HIV/AIDS orphans as farmers: uncovering pest knowledge differences through an ethnobiological approach in Benin

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Abstract

The erosion of local/indigenous farming knowledge in the face of HIV/AIDS deaths in Africa has been noted as a point of concern in the literature and by organizations such as the Food and Agriculture Organization of the United Nations. These concerns are about a break in the transmission of knowledge from adults (deceased parents) to children (orphans). Ultimately, erosion of farming knowledge is implied. This paper examines one aspect of knowledge, using an ethnobiological approach that is language based. Free-listing elicitation of pests in maize fields was conducted with 45 child orphans, 15 non-orphan children, and 30 adults in rural Benin. A cognitive salience index (*CSI*) was developed and an advanced analysis of the *CSI* scores was conducted examining the score differences between child orphans and non-orphan children and adults. The results indicate that orphaned children were more knowledgeable than non-orphaned children. One-parent orphans residing with the surviving parent are more knowledgeable than double orphans farming on their own. Non-affected adults and their children scored significantly lower than AIDS-affected adults and children. Other variables including gender and age were further examined to explain some of the observed differences. The findings indicate that there is a need for rethinking the implications of HIV/AIDS on farming knowledge.

Additional keywords: cultural salience, free listing, household, language, observation skills, utility

Introduction

The spreading of HIV/AIDS to farming communities has increased the precariousness of life for millions of smallholders (Jayne *et al.*, 2004). Previous empirical observations note a shift towards an increasing number of rural children taking on adult responsibilities (Rugalema *et al.*, 1999; Haddad & Gillespie, 2001). In difficult contexts such as HIV/AIDS with its depletive effect on rural livelihoods, agricultural knowledge is a very important resource for rural people (Barnett *et al.*, 1995; Bollinger *et al.*, 1999; Haddad & Gillespie, 2001; Dewagt & Connolly, 2005). However, the intergenerational knowledge gap is speculated to be profound in the face of HIV/AIDS, with the loss of assets and key resources (Haddad & Gillespie, 2001; Loevinsohn & Gillespie, 2003). The gap in farming knowledge AIDS-orphaned children have is of growing international concern. The Junior Farmer Field and Life Schools programme, an initiative of the Food and Agriculture Organization of the United Nations (FAO) in partnership with the World Food Programme and other UN agencies designed to provide agricultural knowledge to these children, exemplifies how serious this issue is being taken in the international arena (Anon., 2005).

The loss of knowledge, however, is not yet firmly documented by systematic empirical studies of orphaned children's farming knowledge. The study presented in this paper examines agricultural knowledge (through the lens of crop pests in maize) of HIV/AIDS orphans relative to adults in HIV/AIDS affected/afflicted and non-affected households and children in non-afflicted/affected households. The study specifically examined the different sub-groups of farmers: orphan farmers, i.e., girls or boys between 10 and 14 years of age, in comparison with adult men and women in the different kinds of households. Pest knowledge differences were evaluated through an ethnobiological approach.

The research was conducted in the Couffo region of Benin among the Adja ethnic group. The Couffo region is one of the most HIV-affected regions in the country. Maize is the main staple food crop for the majority of the households in the Couffo region and is grown mainly for household food consumption. Crop pests are among the most important technical limitations to food security in this context of small-scale farming (Mulder, 2000; Saidou *et al.*, 2004).

Crop pests are well-bounded domains of agricultural folk and scientific knowledge on which agricultural research has abundantly worked (Smith *et al.*, 1984; Jackai & Daoust, 1986; Bentley 1989; 1992; Setamou *et al.*, 1998; Price, 2001; Oerke, 2006; Price & Gurung, 2006). However, HIV/AIDS, with its reported impact on adult mortality, appears to be a threat to agricultural knowledge (Baylies, 2002; Loevinsohn & Gillespie, 2003).

Conceptually, in this paper knowledge is situated as an element of culture. Culture is learned, thus making it distinct from people's biological heritage, and as such, knowledge is a product of learning (Barsh, 1997; Purcell, 1998; Grant & Miller, 2004). Traditional knowledge is linked to subjective experiences and rooted in the culture, history and biophysical environment of the group (Brosius *et al.*, 1986; Purcell, 1998; Price, 2001). A major assumption in ethnobiology is based on language serving as a 'gateway to knowledge' (Price, 2001). Language is a key element in transmitting knowledge across generations, and naming living things allows for communication about these things. Naming reflects the cultural importance of different living things, their biological distinctiveness, as well as the significance of their utility (Ellen, 1982; Gatewood, 1983; Brown, 1984; Berlin, 1992; Grant & Miller, 2004; Price & Björnsen-Gurung, 2006).

Naming delineates semantic domains. A semantic domain is defined as an "organized set of words, concepts or sentences, all of the same level of contrast, that jointly refer to a single conceptual sphere" (Weller & Romney, 1988). According to Price (2001), an important aspect of uncovering farmers' pest knowledge is through the salience of items named by the informants. Item salience is generally evaluated by submitting respondents to a free-list exercise.

Brewer (1995) tested intracultural variation of knowledge using free listing, and concluded that this technique is a reliable and strong indicator and an assessment measure of the respondent's level of knowledge given a specific domain. According to Thompson & Zhang (2006), the free list can be successfully used to evaluate the cultural salience of a group (or sub-group), that is, a group aggregate value can be calculated based on agreement amongst informants about each item. The present study used Sutrop's Cognitive Salience index (*CSI*) (Sutrop, 2001) to reveal the cultural salience among the Adja people from HIV/AIDS-affected and non-affected households. Data collection was rooted in the following inquiry: "what are the differences in salience of maize pests between adult and child farmers of the Adja in the Couffo region, and what could be the link to HIV/AIDS household status (afflicted/affected)?" To this end, it was anticipated that (1) the child farmers have different maize pest salience indexes; and that (2) the differences are linked to their HIV/AIDS-orphanage status, (3) gender, and (4) the adult teachers they followed for farming activities.

Materials and methods

Brief description of the Couffo region and the study population

Couffo is one of the twelve regions of the country. The Couffo region comprises six local governments (municipalities) namely: Aplahoue, Djakotomey, Dogbo, Klouékanmey, Lalo and Toviklin. The principal ethnic or cultural group is the Adja (88%), speaking a language of the same name. Agriculture and small business are the main occupations of the population. The total maize production in 2004 in the Couffo region was 47,741 tons for a total cultivated area of 49,197 hectares (Anon., 2004a). The third general population census in Benin (Anon., 2002), carried out in February 2002, and a census co-organized by IFAD-NGO and Plan International (Anon., 2004b), reported a total of 37,372 orphans (children up to age 18), which represents 12.63% of the population. The present study was conducted in two of the six municipalities: Aplahoue and Klouékanmey. Klouékanmey was chosen for the concentration of care-providing organizations targeting HIV/AIDS-affected households and Aplahoue for being the locality that has benefited from early and intense sensitization campaigns about HIV/AIDS. The campaigns nor the care-providing institutions dealt with agriculture.

Sampling and sample size

The main criterion for the selection was the presence of affected households, that is, villages that contained a high number of affected households and HIV/AIDS orphans, and where child-farmers were within non-affected households. HIV/AIDS orphans were living with a surviving parent or fostering parents. An affected household was characterized by having an HIV/AIDS orphan in residence irrespective of the infection status of the household members, thus fostering households were included. All affected and non-affected households in the sample were farming households where adults and children were involved in maize cultivation.

Table 1. Description of the study sample (n = 90).

Categories of respondents (farmers)	Gender		Total
	Male	Female	
Affected adults	7	8	15
Non-affected adults	7	8	15
Orphan children	24	21	45
Non-orphan children	9	6	15

The HIV/AIDS-affected household and orphan census conducted at the beginning of the study included 88 affected households and 322 orphans. The orphans fell into three categories: fatherless, motherless and double orphans. The orphans who participated in the study were randomly selected from among the 10 to 14-years-old children. The choice of this age range of the children is rooted in findings from previous studies (Stross, 1973; Zarger & Stepp, 2004; Setalaphruk & Price, 2007). Fifteen orphans were randomly selected within each of the groups (double, motherless, and fatherless). In addition, 15 non-orphans were randomly selected in the same villages. Thirty adult farmers were randomly selected equally from the affected (15) and non-affected (15) farm households (Table 1).

Methods and techniques of data collection

The research proceeded through several steps. First, an exploratory field visit was carried out and consisted of informal discussions with resource persons in the study area. Discussions with researchers such as agronomists and entomologists, and extension agents provided comprehensive information on maize pests in the Couffo region, and information on taxonomy and pest incidence. Later on, focus group discussions were carried out with participants from affected and non-affected households. The information gathered was supplemented by individual semi-structured interviews with key informant farmers. The aim was to understand people's view, basic terms and meanings of pests in the Adja cultural setting. The approach also helped to avoid inappropriate translations and thus poor communication. Ultimately, the list task was conducted. Initial visits were conducted with some children who were not part of the study sample in order to test and adjust the focus grid as well as the list task question. As the study consisted of documenting knowledge stock exemplified by salience among the identified categories of farmers, the cultural domain, especially the sub-domain of pests related to maize was used. The present study used the free-listing technique. This functioned perfectly for evaluating group as well as individual item salience based on individual responses.

The *free listing* method is applied through asking informants to list items in a domain (for example, kinds of potatoes or kinds of plants used in medicinal remedies). Free listing is a well-studied and well-established method to capture knowledge in a given domain (Romney & D'Andrade, 1964; Henley, 1969; Bolton *et al.*, 1980). Quinlan (2005: 220) clearly articulates the three assumptions of the method: (1) "when people free list, they tend to list terms in order of familiarity…", (2) "individuals who know a lot about a subject list more terms than people who know less…", and (3) "terms that most respondents mention indicate locally prominent items…".

Practically, the standard procedure consists of asking informants to *list the kinds of X* (s)he knows. Free listing was used in this study to account for types of pests. The main tool for the exercise is a list task. List tasks were conducted through oral interviews. The question was: "*Please name all the maize pests that you know*". The list task technique has been described in detail by Weller & Romney (1988) and Borgatti (1999).

Data analysis

The data collected were analysed by complementary techniques and tools, which are explained below.

Cognitive salience analysis

Analysis of data from the list task covers two parameters: term frequency and mean position on the individual list. The tendency for an item to occur at a given position of the elicited lists of terms corresponds to the mean position of a term, whereas the occurrence of a term across the lists of the informants corresponds to the frequency of that term. The third parameter is the number of subjects (Weller & Romney, 1988; Sutrop, 2001). The combination of frequency and mean position across informants reflects the internal structure of the identified cultural domain and salience. Thus, the basic terms in a domain are the most salient. For the purpose of calculation, the most salient term always named first by all subjects takes the value 1. The less salient terms have a value declining towards 0. Davies & Corbett (1995) incorporated the mean position of a term in a list in order to strengthen the term frequency parameter. Smith *et al.* (1995) developed a free-list salience index (see also Smith & Borgatti, 1997) and proposed a formula that captures frequency of mention and position in the list across informants. Sutrop (2001) reframed the salience index into a cognitive salience index (*CSI*) as applied in this paper whereby the number of items in a list is controlled by using the mean position and can be validly applied with a small sample size. Finally, Thompson & Zhang (2006) noted that cultural saliency can be used as a proxy for knowledge of a domain (at the group and individual level). The Sutrop's cognitive salience index (*CSI*) takes the value 0 for the least salient item, to 1 for the most salient item. The formula to calculate the *CSI* is as follows:

$$CSI = F / (NmP)$$

where F is the frequency of a term (the number of lists where a term is listed), N the total number of lists (number of participants), and mP the mean position of a term. The mean position of a term is calculated as follows:

$$mP = (\sum R_j) / F$$

where R_j is the rank of a term in list j (j = 1, ..., N).
Now the cognitive salience index (CSI) can be written as:

$$CSI = F^2 / (N \sum Rj)$$

The CSI is an integrative salience index that takes into account the frequency of mention and the mean position (mean rank) of items mentioned across informants.

Knowledge differences were evaluated by simple calculation as follows:

$$\Delta(CSI) = CSIF - CSIM$$

where $\Delta(CSI)$ represents the differences in the salience indexes by pests, and $CSIF$ the salience for females and $CSIM$ that of males.

Understanding the basis for pest salience differences across informants: the Tobit model

The Tobit model was chosen to explore the factors that could explain the differences in CSI scores. The reason for choosing this model was dictated by the nature of the total individual CSI score, which varies between 0 and 1. The model and its use have been explained elsewhere (McDonald & Moffitt, 1980; Amemiya, 1984; Greene, 2003; Rahman, 2005). The model assumes that there is an underlying latent variable, y_i, such that:

$$\begin{aligned} y_i &= X_i\beta + u_i \quad && \text{if } X_i\beta + u_i > 0 \\ y_i &= 0 && \text{if } X_i\beta + u_i \leq 0 \\ & && i = 1, 2, \ldots, n \end{aligned}$$

where y_i is the dependent variable (cognitive salience index), n is the number of observations, X_i is a vector of independent variables, β is a vector of parameters to be estimated, and u_i is an independently distributed error term assumed to be normal with zero mean and constant variance σ^2.

Definition of variables

Previous work on folk/indigenous agricultural knowledge emphasized the importance of the household type and composition for children's knowledge (Foster, 1978; Foster & Williamson, 2000; Haddad & Gillespie, 2001; Zarger & Stepp, 2004). Taking into account the fact that HIV/AIDS impacts farm household composition, the present study used several variables to explain the observed variation in pest knowledge, as revealed by the CSI scores. A total of five explanatory (the independent) variables divided into sub-variables were chosen to explain the salience indexes obtained by the respondents. The choice of these variables is based on previous research on HIV/AIDS impacts and on knowledge transmission (Ruddle, 1993; Ohmagari & Berkes, 1997; Bollinger *et al.*, 1999; Rugalema *et al.*, 1999; Baylies, 2002; Loevinsohn & Gillespie, 2003; McMenamy *et al.*, 2005). These variables are defined as follows:

Gender, divided into male and female, is the biological sex (representing learned gender role knowledge) used to categorize male and female adult and child farmers. It is a dummy variable taking the value 1 if female and 0 if male. The literature reports that knowledge and cultural value transmission follow gender lines (Little, 1987; Matthews, 1987; Saito & Spurling, 1995; Setalaphruk & Price, 2007).

Age group (agegrp) encompasses the sub-variables agegrp1 for children of 10–12 years, agegrp2 for children of 13–14 years and agegrp3 for the adults. Knowledge transmission from adult to children is reported to follow age group division (Ruddle, 1993; Ohmagari & Berkes, 1997; Setalaphruk & Price, 2007). Age is expected to correlate positively with the salience indexes.

The *HIV/AIDS status* was divided in HivStat1 for HIV/AIDS orphans, HivStat2 for HIV/AIDS-affected adults, HivStat3 for non-orphans and HivStat4 for non-affected adults. Each sub-variable takes the value 1 where applicable, and 0 otherwise. With respect to the negative impact of HIV/AIDS, a negative sign is expected (Haddad & Gillespie, 2001). This variable was complemented by the *household status* (hsstatus), which is the type of household the respondent was living in at the time of the study. It distinguishes between initial (parental) household and fostering household, and is delineated as Hsstatus1 for children living in their initial households and Hsstatus2 for fostering households. The household is termed 'initial' if the child is living with one or both of the biological parents, and 'fostering' if she/he has moved to another household. It is expected that children living with their own parents have higher salience indexes, and should have a positive sign (Loevinsohn & Gillespie, 2003).

The presence of an adult *teacher* is assumed important in shaping children's indigenous farming knowledge (Ruddle, 1993). This variable is termed here pSuivre, that is, person followed for farm activities. It is divided into pSuivre1 if the adult teacher is the respondent's own parent, pSuivre2 if it is a fostering teacher and pSuivre3 for those who are with no adult teacher. This variable denotes how knowledge is passed on from an adult 'model' to a child. Like the other variables it takes the value 1 if applicable, or 0 if not.

Finally, the dependent variable *cultural salience* is termed knowtot, which is the sum of salience indexes of each individual. The variable knowtot is used here as a proxy to reflect how knowledgeable each respondent is (Thompson & Zhang, 2006).

In the light of the above-defined variables a correlation test was performed using Pearson's correlation coefficient. The aim was to test if the variables were linked in order to avoid multicolinearity. The variables that appeared not to be correlated were considered for advanced regression, and were then included in the model. Fitness and heteroscedasticity tests were also done.

Results

The names of maize pests elicited from informants are listed in Table 2. A wide range of life forms including birds, rodents, insects, and domesticated livestock were elicited. The outcomes consisted of results from the Sutrop's *CSI* calculation, which includes individual as well as group aggregate values. The results from the Tobit regression (Table 3) substantiate the comparative interpretation of the *CSI* results.

Table 2. Scientific names and damages associated with selected maize pests in the Couffo region, Benin.

Local name	English name	Scientific name	Damage caused to maize and other observations	
			Scientific views	Farmers' claims
Abo	Snail	*Achatina fulica*	Snail meat is an important source of protein for the rural poor in Africa, replacing beef, pork, chicken and fish, but contains more protein. Undomesticated forms of snail are serious pests of crops and seedlings and create financial prejudice to farmers. It is almost impossible to control them.	Snails suck maize leaves and stems. When they attack the cobs they make holes in them. The cobs become ugly and have a poor market value when they are sold fresh. Snails are gathered by women and girls for household consumption, but mainly to be sold in the market for additional income.
Djaka	Black rat	*Rattus rattus*	Black rats are omnivorous and capable of eating a wide range of plant and animal foods, ranging from beetles to fruits from different plants. Bush rats rank among the world's worst invaders. Control methods are based on anticoagulant chemical pesticides.	Rats uproot maize seedlings and eat maize cobs and grains. They form a threat to seed germination. Rats are trapped or hunted by men and boys for household consumption.
Edja	Locust/ grasshopper	*Zonocerus variegates*	Locusts and grasshoppers are insect pests that decimate everything in their path. They are mainly herbivorous insects. Cereals, cotton, fruit and vegetable crops are their main targets. Researchers from various countries have been working together to find more environmentally friendly control options for the locust/grasshopper ravaging plagues.	Locusts and grasshoppers eat fresh maize leaves. They are very destructive when they invade crops.
Egbo	Goat	*Capra hircus*	Household livestock. Dangerous for crops when they	Goats eat maize plants, stems and cobs. They are a very

			escape their fences.	important asset for smallholders: they are raised for extra income.
Ehlin	Red-billed Quelea	*Quelea quelea*	The birds are known as African weavers. They are very prolific, and arrive in large flocks wherever grain crops are grown, and eat every seed. Pest control measures have failed. Recent discussions are directed towards harvesting the birds as a natural food resource.	The birds destroy maize cobs and eat the grains. They come in colonies and can speedily remove all the grains from the farm. Farmers spend several hours to chase them from the maize cobs, and sometimes hunt them as protein source.
Ewan	Borers (caterpillars/ larvae of moths and butterflies)	Lepidoptera	Stem and cob borers are important damaging insect pests, accounting, among major limitations to maize production. They can cause incredible yield losses. They encompass several species with a large geographical distribution.	Destroy maize stems, fresh cobs and grains. Make holes in the stems and cobs, making them ugly and of poor market quality.
Eyin	Bees	*Apis melliflora*	Bees feed on pollen and nectar. They are important insects to achieving sufficient pollination of plants. Bees are also natural enemies of several other insects found on the plants' flowers.	Disturb maize flowers and sting farmers during weeding and hunting activities.
Dedi	Ants	*Formica rufa*	Natural enemies of several insects. Eat other insects and larvae.	Bite farmers during weeding activities.
Hanhan	Millipedes	*Trigoniulus corallinus*	Millipedes are a minor pest, but very dangerous when they attack emerging seedlings.	Twine around maize seedlings and suck them.
Hevi	Small birds	*Aves* spp.	–	They are of various kinds, and they attack maize cobs on the farm.
Koklo	Chicken	*Gallus domesticus*	Common and widespread domestic animal. Becomes a threat when it escapes fences.	Eats maize grains and uproots seeds, thus a threat to seed germination.
Takpe	Yellow-necked Spurfowl	*Francolinus leucoscepus*	Birds that feed on insects, plants and seeds. Very devastating for seedlings. Also used for human consumption.	Uproots seedlings and eats maize grains. Chased or trapped by farmers for household consumption. Is also sold in the market to generate additional income.

Table 3. Results of the Tobit model for differences between *CSI* scores.

Variable		Total individual *CSI* score as proxy for knowledge		
		Coefficient	SE [1]	$P > \mid t \mid$ [2]
Age of respondent		–0.126	0.01	0.219
Gender		–0.016	0.008	0.045*
HIV-affected adults		0.132	0.012	0.000***
Non-orphan farmer		–0.022	0.012	0.087*
Own parent as adult teacher		0.016	0.007	0.021**
Fostering parent as adult teacher		–0.01	0.007	0.158
No adult teacher		–0.020	0.008	0.014**
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Constant		0.070	0.008	0.000
Log likelihood	172.946			
χ^2 (7)	111.81			
Number of observations	90			

[1] SE = standard error.

[2] Statistical significance: * = $P < 0.10$; ** = $P < 0.05$; *** = $P < 0.01$.

The CSI scores

HIV/AIDS status and pest-naming ability differences between affected and non-affected adults and orphan and non-orphan children are depicted in Figure 1. Adults living in affected households and HIV/AIDS orphans showed that afflicted adults and orphans had higher *CSI* scores on 10 out of the 12 items compared with the non-affected adults and children. Figure 1 further illustrates that HIV/AIDS-orphaned children had higher scores than HIV/AIDS-affected adults for 5 of the 12 items and had the same score for 4 of the 12 items. HIV/AIDS orphans had higher *CSI* scores for 50% of the items than the HIV/AIDS-affected adults. Overall, non-affected adults and their children scored similarly and significantly lower than the affected adults and children. From this it was concluded that children overall are more like the adults they live with than like other children and that the knowledge of HIV/AIDS-orphaned children as measured by the *CSI* score is greater than that of the HIV/AIDS-affected adults.

The *CSI* scores by gender and HIV/AIDS status were disaggregated. Figure 2 depicts the pest-naming ability of boys and girls by HIV/AIDS-orphan status. The findings show that boy and girl orphans have higher *CSI* scores than boy and girl non-orphans. However, gender-based similarities were found in the overall pattern for 8 of the 12 items. Regarding the other four items, there were three items where orphan girls had scores and non-orphan girls scored not at all. For the last item of the four, it was orphan boys who had a measurable *CSI* score for which non-orphan boys did not score at all. The conclu-

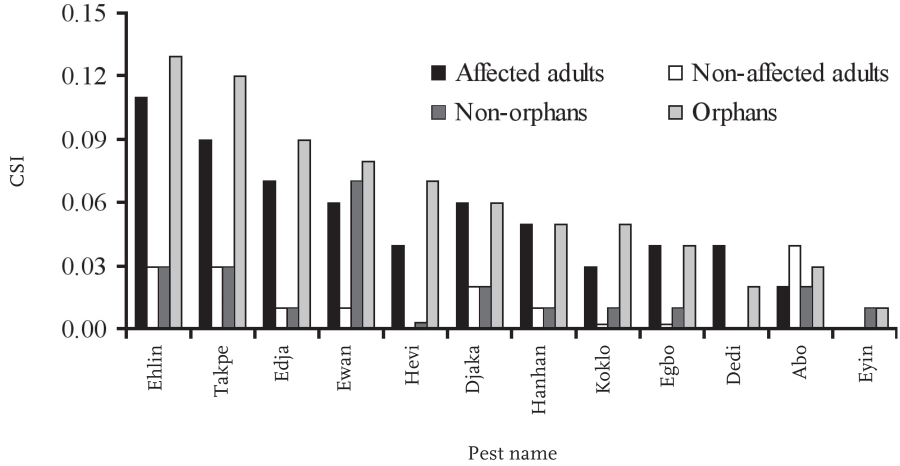


Figure 1. Maize pest naming ability (CSI) of adults and children by different HIV/AIDS status. Pests ranked from the most salient to the least salient. For explanation of pest names see Table 2.

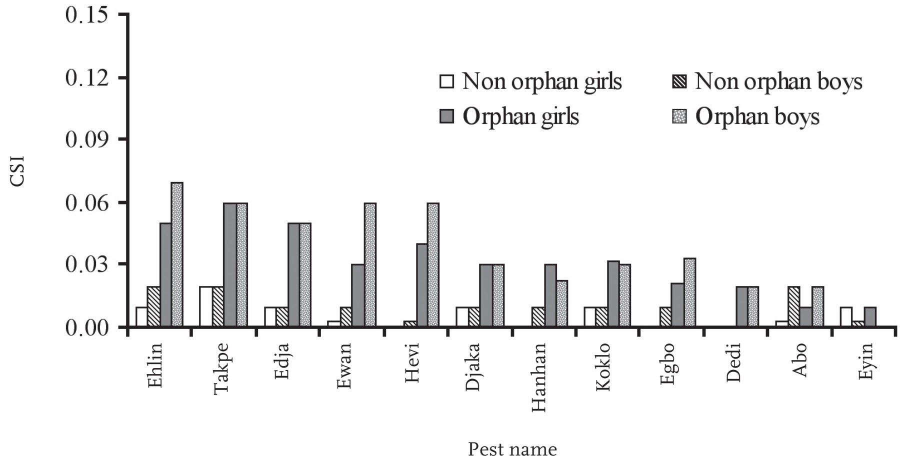
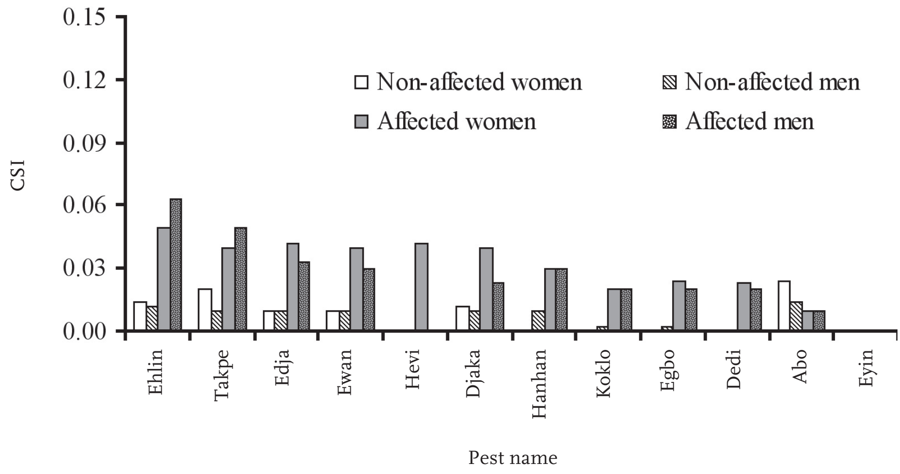


Figure 2. Maize pest naming ability (CSI) of male and female children by different HIV/AIDS status. Pests ranked from the most salient to the least salient. For explanation of pest names see Table 2.

sion that can be drawn here is that whereas HIV/AIDS orphan boys and girls show a very similar gender pattern in the *CSI* scoring, boy orphans scored higher than non-orphan boys and girl orphans scored higher than non-orphan girls. There are also indications of a gender shift in knowledge where orphans are acquiring knowledge of pests that are not normally part of the domain of girls or boys living with non-HIV/AIDS-affected intact



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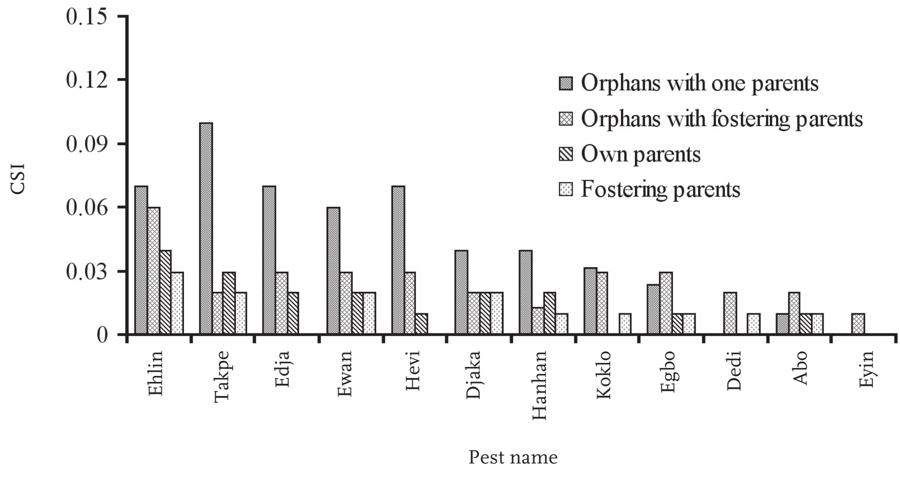

Figure 4. Maize pest naming ability (CSI) of AIDS-orphans aged 10–14 years by type of adult teacher. Pests ranked from the most salient to the least salient. For explanation of pest names see Table 2.

families. Orphan girls and boys scoring in items where non-orphan children of the same gender did not (4 of the 12 items) evidenced this.

The further examination of the *CSI* scores by gender and HIV/AIDS status for adults is depicted in Figure 3. The overall gender pattern does not show a high level of consistency between HIV/AIDS-affected adults and non-affected adults, particularly for women. HIV/

AIDS-affected women had *CSI* scores for 5 of the 12 items for which non-affected women did not score at all. HIV/AIDS-affected women scored higher than non-affected women (relative to patterns among non-affected men and women). Affected women also scored higher relative to affected men for three items in comparison with the pattern observed among non-affected men relative to non-affected women. For one item (*hevi*, generic for small birds) affected women were the only adult group that had a *CSI* score. For one item – *dedi*, or ants – both affected men and affected women had *CSI* sores where neither non-affected men nor non-affected women had a score.

From the above we conclude that there is also a gender difference between affected and non-affected adult men and women. Affected women had higher *CSI* scores and knew more pests than non-affected women. For affected men, the pattern was one of a higher *CSI* score compared with non-affected men rather than gender differences. For only one item did affected women as well as affected men have a *CSI* score where both non-affected men and women did not. Ultimately, the pattern is one where affected men and affected women have higher scores but where the affected women are bringing more items into their knowledge domain with salience.

In order to better understand the role of the adult 'teacher' in the *CSI* scores the children obtained, the *CSI* scores of HIV/AIDS orphan children aged 10–14 years were closely examined for the kind of adult they lived with. To accomplish this, we disaggregated the children's scores into the following categories: (1) HIV/AIDS orphans who are still living with the one remaining parent, (2) orphans living in a fostering household, and (3) double orphans who are farming on their own (Figure 4). For 8 of the 12 items, one-parent orphans outperformed orphans in fostering households. Orphans in fostering households had the highest *CSI* scores on three items (but the values of the *CSI* scores were still low, meaning low saliency). Orphans without an adult teacher (double orphan children farming on their own) had significantly lower *CSI* scores than orphans who continued to reside with the surviving parent. The orphan children without an adult teacher further scored on par or above orphans in fostering households for 5 of the 12 items and lower for 5 of the 12 items. Interesting also is that the only orphans that listed bees as pests were orphan children without an adult teacher.

Ehlin (Red-billed Quelea), *takpe* (Yellow-necked Spurfowl), *djaka* (rat) and *ewan* (butterfly larvae – cob borers) are important crop pests in maize from a scientific standpoint and these items were the most salient. In sum, orphans and affected adults overall had a better ability to name maize pests. It should be noted that the knowledge children have is not fully comparable with adult knowledge. This is clearly shown for the item *eyin* (bees) for a few children who named bees as maize pests. This was the item that had the lowest salience amongst all items, which shows that children are still in a learning process. The exception to this was that orphans residing with the remaining living parent were like adults in that none of them named bees as maize pests. For the most serious pests noted above, orphans residing with a surviving parent had the most impressive performance across all groups in their *CSI* scores.

The outcomes of the Tobit model are displayed in Table 3. The model showed that most of the variables have statistically significant relationships with the total salience index. However, they explain differently the observed differences in pest salience among the respondents.

Two variables contributed positively and significantly to the variation observed in the total individual *CSI* scores: HIV-affected parents ($P < 0.01$) and Own parent as adult teacher ($P < 0.05$) (see Table 3). The first one, above referred to as the variable hivstat2, represents the category of adults with one or more orphans under their care, the second one represents the one-parent HIV/AIDS orphans who continued to reside with the surviving parent (above referred to as pSuivre1).

Three variables were negatively correlated with the *CSI* scores, out of which one was statistically significant at $P < 0.10$, and the two other ones at $P < 0.05$. These were, respectively, non-affected children living in complete households (non-orphans), gender, and children who were double orphans farming on their own without an adult teacher.

Discussion and conclusion

This study examined knowledge of maize crop pests among Adja farmers in an attempt to ascertain what the differences are between HIV/AIDS child orphans and affected adults, and between non-orphan children and non-affected adults. Sharp insights can be gained through the use of salience indexes as a proxy for knowledge of a domain. One of the main findings of this study is that children were more like the adults they live with than like other children. The results show that individuals (adults and children) living in HIV/AIDS-affected households had a better ability to name maize pests than the other respondents. In addition, HIV/AIDS orphans had higher *CSI* scores than all other respondents for the majority of items. This result was not anticipated. One-parent orphan children that continued to reside in the parental home with the surviving parent had higher *CSI* scores than orphans living in fostering households and double orphans. Overall, orphans dramatically outperformed non-orphans living in two-parent maize farming households.

How can we explain the large difference between affected and non-affected adults as well as the fact that affected orphan children had higher *CSI* scores than affected adults? An explanation for the higher ability of affected adults and orphan children in naming maize pests and the saliency of these pests could be the greater dependence on maize for food security (utility) for these families coupled with the greater responsibilities children must shoulder in crop production and crop protection (learning from adults and by direct field observation and work), particularly in one-parent HIV/AIDS families. One of the important implications is that the best channel for children to acquire agricultural knowledge is their closeness to their parents. But the huge differences observed amongst the *CSI* scores we believe to be poverty-induced differences, revolving around resource mobilization to face pest problems in the maize fields (Rugalema *et al.*, 1999). Here one can distinguish between tangible and non-tangible resources. Non-affected household members (adults and children) are better off in terms of land, money and hired labour (Den Ouden, 1995). People in affected households, however, because of the depletion of their resources by necessity are more dependent on fewer resources. One of the resources they have is their agricultural knowledge (non-tangible resource). In situations of shock and stress such as caused by HIV/AIDS, knowledge of the agro-ecosystem is a primary resource (Barnett *et al.*, 1995; Haddad & Gillespie, 2001).

The second major conclusion of this study is the relationship between gender and the *CSI* differences. Affected adult men and women had higher overall *CSI* scores than non-affected men and women. Affected women also had a larger domain in that they had additional pests they named compared with non-affected women. Affected women had substantially higher *CSI* scores than non-affected men as well as being on par with or surpassing affected men in their *CSI* scores (except for one of the 12 items). There were also indications of a gender shifting in knowledge where orphans were acquiring knowledge of pests that are not normally part of the domain of non-affected girls or boys. Orphan girls and boys had *CSI* scores for items that non-orphan children of the same gender had no scores for (4 of the 12 items). These results may indicate that there is a gender shift in knowledge occurring because the repertoire of women and girls is expanding. For affected boys and men, as with affected women and girls, the salience is deepening (higher *CSI* scores per item). However, affected men and boys are not expanding the domain to include more items identified by females.

We can only speculate that one of the factors involved in the differences we see with regard to gender and HIV/AIDS is linked to being either a better-off commercial producer or a cultivator for domestic consumption. Maize in the study region is moving from a purely subsistence crop to one with commercial importance. It can be cultivated for sale to generate income by those who have sufficient resources to do so. Observations by several authors (Leach, 1994; Fagbemissi *et al.*, 2002; Goebel, 2003) suggest that when a crop gains a commercial value, men tend to dominate in many aspects including skills and knowledge. But commercial farmers can also better afford both labour (for scaring off birds) and inputs (such as pesticides) and this might help explain the low *CSI* scores for maize pests among male and female non-affected farmers compared with those who are HIV/AIDS affected. Affected households have a real concern for maize as a subsistence crop and they tend to have a shortage of cash and labour (Haddad & Gillespie, 2001). We believe that the expansion of the domain of maize pests by HIV/AIDS-affected women and girls is linked to both the greater utility of the knowledge due to the importance of maize for food sufficiency and their expanded active participation and responsibility in the production of the crop and its protection. It can be inferred that since maize is grown mainly for household consumption, and also because adults of non-affected households have easier access to inputs such as fertilizer and high-yielding maize varieties, they pay less attention to observing phenomena in their fields, and this is reflected in their children's knowledge base as well (Stross, 1973; Ruddle, 1993). The existence of easy solutions such as pesticides to prevent certain pest problems/constraints may also negatively impact adults perceiving some of the items as pests, that is, a threat to their maize crop and thus may result in a lack of salience (Bentley, 1989; 1992).

An additional finding is that the field data show that people hunt birds for household consumption and thus birds have a positive utilitarian value (Hunn, 1982) and at the same time a negative utilitarian value as a pest that attacks maize cobs (Anon., 2004). The two bird pests that fit this assertion are *ehlin* (Red-billed Quelea) and *takpe* (Yellow-necked Spurfowl). These two birds had the highest *CSI* scores for HIV/AIDS-affected adults and orphans. However, the bird pests that are not eaten are only described with the generic name *hevi*, a term that is used for all small and difficult to name birds. We thus believe that the salience of *ehlin* and *takpe* is not only related to them because both are very destructive pests but also because they are an important source of food for HIV/AIDS-affected households.

In conclusion, the assumption that HIV/AIDS has a negative impact on the knowledge of HIV/AIDS orphans is not supported by the results of this study. HIV/AIDS-affected adults had higher *CSI* scores, and affected women and girls had more pest items in the domain than non-affected women and girls. Affected men and boys, though having larger *CSI* scores than non-affected men and boys, did not seem to expand the gender-based aspects of the domain to the same extent as affected women and girls. HIV/AIDS orphans had the highest *CSI* score and those residing with the surviving parent in the household of origin scored best followed by orphans in fostering households. Double orphans on their own with no adult teacher scored lower. Non-orphans in intact households scored the lowest among the children, and like their parents, very poorly. The results of the Tobit analysis supported the observed differences in the *CSI* scores discussed above. HIV/AIDS-affected adults (statistically significant at $P < 0.01$) and children who had their own parent as teacher (statistically significant at $P < 0.05$) were shown to have the highest saliency for major pests relative to other subjects of the study.

This outcome contradicts the expectations in the literature that HIV/AIDS causes erosion of agricultural knowledge. The need to secure food for the household through maize farming and the shortage of resources emphasize a great utility of the harvest for the HIV/AIDS-affected household. Therefore we assume that one of the reasons for this difference in scores is because HIV/AIDS-affected adults and orphans invest more in their farm in the form of labour and attention. So it can be inferred that utility, necessity and experience have contributed to sharpening their observation skills. This in turn contributed to the knowledge differences revealed by the study. The guiding hand of the surviving parent of an orphan, however, is to be valorized. These findings indicate that there is a need for careful thinking about the implications of HIV/AIDS on farming knowledge and to engage in further empirical research.

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