

# An intervention study for viral hepatitis

## Peer-led health education among high school students

Hamit Acemoglu, MD, Yilmaz Palanci, MD, Turan Set, MD, Serhat Vancelik, MD, Memet Isik, MD, Harun Polat, PhD.

### ABSTRACT

**الأهداف:** التحقق من فعالية التعليم التشاركي بين الأقران في تحسين كلاً من: معرفة، ومواقف، وسلوكيات طلاب المدارس الثانوية تجاه التهاب الكبد الفيروسي.

**الطريقة:** أُجريت هذه الدراسة الاستطلاعية والتي تقصت عن النتائج قبل وبعد التدخل التوعوي في مركز ارزوروم الطبي، ارزوروم، تركيا وذلك خلال الفترة من فبراير إلى مايو 2007م، وشملت هذه الدراسة 2930 طالباً من 29 مدرسة مختلفة. لقد تم تدريب 559 طالباً لتثقيف أقرانهم حول التهاب الكبد الفيروسي، وقد قام هؤلاء الطلاب بتطبيق معايير تعليمية مُعتمدة في عملية التثقيف.

**النتائج:** أشارت النتائج إلى أن درجات الطلاب الذين قاموا بتثقيف أقرانهم والتي كانت متعلقة بمدى المعرفة كانت  $7.99 \pm 2.73$  قبل التدخل التوعوي، وأصبحت بعد التدخل  $13.91 \pm 3.85$  ( $p=0.000$ ). فيما زادت درجات الطلاب الآخرين بعد التدخل التوعوي من  $7.27 \pm 2.85$  إلى  $11.20 \pm 4.21$  ( $p=0.000$ ). ولقد كان هناك ارتفاعاً واضحاً في نسبة الإجابات الصحيحة المتعلقة بالمعرفة بعد التدخل التوعوي ( $p=0.000$ )، كما وتغيرت إجابات الطلاب التي تكشف عن مواقفهم تجاه الأشخاص المصابين بفيروس الكبد تغيراً واضحاً بعد التدخل ( $p=0.002$ ). وكان هناك تغيراً إيجابياً في سلوكيات الطلاب أيضاً ( $p=0.000$ ).

**خاتمة:** أثبتت هذه الدراسة مدى فعالية تطبيق التعليم التشاركي بين الأقران في برامج التوعية ضد التهاب الكبد الوبائي وذلك بسبب التحسن الملحوظ في معرفة الطلاب الذي تم تدريبهم من قبل أقرانهم، ونحن بحاجة لمزيد من الدراسات التي تمتد لفترات أطول من أجل تسليط الضوء على أهمية التعليم التشاركي بين الأقران.

**Objectives:** To check the effectiveness of peer-led education in improving the knowledge, attitudes, and behavior of high school students regarding viral hepatitis (VH).

**Methods:** This study was conducted at 29 high schools in Erzurum city center, Turkey between February and May 2007.

The study design is a prospective before-and-after intervention trial. In this study, 2930 students from 29 different schools were included. A total of 559 volunteer students were trained as peer educators. These students applied a standard education to their peers.

**Results:** The total knowledge scores of peer educators before was  $7.99 \pm 2.73$ , and  $13.91 \pm 3.85$  after peer-training ( $p=0.000$ ). The total knowledge scores of other students increased from  $7.27 \pm 2.85$  to  $11.20 \pm 4.21$  ( $p=0.000$ ). There was an increase in all correct answers to the knowledge questions after the intervention ( $p=0.000$ ). Response to the questions exploring attitude of students towards people infected with hepatitis virus significantly changed after the training ( $p=0.002$ ). There was also a significant positive change in the behaviors after the intervention ( $p=0.000$ ).

**Conclusion:** The significant increase in the knowledge of students trained by their peers proves this method is effective to be utilized in the prevention strategies regarding VH infections. Further studies with long term follow-up would be useful to demonstrate the long term value of peer education.

*Saudi Med J 2011; Vol. 32 (2): 183-187*

From the Departments of Medical Education (Acemoglu), Family Medicine (Set, Isik), Public Health (Vancelik), Biochemistry (Polat), Ataturk University Faculty of Medicine, Erzurum, and the Department of Public Health (Palanci), Kafkas University Faculty of Medicine, Kars, Turkey.

Received 24th October 2010. Accepted 20th December 2010.

Address correspondence and reprint request to: Assistant Professor Turan Set, Department of Family Medicine, Ataturk University, Faculty of Medicine, Erzurum 25240, Turkey. Tel. +90 (44) 22316535. Fax. +90 (44) 22317228. E-mail: turanset@gmail.com

**Disclosure.** This study was supported by the European Union Research Fund (project number TR0305.02-02/LDI/106), Erzurum, Turkey.

Viral hepatitis (VH) is a widely found infectious disease. Worldwide, 2 billion people have been infected with hepatitis B virus (HBV), 360 million have chronic infection, and 600,000 die each year from HBV-related liver disease, or hepatocellular carcinoma.<sup>1</sup> Other forms of hepatitis are also a major health burden.<sup>2-4</sup> Chronic infection with hepatitis C virus (HCV) is estimated to affect 170 million people worldwide, and 20-30% of these will eventually progress to liver cirrhosis and its sequelae, such as hepatocellular carcinoma.<sup>4</sup> This global health problem is a serious concern in Turkey too, especially in the eastern and south-eastern areas.<sup>5-8</sup> The total seroprevalence rates of 25-60% in the east and south-east areas are reported with hepatitis B surface antigen (HBsAg) seroprevalence rates of 5-10%.<sup>8,9</sup> Hepatitis continues to be a major health problem in Erzurum, where our study was conducted.<sup>10,11</sup> Despite the possible serious complications, hepatitis has the advantage of being preventable with relatively cheap interventions, such as health education, immunization, and environmental measures.<sup>12-15</sup>

Peer education is a powerful tool in educating the youth. Involving the youth in planning, presenting, and evaluating teaching programs can be very effective. When a collaborative approach is used with a youth organization dedicated to community service, it can be an effective method for promoting healthy behaviors.<sup>16,17</sup> Although peer to peer education is a well-known and valued health education method, its use and effectiveness in VH prevention has not been studied in detail.<sup>17,18</sup> In this study, we aim to evaluate and discuss the details of a one-day peer-led education on VH prevention.

**Methods.** This study was conducted at 29 high schools in Erzurum city center, Turkey between February and May 2007, as a prospective before-and-after intervention trial. Erzurum is one of the largest cities in eastern Turkey with 450 thousand inhabitants in the city center. At the time of the study, 17598 pupils in the ninth to eleventh grades were studying in 29 high schools in Erzurum city center. Elementary education in Turkey starts at the age of 7 years. Hence, students in the ninth to eleventh grades are expected to be 16-18 years of age. The study was approved by the Regional Health Directorate, as well as the National Education Directorate.

**Inclusion criteria of peer-led educators.** Volunteers, high-achieving high school students with leadership potential who were selected by their school teachers were included in the study. The research process consisted of 5 stages, such as: stage 1 - program and material preparation. The project coordinators prepared a one-day training program, conducted with standard PowerPoint presentations, trainer's booklet, posters,

and brochures. During this training program, group discussions and presentations were held. The highlights of the program were: program presentation and learning needs, VH types and epidemiology, how to prevent VH, and how to prepare a presentation on the prevention of VH. A survey questionnaire consisting of 25 questions was prepared for data collection. The questionnaire, collecting demographic information, attitude, knowledge, and behavior regarding VH was pre-applied and tested on a group of 50 students, which were not included in the study sample. Appropriate improvements and corrections were carried out after the testing. Stage 2 - training of the trainers. Under the supervision of the project coordinators, a one-day training program was revised and improved with the contribution from 3 departments, namely, Public Health, Infectious Diseases, and Psychology. This program was applied to 10 volunteer doctors from the Faculty of Medicine. In order to increase presentation and communication skills of the 10 volunteer doctors, additional sessions were conducted. Stage 3 - training of the peer educator educators. Peer educators consisted of voluntary students between 16-18 of age, who were trained by a professional peer education trainer to convey their messages. As there is considerable confusion regarding VH in the minds of high school students, peer educators were trained to impart correct factual information on VH prevention and transmission through a single discussion-oriented session lasting one hour. Peer educators were selected with the help of psychological consultation services from each school. One peer trainer per class was selected from each school, making a total of 559 peer trainers. The study questionnaire was applied to this group before the training. The training materials were handed over to the peer trainers to be hung on school walls, and distributed to the students after the presentation. Stage 4 - peer-led training of the students and data collection. The peer educators made a one-hour interactive presentation in their own classrooms (559 classrooms). The presentation included mainly information on the anatomy and physiology of the liver, as well as signs and symptoms of VH, routes of spread, and preventive measures.

**Study questionnaire.** Data was collected with a 25-item questionnaire. Questions consisted of demographic data and knowledge, attitude, and behavior regarding VH. There were 20 multiple choice questions (MCQ) type knowledge questions with 5 choices, and one single best answer. Knowledge scores were calculated adding correct answers given to the MCQ test. The peer educators distributed the information leaflets on VH, and hung the posters on appropriate places in schools.

**Sampling and application.** Before the presentations, the study questionnaire was applied to a sample of 87 classes. These classes were selected randomly, and

weighting was according to the total number of students in each school. All students in the classroom were asked to participate. Participants were informed regarding the study verbally, as well as with written information in the questionnaire. Participation was on a voluntary basis, and data collection was conducted on an anonymous manner. Out of 3055 students, 2982 accepted to participate, and 2930 questionnaires with valid and complete data were analyzed. Stage 5 - post testing. The questionnaire was applied to the same sample of students after one month with the same methodology. This time 2912 students participated, and 2829 questionnaires can now be analyzed.

**Statistical analysis.** All analyses were carried out with the Statistical Package for Social Sciences version 17 (SPSS Inc, Chicago, IL, USA). Continuous variables were expressed as mean  $\pm$  standard deviation, and categorical variables were expressed as frequencies and percentage. McNemar and paired t test analyses were carried out for bivariate comparisons. A  $p < 0.05$  was considered statistically significant.

**Results.** A total of 2930 questionnaires before, and 2829 questionnaires after peer education intervention were analyzed. Demographic characteristics of the participants are presented in Table 1. Highest scores in the pre-test were obtained from Q20 (61.3% correct), and Q10 (59.5% correct). Lowest scores on the contrary were from Q3 (15.3% correct), and Q19 (16.8% correct) (Table 2). Although there was an increase of approximately 100% after education, Q15 (37% correct) and Q17 (36% correct) still scored low on the post-test. Total knowledge scores of the peer educators before was  $7.99 \pm 2.73$ , and  $13.91 \pm 3.85$  after peer-training ( $t=29.26$ ;  $p=0.000$ ). In addition, the total knowledge scores of other students increased from  $7.27 \pm 2.85$  to  $11.20 \pm 4.21$  ( $t=34.59$ ;  $p=0.000$ ). The increase in the knowledge scores for peer educators was 74%, and for other students was 54%. There was an increase in all the

**Table 2 -** Pre-test, post-test scores, and increment percentages of the students trained by their peers.\*

Questions	Percent correct		Increase (%)
	Pre-test	Post-test	
1. Which of the following is a liver function?	20.58	47.56	(131.1)
2. Which pair of the following are the most common viral hepatitis (VH) in Turkey?	55.02	70.27	(27.2)
3. Which types of VH are transmitted through food and/or water?	15.32	49.61	(223.7)
4. Which of the following VH types is not transmitted through blood?	22.35	49.00	(119.2)
5. Which of the following body fluids of a hepatitis B carrier has the highest risk of transmitting the virus?	56.89	71.31	(25.3)
6. Which of the following is not a cause of non-infectious hepatitis?	36.35	50.82	(39.8)
7. The following are symptoms of acute VH except:	57.47	73.50	(27.9)
8. Vaccines are available to prevent which types of the following VH?	38.57	57.70	(49.6)
9. How many shots are required for a complete course of hepatitis B vaccination?	33.96	61.46	(81.0)
10. Which type of cancer can develop in hepatitis B carriers?	59.52	75.32	(26.55)
11. The following are preventive measures against hepatitis A transmission except	54.23	65.87	(21.45)
12. Which of the following methods can be used to disinfect contaminated objects to prevent transmission of VH?	32.29	53.47	(65.6)
13. What is the chance of developing hepatitis B antibodies in children after a full course of hepatitis B vaccination?	30.68	57.41	(87.1)
14. Which of the followings is a common test to identify people who have previously contracted hepatitis B?	57.13	71.88	(25.8)
15. The following statements are correct for hepatitis C except:	19.86	37.64	(89.5)
16. The followings are routes of hepatitis A transmission except:	29.86	54.55	(82.7)
17. Which of the following is not a precaution to prevent hepatitis B infection?	16.96	36.03	(112.4)
18. The followings are routes of hepatitis B transmission except	25.60	50.86	(98.7)
19. Which of the following is the most protective method against hepatitis A infection?	16.83	38.79	(130.5)
20. A person who is a hepatitis B carrier cannot donate blood to which of the following patients?	61.30	68.98	(12.5)

**Table 1 -** Demographic characteristics of the participants.

Demographics	Pre-test	Post-test	P-value*
<b>Group</b>			0.3
Peer educators	559 (19.1)	525 (18.6)	
Peers	2371 (80.9)	2304 (81.4)	
<b>Gender</b>			0.3
Male	1619 (55.3)	1522 (53.8)	
Female	1311 (44.7)	1307 (46.2)	
<b>Class</b>			0.6
9	1068 (36.4)	1066 (37.6)	
10	1209 (41.3)	1147 (40.5)	
11	653 (22.3)	616 (21.8)	
<b>Total</b>	<b>2930 (100.0)</b>	<b>2829 (100.0)</b>	

\*McNemar test used

\*McNemar test used,  $p < 0.05$  for all questions

**Table 3** - Changes of attitudes of students towards viral hepatitis-infected classmates after the training, on the question: What would be your attitude towards your classmate if you get to know that he/she has VH infection?

Answers	Peer-trainer		Other students	
	Pre-test	Post-test	Pre-test	Post-test
	n (%)			
It would not change	55 (9.8)	78 (14.9)	319 (13.5)	382 (16.6)
I would try to help	33 (59.0)	309 (58.9)	1220 (51.5)	1066 (46.3)
I would avoid personal contact	29 (5.2)	14 (2.7)	192 (8.1)	174 (7.6)
I would avoid being in the same room	79 (14.1)	59 (11.2)	355 (15.0)	374 (16.2)
Other	66 (11.8)	65 (12.4)	285 (12.0)	307 (13.3)
<i>P</i> -value	0.019		0.002	

**Table 4** - Changes in students' behavior toward hepatitis B vaccine after education in view of the question "Did you have hepatitis B vaccine?\*

Responses	Pre-test n (%)	Post-test n (%)	<i>P</i> -value
<i>Peer trainers</i>			0.000
Yes	130 (22.3)	216 (41.1)	
No	429 (76.7)	309 (58.9)	
<i>Other students</i>			0.000
Yes	622 (26.2)	1018 (44.2)	
No	1749 (73.8)	1286 (55.8)	

\*McNemar test used

knowledge questions after the intervention ( $p=0.000$ ) (Table 2). Responses to the question exploring attitudes of students towards people infected with hepatitis virus significantly changed after the training. Respondents that chose "my attitude towards him/her would not change if I knew that my classmate had VH infection" in the pre-test was 9.8% for the peer trainers, and 13.5% for other students. These ratios increased to 14.9% ( $p=0.019$ ) for the peer trainers, and 16.6% ( $p=0.002$ ) for other students (Table 3). There was also a significant positive change which is obtaining immunization for hepatitis B in the behaviors of both peer-led educator group and educated peer group after the education ( $p<0.05$ ; Table 4).

**Discussion.** This study supports the value of peer-led education in VH. The intervention was useful in increasing the knowledge, as well as leading to positive changes in the attitudes and practices of the participants. Peer-led education was tested in several different areas such as HIV, alcohol, drug use, eating, nutrition, unnecessary antibiotic use, and sexual health.<sup>19-23</sup> The application of this innovative technique in VH trainings on the other hand is scarce.<sup>18</sup> With a relatively large sample size and the strongly significant findings, our study is contributing to the literature by showing a wider application area and generalizability of the peer-led education technique. One study showed sustained changes even after one year follow up.<sup>24</sup>

Peer influence is an important feature in risky health behaviors in adolescents.<sup>25</sup> Hence, peer education programs are expected to have a strong influence on individual behaviors of adolescents.<sup>26</sup> In one study, education given by medical professionals was more effective in increasing knowledge, even medical students did better than non-medical peer-educators.<sup>27</sup> Due to this view point, in our study, the peer-led educators were trained by the medical staff. Due to its more serious complications, there are a lot of campaigns and public sensitization towards hepatitis B in Turkey.<sup>28</sup> In view of the health policy perspective, hepatitis B has a high priority. Routine hepatitis B vaccination has been included in the extended program on immunization in Turkey since 1998, while hepatitis A vaccination is still not in the program. We assumed that the relatively high knowledge scores from questions related to hepatitis B (Q10 and Q20) when compared with hepatitis A (Q3 and Q19) is a result of the health policies and public awareness campaigns conducted for many years.

In general, the literature shows a better effect of peer education in changing knowledge and attitudes rather than behavior.<sup>20,29</sup> However, our study showed an improvement in all 3 aspects of learning. The most important measurable behavioral change concerning hepatitis is obtaining vaccination. After the intervention, the proportion of obtaining hepatitis B vaccine among the participating students increased approximately twice as seen in Table 4. This shows the effectiveness of the education. Other studies report peer-led education programs to be effective or partially effective.<sup>24,29</sup> One similar previous study from Turkey demonstrated a positive change in the knowledge and attitude of university students.<sup>30</sup>

We expect our peer educators to be even more successful, if they have the opportunity to keep applying the program to their peers. Trainers of peer-led education trained by doctors may increase the success of education in the aspect of knowledge, attitude, and behavior.

Due to the large sample size and emerging trainer load, we included many doctors as trainers in this project. Despite our effort to standardize the trainers, they did not have the same experience and educational background. Although minor, we expect some differences in the educational performance of the trainers. On the other hand, the school types were not homogenous. We had schools with very dense curriculums that had selected high performing students together with vocational schools with a more relaxed program. A more tailored program could be applied considering the different factors in each school. Multiple shorter teaching sessions instead of a single longer one could reveal better results. More questions would be asked regarding hepatitis C due to its high mortality and morbidity. The study is a self-report on how the participants change their behavior, and we cannot observe all the participating students behavior after the training. We based our study on the testimonial of the students.

In conclusion, although the peer trainers did better than their colleagues, the significant increase in the knowledge of students trained by their peers proved that this method is effective to be utilized in the prevention strategies regarding VH infections. Further studies with long term follow-up would be useful to demonstrate the long term value of peer education. The peer trainers can be utilized in future studies to check for a possible increasing trend in their performance with time.

## References

- Shepard CW, Simard EP, Finelli L, Fiore AE, Bell BP. Hepatitis B virus infection: epidemiology and vaccination. *Epidemiol Rev* 2006; 28: 112-125.
- Bunn WB, III. Risk and burden associated with the acquisition of viral hepatitis A and B in the corporate traveler. *J Occup Environ Med* 2008; 50: 935-944.
- Gultekin F, Bakici MZ, Sezer H, Murat I. Prevalance of hepatitis G virus in hemodialysis patients. *Turkiye Klinikleri Journal of Medical Sciences* 2007; 27: 9-12.
- Osoba AO. Hepatitis C virus genotypes in Saudi Arabia. *Saudi Med J* 2002; 23: 7-12.
- Bozkurt H, Kurtoglu MG, Bayram Y, Kesli R, Berktaş M. Distribution of hepatitis C prevalence in individuals according to their age level in Eastern Turkey. *Eur J Gastroenterol Hepatol* 2008; 20: 1249.
- Degertekin H, Yalcin K, Yakut M, Yurdaydin C. Seropositivity or delta hepatitis in patients with chronic hepatitis B and liver cirrhosis in Turkey: a meta-analysis. *Liver Int* 2008; 28: 494-498.
- Ertekin V, Selimoglu MA, Altinkaynak S. Sero-epidemiology of hepatitis B infection in an urban paediatric population in Turkey. *Public Health* 2003; 117: 49-53.
- Yildirim B, Barut S, Bulut Y, Yenisehirli G, Ozdemir M, Cetin I, et al. Seroprevalence of hepatitis B and C viruses in the province of Tokat in the Black Sea region of Turkey: a population-based study. *Turk J Gastroenterol* 2009; 20: 27-30.
- Tasyaran MA. Epidemiology of HBV infections. In: Kilicturgay K, Badur S, editors. *Viral Hepatit*. Istanbul (Turkey): Deniz Ofset; 2001. p. 121-128.
- Altinkaynak S, Selimoglu MA, Ertekin V, Kilicaslan B. Epidemiological factors affecting hepatitis A seroprevalence in childhood in a developing country. *The Eurasian Journal of Medicine* 2008; 40: 25-28.
- Vancelik S, Guraksin A, Alp H. Hepatitis A seroepidemiology in Eastern Turkey. *East Afr Med J* 2006; 83: 86-90.
- Progress in hepatitis B prevention through universal infant vaccination--China, 1997-2006. *MMWR Morb Mortal Wkly Rep* 2007; 56: 441-445.
- Bruguera M. [Prevention of viral hepatitis]. *Enferm Infecc Microbiol Clin* 2006; 24: 649-656. Spanish.
- Ceyhan M, Yildirim I, Kurt N, Uysal G, Dikici B, Ecevit C, et al. Differences in hepatitis A seroprevalence among geographical regions in Turkey: a need for regional vaccination recommendations. *J Viral Hepat* 2008; 15 (Suppl 2): 69-72.
- Layer C, Gille G, Klapp C, Ravens-Sieberer U. [Prevention of hepatitis B in juveniles. Effect of a medical health education lesson in school]. *Med Klin (Munich)* 2004; 99: 703-707. German.
- Fenn J, Rosales C, Logue C. "Sir insulin monk versus the evil Diana betes": a program addressing type 2 diabetes education and prevention in youth. *Diabetes Educ* 2007; 33: 455-459.
- Zucker DM. Peer education for hepatitis C prevention. *Gastroenterol Nurs* 2009; 32: 42-48.
- Galindo L, Maginnis T, Wallace G, Hansen A, Sylvestre D. Education by peers is the key to success. *Int J Drug Policy* 2007; 18: 411-416.
- Cebotarenco N, Bush PJ. Reducing antibiotics for colds and flu: a student-taught program. *Health Educ Res* 2008; 23: 146-157.
- Medley A, Kennedy C, O'Reilly K, Sweat M. Effectiveness of peer education interventions for HIV prevention in developing countries: a systematic review and meta-analysis. *AIDS Educ Prev* 2009; 21: 181-206.
- Ross DA. Approaches to sex education: peer-led or teacher-led? *PLoS Med* 2008; 5: e229.
- Stephenson J, Strange V, Allen E, Copas A, Johnson A, Bonell C, et al. The long-term effects of a peer-led sex education programme (RIPPLE): a cluster randomised trial in schools in England. *PLoS Med* 2008; 5: e224.
- White S, Park YS, Israel T, Cordero ED. Longitudinal evaluation of peer health education on a college campus: impact on health behaviors. *J Am Coll Health* 2009; 57: 497-505.
- Cai Y, Hong H, Shi R, Ye X, Xu G, Li S, et al. Long-term follow-up study on peer-led school-based HIV/AIDS prevention among youths in Shanghai. *Int J STD AIDS* 2008; 19: 848-850.
- Othero DM, Aduma P, Opil CO. Knowledge, attitudes and sexual practices of university students for advancing peer HIV education. *East Afr Med J* 2009; 86: 11-15.
- Mahat G, Scoloveno MA, De LT, Frenkel J. Preliminary evidence of an adolescent HIV/AIDS peer education program. *J Pediatr Nurs* 2008; 23: 358-363.
- Coniglio MA, Giammanco G, Bonaccorso SN, Pignato S. Knowledge of HIV infection, risk perception, and sexual behaviour of undergraduates. May female medical students act as peer educators? *J Prev Med Hyg* 2007; 48: 85-89.
- Karabay O, Tamer A, Koç Ince N, Buyukahraz N, Vardi S. The Efficiency of Two-dose Hepatitis B Vaccination in Health Care Workers for Immunoprophylaxis. *Turkiye Klinikleri Journal of Medical Sciences* 2006; 26: 24-28.
- Shen LX, Hong H, Cai Y, Jin XM, Shi R. Effectiveness of peer education in HIV/STD prevention at different types of senior high schools in Shanghai, People's Republic of China. *Int J STD AIDS* 2008; 19: 761-767.
- Ergene T, Cok F, Tumer A, Unal S. A controlled-study of preventive effects of peer education and single-session lectures on HIV/AIDS knowledge and attitudes among university students in Turkey. *AIDS Educ Prev* 2005; 17: 268-278.