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Social support, gender and pill burden influence viral load suppression among HIV-infected adolescents and young adults in rural south-western Uganda

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ABSTRACT

Adolescents and young adults (AYA) carry a significantly higher risk for HIV infection compared to the general population. HIV-infected AYA also have poorer adherence and viral load (VL) suppression compared to older adult patients. Social support may provide an avenue for interventions to improve adherence and VL suppression in this population. We conducted a cross-sectional study in rural southwestern Uganda to examine the association between social support and VL suppression. We measured family cohesion and various sources of social support namely parent/guardian, teachers, classmates and friend using validated scales, and reliability of the scales using Cronbach's alpha was at least 0.70 on all of them. We defined VL suppression as having less than 1000 copies per ml. We used logistic regression analysis to calculate odds ratios (OR) for the association and to adjust for potential confounders. We enrolled 255 AYA, age range 12–24 years and 50.6% of them were male. Viral load suppression was present in 72.9% of them. In the multiple regression analysis, friend social support was associated with a 10% increase in the odds of VL suppression for every unit increase on the social support scale (OR = 1.10 95% CI 1.05, 1.14). Waiting for more than 15 minutes to see the doctor at the clinic was associated with an almost 2.5-fold increase in the odds of VL suppression (OR = 2.46, 95% CI (1.23–4.92). Males had 48% lower odds of having VL suppression (OR = 0.52, 95% CI, 0.27–0.98) compared to females. Experiencing side effects on antiretroviral therapy (OR = 0.46 95% CI 0.22–0.95), and taking two or more pills per dose (OR = 0.21 95% CI 0.06–0.75) were associated with lower odds of VL suppression. In conclusion, social support is positively associated with VL suppression, and interventions to enhance social support should be developed and tested among HIV-infected AYA.

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Adolescents; HIV; social support; viral load suppression

Introduction

Adolescent and young adult (AYA) populations in the age bracket 12–24 years represent over 40% of new HIV infections globally and are the only age group for which AIDS deaths are not decreasing (). In Uganda, about 1.4 million people are living with HIV.

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AYA aged 12–24 years comprises 33% of the population, but account for nearly 50% of all people living with HIV in the country (). Access to combination antiretroviral therapy (ART) improves the health and survival of people living with HIV () and contributes to a reduction in HIV incidence. ()

Access to ART has rapidly expanded, especially with the World Health Organization (WHO) guidelines which recommend early treatment for HIV-infected individuals, namely the 'test and treat' strategy. () However, the implementation of ART programs among AYA face major challenges to achieve adherence and viral load (VL) suppression. Although a metanalysis on ART adherence among AYA () showed high adherence of almost 84% among those in sub-Saharan Africa, AYA may have lower adherence and VL suppression than adults. Studies in sub-Saharan Africa show that HIV-infected adolescents and young adults on ART have poorer adherence rates and poorer virologic outcomes compared to the older patients. (HYPERLINK \l "LinkManagerBM_REF_lfbzFgSo", HYPERLINK \l "LinkManagerBM_REF_t6CaA9wH")

AYA faces significantly more and unique challenges to adhere to their medications compared to adults. A recent qualitative study conducted in Uganda found the main barriers to ART adherence among AYA include those common with adults such as poverty, food insecurity, privacy, unreliable family support and the burden of taking multiple medications but also unique ones such as school attendance and hormonal changes (). The study also found that peer influence and support, especially among youth living with HIV, was strong and created an important network to support adherence to treatment. Social support is a potentially modifiable factor that could be used as an intervention to support viral load (VL) suppression.

A recent study in Uganda () has shown that social support from family was significantly associated with self-reported adherence. Although many studies have explored the role of social support for ART adherence among AYA, less is known about the role of social support in promoting VL suppression in this age group. Such evidence is necessary to support the development of interventions for social support. Therefore, the objective of this study was to measure the occurrence of various forms of social support and the influence social support has on VL suppression among HIV-infected AYA in south-western Uganda.

Methods

Study setting and participants

The study was conducted in Kabale and Rukiga districts, all located in a rural area in south-western Uganda near the border with Rwanda, approximately 400 km from Kampala, the capital city of Uganda. The main source of income for the majority of residents is farming. According to the most recent Uganda Population-based HIV Impact Assessment survey of 2017 results in this region, HIV prevalence is 7.9% among adults aged 15–64 years and 2.1% among AYA aged 15–24 years. () Participants and their guardians were approached as they returned for their routine visits to the ART clinics. Participants were eligible if they had been on treatment for at least 6 months, willing to participate in an interview for 30 minutes, and consent to access their medical records to obtain viral load data.

Data collection

Data were collected through interviews administered at three county-level health centers offering antiretroviral therapy in the two districts. The interviews lasted 30 minutes on average. Two trained research assistants fluent in English and the local language were hired to administer the interviews. The tools were translated into Rukiga, the local language to cater for participants that were not able to answer questions in English. We did back translation into English to ensure the accuracy of the translation. Data were collected between February and April 2019. The inclusion criteria for the study were: (1) HIV-positive status (2) had received ART for at least 6 months at one of the study's participating clinics; and (3) between the ages 12–24 years and (4) consented or assented to participate in the study.

Measures

The primary outcome for our analysis was VL suppression as a dichotomous outcome. We abstracted VL measurements from patient charts. VL is measured every 6 months and we used the most recent measure available. The VL was measured using Reverse-transcriptase polymerase chain reaction (RT-PCR) test (Roche Amplicor) funded through a Ministry of Health program. VL suppression is the ultimate goal of antiretroviral treatment and was defined as < 1000 copies of HIV/mL as recommended by the Uganda Ministry of Health treatment guidelines ().

The primary explanatory variable was social support. We measured social support using two indicators. The first was that of social support from multiple sources including: parent/caregivers, friends, teachers and classmates, all adapted from the Friendships Qualities Scale (). The second indicator was Family Cohesion and we adapted this from the Family Environment Scale () and the Family Assessment Measure (). All measures have been applied in previous studies in sub-Saharan Africa (HYPERLINK \l "LinkManagerBM_REF_HQA7WVza", HYPERLINK \l "LinkManagerBM_REF_NsueENE7", HYPERLINK \l "LinkManagerBM_REF_ZmshRUHc"). The social support from multiple sources scale has a total of 24 items, each with a possible score with a range from 1 (meaning "never") to 5 (meaning "always"). The range for the composite scale was 24 to 120. The scale assessed the impressions of the quality of children's friendships and relationships with their caregivers, classmates, closest friends and teachers. For each source, we calculated summary scores with higher scores indicating higher levels of social support.

We measured family cohesion with a 6-items scale. Each item was rated on a 1–5 scale with 1 as 'never' and 5 as 'always.' In this scale, adolescents answered questions to examine the level at which they considered their family members supportive of one another. The questions covered the degree of commitment, help and support family members provide to one another and participants rated each item. We generated summary scores from the scale such that higher scores indicating higher levels of family cohesion.

We calculated the Cronbach's alpha for the different social support scales and family cohesion to examine their reliability and all five domains had acceptable scores. The parent/guardian scale had 0.86, a classmate had 0.70; and teacher, friend and family cohesion scored excellent on the scale with scores higher than 0.90.

Demographics and individual factors

The questionnaire covered a wide range of social-demographic characteristics and individual factors. The variables include age, gender, marital status, religion, level of education completed, occupation and income. Individual factors included alcohol, drugs and the use of traditional medicines. We also looked at treatment support and asked whether they had someone to remind them to take their ARVs, used anything to remind them to take their ARVs, and if they belonged to any group that provided them such support. Some health service-related factors were also assessed including money spent on transportation to the clinic, wait times to see the health workers, experiencing drug stock-outs and relationships with clinic staff. Clinical information was also assessed including when they started ART, side effects and current regimen.

Sample size and data analysis procedures

We aimed to interview 254 AYA using consecutive sampling. Our sample size was estimated using the assumption that about 80% of the AYA would be virologically suppressed (). Descriptive statistics were conducted on baseline characteristics and measures of social support.

Bivariate and multiple logistic regression analyses were used to examine the association between social support and VL suppression. Multivariable logistic regression analysis was conducted to compare the demographics and individual factors among VL suppressed and non-VL suppressed groups. The various domains of social support were highly correlated, and showed multicollinearity based on the variance inflation factors. Therefore, only one form of social support was included in the final model. We retained the social support scores in their original continuous scales. In the multivariable logistic regression analysis, we included variables that were significant at the bivariate analysis and/or have a biologically plausible relationship with viral load suppression. We present both the crude (bivariate) and adjusted (multiple regression) results. We examined the overall model for significance using the log likelihood ratio test. Data were analyzed using STATA version 14.

Ethical considerations

The study obtained IRB approval from Mbarara University of Science and Technology. Permission was requested and granted from the three health centers where the study took place. Participants aged 18 years or more provided written consent to participate. Caregivers provided written consent for participants under the age of 18 to participate and the AYA provided voluntary written assent to participate in the study. Participants were aware of their freedom to withdraw from the study at any time. Client interviews were held in a closed room to ensure confidentiality.

Results

We enrolled 255 AYA in the study. As shown in Table 1, of the 255 AYA who participated in the study, most (50.6%) were male, 37.3% were adolescents between

Table 1. Baseline characteristics of the adolescents and young adults

Variable	n (%)
Age Categories	95 (37.3)
12–17 years old	160 (62.7)
18–24 years old	
Gender	126 (50.6)
Male	129 (49.4)
Female	
Marital Status	172 (67.5)
Single	52 (20.4)
Married	21 (8.2)
In a relationship	6 (2.4)
Separated	
District of Residence	172 (67.5)
Kabale	76 (29.8)
Rukiga	7 (2.7)
Rubanda	
Religion	54 (21.2)
Muslim	198 (77.7)
Christian	3 (1.1)
Other	
Education level	19 (7.4)
No formal education	54 (21.2)
Some primary education	69 (27.1)
Completed primary education	36 (14.1)
Some secondary education	56 (22.0)
Completed secondary education	21 (8.2)
Higher education(college/university)	
Occupation	9 (3.5)
Employed in public sector	50 (19.6)
Employed in private sector	50 (19.6)
Self employed	111 (43.6)
Student	35 (13.7)
None	
Dependents	168(65.9)
None	36(14.1)
1	28(11.0)
2	9(3.5)
3	14(5.5)
4 or more	

ages 12–17 and 62.7% were young adults between ages 18–24. About two-thirds of the participants were single and most (65.9%) had no dependents. Almost 44% of them were students.

Overall, 186 (72.9%) of the 255 AYA enrolled in the study had achieved VL suppression. Baseline characteristics and individual factors are segregated by VL suppression and are shown in Table 2. Females were more likely to have VL suppression compared to the males ($p = 0.005$). However, participants who had two or more pills per dose or had experienced side effects with treatment were significantly less likely to achieve VL suppression. Use of alcohol, the amount of money spent on transport, or the nature of the relationship with clinic staff were not associated with VL suppression.

Specific items measuring levels of social support and family cohesion are provided in Table 3. The items used for social support and family cohesion were measured on these sources as shown: parent/guardian, classmate, teacher, friend and family cohesion. The

Table 2. Baseline characteristics and individual factors among VL and non-VL suppressed AYA

Characteristic	VL suppression n = 186 n (%)	No VL suppression n = 69 n (%)	p-value
Age Categories	77 (41.7)	18 (25.0)	0.06
12–17 years old	109 (58.3)	51 (75.0)	
18–24 years old			
Gender	104 (55.9)	25(36.2)	0.005
Female	82(44.1)	44(63.8)	
Male			
Education level	9(4.8)	10(14.5)	0.007
No formal education	42(22.8)	12(17.4)	
Some primary education	59(31.7)	10(14.5)	
Completed primary education	27(14.5)	9(13.0)	
Some secondary education	36(19.4)	20(28.9)	
Completed secondary education	13(6.8)	8(11.6)	
Tertiary/College/university			
Ever consumed alcohol	155(83.3)	53(76.8)	0.233
No	31(16.7)	16(23.2)	
Yes			
Pills per dose	41(22.0)	3(4.4)	<0.001
1	145(78.0)	66(95.7)	
2 or more			
People remind them to take ARVs	34(18.3)	17(24.6)	0.259
No	152(81.7)	52(75.4)	
Yes			
Money spent on transportation to clinic(Uganda	36(19.4)	26(37.7)	0.215
Shillings)*	101(54.3)	30(43.5)	
No money spent	49(26.3)	13(18.8)	
1,000–5,000			
More than 5,000			
Wait time to see doctor at the clinic	69(37.1)	41(59.4)	0.001
Less than 15 minutes	117(62.9)	28(40.6)	
More than 15 minutes			
Experience Side effects	134 (72.0)	35 (50.7)	0.001
No	52 (27.0)	34 (49.3)	
Yes			
Relationship with staff at the clinic	108 (58.1)	40(58.0)	0.795
Excellent	71 (38.2)	28(40.6)	
Good	7 (3.7)	1(1.4)	
Fair or poor			

Note: *1 USD = 3700 Uganda shillings

classmate social support scale had the lowest mean score of 14.70 and family cohesion the highest with a score of 27.19

Results from bivariate and multivariable analysis examining the correlates of VL are presented in Table 4. In the bivariate analysis, friend social support, gender, pills per dose, experience side effects, wait time to see a doctor at the clinic were significantly associated with VL suppression. In the bivariate analysis, there was a significant 6% increase in the odds of having VL suppression for every unit increase in the parent/guardian social support scale (OR = 1.06, 95% CI 1.02, 1.09). All the sources of social support were associated with a significant increase in the odds of achieving VL suppression with every unit increase on the social support scale. However, family cohesion was not significantly associated with VL suppression.

In the multivariable regression, we included only one form of social support, namely friend, in the final model. Friend social support was associated with a significant 10% increase in the odds of VL suppression for every unit increase on the social support scale

Table 3. Itemized description of the different sources of social support and family cohesion

Social support from multiple sources (maximum score per Item 5)	Mean (SE)
Parent/Guardian	
Have parents/guardians that don't really understand you	3.57(0.09)
Have parents/guardians who don't seem to want to hear about your problems	3.41(0.09)
Have parents/guardians who care about your feelings	3.96(0.09)
Have parents/guardians who treat you like you really matter	4.15(0.08
Have parents/guardians who like you the way you are	4.13(0.08)
Have parents/guardians who act like what you do is important	4.13(0.08)
Parent/guardian summary	**20.72(0.36)**
Teacher	
Has a teacher who helps you when you have a problem	3.96(0.09)
Has a teacher who helps you do your best	4.0(0.09)
Has a teacher who cares about you	3.95(0.09)
Has a teacher who is fair to you	3.90(0.09)
Has a teacher who cares if you feel bad	3.90(0.09)
Has a teacher who treats you like a person	4.09(0.09
Teacher summary	**17.03(0.77)**
Friend	
Has a close friend who you can tell your problems to	3.81(0.09)
Has a close friend who really understands you	3.93(0.09)
Has a close friend that you can talk to about things that bothers you	3.92(0.09)
Has a close friend that you like to spend time with	3.99(0.09)
Has a close friend that really listens to what you have to say	4.06(0.08)
Has a close friend that cares about your feelings	3.97(0.09)
Friend summary	**23.59(0.50)**
Classmates	
Has classmates that like you the way you are	3.89(0.09)
Has classmates that you can become friends with	3.82(0.09)
Has classmates that sometimes make fun of you	3.82(0.10)
Has classmates that pay attention to what you say	3.23(0.12)
Doesn't get asked to play games with your classmates	3.82(0.11)
Spends recess alone	2.18(0.11)
Classmate summary	**14.70(0.64)**
Family Cohesion	
Family members ask each other for help before asking non-family members	4.41(0.38)
Family members like to spend free time with each other	4.45(0.38)
Family members feel close to each other	4.59(0.38)
Available when other members of your family want to talk to you	4.66(0.38)
Listen to what other family members have to say even when you disagree	4.65(0.38)
Do things together as a family	4.58(0.38)
Family summary	**27.19(2.26)**

(OR = 1.10, 95% CI 1.05, 1.14). Other factors that were significant were gender, wait time at the clinic, experience of side effects and pill burden. Males had 48% lower odds of having VL suppression (OR = 0.52, 95% Cl, 0.27–0.98) compared to females. AYA that waited more than 15 minutes to see the doctor at the clinic were 2.46 times more likely to have VL suppression compared to AYA that waited less than 15 minutes (OR = 2.46, 95% CI (1.23–4.92). AYA that experienced side effects were less likely to have VL suppression compared to those who had not experienced side effects (OR = 0.46, 95% CI 0.22–0.95). The odds of having VL suppression were 79% lower among those who took 2 or more pills per dose (OR = 0.21, 95% CI 0.06–0.75), compared to those who took only 1 pill per dose.

Discussion

This study examined viral load suppression among HIV-infected adolescents and young adults in rural southwestern Uganda and its correlates. Our data showed that almost 73% of

Table 4. Logistic regression analysis for factors associated with viral load suppression among adolescents and young adults

Variable	Bivariate analysis OR (95% CI)	p-value	Multivariable analysis + OR (95% CI)	p-value
Age				
12–17 years old	1.0	0.072	-	
18–24 years old	0.66 (0.39–1.15)			
Gender				
Female	Ref	0.006	1.0	
Male	0.45 (0.25–0.79)		0.52 (0.27–0.98)	0.044
Education level				
No formal education	Ref	0.016	-	
Some primary education	3.89 (1.29–11.75)	0.001		
Completed primary education	6.56 (2.13–20.14)	0.045		
Some secondary education	3.33 (1.03–10.79)	0.197		
Completed secondary education	2.0 (0.70–5.74)	0.358		
Higher education (college/university)	1.81 (0.51–6.36)			
Ever consumed alcohol				
No	Ref		-	
Yes	0.66 (0.34–1.31)	0.235		
Pills per dose				
1	Ref	0.003	1.0	
2 or more	0.16 (0.05–0.54)		0.21 (0.06–0.75)	0.016
People remind them to take ARVs				
No	Ref	0.261	-	
Yes	1.46 (0.75–2.83)			
Money spent on transportation to clinic (UGX)				
Nothing	Ref	0.007	1.0	0.606
1,000–5,000	2.43 (1.27–4.65)	0.013	1.22 (0.57–2.62)	0.931
More than 5,000	2.72 (1.23–6.01)		0.96 (0.37–2.51)	
Wait time to see doctor at the clinic				
Less than 15 minutes	Ref	0.002	1.0	
More than 15 minutes	2.48 (1.41–4.37)		2.46 (1.23–4.92)	0.011
Experience Side effects				
No	Ref	0.002	1.0	
Yes	0.40 (0.23–0.71)		0.46 (0.22–0.95)	0.035
Experienced ARV drug stock outs				
No	Ref	0.012	-	
Yes	6.44 (1.49–27.73)			
Parent/Guardian social support	1.06 (1.02–1.09)	0.003	-	
Teacher social support	1.04 (1.02–1.06)	0.001	-	
Friend social support	1.08 (1.04–1.11)	<0.001	1.10 (1.05–1.14)	<0.001
Classmates social support	1.05 (1.03–1.08)	<0.001	-	
Family Cohesion	0.995 (0.989–1.00)	0.32	-	

Notes: *Social support and family cohesion scales represent a one unit increase in the summary scale. +Variables in the final multivariable analysis model are sex, pills per dose, money spent on transportation, clinic wait time, experience of side effects and friend social support.

AYA had virological suppression. Our data also show that social support is a significant contributor to VL suppression in addition to other factors such as pill burden, gender, wait time to see the doctor and experience of side effects.

The proportion of VL suppression seen in our study is comparable to the 70.6% reported in a study conducted in Masaka (), a geographically proximal town to Mbarara, Uganda where our study was conducted, and also close to that seen in other recent studies in sub-Saharan Africa (HYPERLINK \l "LinkManagerBM_REF_HAFJJhOz", HYPERLINK \l "LinkManagerBM_REF_CGGlQtW9"). It is slightly lower than the average adherence rate among adults and children which was 77% in a metanalysis of studies from lower and middle-income countries (). However, it should be noted that the metanalysis used

adherence which is prone to social desirability bias. The VL suppression in our study is also much lower than the recommended UNAIDS target of 90-90-90. Although the VL suppression levels appear lower than optimal, they are much higher than those seen especially in higher-income countries, for instance, in the United States where VL suppression was less than 60% in AYA of the same age category. ()

Friend social support was significantly associated with higher odds of VL suppression. This finding is consistent with previous studies that show that AYA with social support will have better adherence (HYPERLINK \l "LinkManagerBM_REF_rxpviiHb", HYPERLINK \l "LinkManagerBM_REF_YJ2loafx"). In the bivariate analysis, friend social support had the highest odds ratio among the four sources, but this is not sufficient evidence to state it is the most important source of social support. The important role of friends, peers and support groups has been shown to form an important network to support ART adherence and VL suppression in other studies (HYPERLINK \l "LinkManagerBM_REF_lArPykTd", HYPERLINK \l "LinkManagerBM_REF_Owd7qRBp"), although a recent study in Uganda did not show a significant association of the social support from classmates, teachers and friends. ()

Our data showed family cohesion was not significantly associated with VL suppression. This finding is in disagreement with several other studies. A recent study conducted in Uganda showed that one of the main barriers to ART adherence and VL suppression among AYA was unreliable family support (). Several studies show the role of the family is critical (HYPERLINK \l "LinkManagerBM_REF_BLT5Lv92", HYPERLINK \l "LinkManagerBM_REF_YJ2loafx") that it seems to modify the effect of peer-based interventions. A study done in South Africa revealed that peer support for adherence had a positive impact on HIV treatment outcomes among participants with functional families but not in those with dysfunctional ones. () However, the results in our study could be explained by two factors. First, there were generally high scores on the family coherence scale by respondents. Our data generally showed high scores on the family cohesion scale for majority of the respondents. These high scores translate into a lack of sufficient variability on the scale and this general uniformity in the scores may explain the lack of association with viral load. Second, family cohesion may not translate into family social support. Although family cohesion shows how well knit together the family is, this may not equate to individual-level support that the adolescents need.

Most of the correlates of adherence identified in this study are consistent with those findings in other studies conducted in sub-Saharan Africa. Gender, pills per dose and experience of side effects were significant in the multivariable analysis. Males were shown to be less likely to have VL suppression compared to females which is in agreement with findings from many other studies. Several studies show that men are less likely to be virologically suppressed (HYPERLINK \l "LinkManagerBM_REF_CGGlQtW9", HYPERLINK \l "LinkManagerBM_REF_mUKNRDlP", HYPERLINK \l "LinkManagerBM_REF_Sxum4T2O") probably because of their poorer health care-seeking behavior.

AYA who took two more pills per dose were less likely to be adherent than those who took one pill per dose. These findings are similar to findings in a systematic review among adolescents in low- and middle-income countries (). Our study also showed that AYA who experienced side effects were less likely to have VL suppression consistent with a recent metanalysis (). Our study also revealed that those that waited more than 15 minutes to see a doctor at the clinic were more likely to have VL suppression

compared to those who waited for less. This finding is inconsistent with other studies which suggest that longer wait times at the clinic are a barrier to adherence and VL suppression (). However, it is possible that AYA who wait longer at the clinic may have more chance to interact with their peers and friends, a source of social support that is significantly associated with viral load suppression. More research is needed to explain these findings and interventions could be designed to take advantage of these wait times. For instance, organized peer interactions could be arranged while the AYA is waiting for their turns to see a clinician.

Strengths and limitations

Our study has important strengths. First, we used VL, a biological marker that is not prone to social desirability bias as a measure of treatment success. Second, there are limited data on the role of social support in viral load suppression among HIV infected adolescents. Our study has some weaknesses. The results may not be generalized to the larger Ugandan population, as the study was limited to AYA in south-western Uganda. Also, we conducted a cross-sectional study, and the data cannot strictly be used to support directionality or causality between social support and VL, as we are not certain what came first. Lastly, our analysis combines findings from adolescents and young adults, yet these two groups may have different developmental needs. Our sample size did not permit a disaggregated analysis to examine this important difference between these two age categories. Future studies should be powered to explore this age interaction.

Conclusions and recommendations

Social support is positively associated with viral load suppression. Our results highlight the need for future public health programs to address interventions for social support especially around friends as it is seen to be an important type of support. There should be more programs targeted at males as they have lower VL suppression than females. There should be more sensitization done on the importance of taking ART medication regardless of side effects and there needs to be more biomedical advances to reduce pill burden.

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Disclosure statement

There are no interests to declare.

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