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The impact of a chlamydia education program on practice nurse's knowledge and attitudes in relation to chlamydia testing: a cross-sectional survey

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Abstract. ***Background*:** We aimed to determine the impact of a chlamydia (*Chlamydia trachomatis*) education program on the knowledge of and attitudes towards chlamydia testing of practice nurses (PNs). ***Methods*:** A cross-sectional survey was conducted at baseline and 6–12 months following recruitment with PNs in the Australian Chlamydia Control Effectiveness Pilot. Likert scales were analysed as continuous variables (scores), and *t*-tests were used to assess changes in mean scores between survey rounds and groups. ***Results*:** Of the 72 PNs who completed both surveys, 42 received education. Epidemiology knowledge scores increased significantly between surveys in the education group ($P < 0.01$), with change in knowledge being greater in the education group compared with the non-education group ($P < 0.01$). Knowledge of recommended testing scenarios ($P = 0.01$) and retesting following treatment ($P < 0.01$) increased in the education group. Attitudes to testing scores improved over time in the education group ($P = 0.03$), with PNs more likely to want increased involvement in chlamydia testing ($P < 0.01$). Change in overall attitude scores towards testing between surveys was higher in the education group ($P = 0.05$). Barriers to chlamydia testing scores also increased in the education group ($P = 0.03$), with change in barriers greater in the education vs the non-education group ($P = 0.03$). ***Conclusion*:** The education program led to improved knowledge and attitudes to chlamydia, and could be made available to PNs working in general practice. Future analyses will determine if the education program plus other initiatives can increase testing rates.

Additional keywords: Australia, barriers, general practice, sexually transmissible infections.

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Introduction

Chlamydia (*Chlamydia trachomatis*) is the most commonly diagnosed bacterial sexually transmissible infection worldwide, with over 100 million cases diagnosed annually. Diagnoses have increased considerably over the last decade, with over 235 000 in the UK[1] and over 80 000 in Australia.[2] Most chlamydia diagnoses are among 15- to 29-year-olds and prevalence estimates suggest that ~3–5% of young adults are infected at any point in time.[3,4] Chlamydia infection is asymptomatic in ~80% of people and, if untreated, potential consequences include pelvic inflammatory disease, ectopic pregnancy and infertility.[5]

In Australia, general practice plays a key role in the diagnosis and treatment of chlamydia.[6,7] Most young people attend general practice at least once annually,[7,8] making it an ideal setting for offering chlamydia testing to this population. Annual chlamydia testing for all sexually active people aged 15–29 years is recommended in the Royal Australian College of General Practitioners (RACGP) preventive health guidelines.[9] Despite this, the proportion of 16- to 29-year-olds tested in Australian general practice is low (8.9%)[8] with barriers to testing in general practice, such as time and workload demands; a lack of clinician knowledge, awareness and training; and concerns around

'offending' patients by offering chlamydia testing being identified as reasons for low uptake.[10]

The Australian Chlamydia Control Effectiveness Pilot (ACCEPt) is a world first cluster randomised controlled trial investigating the feasibility and effectiveness of a multifaceted intervention to increase chlamydia testing rates in general practice. An optional component of the ACCEPt intervention involves enhancing the role of practice nurses (PNs) in chlamydia testing. PNs are an integral part of Australian general practice, but their role in preventive care, including sexual health, is less established compared with countries such as the UK.[11] However, in recent years, alongside increasing numbers and an expansion in scope of practice, PNs have demonstrated an interest in increasing their involvement in sexual health care.[12,13]

To facilitate their involvement in chlamydia testing, PNs have raised the importance of education and training;[13] however, there are no published evaluations of the impact of education on PNs' chlamydia knowledge and attitudes. We thus aimed to examine the impact of a chlamydia education program on PNs' knowledge and attitudes in relation to chlamydia testing.

Methods

Setting

ACCEPt aims to determine whether an organised program of annual chlamydia testing in young people aged 16–29 years will lead to a reduction in chlamydia prevalence. The key components of the multi-faceted testing intervention, aimed at general practitioners (GPs), are: incentive payments, quarterly feedback, a computer alert prompting chlamydia testing, and education programs for GPs and PNs. A total of 134 participating general practice clinics (hereafter referred to as practices) are located in 54 rural, remote and regional towns of four Australian states. A further nine practices in metropolitan areas were included to assess the feasibility and acceptability of the ACCEPt chlamydia testing intervention in an urban general practice clinic setting as well as to provide urban data for comparison. Details of ACCEPt practice recruitment, including eligibility criteria, have been reported previously.[4] PNs participating in this study were recruited from practices in both urban and rural or regional towns.

Ethical approval

ACCEPt received ethical approval from the RACGP National Research and Evaluation Ethics Committee, the Aboriginal Health and Medical Research Council Ethics Committee and the University of Melbourne Human Research Ethics Committee.

ACCEPt PN group

Practices randomised to the ACCEPt intervention arm could choose to increase the role of PNs in chlamydia testing as an additional component of the ACCEPt testing intervention. PNs working at these practices that had been recruited into ACCEPt at the time of clinic recruitment (signed a consent form) were offered a chlamydia diagnosis and management education program. Additionally, a financial incentive for each chlamydia test with PN involvement (counselling patient, administering the test under a GP's supervision, discussing partner notification with a patient, discussing treatment) could be claimed by the practice. This study measures the impact of the first component: the education program.

The education program aimed to increase PNs' knowledge and awareness of chlamydia and equip PNs with the skills to discuss chlamydia testing, partner notification and prevention with young adults. The onsite 2-h education session was offered to all participating PNs working at ACCEPt intervention practices; however, not all participating PNs who were invited attended the education session. The session was delivered by ACCEPt staff, and covered chlamydia epidemiology, presentation and complications, recommended testing practices and management of cases, along with strategies to introduce and streamline testing within practices. PNs who attended the education session were also provided with a chlamydia education pack, endorsed by the Australian Primary Health Care Nurses' Association, the peak professional body for primary health care nurses.

Survey administration

At the time of their recruitment and before the education program, all participating PNs were asked to complete a self-administered paper survey and return it either directly to ACCEPt staff or via reply-paid mail (Survey 1). At least 6–12 months following recruitment, a second self-administered paper survey (Survey 2) was mailed to PNs who had completed Survey 1 in both control and intervention practices, whether or not they had attended the education session. For both surveys, non-responders were reminded by mail sent to the practice or via the practice manager.

Survey content

The PN survey was developed using the ACCEPt GP survey as a basis, with questions removed, modified or added to reflect the PNs' scope of practice. Pilot testing of the survey was conducted with PNs to ensure validity with the target group and feasibility of questionnaire length. Knowledge questions asked participants to identify which two of four age groups of males and females (15-19; 20–24; 25–29; 30–34 years) had the highest chlamydia infection rates, and to indicate on a four-point Likert scale if they agreed that chlamydia was mostly asymptomatic. Participants were presented with eight clinical scenarios (for example, an 18-year-old woman with low abdominal pain) and indicated on a four-point Likert scale if testing should be offered. Participants were asked if and when a follow-up test should be performed in patients who tested positive and negative. Using five-point Likert scales, the survey also captured PNs' attitudes towards increasing involvement in and possible barriers to testing.

Data analysis

Using χ^2 tests, we compared the characteristics of PNs who received the education program and those who did not. Knowledge and attitude responses were analysed as continuous variables (mean scores). Paired-sample *t*-tests were used to measure differences in mean scores between Survey 1 and Survey 2 for each group (education and non-education) separately, and two-sample *t*-tests to assess whether the change in mean scores between survey rounds was greater in one group versus the other.

For knowledge questions using Likert scale responses, a score of ≥3 indicated a correct response: correctly identifying that most chlamydia infections are asymptomatic (1 = strongly disagree, 2 = disagree, 3 = agree and 4 = strongly agree) and correctly identifying whether a chlamydia test should be offered (1 = definitely not offer a test, 2 = probably not offer a test, 3 = probably offer a test and 4 = definitely offer a test) for all listed scenarios except that of a 33-year-old woman, (where the score allocation was: 4 = definitely not offer a test, 3 = probably not offer a test, 2 = probably offer a test and 1 = definitely offer a test). Questions relating to age groups at risk of chlamydia and retesting practices were coded into 3 part responses with a score of ≥2 considered correct: correctly identifying one or both age groups at risk of chlamydia (1, = none correct, 2 = one group correct and 3 = both groups correct) and correctly identifying that a repeat chlamydia test is recommended following negative or positive results and the timeframe for testing (1 = neither part correct, 2 = one part correct and 3 = both parts correct).

For the attitudes statements, a score of ≥4 indicated agreement, <3 disagreement and ≥3 to <4 neutrality (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). Previous analysis of baseline data revealed high knowledge scores for individual questions; therefore, combined scores for knowledge questions and combined attitudes scores were calculated to detect changes between Survey 1 and Survey 2. We calculated 95% confidence intervals for mean scores; *P*-values of ≤ 0.05 were considered statistically significant. Analyses were carried out using Stata ver. 12.0 (College Station, TX, USA).

Results

Participant characteristics

Of a total of 188 PNs enrolled in ACCEPt (i.e. had signed a consent form) and given a survey, 137 (73%) completed Survey 1. Thirty-seven of these PNs subsequently left their practices, leaving 100 eligible PNs, 72% of whom completed Survey 2. There was a missing response rate of 0–5% for each question. Of PNs who responded to both surveys, 58% had participated in the education program (the 'education group') and 41% had not (the 'non-education group'). These two groups form the basis of this analysis (Table 1). In the education group, all PNs were in practices involved in the ACCEPt intervention, compared with 43% of the non-education group (see Fig. 1).

Table 1. Participant characteristics at repeat survey

ACCEPt, Australian Chlamydia Control Effectiveness Pilot; STI, sexually transmissible infection; *$P \leq 0.05$

Variable	Category	Overall $N = 72$ *n* (%)	Education $N = 42$ *n* (%)	Non-education $N = 30$ *n* (%)	χ^2 *P*-value
ACCEPt randomisation	Control	17 (23.6)	–	17 (56.7)	<0.01*
	Intervention	55 (76.4)	42 (100)	13 (43.3)	
Age (years)	<30	4 (5.5)	2 (4.8)	2 (6.7)	0.38
	30–44	22 (30.6)	13 (30.9)	9 (30.0)	
	45–59	35 (48.6)	23 (54.8)	12 (40.0)	
	60+	11 (15.3)	4 (9.5)	7 (23.3)	
Sex	Male	1 (1.4)	0	1 (3.3)	0.42
	Female	71 (98.6)	42 (100)	29 (96.7)	
Clinic location (state)	Queensland	11 (15.2)	4 (10.3)	5 (19.2)	0.07
	South Australia	1 (1.5)	0	1 (3.9)	
	New South Wales	24 (33.3)	10 (25.6)	11 (42.3)	
	Victoria	36 (50)	25 (64.1)	9 (34.6)	
Country of qualification	Overseas	6 (8.3)	4 (9.5)	2 (6.7)	1.00
	Australia	66 (91.7)	38 (90.5)	28 (93.3)	
Years qualified	<5	1 (1.4)	0	1 (3.3)	0.26
	5–10	10 (13.9)	5 (11.9)	5 (16.7)	
	10–20	16 (22.2)	12 (28.6)	4 (13.3)	
	>20	45 (62.5)	25 (59.5)	20 (66.7)	
Years in general practice	<5	23 (32.9)	15 (37.5)	8 (26.7)	0.53
	5–10	28 (40.0)	13 (32.5)	15 (50.0)	
	11–20	14 (20.0)	9 (22.5)	5 (16.7)	
	>20	5 (7.1)	3 (7.5	2 (6.7)	
Hours worked per week	<20	19 (26.8)	11 (26.2)	8 (27.6)	0.82
	20–30	22 (31.0)	12 (28.6)	10 (34.5)	
	30–40	26 (36.6)	17 (40.5)	9 (31.0)	
	>40	4 (5.6)	2 (4.8)	2 (6.9)	
Pap test provider	No	36 (50)	23 (54.8)	13 (43.3)	0.34
	Yes	36 (50)	19 (45.4)	17 (56.7)	
Interest in sexual health	No	33 (45.8)	20 (47.6)	13 (43.3)	0.72
	Yes	39 (54.2)	22 (52.4)	17 (56.7)	
Formal STI training or education	No	43 (59.7)	24 (57.1)	19 (63.3)	0.60
	Yes	29 (40.3)	18 (42.9)	11 (36.7)	

Knowledge

Chlamydia epidemiology

Knowledge of chlamydia epidemiology increased significantly between Survey 1 and Survey 2 in the education group (mean score: 10.1 vs 11.3, $P < 0.01$) with increases in knowledge about the age groups at highest risk for chlamydia in males (mean score: 2.0 vs 2.3, $P = 0.03$) and knowledge about the asymptomatic nature of chlamydia in females (mean score: 3.1 vs 3.5, $P < 0.01$). There was no change in overall knowledge for the

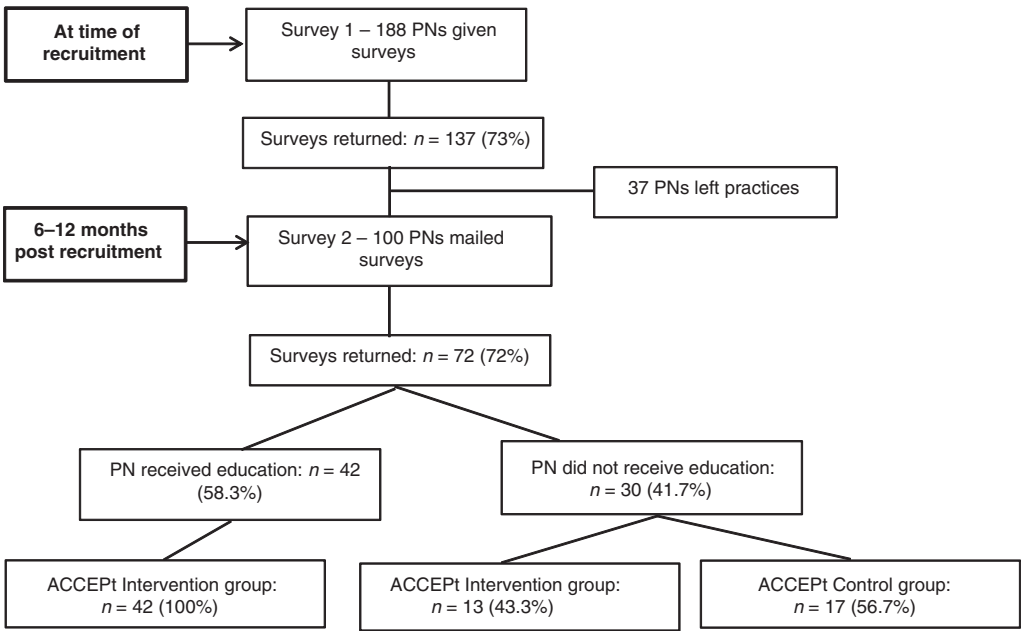

Fig. 1. Flow chart of survey sampling process. PN, practice nurses; ACCEPt, Australian Chlamydia Control Effectiveness Pilot.

Table 2. Knowledge of chlamydia epidemiology
CI, confidence interval; $*P \leq 0.05$

Questions and answers	Education group				Noneducation group				Change in mean score[B]
	Survey 1 (95% CI)	Survey 2 (95% CI)	Difference	*P*-value[A]	Survey 1 (95% CI)	Survey 2 (95% CI)	Difference	*P*-value[A]	*P*-value
'Which two age groups have the highest infection rates?'									
Women[C]	2.2 (2.0–2.4)	2.3 (2.1–2.5)	+0.1	0.35	2.2 (2.1–2.4)	2.3 (2.1–2.5)	+0.1	0.33	0.96
Men [D]	2.0 (1.8–2.2)	2.3 (2.1–2.5)	+0.3	0.03*	2.1 (1.9–2.1)	2.1 (1.9–2.4)	0	0.77	0.17
'To what extent do you agree or disagree with the following statements?'									
Most chlamydia infections are asymptomatic in women[E]	3.1 (2.8–3.4)	3.5 (3.3–3.7)	+0.4	<0.01*	3.2 (2.9–3.6)	3.1 (2.9–3.5)	–0.1	0.75	0.06
Most chlamydia infections are asymptomatic in men[E]	3.0 (2.7–3.3)	3.2 (2.9–3.4)	+0.2	0.24	3.2 (3.0–3.5)	2.8 (2.5–3.1)	–0.4	0.01*	0.01*
Combined chlamydia epidemiology knowledge score[F]	10.1 (9.4–10.8)	11.3 (10.7–11.8)	+1.2	<0.01*	10.8 (10.1–11.6)	10.5 (9.9–11.0)	–0.3	0.36	<0.01*

[A]Change in mean score from Survey 1 to Survey 2 within each group.
[B]Change in mean score from Survey 1 to Survey 2 between groups.
[C]Age group categories for this question were 15–19 years, 20–24 years, 25–29 years and 30–34 years. The correct age groups were 15–19 years and 20–24 years, scored as 1 = none correct, 2 = one group correct or 3 = both correct.
[D]Age group categories for this question were 15–19 years, 20–24 years, 25–29 years and 30–34 years. The correct age groups were 20–24 years and 25–29 years, scored as 1 = none correct, 2 = one group correct or 3 = both correct.
[E]Scored from 1 = strongly disagree to 4 = strongly agree.
[F]Maximum score = 14.

non-education group and a significant decrease in knowledge about the asymptomatic nature of chlamydia in males. Change in overall knowledge was significantly greater in the education group compared with the non-education group (mean change in score: +1.2 vs –0.3, $P < 0.01$; Table 2).

Chlamydia testing practices

Knowledge of scenarios where chlamydia testing is recommended increased significantly overall in the education group (mean score: 27.4 vs 28.7, $P = 0.01$), with increases in both groups for identifying that a chlamydia test should be offered to a 26-year-old male requesting a truck licence medical (mean score: 3.1 vs 3.5, $P = 0.04$) and a 22-year-old Aboriginal male presenting with a sore throat (mean score: 3.2 vs 3.6, $P = 0.01$). Knowledge relating to recommended retesting following a positive chlamydia result also increased significantly in the education group (mean score: 2.4 vs 2.8, $P < 0.01$). Change in mean score between Surveys 1 and 2 was higher for the education group vs the non-education group when identifying that a chlamydia test is recommended for a 23-year-old married female presenting for a Pap test (difference of +0.2 vs –0.3, $P = 0.04$). (Table 3).

Attitudes to chlamydia testing

Overall, attitudes to chlamydia testing improved over time in the education group (mean score: 24.2 vs 25.3, $P = 0.03$) but not in the non-education group. PNs in the education group were more likely to want to become more involved with chlamydia testing over time (mean score: 3.9 vs 4.4, $P < 0.01$). No significant change was observed for most statements in the non-education group. Change in positive attitudes towards testing between surveys was higher in the education group vs the non-education group overall (difference: +1.1 vs –0.6, $P = 0.05$), with increases in wanting to be more involved in testing (difference: +0.5 vs –0.1, $P = 0.04$) and managing recall or reminder systems (difference: +0.1 vs –0.3, $P = 0.05$; Table 4).

Reported barriers to chlamydia testing increased significantly overall in the education group (mean score: 16.6 vs 18.2, $P = 0.03$), with increases in time or workload constraints (mean score: 2.4 vs 3.0, $P = 0.01$), and difficulty offering or discussing testing in a non-sexual health consultation (mean score: 2.5 vs 3.0, $P = 0.03$). The change in overall barriers was significantly greater in the education compared with the non-education group (difference: +1.6 vs –1.1, $P = 0.03$), specifically

Table 3. Knowledge of recommended testing and retesting practices
CI, confidence interval; OCP, oral contraceptive pill; $*P \leq 0.05$

Questions and answers	Education group				Non-education group				Change in mean score[B]
	Survey 1 (95% CI)	Survey 2 (95% CI)	Difference	*P*-value[A]	Survey 1 (95% CI)	Survey 2 (95% CI)	Difference	*P*-value[A]	*P*-value
				‘Should a chlamydia test be offered to the following patients?’					
23-year-old married female, Pap test[C]	3.3 (3.1–3.6)	3.5 (3.3–3.8)	+0.2	0.12	3.4 (3.2–3.7)	3.2 (2.8–3.5)	–0.2	0.21	0.04*
18-year-old female, abdominal pain[C]	3.9 (3.7–3.9)	4.0 (3.8–4.0)	+0.1	0.26	3.9 (3.7–3.9)	3.9 (3.8–4.0)	0	0.71	0.74
26-year-old male, truck licence medical[C]	3.1 (2.9–3.4)	3.4 (3.2–3.7)	+0.3	0.04*	2.7 (2.3–3.2)	3.0 (2.7–3.4)	+0.3	0.03*	0.99
24-year-old female, pregnant[C]	3.4 (3.1–3.7)	3.5 (3.2–3.8)	+0.1	0.32	3 (2.6–3.4)	3.3 (2.9–3.7)	+0.3	0.28	0.51
22-year-old Aboriginal male, sore throat[C]	3.2 (2.9–3.5)	3.6 (3.4–3.8)	+0.4	0.01*	3.1 (2.7–3.4)	3.4 (3.1–3.7)	+0.3	0.05*	0.79
33-year-old female, OCP script[D]	2.5 (2.3–2.7)	2.6 (2.3–2.8)	+0.1	0.83	2.7 (2.4–2.9)	2.4 (2.0–2.7)	–0.3	0.12	0.12
17-year-old male, genital warts[C]	3.9 (3.9–4.0)	4.0 (4.0–4.0)	+0.1	0.16	3.8 (3.6–4.1)	3.9 (3.8–4.0)	+0.1	0.18	0.45
34-year-old male, requesting HIV test[C]	3.9 (3.9–4.0)	3.9 (3.9–4.0)	0	0.32	4.0 (3.9–4.0)	4.0 (3.89–4.03)	0	1.00	0.64
Combined testing score[E]	27.4 (26.5–28.3)	28.7 (27.9–29.4)	+1.2	0.01*	26.8 (25.9–27.8)	27.4 (26.43–28.32)	+0.6	0.20	0.16
				‘Should a follow-up test be performed or when should test be performed?’					
After a negative test[E]	2.1 (1.8–2.4)	2.3 (2.0–2.6)	+0.2	0.30	1.9 (1.7–2.2)	2.1 (1.8–2.4)	+0.2	0.46	0.80
After a positive test[F]	2.4 (2.3–2.6)	2.8 (2.7–2.9)	+0.4	<0.01*	2.2 (2.0–2.4)	2.2 (2.0–2.5)	0	0.63	0.1

[A]Change in mean score from Survey 1 to Survey 2 within each group.
[B]Change in mean score from Survey 1 to Survey 2 between groups.
[C]Scored from 1 = definitely not offer a test to 4 = definitely offe ra test.
[D]Scored from 1 = definitely offer a test to 4 = definitely not offer a test.
[E]Maximum possible score = 32.
[F]Two-part question and response: (a) retest recommended; (b)12 months after a negative test. Scored as 1 = neither part correct, 2 = one part correct or 3 = both parts correct.
[G]Two-part question and response: (a) retest recommended; (b)3 months after a positive test. Scored as 1 = neither part correct, 2 = one part correct or 3 = both parts correct.

Table 4. Attitudes towards involvement in chlamydia testing
CI, confidence interval; PN, practice nurse; *$P \leq 0.05$

Attitude statements	Education group				Non-education group				Change in mean score[B]
	Survey 1 (95% CI)	Survey 2 (95% CI)	Difference	*P*-value[A]	Survey 1 (95% CI)	Survey 2 (95% CI)	Difference	*P*-value[A]	*P*-value
PNs can conduct chlamydia testing[C]	4.4 (4.2–4.6)	4.4 (4.2–4.6)	0	1.0	4.3 (4.0–4.6)	4.0 (3.7–4.4)	–0.3	0.24	0.29
PN should have a greater role in testing[C]	4.2 (4.0–4.4)	4.3 (4.1–4.5)	+0.1	0.57	3.7 (3.4–4.0)	3.7 (3.4–3.9)	0	0.71	0.51
PNs require additional training or skills to manage testing[C]	4.0 (3.8–4.2)	4.2 (3.9–4.5)	+0.2	0.17	4.0 (3.8–4.3)	4.1 (3.9–4.4)	+0.1	0.50	0.67
I would like to be more involved in testing[C]	3.9 (3.7–4.2)	4.4 (4.2–4.6)	+0.5	<0.01*	4.0 (3.7–4.4)	3.9 (3.6–4.3)	–0.1	0.75	0.04*
I would like to be more involved in managing a recall or reminder system[C]	3.9 (3.6–4.2)	4.0 (3.7–4.3)	+0.1	0.36	4.0 (3.7–4.4)	3.7 (3.4–3.9)	–0.3	0.12	0.05*
I would like to be more involved in discussing partner notification with patients[C]	3.6 (3.3–3.9)	3.9 (3.6–4.3)	+0.3	0.07	3.8 (3.4–4.1)	3.7 (3.3–3.9)	–0.1	0.54	0.09
Combined attitudes score[D]	24.2 (23.1–25.3)	25.3 (24.5–26.2)	+1.1	0.03*	23.9 (22.6–25.2)	23.3 (22.1–24.4)	–0.6	0.43	0.05*

[A]Change in mean score from Survey 1 to Survey 2 within each group.
[B]Change in mean score from Survey 1 to Survey 2 between groups.
[C]Scored from 1 = strongly disagree to 5 = strongly agree.
[D]Maximum score = 30.

for time or workload constraints (difference: +0.6 vs –0.6, $P < 0.01$; Table 5).

Discussion

Our chlamydia education program led to increased knowledge and improved attitudes to chlamydia testing among PNs in general practice. PNs who received education had greater knowledge overall about chlamydia epidemiology and significantly more positive attitudes to chlamydia testing compared with those who did not receive education. PNs also demonstrated improved knowledge levels around chlamydia testing and retesting following the education program.

To our knowledge, this is the first survey to examine changes in PNs' knowledge and attitudes following participation in a chlamydia education program. Response rates were considerably higher than for other chlamydia knowledge and attitude surveys conducted in Australia among general practitioners.[14–16] Despite these strengths, our study was limited by the sample size, which was restricted to PNs participating in ACCEPt, and may have affected the ability to detect significant differences in responses between survey rounds and between groups. Additionally, the presence of PNs in the non-education group who were located at ACCEPt intervention clinics may have affected results. Data were not collected from these PNs as to why they did not attend the education session, but a possible reason may be that they had already undergone chlamydia or sexual health education or training. Finally, those PNs participating in ACCEPt who completed both surveys may be more interested in sexual health. This may account for the good overall levels of knowledge at baseline, as reported previously.[17]

Barriers to chlamydia testing in general practice include a lack of chlamydia knowledge (including of risk and epidemiology), limited awareness of chlamydia testing and lack of training.[10] Although no studies have examined the impact of education on knowledge and attitudes to chlamydia testing in general practice, limited research has examined the effect of educational interventions on testing rates. The provision of chlamydia education, training and support for both GPs and PNs has been associated with increased testing rates in the UK and USA, with PNs taking part in promoting and conducting testing within clinics.[7,19–23] Recent research has found an association between higher levels of knowledge of chlamydia testing guidelines and increased testing rates in Australian GPs.[24] Our study did not aim to determine the impact of providing chlamydia education to PNs on clinics' chlamydia testing rates, but did measure the change in knowledge of testing and retesting. This knowledge improved significantly between surveys for PNs who had received education, but there was no significant difference between the education and non-education groups for change in testing and retesting knowledge. In addition, significant improvements in knowledge between surveys occurred in both groups (education and non-education) for specific testing scenarios involving males with non-sexual health presentations. A possible reason for these results is that PNs in both groups (education and non-education) may have been exposed to components of the ACCEPt testing intervention, such as educational materials, regular clinic communications and quarterly testing feedback meetings provided to the GPs. Throughout the ACCEPt intervention, the importance of offering opportunistic chlamydia testing to males (as well as females) was emphasised because males had lower testing rates

Table 5. Barriers to increasing chlamydia testing
CI, confidence interval; PN, practice nurse; $*P \leq 0.05$

Barriers to increasing chlamydia testing in general practice	Education group				Noneducation group				Change in mean score[B]
	Survey 1 (95% CI)	Survey 2 (95% CI)	Difference	*P*-value[A]	Survey 1 (95% CI)	Survey 2 (95% CI)	Difference	*P*-value[A]	*P*-value
Time or workload constraints[C]	2.4 (2.1–2.7)	3.0 (2.7–3.3)	+0.6	0.01*	3.2 (2.8–3.6)	2.6 (2.1–3.1)	–0.6	0.07	<0.01*
Difficulty offering or discussing test in nonsexual health consultation[C]	2.5 (2.1–2.9)	3.0 (2.7–3.4)	+0.5	0.03*	2.4 (1.9–2.9)	2.6 (2.1–3.2)	+0.2	0.49	0.40
Lack of support for PNs[C]	2.7 (2.2–3.2)	2.8 (2.3–3.3)	+0.1	0.65	2.2 (1.7–2.6)	2.3 (1.7–2.8)	+0.1	0.72	0.98
Patients lack of knowledge about chlamydia[C]	2.8 (2.5–3.1)	3.1 (2.8–3.4)	+0.3	0.19	3.3 (2.8–3.7)	3.1 (2.7–3.4)	–0.2	0.54	0.19
Lack of a recall or reminder system for chlamydia[C]	3.0 (2.6–3.4)	2.9 (2.4–3.4)	–0.1	0.71	3.2 (2.7–3.7)	2.9 (2.4–3.5)	–0.3	0.45	0.71
Lack of support for contact tracing or following up partners of positive cases[C]	3.2 (2.7–3.6)	3.3 (2.8–3.7)	+0.1	0.71	3.7 (3.3–4.2)	3.4 (2.8–3.9)	–0.3	0.30	0.28
Combined barriers score[C,D]	16.6 (14.9–18.2)	18.2 (16.8–19.6)	+1.6	0.03*	17.9 (16.3–19.5)	16.8 (14.6–19.0)	–1.1	0.34	0.03*

[A]Change in mean score from Survey 1 to Survey 2 within each group.
[B]Change in mean score from Survey 1 to Survey 2 between groups.
[C]Scored from 1 = definitely not to 5 = definitely.
[D]Maximum score = 30.

than females but almost equal chlamydia prevalence.[4,8] Additionally, RACGP guidelines for testing changed between the two surveys to include sexually active males up to the age of 29 years, with this change promoted during the ACCEPt intervention components detailed above.

Our study also examined PN attitudes to chlamydia testing. The results suggest that those who participated in education increased their support for and willingness to be involved in testing. Interestingly, following participation in education, compared with the non-education group, there was an increase in perceived barriers to increasing testing, specifically for time or workload constraints. A possible explanation is that the question may have been interpreted as referring to barriers to testing for the practice as a whole, rather than for the individual PN. Increased testing rates at intervention practices may have led to the perception that the practice's overall workload had increased, as well as that of PNs involved in testing. Time and workload pressures have been commonly raised as barriers to chlamydia testing, at both the individual GP level and at practice level in Australia and the UK.[10]

Overall, PN participants agreed that additional education was required to manage chlamydia testing. Access to quality accredited education is essential if PNs are to increase their involvement in chlamydia testing. It is possible that an educational program such as that delivered within ACCEPt could be implemented across primary care, complementing the growing options for PN education in Australia. Historically, post-registration education for PNs in Australia has been informal, largely unaccredited and not linked to any professional competencies.[25] However, the role of education for PNs as a means to achieve career progression by building skills and knowledge to increase their scope of practice has been recognised. The provision of accredited sexual health education, alongside the creation of sexual health competency standards for PNs are important steps in the expansion of the PN role, and will contribute to the establishment of an education and career framework for nurses in Australian general practice.[26,27]

In conclusion, we evaluated the impact of a chlamydia education program for PNs, delivered as part of a multifaceted package aimed at increasing testing rates. We found improvements in knowledge of chlamydia epidemiology, knowledge about testing practices and in PNs' support for, and willingness to be involved in chlamydia testing. PNs have the potential to make an important contribution to increasing chlamydia testing rates in Australian general practice, but have expressed the need for further education. Chlamydia educational programs should be made available to PNs working in general practice. Further evaluation of clinic data from ACCEPt is planned to determine whether this education intervention leads to increased chlamydia testing.

Conflicts of interests

None declared.

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References

1 Public Health England (PHE). Selected STI diagnoses & rates in the UK by gender & age group, 2009–2013. London: PHE; 2014. Available online at: https://www.gov.uk/government/statistics/sexually-transmitted-infections-stis-annual-data-tables [verified May 2015].

2 The Kirby Institute. HIV, viral hepatitis and sexually transmissible infections in Australia annual surveillance report. Sydney: UNSW Australia; 2014.

3 Adams EJ, Charlett A, Edmunds WJ, Hughes G. *Chlamydia trachomatis* in the United Kingdom: a systematic review and analysis of prevalence studies. *Sex Transm Infect* 2004; 80: 354–62. doi:10.1136/sti.2003.005454

4 Yeung AH, Temple-Smith M, Fairley CK, Vaisey AM, Guy R, Law MG, Low N, Bingham AL, Gunn J, Kaldor J, Donovan B, Hocking JS. Chlamydia prevalence in young attenders of rural and regional primary care services in Australia: a cross-sectional survey. *Med J Aust* 2014; 200: 170–5. doi:10.5694/mja13.10729

5 Peipert J. Genital chlamydial infections. *N Engl J Med* 2003; 349: 2424–30. doi:10.1056/NEJMcp030542

6 Grulich AE, de Visser RO, Smith AM, Rissel CE, Richters J. Sex in Australia: sexually transmissible infection and blood-borne virus history in a representative sample of adults. *Aust N Z J Public Health* 2003; 27: 234–41. doi:10.1111/j.1467-842X.2003.tb00814.x

7 McNulty CA, Hogan AH, Ricketts EJ, Wallace L, Oliver I, Campbell R, Kalwij S, O'Connell E, Charlett A. Increasing chlamydia screening tests in general practice: a modified Zelen prospective cluster randomised controlled trial evaluating a complex intervention based on the theory of planned behaviour. *Sex Transm Infect* 2013; 90: 188–94. doi:10.1136/sextrans-2013-051029

8 Kong F, Hocking J, Merritt T, Pirotta M, Heal C, Bergeri I, Donovan B, Hellard ME. Australian general practitioner chlamydia testing rates among young people. *Med J Aust* 2011; 194: 249–52.

9 Royal Australian College of General Practitioners (RACGP). Guidelines for preventive activities in general practice, 8th edn. Melbourne: RACGP; 2012.

10 Yeung A, Temple-Smith M, Fairley C, Hocking J. Narrative review of the barriers and facilitators to chlamydia testing in general practice. *Aust J Primary Health* 2015; 21: 139–47. doi:10.1071/PY13158

11 Parker R, Walker L, Hegarty K. Primary care nursing workforce in Australia: a vision for the future. *Aust Fam Physician* 2010; 39: 159–60.

12 Abbott P, Dadich A, Hosseinzadeh H, Kang M, Hu W, Bourne C, Murray C, Reath J. Practice nurses and sexual health care: enhancing team care within general practice. *Aust Fam Physician* 2013; 42: 729–33.

13 Lorch R, Hocking J, Guy R, Vaisey A, Wood A, Lewis D, Temple-Smith M. on behalf of the ACCEPt consortium. Practice nurse chlamydia testing in Australian general practice: a qualitative study of benefits, barriers and facilitators. *BMC Fam Pract* 2015; 16: 36. doi:10.1186/s12875-015-0251-8

14 Hocking J, Lim M, Vidanapathirana J, Read T, Hellard M. Chlamydia testing in general practice – a survey of Victorian general practitioners. *Sex Health* 2006; 3: 241–4. doi:10.1111/j.1467-842X.2006.tb00862.x

15 Khan A, Hussain R, Plummer D, Minichiello V. Willingness to offer chlamydia testing in general practice in New South Wales. *Aust N Z J Public Health* 2006; 30: 226–30. doi:10.1111/j.1467-842X.2006.tb00862.x

16 Temple-Smith M, Mak D, Watson J, Bastian L, Smith A, Pitts M. Conversant or clueless? Chlamydia-related knowledge and practice of general practitioners in Western Australia. *BMC Fam Pract* 2008; 9: 17. doi:10.1186/1471-2296-9-17

17 Lorch R, Hocking J, Temple-Smith M, Law M, Yeung A, Wood A, Vaisey A, Donovan B, Fairley CK, Kaldor J, Guy R. The chlamydia knowledge, awareness and testing practices of Australian general practitioners and practice nurses: survey findings from the Australian Chlamydia Control Effectiveness Pilot (ACCEPt). *BMC Fam Pract* 2013; 14: 169. doi:10.1186/1471-2296-14-169

18 Forsetlund L, Bjorndal A, Rashidian A, Jamtvedt G, O'Brien MA, Wolf F, Davis D, Odgaard-Jensen J, Oxman AD. Continuing education meetings and workshops: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev* 2009; (2): CD003030. doi:10.1002/14651858.CD003030.pub2

19 Armstrong B, Kinn S, Scoular A, Wilson P. Shared care in the management of genital *Chlamydia trachomatis* infection in primary care. *Sex Transm Infect* 2003; 79: 369–70. doi:10.1136/sti.79.5.369

20 Kalwij S, Macintosh M, Baraitser P. Screening and treatment of *Chlamydia trachomatis* infections. *BMJ* 2010; 340: c1915. doi:10.1136/bmj.c1915

21 Kettinger LD. A practice improvement intervention increases chlamydia screening among young women at a women's health practice. *J Obstet Gynecol Neonatal Nurs* 2013; 42: 81–90. doi:10.1111/j.1552-6909.2012.01427.x

22 McNulty CA, Thomas M, Bowen J, Buckley C, Charlett A, Gelb D, Foy C, Sloss J, Smellie S. Interactive workshops increase chlamydia testing in primary care – a controlled study. *Fam Pract* 2008; 25: 279–86. doi:10.1093/fampra/cmn032

23 Shafer MA, Tebb KP, Pantell RH, Wibbelsman CJ, Neuhaus JM, Tipton AC, Brown Kunin S, Ko TH, Schweppe DM, Bergman DA. Effect of a clinical practice improvement intervention on chlamydial screening among adolescent girls. *JAMA* 2002; 288: 2846–52. doi:10.1001/jama.288.22.2846

24 Yeung A, Temple-Smith M, Spark S, Guy R, Fairley CK, Law M, Wood A, Smith K, Donovan B, Kaldor J, Gunn J, Pirotta M, Carter R, Hocking J. on behalf of the ACCEPt consortium. Improving chlamydia knowledge should lead to increased chlamydia testing among Australian general practitioners: a cross-sectional study of chlamydia testing uptake in general practice. *BMC Infect Dis* 2014; 14: 584. doi:10.1186/s12879-014-0584-2

25 Parker R, Keleher H, Forrest L. The work, education and career pathways of nurses in Australian general practice. *Aust J Primary Health* 2011; 17: 227–32. doi:10.1071/PY10074

26 Australian Primary Healthcare Nurses' Association (APHCNA). An education and career framework for nurses in general practice: consultation paper 2 – a proposed model. Melbourne: APHNA: 2015. Available online at: http://www.apna.asn.au/lib/pdf/consultationpaper2_aproposedmodel_FINAL.pdf [verified October 2015].

27 NSW Sexually Transmissible Infections Programs Unit (NSWSTIPU). Sexual health competency standards for primary health care nurses. Sydney: NSWSTIPU; 2015. Available online at: http://stipu.nsw.gov.au/general-practice-resources/primary-health-care-nurses/ [verified]