

## Quality improvement in action

# Quality improvement in travel medicine: a programme for yellow fever vaccination centres in England, Wales and Northern Ireland

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### ABSTRACT

**Background** The National Travel Health Network and Centre (NaTHNaC), a United Kingdom public health body, is responsible for designating nearly 3500 Yellow Fever Vaccination Centres (YFVCs) in England, Wales and Northern Ireland (EWNI). In 2005, NaTHNaC established a programme of registration, training, clinical standards and audit for YFVCs following the mandate of International Health Regulations (IHR, 2005).

**Assessment of problem** Administration of yellow fever (YF) vaccine is complex because of the changing epidemiology of YF and the risk of rare, severe adverse events following vaccination. Additionally, there is little formal assessment of providers of travel medicine, particularly in the area of YF vaccination. In 2004, prior to introducing their programme, NaTHNaC sent a questionnaire to all YFVCs in England to assess their practice. This highlighted a need for training and institution of standards to reinforce best practice in vaccination and knowledge about YF.

**Strategies for change** In 2005, NaTHNaC introduced its programme for all YFVCs. It was expected that training, adherence to standards and access to resources would lead to increased confidence and consistency of practice by YF vaccine providers.

**Effects of change** In 2009, a questionnaire was sent to all YFVCs in EWNI to evaluate the impact of the NaTHNaC programme. Among respondents who attended NaTHNaC training 95.8% of respondents indicated that it improved their confidence about YF vaccination. Furthermore, 68.5% of centres made changes to their practice, and improved adherence to core standards was observed.

**Next steps and lessons learned** The NaTHNaC programme has led to improved standards in YFVCs and increased confidence in health professionals who administer the YF vaccine. Although this has not been tested, it is expected that this will translate to more consistent and better care for the international traveller. Elements of the NaTHNaC programme could be a model for improvement of clinical standards and for other countries as they seek to implement IHR (2005) and improve the practice of travel medicine.

**Keywords:** audit and feedback, general practice, primary care, quality improvement, training, vaccination, yellow fever

### How this fits in with quality in primary care

#### What do we know?

There are approximately 3500 YFVCs in EWNI. Nearly 90% of them are in the primary care setting. Since 2005, these centres have been required to adhere to a programme of registration, training, clinical standards and audit.

#### What does this study add?

The NaTHNaC programme has improved the confidence of those providing YF vaccine, led to changes in clinical practice, and improved adherence to core standards. The lessons learned from this programme of improving quality could be applied to other procedures in primary care, and be considered as a model for other countries seeking to improve the practice of travel medicine.

## Background

Yellow fever (YF) is an acute viral haemorrhagic fever endemic in many tropical areas of South America and Africa.<sup>1,2</sup> The control of YF has been through vaccination of individuals at risk and control of the mosquito vectors, particularly *Aedes* spp. in urban areas of endemic countries. Vaccination against YF for international travel is regulated under International Health Regulations (IHR 2005).<sup>3</sup> In 2005, IHR were revised with the goals of improving the surveillance, identification, response and notification of public health emergencies of international concern. As part of the application of prevention measures at international ports, YF vaccination can be required by individual countries as a condition of entry, with the primary goal of preventing the introduction of YF.<sup>3</sup> The YF vaccine is also administered to protect travellers at risk. YF is currently the only disease for which an International Certificate of Vaccination or Prophylaxis (ICVP) may be required for entry into a country.<sup>4</sup>

In the United Kingdom (UK), administration of the YF vaccine is undertaken by specifically designated Yellow Fever Vaccination Centres (YFVCs). One of the key remits of the National Travel Health Network and Centre (NaTHNaC), when it was established in 2002 by the Department of Health (England), was the responsibility for designating YFVCs in England, and subsequently in Wales and Northern Ireland (EWNI). With approximately 3500 YFVCs representing nearly a third of all practices in EWNI, it is a priority that these centres practice to an agreed standard.

NaTHNaC is a public health body, commissioned by the Health Protection Agency (HPA), with the broad goal of *Protecting the Health of British Travellers* by helping to set standards in travel medicine. NaTHNaC's key objectives are to: provide timely, evidence-based advice on travel medicine practice and global health events that might affect British travellers; contribute to surveillance of imported infections; administer YFVCs; engage stakeholders in

travel medicine; provide education and training opportunities; and contribute to setting research priorities. To this end, NaTHNaC provides an open access website ([www.NaTHNaC.org](http://www.NaTHNaC.org)), runs a national telephone advice line and has published the definitive text resource for travel medicine in the UK.<sup>5</sup>

## Assessment of the problem

There is little formal assessment of the knowledge and competency of providers of travel medicine in general practice. As such, NaTHNaC is interested in evaluating the impact of its programme of registration, training, clinical standards and audit on the clinical practice of travel medicine in YFVCs.

YF vaccination is complex due to changes in country requirements for vaccination, the epidemiology of YF and the potential for severe and potentially life-threatening adverse events following vaccination.<sup>2,6-10</sup> In addition, there are increasing numbers of travellers with special health needs going to areas at risk of YF transmission. Of the 5.8 million UK residents who travelled overseas in 2009, it is estimated that 820 000 went to YF-risk countries.<sup>11</sup> These issues necessitate YFVCs carrying out an accurate risk assessment that balances the traveller's itinerary and health status, with the safety of YF vaccine. The overall goal of NaTHNaC's programme is to improve the standard of care around YF vaccination and ultimately to improve the practice of travel medicine.<sup>4</sup>

In 2004, prior to implementing their programme, NaTHNaC sent a questionnaire to all YFVCs in England to assess their practice and perceived needs.<sup>12</sup> The questionnaire was designed following a review of the literature on best practice in travel medicine, and piloted with travel medicine nurses. It covered: type of practice, administration of travel vaccines, training and duties of staff, vaccine storage and record keeping, access to travel health information, and resource and training needs. The YFVCs were identified by a

database held by the Department of Health that listed 4385 YFVCs in England.

A total of 2933 questionnaires were completed, achieving a 69.1% response rate. It is highly likely that the centres that did not respond were no longer practising as YFVCs, since each centre was required to update their details if they wished to continue to administer the YF vaccine. The following were key results:<sup>12</sup>

- 94% of YFVCs were in National Health Service (NHS) general practice (GP) settings
- at least 32% of GP surgeries in England were giving the YF vaccine
- relatively few doses of YF vaccine (median 35) were administered annually by each centre
- 10% of centres stored vaccines in domestic refrigerators; 2% did not record refrigerator temperatures, while nearly 16% of centres did not maintain vaccine records for the required 10-year period
- 95% of nurses working in YFVCs had received general training in travel medicine, however, fewer than 60% of physicians who were in charge of the centres had received such training ( $P < 0.0001$ ). Only 30% of health professionals had received training in YF vaccination. Travel medicine training was most often delivered or sponsored by pharmaceutical companies.

These findings highlighted a need for training to reinforce best practice in vaccination and knowledge about YF, which is delivered without potential commercial bias. It supported the intent by NaTHNaC to institute its programme of registration, training, standards and audit.

The call for improved training and standards of YFVCs has been made by the World Health Organization (WHO) in IHR (2005),<sup>3</sup> by the United States Centres for Disease Control and Prevention,<sup>13</sup> and in the literature.<sup>4,14–16</sup> Although the dominant model of delivery of travel medicine within primary care is convenient to the traveller, the low number of annual YF vaccinations (fewer than one per week) also raised the question of whether patients, who were being seen at practices administering very few doses, were receiving an appropriate level of care.

## Strategies for change

In 2005, NaTHNaC established a programme of registration, training, clinical standards and audit for YFVCs following the mandate of IHR (2005): 'State parties shall designate specific yellow fever vaccination centres within their territories in order to assure the quality and safety of the procedures and materials

employed'.<sup>3</sup> The legislative authority for NaTHNaC to do this on behalf of the Department of Health and HPA falls under the Health Protection Agency Act 2004 and Regulation 7(a) of The Health Protection Agency Regulations 2005.<sup>17</sup> In July 2005, NaTHNaC's responsibility was extended to Wales by the direction of the Welsh Assembly<sup>18</sup> and in October 2007 to Northern Ireland by Direction of the Department of Health, Social Services and Public Safety, Belfast.<sup>19</sup> Health Protection Scotland has a similar programme for YFVCs in Scotland based on the NaTHNaC model.

After rolling out the programme, all YFVCs became bound by the obligations of the Code of Practice ([www.NaTHNaC.org/pro/YFvcinitiative.htm#appendix](http://www.NaTHNaC.org/pro/YFvcinitiative.htm#appendix)), and centres had to update their practice to comply. Some of the standards include:

- Staff must be trained to advise travellers when the YF vaccine is recommended and/or required, and be competent in the safe administration of YF vaccine. As such, a clinical member of each YFVC will attend an NaTHNaC-sponsored training session before designation status is granted, and thereafter every two years. Initial training comprises a full day, with renewal training delivered over half a day. NaTHNaC staff or NaTHNaC-trained travel medicine experts deliver all training.
- Facilities for administering and storing vaccines will conform to acceptable standards.
- Appropriate records for all vaccinations must be maintained for 10 years.

NaTHNaC also established an agreement with Sanofi Pasteur MSD, the manufacturer and supplier of the YF vaccine in the UK, that Sanofi Pasteur MSD would only provide vaccine to centres that had been designated by NaTHNaC. Thus, an NHS, private, occupational health or military practice in EWNI cannot administer the YF vaccine without first applying to NaTHNaC for designation status and undergoing training.

In 2009, a follow-up questionnaire was sent to all YFVCs in EWNI to evaluate the impact of the NaTHNaC programme (see supplementary information online at [www.radcliffe-oxford.com/journals/J10\\_Quality\\_in\\_Primary\\_Care/Supplementary\\_Papers.htm](http://www.radcliffe-oxford.com/journals/J10_Quality_in_Primary_Care/Supplementary_Papers.htm)).<sup>20</sup> As part of the Code of Practice, YFVCs agree to have their practice audited. Key measures of improvement from the perspective of travellers receiving the YF vaccine are: ready access to YFVCs; the assurance that providers are knowledgeable in the assessment of the YF geographical risk and requirements under IHR (2005); that providers administer vaccine safely, and that there is consistency of advice between YFVCs. Clinical care by YFVCs will be improved by compliance with standards (e.g. record keeping and vaccine storage), having access to evidence-based resources for making a YF risk assessment (including on-line

resources and a national telephone advice line) and a regular programme of training around YF vaccination. This should lead to increased confidence of clinicians about complex YF issues.

## Effects of change

Of the 3465 YFVCs in EWNI that were registered when the 2009 questionnaire was sent, a total of 1462 centres responded, and 1438 centres completed the entire survey (41.5%).<sup>20</sup> Responses were reviewed by geographical area (postcode) with 71.6% of postcode areas having a response rate of between 31 and 50%. Response rates to individual questions ranged from 72.6 to 99.9%. The majority of respondents were from GP practices (87.4%); occupational health centres (4.0%), private travel clinics (3.5%), private health facilities (2.4%) and other types of practice (2.7%) comprised the remainder of respondents. Those completing the questionnaire were most often the practice nurse (43.0%) or the nurse responsible for the YFVC (41.8%). The majority (76.6%) of centres had become a YFVC before January 2005, when the NaTHNaC programme was implemented.

## Vaccine administration

A median of 50 doses (interquartile range (IQR), 30–75 doses) of YF vaccine were given annually by YFVCs. There was a significant difference in the number of doses given by clinic type ( $P < 0.005$ ), with private travel clinics administering more doses than other settings.

## Evaluation of NaTHNaC's training programme on the practice of travel medicine

A total of 1326 respondents (92.7%) stated that they had received either full- or half-day training from NaTHNaC. Nearly all (95.8%) indicated that the NaTHNaC training improved their confidence on YF vaccine issues. Initial training is provided by core nursing staff of NaTHNaC in a full-day session, and update training (every two years) by specifically commissioned and trained UK travel medicine experts in a half-day session. The content includes didactic lectures and interactive case-based scenarios. The lectures cover the role of NaTHNaC in travel health, YF disease and epidemiology, YF vaccine and safety, and how YF vaccination fits into the NaTHNaC Code of Practice and IHR (2005). The clinical scenarios are taken from the NaTHNaC telephone advice line, and allow attendees to discuss and debate complex issues

relating to YF vaccination. Attendees also complete a pre- and post-training test that provides them with a benchmark of their understanding of key issues.

After training, 68.5% (890/1300 respondents) of centres made changes to their practice: in risk assessment for YF vaccination (61.9%), record keeping (61.6%) and use of internet resources for YF information (48.1%). GP surgeries were most likely to make changes compared with other centre types ( $P < 0.005$ ; Table 1), however, the size of the YFVC (based on number of travel medicine patients seen annually) did not affect whether practice changes were made.

There was improved adherence to the core standards in comparison with the baseline study (Table 2).<sup>12</sup> Only 3.4% ( $n = 43$ ) of YFVCs stored vaccines in a domestic refrigerator (with no internal/external thermometer) compared with 10% in the baseline study ( $P < 0.001$  by Kruskal–Wallis test), 0.6% ( $n = 8$ ) did not record refrigerator temperatures (compared with 2%,  $P < 0.001$ ) and only 5.8% ( $n = 81$ ) of centres kept vaccine records for less than the required 10-year period (compared with 15.7%,  $P < 0.001$ ).

Following training, the proportion of practitioners who felt highly confident about YF vaccination ranged from 76.4 to 97.8% (Figure 1). Respondents were highly confident about the storage (97.8%) and administration (96.8%) of YF vaccine, but less so about making risk assessments for those with chronic medical conditions and who were age 60 years and older.

A difference in confidence levels was apparent between those who did and did not attend training

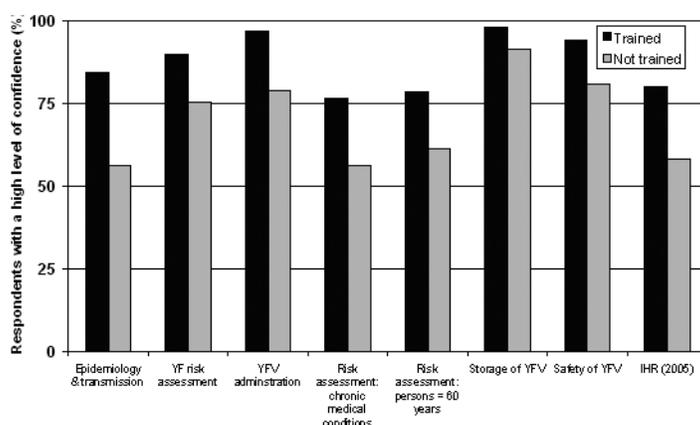
**Table 1** Changes made by Yellow Fever Vaccination Centres to their practice, following institution of the National Travel Health Network and Centre programme of registration, training, standards and audit, by type of practice. Overall, 68.5% of Yellow Fever Vaccination Centres made changes

Centre type	Changes made <i>n</i> (%)
General practice	791 (70.2)*
Occupational health centre	29 (55.8)
Other	16 (57.1)
Pharmacy	3 (60.0)
Private health facility	21 (67.7)
Private travel clinic	17 (40.5)

\* $P < 0.005$  compared with other practice types.

**Table 2** Comparison of results from the two surveys

	2004	2009
Centre type; GP surgery	94.4% ( <i>n</i> = 2694)	87.4% ( <i>n</i> = 1257)
Median number of annual yellow fever vaccine (interquartile range)	35 (20–50)	50 (30–75)
Storage of vaccines in domestic refrigerators	10.0% ( <i>n</i> = 278)	3.4% ( <i>n</i> = 43)
Do not record fridge temperatures	2.0% ( <i>n</i> = 53)	0.6% ( <i>n</i> = 8)
Keep vaccine records for less than 10-year period	17.8% ( <i>n</i> = 468)	5.8% ( <i>n</i> = 81)



**Figure 1** Respondents with a high level of confidence about YF vaccination following attendance at NaTHNaC yellow fever training course (*n* = 1326), compared with those who had not attended training (*n* = 104). Those who received training were more likely to have high confidence levels in all categories,  $P < 0.001$ . High confidence was indicated by a self-selected confidence score of 4 or 5, on a 5-point scale. NaTHNaC, National Travel Health Network and Centre; YF, yellow fever; YFV, yellow fever vaccine; IHR, International Health Regulations

(Figure 1). Of those not attending training, only 56.4% expressed confidence about the global epidemiology and transmission of YF compared with 84.3% of those who had been trained ( $P < 0.001$ ). Among those without training, 58% expressed high confidence about IHR (2005) compared with 80.2% of those who had received training ( $P < 0.001$ ). The main reasons for the lower confidence among those who had not received training were their lack of training (55.6%) and experience (44.4%).

## Next steps and lessons learned

This follow-up survey of YFVCs enabled us to evaluate the impact of the NaTHNaC programme of registration, training, standards and audit on clinical practice by YFVCs in EWNI. The programme has been

associated with improved adherence to basic standards of immunisation practice and with high confidence levels of healthcare providers in YF vaccination. It is expected that improved standards and increased confidence will improve quality through consistent and better care for international travellers who visit GP surgeries or private travel medicine clinics. However, this has not been formally tested in the field of travel medicine, and the impact of clinical guidelines in general practice has been mixed.<sup>21</sup> The establishment of a nationally approved programme that requires YFVCs to register with NaTHNaC, attend training and sign a Code of Practice outlining clear practice standards, are likely to be key features that lead to practice improvements. In addition, YFVCs are not able to buy YF vaccine if they have not undergone the designation process. NaTHNaC also frequently communicates with YFVCs via email alerts and newsletters, answers their clinical queries on our national

advice line and posts updated information on our website. These are all measures that can successfully lead to practice change; the first step in trying to improve care and outcomes.<sup>22</sup>

In order to determine whether standards are maintained, NaTHNaC has developed an assessment and audit instrument that will audit vaccine storage, record keeping and administration. It will also assess responses to clinical scenarios that will be answered by the healthcare providers at the YFVCs. NaTHNaC also plans to explore whether the number of YF vaccine doses given annually correlates with accuracy in answering the clinical scenarios. There will be specific feedback to centres based on their performance on the audit; this audit will be rolled out in late 2011.

The study has also helped to identify areas of relatively low confidence where the NaTHNaC training can be modified. These are in the areas of YF vaccine indications for persons who are elderly or with special health needs, the epidemiology of YF risk and how IHR (2005) apply to YF vaccination (Figure 1). YFVCs have responsibility for making appropriate decisions when these complex situations arise in practice, however, they do have the option to discuss them with NaTHNaC over their advice line.

In order to allow more clinical personnel in each YFVC to have access to training, NaTHNaC will develop on-line training for YFVCs that are renewing their registration. Continuing professional development credits have been provided for all NaTHNaC YF training to provide added value. These efforts should help to overcome both lack of confidence and experience, and will be important to some practices, that based on the estimated number of YF vaccine doses given, have only limited opportunities to see patients travelling to YF risk countries.

The major limitation of the study was that the response rate was lower than in the baseline study. It is not possible to know whether the YFVCs that felt they had benefitted from the NaTHNaC programme were more or less likely to complete the questionnaire than those centres that did not consider the programme to be beneficial. However, the distribution of the YFVCs that completed the questionnaire was similar to the complete database in terms of location. The response rate was likely to be affected by the demands placed upon healthcare providers during the influenza pandemic of 2009. It is also possible that factors, such as other training opportunities or greater awareness of immunisation standards, could have led to improvements in practice.

The lessons learned from implementation of a standard for YF vaccination could be applied to other areas of clinical practice (Box 1).

Internationally, although several WHO Member States have developed a process of designation of specific YFVCs in accordance with the IHR (2005),

### Box 1 Recommendations for yellow fever practice standardisation

- Nationally agreed standards.
- Central regulatory or designation authority.
- Application of standards to all practice settings (e.g. NHS, private, occupational health).
- Training at regular intervals with both didactic and interactive case-based discussions.
- Linkage of registration with training and/or evidence of competence.
- Provision of evidence-based central resources to aid decision-making (e.g. web-based or via an advice line).
- Regular assessment of administrative and clinical adherence to practice standards.
- Feedback to practices about performance on assessment with suggestions/requirements for compliance.

only rarely has it been tied to standards, education and audit.<sup>16,23–25</sup> The successes seen with the NaTHNaC programme could be a model for other countries as they seek to implement IHR (2005) and improve the quality of practice of travel medicine.

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#### CONTRIBUTORS

HS and DRH conceived the questionnaire. Each author contributed to its design and implementation. NB posted the questionnaire on-line and collected all of the data. NB sorted and cleaned the data, and NB and NL analysed it. NB wrote the first draft of the paper. DRH extensively revised the draft, and submitted a revised manuscript for HS and NL to review. HS and NL made comments and changes to the manuscript that were reviewed by NB and DRH. DRH is the guarantor of the final submission.

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#### PEER REVIEW

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