

Text message reminders do not improve hepatitis B vaccination rates in an Australian sexual health setting

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ABSTRACT

Objective To evaluate the impact of text message reminders (short messaging service (SMS)) on hepatitis B virus (HBV) vaccination completion among high risk sexual health center attendees.

Materials and Methods In September 2008, Sydney Sexual Health Centre implemented an SMS reminder system. The authors assessed the impact of the reminder system on HBV vaccination rates among patients who initiated a course. The authors used a chi-square test and multivariate logistic regression to determine if SMS reminders were associated with second and third dose vaccine completion, compared with patients prior to the intervention.

Results Of patients sent SMS reminders in 2009 (SMS group), 54% (130/241) received 2 doses and 24% (58/241) received 3 doses, compared to 56% (258/463) ($P=0.65$) and 30% (141/463) ($P=0.07$) in the pre-SMS group (2007), respectively. Findings did not change after adjusting for baseline characteristics significantly different between study groups. There were no significant differences in completion rates among people who injected drugs, HIV-negative gay and bisexual men (GBM), and HIV-positive GBM. Among sex workers, travelers, and people who reported sex overseas, second and third dose completion rates were significantly lower in the SMS group compared to the pre-SMS group. In the SMS group, 18% of those who only had one dose attended the clinic within 1–18 months and 30% of those who had 2 doses attended in 6–18 months, but vaccination was missed.

Discussion SMS reminders did not increase second or third vaccine dose completion in this population.

Conclusion Clinician prompts to reduce missed opportunities and multiple recall interventions may be needed to increase HBV vaccination completion in this high risk population.

Keywords: short messaging service (SMS), text messaging, vaccination reminders, Hepatitis B vaccination, sexual health

INTRODUCTION

Background and significance

The majority of mobile phone owners use short messaging service (SMS), or “text messaging,” on a regular basis.¹ Many health care providers are adopting SMS as a strategy to streamline patient-provider communication and improve patient outcomes because it is an instantaneous, cost-effective, and increasingly ubiquitous mode of communication.² One potential health application of SMS is as a reminder tool for vaccinations that require multiple clinic visits at scheduled intervals, particularly in populations where vaccination completion rates are low.

Hepatitis B virus (HBV) is common, serious, and vaccine-preventable.³ Vaccination at 0, 1, and 6 months provides life-long immunity in over 90% of adults.³ The second dose is required to boost immunity. The third dose is important to provide long-term protection and a complete 3-dose series induces protective levels of neutralizing antibody against HBV in >90% of adults. The frequency of seroconversion increases from ~35% after the first injection to over 90% after the third injection, yet few adults at high risk for HBV infection complete the 3-dose series.^{3–5}

In Australia, priority populations for HBV prevention are those considered to have a higher exposure risk. This includes people who inject drugs, gay and bisexual men (GBM), people living with HIV, sex workers, and Aboriginal people.⁶ In a large cohort of Australian gay men, only 53% of HIV negative and 24% of HIV positive men had serological evidence of

HBV vaccination.⁷ HBV vaccine series completion rates among GBM attending sexual health clinics in a number of countries have been reported to range between 26% and 73%.^{8–12} At an Australian primary care center, only 21% of patients (predominantly people who inject drugs, sex workers, and Aboriginal people) who commenced a course of HBV vaccinations completed the recommended 3-dose series.⁵

There are limited data on the effectiveness of various strategies to improve vaccination completion rates in high-risk adult populations.¹² Strategies that have been implemented by sexual health services to increase HBV vaccine uptake and completion include letters, telephone calls, specialized vaccination clinics, case management programs, and accelerated schedules.^{5,13–15} Sansom et al. found that telephone recall and reminders were more effective than standard follow up for completion of the second HBV dose but not the third, and a combination of SMS reminders, referrals, and a specialized vaccine clinic service resulted in high uptake and completion rates in a HIV-positive cohort in the United States.^{14,16} SMS reminders have been associated with improved HBV vaccination rates in travelers¹⁷ but, to our knowledge, have not previously been evaluated as a strategy to increase HBV vaccination completion rates in people who inject drugs, HIV-negative GBM, or sex workers attending sexual health clinics.

OBJECTIVE

The aim of this study was to evaluate the impact of a SMS reminder system on second and third HBV vaccine dose completion rates

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among high risk, HBV-susceptible patients attending a sexual health center in Sydney, Australia.

MATERIALS AND METHODS

Setting

Sydney Sexual Health Centre (SSHC) is a large, publically funded sexual health clinic in metropolitan Sydney, New South Wales, Australia, with a high caseload of people living with HIV, GBM, and sex workers. Sydney is the largest city in Australia with a population of 7,544,500.¹⁸

All patients are asked about past HBV vaccination on their first visit to SSHC. If no prior vaccination is reported or the patient's vaccination status is uncertain, SSHC policy is to screen high risk patients for past infection by core antibodies. Free HBV vaccinations are offered to HBV-susceptible people living with HIV, GBM, Aboriginal people, people who inject drugs, and sex workers (hereafter referred to as eligible patients) at 0, 1, and 6 months.

Since September 2008, SMS reminders for HBV vaccinations have been offered to patients who have provided a mobile phone number and have commenced a course of vaccination. If the patient consents, the clinician is prompted to set the date(s) future vaccine doses are due from a calendar in the electronic medical record. (If the second dose is delayed, the vaccinator providing the second dose will revise the third dose reminder date). Reminders are relayed one business day prior to the agreed upon date: "You are due for a vaccination. Please call 02 9382 7440 to book an appointment." Messages appear on the patient's mobile phone from "SSHC" and are billed to SSHC at a charge of \$0.10 AUS per message. SSHC has never employed any other form of vaccination recall (e.g., telephone, letter, email) although clinicians are encouraged to assess vaccine status at every consultation to identify patients who are eligible or overdue. The SMS program was unable to monitor if the text message was successfully received or not.

Study design

Using a before and after design, we assessed the proportion of eligible patients who received 2 doses and 3 doses of HBV vaccine in 2009 (after the reminder system was implemented—SMS group) and in 2007 (before the reminder system was implemented—pre-SMS group). The year 2009 was chosen as it was the year when the SMS program was first introduced and 2007 was selected as a comparator year as it was the closest time period to the intervention that would allow a 12-month follow-up period.

Data extraction

The following variables, extracted from the in-house electronic database, were utilized in the analysis: unique identifier, demographics (age, sex, postcode, country of birth, and Aboriginal status), HIV status, patient's self-reported risk information (gender of sexual partners, current and past injecting drug use, current and past commercial sex work, sex overseas in the past 12 months), self-reported natural or acquired HBV immunity, current HBV serology results including type of test and the date ordered, HBV vaccinations provided at SSHC, and date vaccination reminders were sent.

Study groups

The pre-SMS group included all eligible, HBV-susceptible patients who attended SSHC for the first time in 2007 and commenced HBV vaccination in 2007 (before the reminder system was implemented). The SMS group included all HBV-susceptible, eligible patients who attended SSHC for the first time in 2009, commenced HBV vaccination in 2009 and were sent vaccination reminders for subsequent doses. We assessed only new patients because detailed HBV data are documented at the patient's first visit. HBV-susceptible was defined as

having no recollection of past HBV vaccination or infection and a negative HBV core antibody result.

Statistical analysis

We conducted a post hoc sample size estimation using Pearson's chi-squared test. We estimated that a minimum of 326 participants (163 in each group) would be required to detect a 15% difference with a 95% confidence interval and a power of 80%.

The primary outcome was completion of second dose and third dose HBV vaccinations within 12 months of commencing a course. We utilized a 12-month follow-up period to allow individuals a few months after each reminder to return for the vaccine with the third dose due 5 months after the second. According to the Australian Immunisation Handbook, there is some flexibility regarding the intervals between the vaccine doses in the three-dose schedule which may be required to maximize compliance in high-risk but hard-to-reach populations.³

We used a chi-square test to determine if the proportion of patients who received a second dose and third dose was significantly different between the SMS and pre-SMS groups overall and by risk group (i.e., HIV negative and positive GBM, sex workers, travelers, and people who reported sex overseas in the last 12 months). These risk groups were defined using self-reported risk information from the patient's medical record.

Baseline characteristics of patients receiving their first vaccine among both groups were compared using a chi-square test. Characteristics found to be statistically different between the groups were included in a multivariate logistic regression. Factors with a statistical difference of <0.05 were considered to be significant and included in a backward stepwise multivariate model.

We also identified missed opportunities for follow up vaccination in patients in the pre-SMS and SMS groups who had initiated the vaccine course (one dose) and patients who received 2 (but not 3) doses. We then measured subsequent return clinic visits within 18 months. We examined the timing of the return visits according to the recommended vaccination spacing at 0, 1, and 6 months, focusing on return visits after 1 month for those who had initiated the course (one dose), and after 6 months for those who received 2 doses.

Data analysis was undertaken in Stata 12.0.

Ethical approval was obtained from the South Eastern Sydney Illawarra Area Health Service (Northern Sector) Human Research Ethics Committee for use of retrospective patient data (reference 08/223).

RESULTS

There were 463 patients in the pre-SMS group in 2007 and 241 patients in the SMS group in 2009. The SMS group was smaller because it included only those patients who were sent vaccination reminders in 2009. Risk group categories (e.g., sex workers, HIV positive, GBM) were not mutually exclusive. Other than people who inject drugs, there were no significant differences in these proportions between the pre-SMS and SMS group (Table 1). There were no significant differences in other patient characteristics between the SMS and pre-SMS groups, except for country of birth ($P=0.01$) and age group ($P=0.02$) (Table 1).

In the pre-SMS group, 258 of the 463 (56%) patients returned for their second dose within 12 months of the first dose. Second dose completion was highest in HIV-positive GBM (88%) and sex workers (83%) and around 50% in all other risk groups.

In the SMS group, a similar proportion (54%, 130 of 241) of patients returned for their second dose within the 12 months, also highest among HIV-positive GBM (75%) and sex workers (68%), and lower in other risk groups (Table 2).

Table 1: Baseline characteristics of patients given their first HBV vaccine dose in the SMS group (2009) compared to the pre-SMS group (2007).

	Pre-SMS group (2007)	SMS group (2009)	P-value
	n = 463 (%)	n = 241	
Age group (years)			0.02
<20	37 (8)	11 (5)	
20–29	252 (54)	152 (63)	
30–39	106 (23)	58 (24)	
40+	68 (15)	20 (8)	
Sex			0.12
Male	319 (69)	147 (61)	
Female	139 (30)	89 (37)	
Transgender	3 (1)	3 (1)	
Country of birth			0.01
Australia	178 (38)	57 (24)	
Asia	166 (36)	106 (44)	
Europe	62 (13)	35 (15)	
Other	55 (12)	41 (17)	
Unknown	2 (0)	2 (1)	
Risk group			
GBM	292 (63)	143 (59)	0.15
HIV positive GBM	8 (2)	4 (2)	0.19
HIV negative GBM	284 (61)	139 (58)	0.10
Sex workers	111 (24)	75 (31)	0.40
PWID	15 (3)	5 (2)	0.02
Sex overseas in the last 12 months	123 (27)	75 (31)	0.20
Traveler	24 (5)	13 (5)	0.73
Place of residence			0.80
Metropolitan NSW	444 (96)	228 (95)	
Regional/Rural NSW	7 (2)	5 (2)	

GBM = gay and bisexual male; PWID = people who inject drugs; NSW = New South Wales.

Using a chi-square test, there were no significant differences in the proportion who received at least 2 vaccines by 12 months between the SMS and pre-SMS group overall or among people who inject drugs, GBM overall, HIV-positive GBM, and HIV-negative GBM. The proportion of sex workers, travelers, and people who reported sex overseas in the last 12 months and who received at least 2 doses of vaccine was lower in the SMS group compared to the pre-SMS group (Table 2). This difference was statistically significant.

In the pre-SMS group, 141 of the 463 (30%) patients returned for their third dose within the 12 months of the first dose. Full course completion was highest in HIV-positive GBM (75%) and sex workers (52%) and ranged from 21 to 33% in all other risk groups (i.e., people who inject drugs, HIV-negative GBM, travelers, and people who reported sex overseas in the last 12 months). In the SMS group, 24% (58 of 241) of patients returned for their third dose within the 12 months with a range from 0 to 31% across all risk groups (Table 2).

Table 2: Second and third HBV vaccine dose completion within 12 months of first dose in the SMS and pre-SMS groups, overall and by risk group.

	Second Dose Completion			Third Dose Completion		
	Pre-SMS group (2007) (n/n) %	SMS group (2009) (n/n) %	Chi-square	Pre-SMS group (2007) (n/n) %	SMS group (2009) (n/n) %	Chi-square
Overall	(258/463) (56)	130/241 (54)	0.65	141/463 (30)	58/241 (24)	0.07
PWID ever	7/15 (47)	2/5 (40)	0.80	5/15 (33)	0/5 (0)	0.14
GBM	153/292 (52)	80/143 (56)	0.49	78/292 (27)	38/143 (27)	0.98
HIV positive GBM	7/8 (88)	3/4 (75)	0.58	6/8 (75)	1/4 (25)	0.10
HIV negative GBM	146/284 (51)	77/139 (55)	0.44	72/284 (25)	37/139 (27)	0.78
Sex workers	92/111 (83)	51/75 (68)	0.02	58/111 (52)	23/75 (31)	0.00
Sex overseas in the last 12 months	73/123 (59)	33/75 (44)	0.04	39/123 (32)	18/75 (24)	0.25
Traveler	12/24 (50)	2/13 (15)	0.04	5/24 (21)	0/13 (0)	0.08

PWID = people who inject drugs, GBM = gay and bisexual male.

Using a chi-square test, there were no significant differences in the proportion who were fully vaccinated by 12 months between the SMS and pre-SMS group overall or by risk group (excluding sex workers in which the proportion fully vaccinated was lower in the SMS group compared to the pre-SMS group) (Table 2). Using logistic regression to adjust for age and country of birth, the same findings remained for the overall sample, for GBM overall, for HIV-negative GBM, and for sex workers (Table 3). Logistic regression could not be undertaken for other risk groups (i.e., people who inject drugs, HIV-positive GBM, travelers, and people who reported sex overseas in the last 12 months) due to small numbers.

Missed vaccination opportunities

In the pre-SMS group ($n = 463$), 167 individuals initiated a HBV vaccination course and received only one dose and 96 individuals only 2 doses. Of those who had only 1 dose (and not a second or third), 48 (29%) attended the clinic within 1–12 months of course initiation and were not vaccinated (Table 4). Of those who had only 2 doses (and not a third), 24 (25%) attended the clinic within 6–18 months of their second dose (Table 4) and were not vaccinated.

In the SMS group ($n = 241$ clients), 98 individuals initiated a HBV vaccination course and received only one dose and 61 individuals only 2 doses. Of those who had only one dose, 18 (18%) attended the clinic within 1–18 months of course initiation and were not vaccinated (Table 4). Of those who had only 2 doses, 18 (30%) attended the clinic within 6–18 months of their second dose (Table 4) and were not vaccinated.

Table 3: Association between receiving a SMS reminder and completion of a 3-dose HBV vaccine series in 12 months compared to pre-SMS group.

Model	Odds Ratio (95% CI)	
	Pre-SMS group	SMS group
Overall		
Unadjusted*	1.00	0.72 (95% CI, 0.51-1.03)
Adjusted†	1.00	0.70 (95%CI: 0.48-1.01)
GBM all		
Unadjusted*	1.00	0.99 (95% CI, 0.63-1.56)
Adjusted†	1.00	1.06 (95% CI, 0.67-1.70)
HIV neg GBM		
Unadjusted*	1.00	1.10 (95% CI, 0.70-1.74)
Adjusted†	1.00	1.20 (95%CI, 0.74-1.93)
Sex workers		
Unadjusted*	1.00	0.42 (95%CI, 0.23-0.76)
Adjusted†	1.00	0.40 (95%CI, 0.22-0.75)

*Unadjusted, †Adjusted for age, country of birth. GBM = gay and bisexual male.

DISCUSSION

We found that SMS reminders did not increase second or third HBV vaccine completion rates within 12 months of initiating a course. In both the pre-SMS and SMS groups, approximately half of new patients returned for their second dose and only one quarter completed the 3-dose series within 1 year. We also identified missed opportunities for HBV vaccination. Approximately a third of individuals who only had 1 or 2 doses had clinical opportunities within 18 months to be vaccinated.

We are not aware of any other studies which have evaluated SMS reminders as a HBV vaccination strategy in high risk adults attending a sexual health service. The low rates of second and third dose completion in this study were unexpected given that rates of sexually transmissible infections (STIs) and HIV screening among GBM attending SSHC doubled after the SMS reminder system was implemented.¹⁹ It remains unclear why routine STI and HIV screening rates but not vaccination rates improved with SMS reminders in a similar study population.

It is possible that some patients may be more motivated to test for STI and HIV than vaccinate against HBV. A cross-sectional survey of gay men found social-cognitive variables such as attitudes, social norms, and perceived vulnerability predicted their intention to vaccinate.²⁰ Patients may benefit from more intensive education about the risks of HBV and the benefits of vaccination (beyond the current standard of care) and tailored SMS reminders with health promotion messaging. Adding educational content to SMS vaccination reminders improved the uptake of second dose influenza vaccine in children²¹ and vaccine focus group research has demonstrated that simple, empowering messages are preferred by adults.²²

Additional strategies to increase HBV vaccine course completion should also be considered. A follow up reminder relayed soon after the initial SMS may be beneficial. A 2005 systematic review of vaccination recall interventions (including letters and telephone messages but not SMS) demonstrated that telephone reminders are the most effective single intervention and that multiple reminders are more effective than single reminders.¹² The Centers for Disease Control and Prevention

Table 4: Timing of center attendances among clients with an incomplete HBV vaccination course in 2009 and 2007.

Timing of non-vaccine related visits among clients who only received one dose	Proportion attending for a non-vaccine related visit	
	Pre-SMS group (2007) n (%)	SMS group (2009) n (%)
<1 month	22 (13)	12 (12)
1–12 months ^a	44 (26)	17 (17)
12–18 months ^a	4 (3)	1 (1)
No return	97 (58)	68 (69)
Total	167	98
Timing of non-vaccine related visits among clients who only received 2 doses		
<6 month	19 (20)	14 (23)
6–12 months ^a	16 (17)	14 (23)
12–18 months ^a	8 (8)	4 (7)
No return	53 (55)	29 (48)
Total	96	61

^aMissed vaccination opportunity.

recommends multi-component interventions, of which nurse-led standing orders, free vaccine provision, and clinic-based education are already standard practice at SSHC.²¹ Prompts, checklists, and registries that remind clinicians to offer vaccinations are also recommended and may reduce missed opportunities for vaccination. Ideal clinician reminder interventions are simple and automated²³ and, while SSHC does not currently have a system to identify patients who are eligible or overdue for a vaccination, an electronic prompt function could be developed and integrated into the electronic medical record.

A strength of this study is the low cost of the SMS intervention, which was absorbed entirely by the clinic. There are, however, a few limitations to consider. First, we used a before-and-after evaluation design rather than a randomized controlled trial and so there may have been factors we did not measure and adjust for which could have influenced the study outcomes (e.g., attitudes about vaccination or concurrent health promotion initiatives). We are not aware of initiatives during the study period that may have influenced vaccine uptake. It is also possible that some reminders may not have been received by patients who changed their mobile phone number or had an incorrect number recorded in the system. We believe this would be uncommon as the study included only new patients who would have recently recorded their contact details and because other SMS reminder interventions that reported positive outcomes were conducted at the clinic during the study period suggesting a high proportion of correct numbers.¹⁹ In addition, vaccination rates may have been under estimated among patients who completed their vaccine series at a different service although we have no reason to believe this would impact one group more than the other. Lastly, conducting the study at a single site limits the generalizability of our findings.

CONCLUSION

This study has identified that SMS reminders do not increase HBV vaccine completion rates in this setting. Comprehensive vaccination

programs targeting high-risk populations are the most effective way to prevent HBV infection and disease and additional strategies, such as adding educational content to SMS vaccination reminders, implementing clinician prompts to reduce missed opportunities, and combining multiple interventions, are needed. Future evaluations of these strategies would, ideally, use a randomized controlled design and have the capacity to monitor if reminders were successfully received.

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COMPETING INTERESTS

The authors have no competing interests to declare.

CONTRIBUTORS

All authors provided substantial contributions to the paper, approved the final manuscript, and are accountable for all aspects of the work. RG and HW developed the initial concept, designed the study, provided statistical analysis support, and critically revised the manuscript. R.M. drafted and critically revised the manuscript and interpreted the study. A.D. drafted the analysis plan, conducted the analysis, cleaned, and presented the data and critically revised the manuscript. V.K. and A.M. interpreted the study and provided critical revisions to the draft manuscript.

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REFERENCES

1. Pew Research Centre. Texting, Social Networking Popular Worldwide 20 December 2011. www.pewglobal.org/files/2011/12/Pew-Global-Attitudes-Technology-Report-FINAL-December-20-2011.pdf. Accessed December 1, 2014.
2. Downer SR, Meara JG, Da Costa AC, et al. SMS text messaging improves outpatient attendance. *Aust Health Rev*. 2006;30(3):389–396.
3. Australian Immunisation Handbook 10th ed. Canberra: Australian Government Department of Health, 2013. <http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/handbook10-4-5>. Accessed November 23, 2014.
4. Ioannou, GN. Hepatitis B Virus in the United States: Infection, Exposure, and Immunity Rates in a Nationally Representative Survey. *Ann Int Med*. 2011;154(5):319–328.
5. Macdonald V, Dore GJ, Amin J, et al. Predictors of completion of a hepatitis B vaccination schedule in attendees at a primary health care centre. *Sexual Health*. 2007;4(1):27–30.
6. Second National Hepatitis B Strategy 2014–2017. Australian Government Department of Health, 2014. <http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-bbvs-hepb>. Accessed January 5, 2015.
7. Jin F, Prestage GP, Zablotska I, et al. High rates of sexually transmitted infections in HIV positive homosexual men: data from two community based cohorts. *Sex Transm Infect*. 2007;83(5):397–399.
8. Ramasami S, Abu-Rajab K, Sarkar P, et al. Audit of hepatitis B vaccination of men who have sex with men attending Scottish genitourinary medicine clinics. *Int J STD AIDS*. 2009;20(8):575–576.
9. McMillan A. Hepatitis B vaccination of men who have sex with men: experience with an accelerated course of vaccination in a genitourinary medicine clinic. *Int J STD AIDS*. 2005;16(9):633–635.
10. Graham D, McClean H. Yorkshire regional audit of hepatitis B vaccination. *Int J STD AIDS*. 2007;18(3):212–214.
11. Gunn RA, Lee MA, Murray PJ, et al. Hepatitis B vaccination of men who have sex with men attending an urban STD clinic: impact of an ongoing vaccination program, 1998–2003. *Sex Transm Dis*. 2007;34(9):663–668.
12. Jacobson Vann JC, Szilagyi P. Patient reminder and recall systems to improve immunization rates. *Cochrane Database Syst Rev*. 2005;20(3):6–10.
13. Harris JL, Jones TS, Buffington J. Hepatitis B vaccination in six STD clinics in the United States committed to integrating viral hepatitis prevention services. *Public Health Rep*. 2007;122(Suppl 2):42–47.
14. Sansom S, Rudy E, Strine T et al. Hepatitis A and B vaccination in a sexually transmitted disease clinic for men who have sex with men. *Sex Transm Dis*. 2003;30(9):685–688.
15. Warwick Z, Dean G, Carter P. B safe, B sorted: results of a hepatitis B vaccination outreach programme. *Int J STD AIDS*. 2007;18(5):335–337.
16. Rock C, de Barra E, Sadler C, et al. Impact of a new vaccine clinic on hepatitis B vaccine completion and immunological response rates in an HIV-positive cohort. *J Infect Public Health*. 2013;6(3):173–178.
17. Vilella A, Bayas JM, Diaz MT, et al. The role of mobile phones in improving vaccination rates in travelers. *Prevent Med*. 2004;28(4):503–509.
18. Australian Bureau of Statistics. Australian Demographic Statistics, September 2014. <http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0/>. Accessed March 31, 2015.
19. Bourne C, Knight V, Guy R, et al. Short message service reminder intervention doubles sexually transmitted infection/HIV re-testing rates among men who have sex with men. *Sex Transm Infect*. 2011;87(3):229–231.
20. Schutten M, de Wit JB, van Steenberghe JE. Why do gay men want to be vaccinated hepatitis B? An assessment of psychosocial determinants of vaccination intention. *Int J STD AIDS*. 2002;13(2):86–90.
21. Center for Disease Control. *Strategies for Increasing Adult Vaccination Rates*. <http://www.cdc.gov/vaccines/hcp/patient-ed/adults/for-practice/reminder-sys.html>. Accessed November 23, 2014.
22. Stockwell MS, Hofstetter AM, et al. Text message reminders for second dose influenza vaccine: a randomized controlled trial. *Pediatrics*. 2015;135(1):e83–e91.
23. Ramakrishnan A. *Adult Immunization: The Consumer Perspective and CDC Communication Efforts*. National Influenza and Adult Immunization Summit. 13–15 May, 2014. Atlanta Georgia. http://www.izsummitpartners.org/wp-content/uploads/2014/05/1e-3_Ramakrishnan_Adult-Immunization-CDC-Communications.pdf. Accessed June 15, 2015.

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