurs with Mngadi (2016) and Hampton (2018) who found witchcraft to be prevalent in Khayelitsha and associated with economic and spiritual insecurity. The women expressed concerns about rats and cats being used by malevolent people, perhaps with the assistance of a 'bad' sangoma (witchdoctor). The presence of one or more of these animals in a person's house is thus avoided. One of the women told us that she feared that a cat might kill her child by sleeping on its head and suffocating it, perhaps under the influence of an evil spell.

7. Concluding remarks

In conclusion, our results show that the use of rodenticides is related to rodent infestation, but that people living in Khayelitsha Site C with young children living in their households are less likely to purchase rodenticides. This quantitative finding is supported by the qualitative research suggesting that people in Khayelitsha are aware of the dangers rodenticides, both legal and illegal, can pose to children. The best regression model suggested that the decision to purchase poison was linked to the extent of rodent damage in the household, the presence of a pet cat, beliefs surrounding rats being linked to witchcraft, and most importantly the presence of young children in the household. This last determinant is a key finding as it indicates that people living in Khayelitsha are not letting their struggles with rats hinder their abilities to protect their children from accidental poisoning.

Finally, the fact that aldicarb seems to be extremely hard to come by is useful information as it suggests that action against the informal market for these

‘street pesticides’ may have been at least partially successful in removing at least one of the more toxic poisons sold by the vendors. However, it could also simply be the case that the remaining supplies of aldicarb following its ban more than a decade ago, have dried up and are no longer for sale through the informal sector. This may be a good start for the protection of children, but it does not solve the problem of how the people of Khayelitsha are meant to deal with their rat infestation problem - endangering children in a different way. More research into methods that are effective in reducing rat infestation, as well as being both ethical and affordable, need to be researched, in order to deal with the rat problem in Khayelitsha.

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Appendix

Table A: Probit Regressions

Regressors	1	2	3	4	5
1= Young children 0=No young children	-0.357** (0.138) p=0.029	-0.402** (0.150) p=0.026	-0.365** (0.151) p=0.039	-0.453** (0.432) p=0.038	-0.494** (0.158) p=0.012
Index of rodent problem past year 0-4		0.442*** (0.054) p=0.000	0.435*** (0.050) p=0.000	0.432*** (0.077) p=0.000	0.442*** (0.069) p=0.000
Household asset index (weighted by average price and scaled from 0 to 100) 1=Employed 0=Unemployed			-0.001 (0.002) p=0.551	0.236 (0.133) p=0.109	
1= Worried about secondary poisoning 0 = Do not worry about secondary poisoning				-0.266 (0.392) p=0.515	
1= Cat that is actively cared for 0 = No cat that is actively cared for				-0.666*** (0.196) p=0.008	-0.728*** (0.213) p=0.008
1= Agreed strongly that they worry about witchcraft 0 = Does not agree				0.744 (0.408) p=0.102	0.950** (0.356) p=0.026
Constant	-0.064 (0.117)	-0.944*** (0.125)	-0.815*** (0.225)	-0.672** (0.323)	-0.793*** (0.115)
Observations	218	216	216	193	193
Prob > F	0.0295	0.0001	0.0004	0.0013	0.0005

*Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.*