The importance of coherently understanding cervical cancer vaccination: factors associated with young Australian women’s uptake of the HPV vaccine

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ABSTRACT

Background: Cervical cancer vaccination is efficacious and widely available, yet uptake is less than optimal, even in countries such as Australia that provide government-funded vaccination programmes. Effective communication strategies are needed for presenting Human Papillomavirus (HPV) vaccine-related information in a format that enhances understanding about the vaccine, and ultimately, uptake of the vaccine. Using the Common Sense Model framework, we aimed to assess the role of illness coherence in women’s decisions to undergo the vaccine. As a secondary aim, we piloted a communication strategy entailing the provision of Disease Risk-Action Link information about the links between HPV, cervical cancer, and vaccination on women’s cervical cancer illness coherence.

Methods: In total, 132 young Australian women (18–26 years old) completed online surveys measuring illness coherence, vaccine status, intentions to undergo vaccination, and medical/demographic variables. Women who had not undergone vaccination were then randomised to receive either a brief or detailed information message about cervical cancer. Messages varied by the extent of detail (brief vs. detailed) providing Disease Risk-Action Link information about the link between the action of the vaccine, the HPV, and cervical cancer. Next, illness coherence was re-assessed.

Results: ANOVA results suggested that women who were vaccinated reported higher levels of illness coherence. Linear regression analyses indicated that, in non-vaccinated women, illness coherence was significantly associated with intentions to vaccinate. ANCOVA analysis indicated that non-vaccinated women assigned to the detailed message condition reported greater increases in illness coherence compared to those assigned to the brief message condition.

Conclusion: Illness coherence appears to be an important factor in actual vaccination uptake and intentions to vaccinate. The experimental informational message manipulation further demonstrated that the provision of detailed messages highlighting...
the Disease-Risk-Action Links in the cervical cancer context can promote illness coherence.

Cervical cancer is the fourth most common cancer in women of all ages worldwide, and is the second most common cancer in women aged 15–44 years of age (Bruni et al., 2017), with almost 12,000 women in the US, 3200 in the UK, and 938 Australian women diagnosed each year (Bruni et al., 2017; Cancer Research UK, 2016; Centers for Disease Control and Prevention, 2016). The Human Papillomavirus (HPV) is a widespread sexually transmitted disease that is causally linked with 99.7% of cervical cancer cases (Sudenga, Royse, & Shrestha, 2011; Walboomers et al., 1999). It is through persistent infection with high-risk HPV strains (such as types 16 and 18 which account for 70% of all cervical cancers) that pre-cancerous lesions can develop and lead to cervical cancer (Clifford, Smith, Plummer, Munoz, & Franceschi, 2003; Dunne & Markowitz, 2006), with HPV strains 6 and 11 being directly linked to benign genital warts (Greer et al., 1995). The HPV vaccine, Gardasil® (Villa, 2007) protects against infection of HPV strains 6, 11, 16, and 18, and is administered in three doses over a six-month period. In Australia, cervical cancer vaccination is provided at no cost to school-aged children as part of standard immunisation programmes. In addition, Government-funded ‘catch-up’ programmes were offered for 18- to 26-year-old women through general practice settings, but with mixed success as only 53% of this target population undertook vaccination (Australian Government Department of Health and Aging, 2013). This low rate of adherence has been attributed to a general lack of understanding about the vaccination (Brotherton, Piers, & Vaughan, 2016). Importantly, for women over 18 years of age, decisions about whether or not to vaccinate lie with the individual concerned, rather than for school-aged children for whom parental consent is required (Cancer Council Australia, 2015).

Not surprisingly, physician recommendation (Gerend, Zapata, & Reyes, 2013; Gold, Naleway, & Riedlinger, 2013; Rosenthal et al., 2011; Savas, Fernández, Jobe, & Carmack, 2012; Taylor et al., 2012) is a predictor of HPV vaccine uptake. Research to date has also investigated a limited range of cognitive and affective factors associated with HPV vaccination behaviours. From a cognitive perspective, knowledge about (Perez, Cruess, & Strauss, 2016; Vermandere et al., 2014), belief in the efficacy and safety of the HPV vaccine (Chan, Chan, Ng, & Wong, 2012; Fernández et al., 2014; Hutson, Dorgan, Duvall, & Garrett, 2011; Manhart et al., 2011; Marchand, Glenn, & Bastani, 2012; Taylor et al., 2012), greater perceived severity of HPV (Kahn et al., 2008), greater perceived social acceptability of receiving the vaccine (Jowkowski & Ghesnizjani, 2016; Kahn et al., 2008), and greater anticipated regret if one was unvaccinated and later contracted HPV (Christy et al., 2016; McRee, Katz, Paskett, & Reiter, 2014) are associated with increased intentions and uptake. From an affective perspective, worry about developing cervical cancer (Krakow et al., 2015) is also associated with increased acceptance and uptake. However, these findings are limited in their applicability to understanding vaccination behaviours of young adult women generally as many of these studies either focused specifically on minority populations (Gerend et al., 2013; Savas et al., 2012; Taylor et al., 2012) or on parental decisions to vaccinate their school-
aged children (Gerend et al., 2013; Savas et al., 2012; Taylor et al., 2012), rather than on vaccination-related decision-making of young adult women.

Previous research into the uptake of vaccinations other than the HPV vaccine has revealed that timely vaccination reminders (Jacobson & Szilagyi, 2005), improving the ease of access to vaccinations via pharmacy-based services (Burson, Buttenheim, Armstrong, & Feemster, 2016) and providing the vaccine free of charge, and providing behavioural interventions focussing on vaccination knowledge (Hollmeyer, Hayden, Mounts, & Buchholz, 2013) are all associated with increased uptake. Furthermore, individuals are more likely to vaccinate if they perceive the vaccine as safe and effective, and perceive themselves as being at high risk for developing the disease prevented by the vaccine (Weston, Blackburn, Potts, & Hayward, 2017). However, there are certain cognitive factors that have previously been linked with health-protective behaviours and emotional reactions to health threats, such as illness coherence (Azzarello & Jacobson, 2007; Gerend et al., 2013; Gold et al., 2013; Taylor et al., 2012) that have been largely ignored thus far in both voluntary vaccination uptake in general, as well as in the cervical cancer vaccination context.

Illness coherence is a factor situated within the Common Sense Model of health and illness behaviour (Leventhal, Brissette, & Leventhal, 2003). This model implies that the way an individual conceives a certain illness or health threat in terms of identifying the illness, understanding of the illness, perceived risk of developing the illness, as well as perceived control over the illness, and the perceived timeline of the illness will shape the way they respond to that threat (Leventhal et al., 2003). One key factor involved in this conceptualisation of health threats is illness coherence; an individual’s personal understanding of an illness or a health-related context, that is, the extent to which it makes sense (Hall, Weinman, & Marteau, 2004; Moss-Morris et al., 2002). For example, a young woman without HPV may perceive herself to be at very low risk of contracting the virus, and thus may decide that the vaccine is not needed. On the other hand, the same young woman may perceive herself to be of very high risk of contracting the virus, and thus will see much greater value in having the vaccination. Illness coherence differs from knowledge in that an individual may know all the correct facts and details about HPV and the associated vaccine, but may feel confused or overwhelmed by this knowledge. Illness coherence extends on knowledge by representing how confident a woman is in her understanding of HPV and the associated vaccine (Kaptein & Broadbent, 2007). This perceived understanding has been associated with a number of protective and preventive behaviours in a range of contexts (Figueiras & Alves, 2007). For example, individuals with greater illness coherence are more likely to seek medical advice for symptoms of early rheumatoid arthritis (Van der Elst et al., 2015), self-monitor blood glucose levels for Type 2 diabetes (Tanenbaum et al., 2015), and adhere to exercise and medication regimes in individuals with coronary heart disease (Mosleh & Almalik, 2014). These findings suggest that by enhancing illness coherence it may be possible to increase enactment of certain preventive and protective health behaviours.

Several studies have demonstrated that illness coherence is a modifiable characteristic when in the context of disease risk and management (Bishop, Marteau, Hall, Kitchener, & Hajek, 2005; Cameron, Marteau, Brown, Klein, & Sherman, 2012; Hall et al., 2004). Applying an analogue design, one study (Cameron et al., 2012) experimentally increased illness coherence regarding future disease risk through the provision of information linking
disease risk with certain actions that can be taken to reduce this risk (that is, Disease Risk-Action Link information). Here, the one-off provision of information explaining the link between how eating a low-fat diet can reduce the risk of colon cancer for individuals with a genetic predisposition led to increased illness coherence compared with receipt of no risk-action link information.

In a different illness context, another study similarly demonstrated that providing female smokers who have an elevated risk for cervical cancer with detailed information outlining the risk-action link of how smoking increases cervical cancer risk (i.e. explaining how cigarette chemicals pass into the bloodstream and travel through the body to the cervix, causing cellular abnormalities and eventually, cancer) led to greater increases in illness coherence than a brief leaflet about cervical cancer risks generally (Bishop et al., 2005). In these studies, both groups receiving information demonstrated greater illness coherence than women who received no additional information. A related study of female smokers generally, who were not specifically at increased risk for cervical cancer, found that providing either brief or detailed information leaflets explaining the link between smoking and cervical cancer led to similar increases in illness coherence, compared with a no additional information condition (Hall et al., 2004). Together, Bishop et al. (2005) and Hall et al. (2004) suggest that detailed information about the negative impact of smoking on cervical cancer risk may only be beneficial in women who are at risk of cervical cancer.

Within the clinical context of diabetes, another study further demonstrated improvements in patient illness coherence regarding diabetes self-management through a structured education programme that provided information about the Disease Risk-Action Link pertaining to blood glucose regulation and dietary and lifestyle factors (Carey et al., 2014). This study differed from Bishop et al. (2005) and Hall et al. (2004) in that participants received information about the advantages of adopting a health-enhancing behaviour, rather than the disadvantages of continuing a harmful behaviour. Taken together, these findings highlight the importance of illness coherence in the context of health-related behaviours, and demonstrate that illness coherence is modifiable, suggesting that illness coherence may underlie intentions to engage in health behaviours. However, no studies to date have investigated the role of illness coherence regarding cervical cancer vaccination behaviours. It is likely that communications to promote cervical cancer vaccination behaviours will be most effective if they promote coherent Disease Risk-Action Link information between the vaccination, cervical cancer, and common risk factors. Illness coherence can be further promoted through providing information that elaborates on the efficacy of protective and preventive behaviours (Bishop et al., 2005; Cameron et al., 2012). As such, information that presents a detailed account of cervical cancer, risk factors, and the vaccination should promote improved illness coherency.

The primary aim of this study was to investigate the association between illness coherence and cervical cancer vaccination status. We predicted that women who were vaccinated would report higher illness coherence than those who were not vaccinated, and that among non-vaccinated women, greater illness coherence would be associated with greater intentions to vaccinate. As a secondary aim, we piloted an informational message intervention that provides Disease Risk-Action Link information for improving illness coherence. We aimed to demonstrate that illness coherence could be improved by providing women with detailed information about the link between vaccination,
HPV and genital warts, and other risk factors for cervical cancer, such as smoking and the number of sexual partners, compared with brief information related to vaccination.

**Method**

**Participants and procedure**

Women aged between 18 and 26 years who had no prior history of cervical cancer or an abnormal Pap smear, and who had not participated in a school-based cervical cancer vaccination programme, were invited to participate in the study through notices posted in community- and university-based medical centres. A total of 135 women accepted the invitation to participate; 7 women were excluded due to extensive missing data, leaving a final analysable sample of 128. Participants initially completed an anonymous online survey regarding illness coherence, current vaccination status, intentions to be vaccinated (answered by women who were not vaccinated), and demographics. Immediately following completion of these items, non-vaccinated participants were randomly assigned (using a computer-generated randomising programme, Randomizer.org) to receive either the Brief or Detailed information condition regarding cervical cancer vaccination. Immediately after reading this information, all participants’ illness coherence was reassessed. Ethical approval for this study was granted by the relevant institutional human ethics committee.

**Experimental manipulation**

**Brief information condition**

This condition included information concerning threat, vulnerability, and efficacy messages regarding the relationship between cervical cancer, HPV, and the vaccine. Participants were informed that the vaccine protects against two of the sexually transmitted HPV strains that are more likely to lead to cervical cancer, and that it only protects against these strains if they have not already been infected.

**Detailed information condition**

In addition to the information provided in the Brief information condition, the detailed condition expanded upon vaccine and cervical cancer information by explaining in depth the relationship between HPV and genital warts, and other risk factors for cervical cancer, such as smoking and increasing numbers of sexual partners (Franco, Duarte-Franco, & Ferenczy, 2001; Ho, Bierman, Beardsley, Chang, & Burk, 1998). Detailed information was also provided about the effectiveness of the vaccine (see Supplementary File for the information received by both groups).

**Measures**

**Illness coherence**

The illness coherence subscale of the Revised Illness Perception Questionnaire (Moss-Morris et al., 2002) is a generic and freely available measure designed to be adapted for different illness contexts. We adapted this measure to assess illness coherence in relation
to the link between the HPV vaccine and cervical cancer-related disease risk on a 5-point Likert-type scale (0 ‘Not at all’ to 4 ‘Very much’). An example of such a change was ‘the symptoms of my condition are puzzling to me’ to ‘the symptoms of cervical cancer are puzzling to me’. Items were summed with higher scores representing greater illness coherence. Prior work has demonstrated good internal consistency and test–retest reliability for this subscale of the Revised Illness Perception Questionnaire (Moss-Morris et al., 2002). Internal reliability was acceptable in the present study (Cronbach’s α = .91).

Current vaccination status
A single yes/no item was used to measure current vaccination status, ‘Have you completed the cervical cancer vaccination, or part of the three-dose course?’.

Demographics
Age, education level, yearly income, race/ethnicity, and marital status were recorded as possible covariates. In addition, family history of cervical cancer, the number of lifetime sexual partners, condom use practice, prior Pap smear behaviour, and current smoking behaviour were also documented as potential covariates as these variables are associated with increased cervical cancer risk (Magnusson, Sparén, & Gyllensten, 1999; Mohar & Frias-Mendivil, 2000).

Data analysis
All analyses were conducted in SPSS ver 24. Descriptive statistics were conducted on all variables, and bivariate relationships were investigated using χ² and t-tests between demographics and pre-manipulation variables by condition allocation and vaccination status to identify covariates. Analysis of variance (ANOVA) was used to compare illness coherence between vaccinated and non-vaccinated women, controlling for any relevant covariates. For those women who had not received an HPV vaccine, a linear regression was run between pre-manipulation illness coherence and intention to receive an HPV vaccine, to determine whether women who reported higher illness coherence also reported stronger intentions to receive the HPV vaccine. To address the secondary aim of assessing the impact of the experimental manipulation (brief versus detailed information) on illness coherence, an ANCOVA was conducted on non-vaccinated women comparing post-manipulation illness coherence between conditions, controlling for any identified covariates and pre-manipulation illness coherence scores. Cohen’s d is reported for all effect sizes. Power calculations for the two ANCOVAs using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) indicated a required sample size of 126 to detect a moderate effect (Cohen’s d = .55) maintaining type I error at .05, and power at .80. For the regression, a sample size of 107 women was required to detect a moderate effect (Cohen’s d = .55) maintaining type I error at .05, and power at .80.

Results
Sample characteristics are provided in Table 1. Most respondents were young adult Caucasians who were single, and had completed their final year at high school. Over half of the participants had a yearly income of less than $20,000 and reported ‘never’ smoking.
Table 1. Pre-manipulation sample characteristics.

|                          | Whole sample  | Manipulation groups | Manipulation groups |
|--------------------------|---------------|---------------------|---------------------|
|                          | (N = 128)     | Brief (n = 28)      | Detailed (n = 23)   | t/χ² | p    |
| Age – Mean (SD)          | 21.44 (1.89)  | 21.50 (1.80)        | 21.26 (1.57)        | 0.50 | .619 |
| Education                |               |                     |                     | 0.74 | .692 |
| Did not complete high school | 11 (8.6)    | 3 (10.7)            | 1 (4.4)             |      |      |
| Completed high school    | 92 (71.9)     | 22 (78.6)           | 19 (82.6)           |      |      |
| College or undergraduate degree | 24 (18.8)  | 3 (10.7)            | 3 (13.0)            |      |      |
| Postgraduate degree      | 1 (0.7)       | 0 (0.0)             | 0 (0.0)             |      |      |
| Income                   |               |                     |                     | 2.52 | .284 |
| $0–$20,000               | 69 (53.9)     | 15 (53.5)           | 16 (69.6)           |      |      |
| $20,001–$40,000          | 40 (31.2)     | 8 (28.6)            | 6 (26.1)            |      |      |
| More than $40,000        | 19 (14.9)     | 5 (17.9)            | 1 (4.3)             |      |      |
| Race                     |               |                     |                     | 0.22 | .638 |
| Caucasian                | 103 (80.5)    | 23 (82.1)           | 20 (87.0)           |      |      |
| Other                    | 25 (19.5)     | 5 (17.9)            | 3 (13.0)            |      |      |
| Marital status           |               |                     |                     | 0.02 | .898 |
| Single                   | 105 (82.0)    | 24 (85.7)           | 20 (87.0)           |      |      |
| Married                  | 23 (18.0)     | 4 (14.3)            | 3 (13.0)            |      |      |
| Family history of cervical cancer |           |                     |                     | 2.53 | .111 |
| Yes                      | 5 (96.1)      | 0 (0.0)             | 2 (8.7)             |      |      |
| No                       | 123 (3.9)     | 28 (100.0)          | 21 (91.3)           |      |      |
| Sexual partners          |               |                     |                     | 5.65 | .342 |
| 1 or less                | 25 (19.5)     | 7 (25.0)            | 5 (21.7)            |      |      |
| 2                        | 23 (18.0)     | 2 (7.1)             | 6 (26.1)            |      |      |
| 3                        | 29 (22.7)     | 8 (28.6)            | 2 (8.7)             |      |      |
| 4                        | 19 (14.8)     | 4 (14.3)            | 3 (13.1)            |      |      |
| 5+                       | 32 (25.0)     | 7 (25.0)            | 7 (30.4)            |      |      |
| Condom use               |               |                     |                     | 1.71 | .426 |
| Never                    | 22 (17.3)     | 7 (25.9)            | 3 (13.0)            |      |      |
| Sometimes                | 70 (55.1)     | 13 (48.2)           | 11 (47.9)           |      |      |
| Always                   | 35 (27.6)     | 7 (25.9)            | 9 (39.1)            |      |      |
| Have had a pap smear     |               |                     |                     | 0.27 | .601 |
| Yes                      | 87 (68.0)     | 15 (53.6)           | 14 (60.9)           |      |      |
| No                       | 41 (32.0)     | 13 (46.4)           | 9 (39.1)            |      |      |
| Smoking status           |               |                     |                     | 1.74 | .628 |
| Never smoked             | 65 (50.8)     | 13 (46.4)           | 9 (39.1)            |      |      |

K. A. SHERMAN ET AL.
| Smoking Habit          | N  | %   | N  | %   | N  | %   |
|-----------------------|----|-----|----|-----|----|-----|
| Almost never smoke    | 43 | 33.6| 9  | 32.1| 11 | 47.8|
| Often smoke           | 14 | 10.9| 5  | 17.9| 2  | 8.7 |
| Very often smoke      | 6  | 4.7 | 1  | 3.6 | 1  | 4.4 |

**Likelihood of getting vaccination**

| Not likely | 17 | 33.3 | 10 | 35.7 | 7  | 30.4 |
| Likely     | 34 | 66.7 | 18 | 64.3 | 16 | 69.6 |

**Illness Coherence** – Mean (SD)

|          | N  | %   | N  | %   | N  | %   |
|----------|----|-----|----|-----|----|-----|
|          | 13.93 (3.66) | 12.07 (3.57) | 13.26 (3.09) | -1.24 | .219 |

*Likelihood of getting vaccination reported only for women who were not vaccinated.
cigarettes. Most women reported having three or more sexual partners. Sixty per cent (n = 77) of participants had completed or initiated vaccination, leaving 40% (n = 51) of participants not having received the vaccine. This is comparable to the government reported 68% level of vaccination uptake in Australian women by the age of 21 (National HPV Vaccination Program Register, 2015). Of the demographic characteristics, Pap smear history [\( \chi^2(1, 132) = 6.51, p = .011 \)] was the only variable associated with being vaccinated, with vaccinated participants more likely to have had a Pap smear. As such, Pap smear history was controlled for in the ANOVA comparing illness coherence levels between those who were and were not vaccinated. There were no significant differences on any demographic or medical variables between assigned experimental manipulation groups (see Table 1).

Vaccination status and illness coherence

ANOVA indicated a significant difference in illness coherence by vaccination status. Specifically, women who were vaccinated reported significantly higher illness coherence \( F(1, 125) = 9.49, p = .003, \text{Cohen’s } d = .55 \). For those women who had not received a vaccination, linear regression analysis confirmed that intentions to receive a cervical cancer vaccination were significantly and positively associated with illness coherence \( \beta = 0.76, SE = 0.35, t(49) = 2.18, p = .034, \text{Cohen’s } d = .62 \).

Impact of the experimental manipulation

ANCOVA indicated a significant difference in illness coherence scores between the two conditions, \( F(1, 46) = 8.41, p = .006, \text{Cohen’s } d = .86 \). Post-manipulation illness coherence scores were significantly greater for the Detailed (\( M = 15.69, SE = 0.60 \)) than the Brief (\( M = 13.28, SE = 0.54 \)) condition.

Discussion

Despite the provision of the HPV vaccine to Australian women, and its known benefits (Villa, 2007), not all of this target population are opting to undergo vaccination (Australian Government Department of Health and Aging, 2013). Prior research has identified that illness coherence, an individual’s personal understanding of an illness or a health-related context has an important influence on preventive health behaviours (Hall et al., 2004; Moss-Morris et al., 2002), such as women’s HPV vaccination behaviours. This study aimed to determine the extent to which illness coherence accounts for differences in rates of actual vaccination, and intentions to vaccinate for women not yet vaccinated. As a secondary aim, we piloted a brief information-based intervention, similar to that previously applied in the cervical cancer context (Hall et al., 2004), aimed at improving illness coherence in women who were not yet vaccinated. As predicted, the results indicated that women reported higher levels of illness coherence if they were vaccinated, compared with non-vaccinated women. Moreover, among non-vaccinated women, intentions to vaccinate in the future were higher in women who had greater illness coherence. The experimental manipulation of illness coherence in the subset of non-vaccinated women further demonstrated that providing detailed information regarding the actions of the
HPV vaccination led to significantly greater increases in illness coherence, compared with a provision of brief information about the vaccine.

Illness coherence has previously been associated with a range of protective and preventive behaviours in many health settings (Carey et al., 2014; Figueiras & Alves, 2007; Tanenbaum et al., 2015; Van der Elst et al., 2015). The results of the present study extend on these works by indicating that holding a coherent understanding of cervical cancer is associated with both greater intention to be vaccinated, as well as having undergone vaccination. As such, it may be that having a coherent understanding of the ways in which the HPV virus is contracted and its link to cervical cancer, genital warts, and the vaccine, enhances an individual’s motivation to undergo vaccination (Hall et al., 2004; Leventhal, Weinman, Leventhal, & Phillips, 2008). Moreover, the subgroup analysis of women who have not undergone vaccination provided further support for this claim by demonstrating that intentions to vaccinate were stronger in women with a more coherent understanding of cervical cancer. While these results complement that of other work conducted in cervical cancer, in which illness coherence was associated with the intention to uptake other preventive and protective behaviours, such as quitting smoking (Hall et al., 2004), this study extends this work to demonstrate that illness coherence is associated not only with the intention to vaccinate, but also the likelihood of actually being vaccinated. Cervical cancer is, therefore, one more health domain in which illness coherence is associated with both intention and likelihood to engage in protective and preventive behaviours.

Regarding the experimental intervention, consistent with expectations, the detailed information condition increased illness coherence in women who were not yet vaccinated. This is an important finding as it suggests that detailed information, like provided in the present study, may increase HPV vaccination rates if it is made publically available to women who are not yet vaccinated. This is contrary to the findings of Hall et al. (2004), in which there was no difference in the level of improvement in illness coherence between detailed and brief information leaflets. However, one key difference between the piloted manipulation in the present study compared to that of Hall et al. (2004) was that our detailed information focussed on the efficacy of our advocated behaviour (i.e. uptake of the HPV vaccine) at preventing cervical cancer, rather than focussing on how smoking may increase your risk for cervical cancer. It may be that elaborating about the effectiveness of a particular preventive behaviour, rather than focussing on the biological impact of a risky behaviour, provides a more salient Disease Risk-Action Link that people can adopt (Cameron et al., 2012).

In light of these findings, limitations of this study must be considered. The cross-sectional nature of data precludes causal inferences. Although prospective studies indicate that illness representations, such as illness coherence, are relatively stable (Rutter & Rutter, 2007), longitudinal data are needed to confirm the direction of causality. Additional research is required to determine whether the hypothesised causal pathway of enhanced illness coherence leading to actual uptake of the HPV vaccine applies. Further, future research should aim to assess the impact of detailed vs. brief messages on psychological constructs other than illness coherence, such as vaccination intention and perceived vaccine effectiveness. Despite the fact that this study has shown that illness coherence is greater in both those who have taken up the HPV vaccine, and is associated with higher intentions in those who have not undergone the vaccine, longitudinal data are needed to demonstrate that this increase in intentions due to illness coherence translates to an increase in likelihood of actually undergoing the vaccine. Another
limitation of this study is that the measure of vaccine status did not distinguish between women who had completed all doses of the vaccine versus those who had only partially completed the vaccine schedule. We are not to know whether the partial completers completed their vaccination at a later date, or whether they discontinued from the vaccination programme. It is possible that individuals who commence but do not complete the vaccination schedule may be influenced by other factors. Due to the nature of the way in which vaccine uptake was measured in this study, it is not possible to examine this alternate path. This is a possible avenue for future research. Nonetheless, findings from this study provide a foundation on which future research and interventions aimed at increasing vaccine uptake in this population of women may be designed. This is crucial given that high uptake of the HPV vaccine is necessary for achieving a maximum reduction in overall cervical cancer rates (Harper & Paavonen, 2008).

**Conclusion**

This study is the first to examine cervical cancer vaccination behaviours in regards to illness coherence, a known psychosocial predictor of health behaviour. These findings suggest that women are more likely to be vaccinated if they have greater illness coherence. Further, women who were not vaccinated reported greater intentions for vaccination if they had stronger illness coherency. Our experimental manipulation added further to these findings by suggesting that illness coherence may be promoted by providing women with detailed information about cervical cancer, HPV, and the vaccine.

**Geolocation information**

Sydney, New South Wales, Australia.

**Disclosure statement**

No potential conflict of interest was reported by the authors.

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