Prevalence and characteristics of psychotic-like experiences in Kenyan youth

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ABSTRACT

Current evidence suggests that there may be significant differences in psychotic symptom prevalence in Africa compared with other cultures. However, there have been few studies evaluating these symptoms in the continent. We conducted a cross-sectional survey of psychotic-like experiences (PLEs) in 2963 Kenyan students from seven tertiary academic institutions spread across Kenya, using a self-administered psychosis questionnaire evaluating psychotic experiences and demographic variables. Logistic regression was used to evaluate relationship between PLEs and demographic variables. Latent class analysis (LCA) was used to determine specific classes of psychotic experiences. Twenty-three percent of respondents reported having at least one PLE, and 19% reported this unrelated to drug use or sleep. Compared to students identifying as Protestant Christians, Catholics had a lower likelihood of having any PLE or visual hallucinations. Other demographic variables were not significantly associated with PLEs. LCA of PLEs resulted in a three-class model that comprised 1) a non-psychotic class (83.8%), 2) a predominantly hallucinatory class ("type I PLE"; 12.7%), and 3) a multiple symptom class ("type II PLE"; 3.5%). Both psychotic classes had a predominance of male students. Further studies are required to clarify functionality and clinical progression associated with observed patterns of psychosis, as well as the generalizability of our findings.

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1. Introduction

Individuals who report psychotic-like experiences (PLE) have been found to be at increased risk of future psychotic disorders (Simon et al., 2001; Verdoux and Cougnard, 2006; Kelleher et al., 2011). A growing body of evidence suggests that PLEs such as delusionary or hallucinatory experiences are much more frequent in the general population than psychotic disorders, suggesting the existence of a symptomatic psychosis continuum in the community (Johns and van Os, 2001; Verdoux and van Os, 2002). Explorations of the expression of PLEs in a non-clinical population, in addition to symptoms in defined disorders, are therefore necessary to better understand the etiology and pathogenesis of psychosis (Verdoux and van Os, 2002).

The reported prevalence rates of PLEs appear to be dependent on the specific population studied (Nuevo et al., 2010). For example, community surveys in various countries have shown rates ranging from about 1 to 46% (Ochoa et al., 2008; Morgan et al., 2009; Gureje

et al., 2010; Jenkins et al., 2010; Nuevo et al., 2010; Gale et al., 2011), while others have reported a higher prevalence in university students compared to the general population (Loewy et al., 2007). There has been only minimal investigation of PLEs in Africa, due to a dearth of psychiatric research relative to that in many developed countries (Ndetei, 2008). However, it is expected that their rates would far exceed that for diagnosable psychotic illness in the continent. Results from systematic reviews of schizophrenia have been variable, suggesting both similar (Saha et al., 2006) and differing (Goldner et al., 2002) rates across cultures. Delusional ideation has been reported to be more frequent in a rural Ugandan community, compared to studies conducted in Europe (Lundberg et al., 2004), but such cultural comparisons are limited by differences in the world view of concepts, which may influence the perception of psychotic illness (Ndetei and Vadher, 1984; Maslowski and Oosthuizen, 1993; Maslowski et al., 1998; Okulate and Jones, 2003; Teuton et al., 2007; Olugbile et al., 2009). Others have found up to a 10-fold difference in rates of paranoid schizophrenia between high prevalence regions such as western Ireland and northwestern Croatia and the lowest prevalence regions in many developing countries (Torrey, 1981). In Africa, the prevalence of schizophrenia is often noted to be relatively low, ranging between 4.3 and 60.0 per 1000 (Ben-Tovim

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and Cushnie, 1986; Tafari et al., 1991; Kebede et al., 2003); however, rates of illness may be underestimated due to cultural differences in clinical presentation, inaccurate translation of survey tools, or assessment of non-representative populations.

Kenya is a developing nation in Eastern Africa, with the poverty incidence estimated to be above 50%, with varying rates regionally (Central Bureau of Statistics, 2005). Most Kenyans are bilingual in English and Swahili, which facilitates the use of epidemiologic surveys developed in English. Kenya also has a relatively young population, with about two-thirds being 24 years or younger (Kenya National Bureau of Statistics, 2009). Therefore, assessments done in Kenyan youth are significant in understanding, to a large degree, the mental well-being in the country. Considering the high illiteracy rate in sub-Saharan Africa, there may be a unique advantage in conducting self-administered surveys from students with higher educational attainment, who would be expected to be more likely to comprehend survey items than those from the general community. This is particularly important when investigating relatively complex phenomena such as psychotic experiences. It is estimated that about 3% of the tertiary school-aged cohort in Kenya is enrolled in colleges or universities (Kimalu, 2001; Otieno and Ngolovoi, 2009). Colleges and universities in Kenya both offer undergraduate training, although colleges are considered less competitive than universities.

Our current study investigates the prevalence of various PLEs in Kenyan college students, and their relationship to key demographic variables. It is expected that PLEs will be significantly more common than rates of psychotic illness in Africa. We further examine gender-related differences in prevalence rates, and consistent with previous studies of psychosis (Spauwen et al., 2003; Scott et al., 2008), we hypothesize that PLEs will be more prevalent in males. Finally, we explore patterns of psychotic experiences, which may identify unique classes of affected individuals.

2. Methods

2.1. Participants

A total of 3250 students were invited to participate, out of which 2963 students completed the questionnaire. Participants ($N = 2963$) consisted of college students from seven tertiary academic institutions spread across Kenya (Kisumu, Meru, Muranga, Nairobi, Nakuru, Mombasa, and Port Reitz), and were fluent in English. All participants were students specializing in health fields in the various institutions, and their ages ranged from 15 to 48 years. Prospective participants were informed of the study during a break while in class, and asked to gather back in class at a designated time. The requirements of the study were described, and students were given the options to decline or to participate and assured of anonymity. A research assistant distributed questionnaires and was available if needed.

Demographic profiles of participants ($n = 2963$) are shown in Table 1. Written and signed consent was obtained from all participants. The study was approved by the Kenyan Medical Research Institute (KEMRI), and the Ministry of Education, Science and Technology, Kenya.

2.2. Assessments

Participants completed the *psychosis screen* (Part 2) of the World Health Organization's Composite International Diagnostic Interview, version 3.0 (CIDI 3.0) (Kessler and Ustun, 2004), which examined six different domains of past or lifetime psychotic experience: 1) visual hallucinations, 2) auditory hallucinations, 3) thought insertion and broadcasting, 4) belief that one's mind was being controlled by an outside force (mind control), 5) referential thinking, and 6) persecutory ideation. For each domain, participants were asked to report whether or not they had ever experienced the phenomenon and, if so, if it had occurred outside of dreaming, being half-asleep, or under the influence of alcohol or drugs. Previous validity studies of the CIDI psychosis module have shown high agreement with clinician interviews when symptoms are based on questions asked of participants, and less so for symptoms requiring interviewer judgment (Cooper et al., 1998; Gureje et al., 2010). Additional items on the questionnaire investigated the number of times psychotic experiences had occurred, and why participants believed the phenomenon had occurred (i.e. attribution). Data were also obtained regarding whether participants had ever sought help or treatment from a mental health professional for any reported symptoms, been given a psychiatric diagnosis, or been hospitalized for any psychotic experience.

Table 1

Demographic profiles of surveyed Kenyan university students ($N = 2963$).

Demographic variable	Value[a]
Age (years)	
Mean (standard dev.)	21.3 (2.8)
Gender	
Female	1430 (48.3)
Male	1513 (51.1)
Not provided	20 (0.7)
Marital status	
Single	2774 (93.6)
Married	132 (4.5)
Other	57 (1.9)
Religion	
Protestant	1779 (60.0)
Catholic	851 (28.7)
Muslim	131 (4.4)
Other	164 (5.5)
Not provided	38 (1.3)
Residence	
Home/with relatives	390 (13.5)
University hostel	2164 (74.7)
Other hostel	313 (10.8)
Other	31 (1.1)

[a] Values are given as number of participants (percentages), unless stated otherwise.

2.3. Statistical analysis

General statistical analyses were done using SPSS 11.0.1 (SPSS Inc., Chicago, IL). Group comparisons were performed using Pearson chi-square (χ^2) test or the Fisher exact test (two-tailed for all tests). Logistic regression was used to calculate odds ratios, describing the strength of association between demographic variables and psychotic experiences.

We used latent class analysis (LCA) (McCutcheon, 1987; Yang and Becker, 1997; Sullivan et al., 1998) to determine empirically the typologies of psychotic experiences in Kenyan students. LCA is a "categorical analog" to factor analysis and is particularly appropriate for data on the presence or absence of symptoms. Using Latent Gold 4.5 (Statistical Innovations, Belmont, MA), we applied LCA to a 1271×6 data matrix in an iterative manner. The rows corresponded to 1271 of 2963 surveyed Kenyan students who completed all six psychotic experience and gender items on the questionnaire. We included gender as a co-variate in the analysis to allow for the possibility of gender-related differences in symptoms. We determined the best class solution with reference to the lowest Bayesian information criterion (BIC), among one- to six-cluster solutions generated. BIC values were: 1-class: 3746; 2-class: 3132; 3-class: 3110; 4-class: 3142; 5-class: 3187; 6-class: 3237. BIC takes into account the number of parameters used in model estimation (Schwarz, 1978) and rewards models with fewer classes that more accurately reproduce the data. Smaller BIC values are preferred as they represent model improvement over larger values. We had relatively clear evidence in favor of a three-class solution (BIC values not shown). Individual subjects were then assigned class membership based on the likelihood of their particular response profile. We then explored LCA class differences in the rates of 1) demographic variables, 2) individual psychotic experiences (i.e. prevalence, frequency and attributions), and 3) history of professional treatment. Given the number of variables compared, the overall type I error was inflated. We employed a two-tailed significance level of 0.01 to compensate partially for the number of comparisons.

3. Results

3.1. Demographics

The demographic profiles of the 2963 students surveyed are shown in Table 1. The remaining students either did not return to class for the study, or did not complete the questionnaire without giving a reason. The mean (standard deviation (S.D.)) age of the students was 21.26 (2.77) years, the median age was 21 years, and ages ranged between 15 and 48 years. There were 54 students aged 30 and above.

3.2. Prevalence and presentation of psychotic experiences

Prevalence of psychotic experiences among the students surveyed is reported in Table 2. Among those who completed the entire

Table 2
Prevalence of psychotic experiences of surveyed Kenyan university students.

Psychotic experience[a]	
Any psychotic experience[b]	
Total	322 (23.0)
Not sleep/drug related	269 (19.2)
Female	118 (18.0)
Male	151 (20.3)
Visual hallucinations	
Total	407 (17.4)
Not sleep/drug related	304 (13.0)
Female	133 (12.1)
Male	170 (13.8)
Auditory hallucinations	
Total	255 (11.9)
Not sleep/drug related	201 (9.4)
Female	100 (9.9)
Male	101 (9.1)
Thought broadcasting/insertion	
Total	162 (8.9)
Not sleep/drug related	133 (7.3)
Female	58 (6.8)
Male	76 (7.9)
Mind control	
Total	156 (8.9)
Not sleep/drug related	122 (7.0)
Female	47 (5.9)
Male	75 (8.0)
Referential thinking	
Total	108 (6.4)
Not sleep/drug related	81 (4.8)
Female	32 (4.1)
Male	49 (5.5)
Persecutory ideation	
Total	112 (5.5)
Not sleep/drug related	88 (4.3)
Female	38 (3.9)
Male	49 (4.7)

[a] Prevalence estimates derived using total numbers of students completing specific item on the questionnaire.
[b] Refers to prevalence of any of the six psychotic experiences asked. Prevalence estimates were based on students completing all six psychotic experience items (N = 1399).

psychosis questionnaire, 322 (23.0%) reported having experienced a psychotic symptom in the past, of which 269 (19.2%) reported at least one psychotic phenomenon that occurred while not half-asleep, dreaming, or under the influence of drugs or alcohol; the prevalence was 20.3% for males and 18.0% for females. The most commonly reported symptom was visual hallucinations (13.0%), followed by auditory hallucinations (9.4%,) while the least common was paranoia (4.3%).

The mean age (S.D.) of first occurrence of a psychotic symptom was 15.5 (4.6) years overall with a mean of 15.6 (5.0) years for males and 15.4 (4.2) years for females. The median age for all groups was 17 years.

3.3. Gender effects

Fig. 1 shows the prevalence of psychotic experiences across genders. There was no significant difference in the frequency of occurrence of any experience, but, there was a trend level effect ($p = 0.09$) for the psychotic symptom of 'mind control', which was more prevalent in males.

Mean (S.D.) lifetime number of psychotic experiences was 6.0 (2.9) for males, and 4.1 (3.1) for females, however, differences did not reach statistical significance. Four males (2.6% of those with psychotic experiences) and six females (5.1% of those with psychotic experiences) reported lifetime history of seeking professional help for psychotic symptoms. Past psychiatric hospitalization was reported by two males (1.3%) and three females (2.5%).

3.4. Attributions of psychotic experience

Students were asked what they thought might have caused them to experiences psychotic phenomena. The various attributions of psychotic experiences are listed in Table 3. Among the attribution categories, those reporting visual hallucinations most commonly indicated that they thought experiences occurred following thinking deeply about something or about future events (23.8%). These thoughts were not indicated to involve themes of sadness, anger or happiness, although, some may have been. Examples of these *future/deep thoughts* included answers such as "critical thinking about some issues in life", "I was thinking about her", "I had thoughts of the future", "strong desire to be a soldier", or "imagination". Of the individuals who answered the query, 19.8% indicated that they did not know the cause of visual experiences, 14.1% indicated it may have been due to a *physical illness*, which included answers such as "sickness", "dizziness", or "malaria", and 13.2% stated it was due to *stress* or *anxiety*. Among those experiencing auditory hallucinations that indicated attributions, 42.7% did not know the cause of this, and 18.7% related it to *future/deep thoughts*. The cause of thought broadcasting/insertion was not known by 30.4% of those reporting this experience, while 25.3% attributed it to *stress/anxiety*. Similarly, mind control was thought to be caused by *stress/anxiety* in 32.4% of students, while 30.9% of those reporting did not the cause. Furthermore, 10.3% of students reporting mind control stated this may have been due to *fears*. Fear answers across PLEs included answers such as "watched a scary movie", "bomb blast" and "my fear of spiders". The majority of those with referential thinking (35.1%) or persecutory ideation (31.8%) did not know the cause of these experiences. In addition, 22.7% of persecutory ideation was attributed to *envy* or *jealousy*.

3.5. Relationships of psychotic experiences and demographic variables

Odds ratios and 95% confidence intervals are shown in Table 4. There was a significant association between students who identified as Catholic (compared to Protestants) and lower likelihood of psychotic experiences, and specifically visual hallucinations. There was additionally a trend level relationship between 'mind control' and male gender (compared to female) and living in an off-campus hostel (compared to on-campus). Other relationships were not significant.

3.6. Latent class analysis (LCA)

Of the 1271 analyzed, a three-class LCA model was found to be the best fit using the lowest BIC values. The prevalence of the three classes were 83.8%, 12.7% and 3.5% respectively. Fig. 2 depicts the conditional probabilities of having individual psychotic experiences among the three LCA derived classes. Observation of symptom distribution indicates that the largest cluster consists of largely asymptomatic individuals. Two additional clusters were derived, which consisted of a differential pattern of psychotic experiences, and thus were termed 'type I' and 'type II' PLEs. Type I PLE individuals comprised 12.7% of the surveyed population, and were characterized by relatively higher probabilities of having experienced hallucinations, particularly visual hallucinations, compared to other psychotic experiences. Type II PLE individuals, with a 3.5% prevalence, had relatively high probabilities of each of the six psychosis items, with the highest probability for mind control.

3.7. Demographics and mental health care across the latent classes

Table 5 depicts the demographic profiles of the three observed classes. Mean age in each class approximated 21 years, which did not statistically differ across groups. There were relatively more males than females in both type I (males = 69.0%; females = 31.1%) and type II (males = 64.4%; females = 35.6%) PLE classes, while the
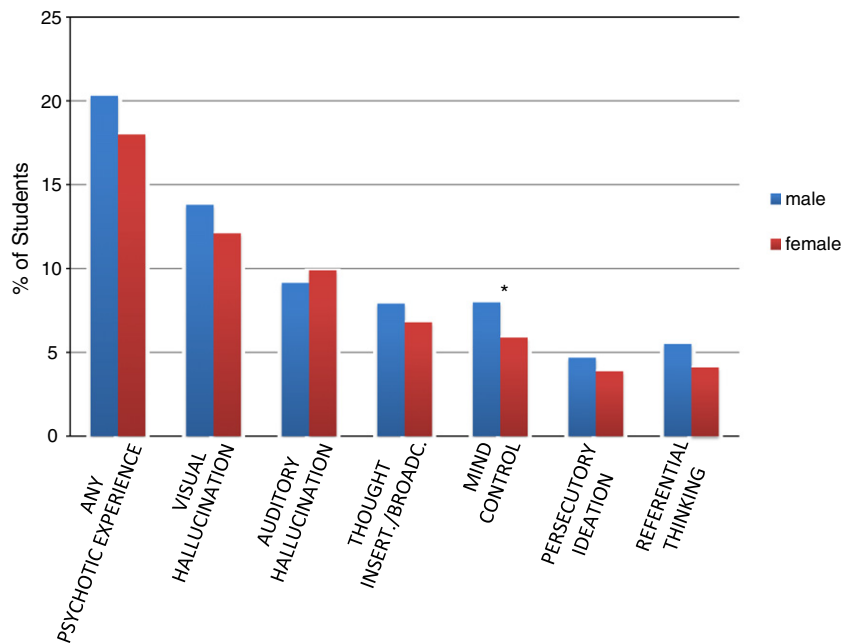
Fig. 1. Gender differences in PLE prevalence. The graph shows the percentage of college students that reported any PLE (1st bars), and specific PLEs, for each gender. There were no statistically significant ($p<0.05$) differences in the frequency of any PLE between genders, using chi-square analysis. *$p<0.10$. Blue = males; red = females.

non-psychotic class showed equal numbers of males and females. Other demographic differences did not reach statistical significance across the three groups.

4. Discussion

We found that in the population of college students surveyed, PLEs were relatively common (23% of those surveyed), with visual hallucinations and auditory hallucinations being the most prevalent experiences. Slightly less than half of those reporting a history of PLEs (43.7%), had more than one type of experience. Considering the worldwide prevalence of schizophrenia and related disorders (Perala et al., 2007), it is unlikely that the observed PLEs indicate psychotic disorders exclusively, but rather a continuum including individuals who are clinically unaffected. Also using the CIDI psychosis screen, rates of 2.1–11.7% have been reported in Nigerian, New Zealand, and Spanish studies (Ochoa et al., 2008; Gureje et al., 2010; Gale et al., 2011), which were lower than those we found. In a large cross-national community study using the CIDI, Nuevo et al. found the overall prevalence of any PLE to be 12.5% (Nuevo et al., 2010). However, they reported considerable prevalence differences across countries, with about 0.66% in Vietnam to 46% in Nepal. Furthermore, the PLE rates in Kenya were reported as 18.7% (Nuevo et al., 2010), which is comparable to those found in our studies. Using alternative screening tools, other authors have reported rates of PLEs between 4 and 19% in community surveys (Fresan et al., 2007; Morgan et al., 2009; Jenkins et al., 2010). Our investigation, however, involved a select population — students, who may have more delusional beliefs, distress and preoccupation associated with beliefs than those from the general population (Lincoln and Keller, 2008). It has also been suggested that psychotic symptoms are reported more frequently in younger age groups compared with the general population (Scott et al., 2006). In a survey of U.S. college students, 43% of students reported having eight or more positive symptoms on a prodromal questionnaire (Loewy et al., 2007), while an 18% PLE prevalence was found in psychology university students in Argentina by other authors (Leiderman, 2011).

Perceptual experiences (i.e. visual and auditory hallucinations) were the most prevalent PLEs among the college students surveyed, while referential thinking (6.4%) and paranoid ideation (5.5%) were the least prevalent. Other authors have similarly reported increased rates of perceptual experiences, compared to paranoia and referential thinking, in adult, adolescent and pre-adolescent community samples (Mojtabai, 2006; Gureje et al., 2010; Fonseca-Pedrero et al., 2011; Gale et al., 2011; Kelleher et al., 2011; Leiderman, 2011). Lesser rates of perceptual experiences relative to other PLEs have been found by other

Table 3
Students' attributions of psychotic experiences[a].

Attribution	Visual hallucinations	Auditory hallucinations	Thought broadcasting/insertion	Mind control	Referential thinking	Persecutory ideation
Don't know	45 (19.8)	64 (42.7)	24 (30.4)	21 (30.9)	13 (35.1)	14 (31.8)
Stress/anxiety	30 (13.2)	9 (6.0)	20 (25.3)	22 (32.4)	3 (8.1)	1 (2.3)
Sadness/depression	6 (2.6)	2 (1.3)	1 (1.3)	2 (2.9)	3 (8.1)	1 (2.3)
Spiritual	17 (7.5)	11 (7.3)	4 (5.1)	1 (1.5)	3 (8.1)	1 (2.3)
Physical illness	32 (14.1)	7 (4.7)	3 (3.8)	1 (1.5)	2 (5.4)	1 (2.3)
Fear	16 (7.0)	10 (6.7)	5 (6.3)	7 (10.3)	2 (5.4)	4 (9.1)
Future/deep thinking	54 (23.8)	28 (18.7)	5 (6.3)	3 (4.4)	3 (8.1)	–
Happiness/joy	1 (0.4)	1 (0.7)	–	–	–	–
Anger	–	1 (0.7)	1 (1.3)	2 (2.9)	–	1 (2.3)
Envy/jealousy	–	–	–	–	–	10 (22.7)
Other[a]	26 (11.5)	17 (11.3)	16 (20.3)	9 (13.2)	8 (21.6)	11 (25.0)

[a] Includes other, indecipherable or incomplete answers given.

Table 4
Odds ratios of psychotic experiences against demographic variables.

Demographic variable[a]	Any psychotic experience OR (95% CI)	Visual hallucinations OR (95% CI)	Auditory hallucinations OR (95% CI)	Thought broadcasting/ insertion OR (95% CI)	Mind control OR (95% CI)	Referential thinking OR (95% CI)	Persecutory ideation OR (95% CI)
Gender (female)							
Male	1.16 (0.89–1.51)	1.16 (0.91–1.48)	0.93 (0.69–1.23)	1.18 (0.83–1.68)	1.39[*] (0.95–2.03)	1.36 (0.79–1.88)	1.22 (0.86–2.15)
Residence (uninversity hostel)							
Other hostel	0.85 (0.62–1.18)	0.98 (0.74–1.30)	0.96 (0.68–1.35)	1.20 (0.81–1.79)	1.47[*] (0.99–2.20)	0.94 (0.55–1.61)	0.92 (0.55–1.54)
Home/with relatives	0.83 (0.56–1.22)	0.99 (0.70–1.41)	0.86 (0.56–1.34)	0.91 (0.55–1.53)	1.26 (0.77–2.06)	0.74 (0.37–1.50)	0.62 (0.30–1.30)
Marital status (single)							
Married	0.90 (0.46–1.76)	1.15 (0.66–2.02)	0.51 (0.21–1.27)	0.79 (0.31–1.97)	0.66 (0.24–1.83)	0.73 (0.24–2.23)	1.02 (0.38–2.73)
Religion (Protestant)							
Catholic	**0.68**[**] (0.49–0.93)	**0.64**[**] (0.48–0.86)	0.82 (0.59–1.15)	0.79 (0.53–1.18)	0.98 (0.65–1.48)	1.14 (0.70–1.87)	0.75 (0.44–1.25)
Muslim	0.62 (0.27–1.40)	0.78 (0.41–1.48)	0.82 (0.37–1.83)	0.44 (0.13–1.41)	0.74 (0.26–2.07)	0.89 (0.29–2.76)	0.92 (0.34–2.49)

[a] Variables in parentheses represent the 'reference variable'.
[*] $p < 0.10$.
[**] and bold: $p < 0.05$.

authors (Alptekin et al., 2009; Jenkins et al., 2010), including several studies where paranoia was reported as the most frequent PLE (Shevlin et al., 2007; Morgan et al., 2009; Yung et al., 2009; Barragan et al., 2011). Variations in the relative prevalences of individual PLEs across studies may reflect differences in the phrasing of screening questions. For example, in questions evaluating paranoia, including a qualifier assessing a third person's perception may decrease the prevalence of this symptom. Thus, it could be expected that a "paranoia" question phrased as: "*Have you ever felt as if some people are not what they seem to be?*" as in some studies (Yung et al., 2009; Barragan et al., 2011) would result in a much higher endorsement rate than: "*Did you ever believe that there was an unjust plot going on to harm you or to have people follow you that your family and friends did not believe was true?*" which was used in our study.

We did not find a significant gender difference in the prevalence of PLEs, except for delusions involving mind control, a symptom that was slightly more prevalent in males. There were also no differences in the age of onset of psychotic experiences. This is in contrast to other studies, reporting higher rates of schizophrenia (McGrath, 2005) and psychotic experiences (Spauwen et al., 2003; Scott et al., 2008) in young males. Young males have also been described as being more likely to have schizophrenia in a rural population in Ethiopia (Kebede et al., 2004). While males have been noted to have an earlier age of onset of psychotic disorders (Gureje, 1991; Hambrecht et al., 1992), our findings suggest that PLEs represent different phenomena than psychotic disorders, with similar age of onset across genders. This appears consistent with a community survey in rural Ethiopia showing comparable ages of onset of psychotic symptoms in males and females (Kebede et al., 2003).

It is of interest that although many students did not know the causality of their PLEs, several indicated specific attributions. Anxiety or stress was often reported as preceding the onset of psychotic experiences, particularly of visual hallucinations, thought broadcasting/ insertion and mind control (i.e. 13.2–32.4% across these three PLEs).
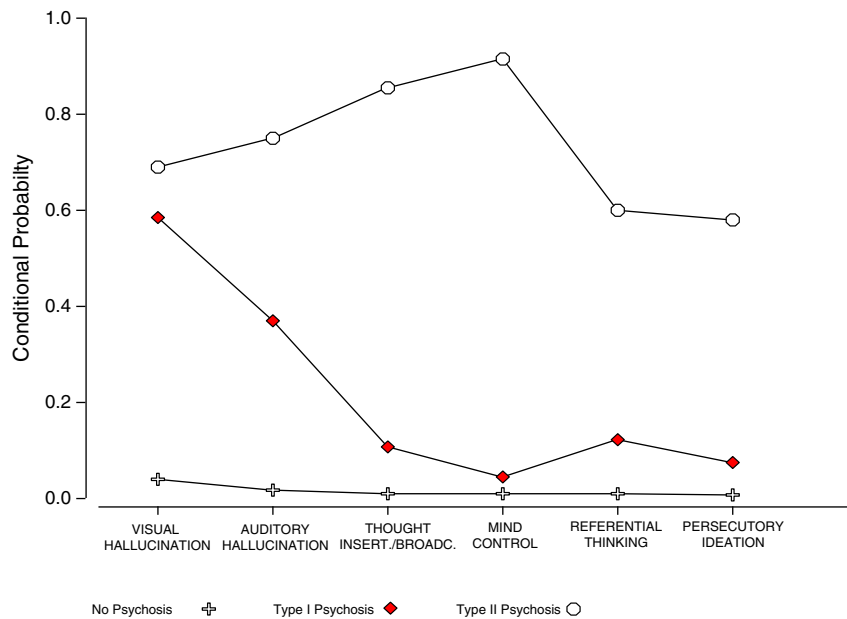

Fig. 2. Classes of psychotic experiences in Kenyan college students. Latent class analysis (LCA) was used to classify students based on their reports on the presence of absence of PLEs. Gender was included as a covariate in the analysis. Only students that indicated "yes" or "no" on the psychosis questionnaire and reported their gender were used in the LCA ($N = 1271$). The graph shows the three classes derived from LCA (i.e. "no psychosis", "type I PLE" and "type II PLE"), and the probability of having a specific PLE in each class.

Table 5
Characteristics of the three classes of youth derived from latent class analysis (LCA) data of psychosis survey of Kenyan university students.

Feature	No psychosis $N = 1065$ (83.8%)	PLE type I $N = 161$ (12.7%)	PLE type II $N = 45$ (3.5%)	F or χ^2	p
Demographics:					
Age (years)				0.83	0.4
Mean (S.D.)	21.2 (2.7)	21.5 (2.3)	21.1 (1.8)		
Gender				22.3	**<0.0001**[**]
Female	531 (49.9)	50 (31.1)	16 (35.6)		
Male	534 (50.1)	111 (69.0)	29 (64.4)		
Marital status				2.6	0.62
Single	1004 (95.2)	152 (95.6)	45 (100.0)		
Married	49 (4.6)	7 (4.4)	0		
Other	2 (0.2)	0	0		
Religion				7.1	0.32
Protestant	648 (62.1)	102 (65.8)	35 (77.8)		
Catholic	309 (29.6)	40 (25.8)	10 (22.2)		
Muslim	38 (3.6)	6 (3.9)	0		
Other	49 (4.7)	7 (4.5)	0		
Residence				7.1	0.3
Home/with relatives	172 (16.4)	16 (10.2)	5 (11.1)		
University hostel	786 (75.1)	127 (80.9)	33 (73.3)		
Other hostel	77 (7.4)	12 (7.6)	6 (13.3)		
Other	12 (1.2)	2 (1.3)	1 (2.2)		
Mental health care:					
Talked to doctor/MH professional[a]				0.5	0.46
Yes	–	2 (6.7)	2 (13.3)		
No	–	28 (93.3)	13 (86.7)		
Hospitalized[a]				0.8	0.38
Yes	–	3 (4.9)	0		
No	–	58 (95.1)	15 (100)		

Latent class analysis was applied to data from the 1271 participants that completed all psychosis screen items. The best derived model was a three-class-solution [i.e. 1) no psychosis, 2) psychotic-like experience (PLE) type I, and 3) PLE type II]. Profiles of participants grouped in the three derived latent classes are shown in the table.
Values are given as means (age) or number and percentage of participants. Groups were compared using ANOVA or chi-square analysis.
  [a] Analysis was done without the "no psychosis" group.
  [**] and bold: $p < 0.01$.

Other affective states, including depression, anger, happiness or fear, were less commonly associated with PLEs, but also reported. This is consistent with the literature, which often associates anxiety or depression with the onset of psychotic symptoms, including in Africa (Guinness, 1992). Of note, a large proportion of students with visual (23.8%) or auditory (18.7%) hallucinations indicated that these were caused by thinking deeply or a lot about something, often involving their aspirations or other aspects of their future, which are not typically associated with psychosis onset. However, it is conceivable that while not specifically reported by students, some of these 'thinking' attributions could include themes of anxiety, stress, or sadness, which culturally may be less commonly verbalized. The relatively low percentage of association with spiritual themes (1.5–8.1% across experience types), unlike those previously reported in Africa (Patel, 1995), might be a function of the better educated population evaluated. Most students, however, did not answer questions on attributions; thus, our report may not be representative of our population studied.

Among the demographic variables, only religion showed a significant inverse relationship to PLEs in our sample. Catholic faith was associated with a lower frequency of PLEs, as well as visual hallucinations. It is of interest that a lower frequency of religious delusions (Getz et al., 2001), shorter duration of untreated psychosis (Moss et al., 2006), and better general mental health status (Boey, 2003) in Catholics have previously been reported. However, other authors have reported that religious coping with stressful events is more effective in Protestants compared to Catholics (Tix and Frazier, 1998). While our study does not directly address the cause of the PLE–religion relationship, differences in the degree of religious attendance or social supports provided by religious groups may contribute. There is limited scientific evidence suggesting that these factors are greater in Catholics

compared to those of other faiths. Catholic Church attendance has been reported as higher than Orthodox Church attendance in Eastern Europe (Need and Evans, 2001). Similarly, in a Scottish study, church attendance was greater in Catholic children compared to those affiliated with the Church of Scotland; and this was related to improved measures of mental health (Abbotts et al., 2004). Larger family size has also been reported in Catholics compared to non-Catholics (Compton et al., 1985), which, because of greater social supports, may positively affect mental well-being. However, larger families have generally either not been associated with (Schor, 1988; Taanila et al., 2004) or shown an increased risk for psychiatric morbidity (Amoran et al., 2005).

A major finding in our study was the identification, using latent class analysis, of two classes of individuals with psychotic experiences. The less prevalent psychotic symptom cluster (termed "type II PLE") incorporated students who tended to have multiple symptoms, typically reporting a history of both hallucination(s) and delusion(s). The multi-symptom pattern in this psychosis class, as well as the observed prevalence (3.5%) approximating that of psychotic disorders in the community (Perala et al., 2007), suggests that this class of PLE may involve students that have a clinically diagnosable psychotic disorder, such as schizophrenia, schizoaffective disorder or a mood disorder with psychotic features. A second class of individuals was also observed, who reported PLEs of higher prevalence (12.7%; "type I PLE"), consisting predominantly of hallucinatory experiences, especially visual hallucinations. Considering the relatively high prevalence of this type I PLE observed, it is unlikely that this group represents individuals with clinically diagnosable psychotic disorders, although future studies will be required to investigate if diagnosable disorders may exist for a subset of these individuals. Hallucinations are commonly found among those without mental

illness, suggesting that they are either not necessarily pathologic, or that less-than-hallucinatory experiences are routinely mischaracterized as hallucinations by some individuals (Johns, 2005; Pierre, 2010). Hallucinations can also occur in the context of conversion disorder, trauma, sensory deprivation, and certain cultural settings indicating limited diagnostic specificity and relevance (Pierre, 2010). In students, perceptual abnormalities have been less associated with distress, depression or poor functioning compared to "bizarre experiences" or "persecutory ideas" (Armando et al., 2010). Our findings using latent class analysis share some similarity to findings from a previous general U.S. population survey which showed that the best fitting latent class model was a four-class solution, with a 'psychosis class', a 'hallucinatory class', an 'intermediate class', and a 'normative class' (Shevlin et al., 2007). Gale et al., however, reported a three-class solution from a community survey, with a 'psychotic class', a 'hallucinatory class', and a 'normal class', which is highly similar to that found in our study (Gale et al., 2011).

Our findings may have potentially important clinical implications. We found that perceptual abnormalities are a less common finding than delusions, suggesting that evaluating delusions is more useful for estimating psychopathology than evaluating hallucinations. Focusing predominantly on delusional phenomena to describe "at-risk" individuals may better predict the future development of a psychotic disorder than if psychotic experiences are considered indiscriminately. If the two types of PLEs reported represent different biological entities, it appears likely that type II individuals have greater difficulty functioning than those with type I PLE due to the presence of delusional symptomatology together with perceptual abnormalities. Type II PLE is expected to comprise individuals who would fit diagnostic criteria for a psychotic disorder, as well as those with multiple attenuated psychotic symptoms (Woods et al., 2010; Mamah and Barch, 2011) who would be at risk for developing a psychotic disorder in the future. Thus, there may be good reason to more specifically target individuals with a type II psychotic symptom constellation for closer evaluation, monitoring and possibly early intervention strategies. Longitudinal studies are required to evaluate the clinical outcome of individuals classified in either psychotic class, to better understand differences in the need for early intervention.

A limitation of our study is that results may not necessarily be generalizable to the community in which the study was conducted. College students represent a unique population and their psychotic experiences will likely differ from individuals in the community. The male predominance in both observed psychotic classes could be a reflection of the younger age range of the students, and thus not seen in community surveys. Questionnaire items were also not fully completed by all study participants, which may have influenced our findings by excluding individuals who are cognitively impaired or distractible due to psychopathology. A larger number of individuals completing items investigating hallucinations may reflect greater ease in comprehending these questions compared to those investigating delusions. However, this would not influence the latent class loadings, which included only completers.

In summary, we found that psychotic-like experiences are relatively common in Kenyan college students. Two classes of psychotic experiences were observed: one consisting predominantly of perceptual abnormalities, and another also involving delusional experiences. Future studies will be required to understand the relationship of psychotic experiences to future functioning and in evaluating risk for development of psychotic disorders.

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