Identification of innovation in public health

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ABSTRACT
Background The National Horizon Scanning Centre provides national policy-makers in England with forewarning about emerging and new health technologies. This includes public health interventions (PHIs) but identification of these interventions is not always easy.

Objectives The aim of this study was to explore the meaning and define innovation in public health.

Methods We used a quasi-Delphi method with questionnaire 1 sent to 106 public health and horizon scanning professionals and decision-makers in June 2008. Questionnaire 2 was developed based on answers to questionnaire 1 and sent to all respondents.

Results A definition of innovative PHIs was developed: ‘Innovative PHIs are generally new and different to established interventions. They should be equitable, applicable to all in a population, cost-effective and may address health determinants in the non-health sector of society. A good evidence base is ideal, but sometimes it may be necessary to consider PHIs lacking evidence’. Sources suggested for identifying innovative PHIs were similar to those used for other types of health technologies.

Conclusion Our findings should help early awareness and alert systems distinguish innovative from non-innovative PHIs, although its application in practice needs trialling.

Keywords definition, horizon scanning, identification, innovation, innovative, interventions, population health, public health intervention

Introduction
Public health interventions (PHIs) are intended to improve or protect health, or prevent ill health in populations and the implementation of effective PHIs is a government priority. However, although there is a plethora of literature and research covering the major determinants of health, there is a lack of rigorous implementation of effective public health solutions, which could improve the health of the nation.

Within England the National Institute for Health and Clinical Excellence (NICE) is responsible for publishing guidance on promoting good health and the prevention and treatment of ill health, and has a role to play in the assessment and uptake of PHIs deemed to be effective and cost-effective. Ideas for public health topics originate from a variety of sources including stakeholders, the National Horizon Scanning Centre (NHSC), NICE advisory committees and members of the public. NICE public health guidance is aimed at public health professionals and practitioners, and others with a direct or indirect role in public health within the NHS, local authorities and the wider public, voluntary, community and private sectors.

The NHSC is an early awareness and alert (EAA) system for the identification of innovation in healthcare. The NHSC is part of the National Institute for Health Research and provides advance notice to the English Department of Health, NICE and other national policy-makers of significant new and emerging health technologies up to 3 years before launch. The NHSC has clear work streams in which technologies are identified, filtered, prioritized and researched. The majority of 1000 or so technologies identified and researched by the NHSC each year are not labelled

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as PHIs, though some interventions such as drugs that aim to reduce cardiovascular risk, improve glucose control, aid smoking cessation and reduce obesity could be classified as PHIs.

PHIs have been defined\(^6\)–\(^9\) but innovation in public health has not been addressed to our knowledge. Previous definitions of PHIs suggest only what PHIs are, not the difference between an existing PHI and a significantly different or innovative PHI.

A public health research programme, funded by the National Institute for Health Research, has recently been established to better understand the significance and context of PHIs, and to evaluate them.\(^{10}\) Perhaps a clear definition of innovation in public health would help the NHSC and other EAA systems to identify those new and innovative PHIs worth evaluating and implementing.

In this paper, we set out to explore the meaning of innovation in public health by capturing the opinions and views of public health professionals and horizon scanning agencies. Whilst our primary aim is to define innovation in public health, the first step required clarification of the definition of PHIs.

**Methods**

We sent a two-stage quasi-Delphi technique questionnaire to the 60 Directors of Public Health, consultants and trainees in public health working in one region of England (contact information was provided by the West Midlands Public Health Observatory), 26 members of the public health consideration panel at NICE (national experts) and 20 members of the EuroScan collaboration, representing 14 international EAA agencies (http://www.euroscan.org.uk/). Public health professionals from the West Midlands region were included as a group that would be representative of public health professionals within England. NICE Public health consideration panel members were included as they are actively involved in making national decisions on PHIs. EuroScan members were included to provide a wider horizon scanning perspective and because many EuroScan member agencies support local or national government decision-making and have an interest in identifying new and emerging PHIs.

The first questionnaire (Fig. 1) explored beliefs about what PHIs are, how innovative PHIs can be distinguished from interventions that are not innovative, and sources to identify PHIs.

A definition of PHIs, adapted from current definitions, was presented in the first questionnaire and participants asked if they would like to change or add to the definition. Participants were asked to suggest characteristics of innovative PHIs. To aid their consideration participants were given a list of possible PHIs ranging from drugs to treat individuals to community wide interventions, and asked to score how strongly they thought each intervention was a PHI. They were asked to list three PHIs that they considered the most important within the last decade, and invited to suggest characteristics of innovation in public health, and to score their agreement with four statements about the novelty of PHIs. Finally, participants were asked how they or their organizations identified PHIs, or how they would identify PHIs if asked. Questions requiring participants to give their level of agreement utilized a Likert-scale ranging from 1 to 9 (1 = complete disagreement, 9 = complete agreement).

The questionnaire was piloted by four senior academics from the Department of Public Health and Epidemiology at the University of Birmingham in May 2008. The finalized questionnaire was sent out to the sample in June 2008 with a reminder email after 2 weeks to non-responders.

Qualitative data from the first questionnaire were analysed and similar data categorized and discretely grouped. Descriptive statistics (median, mean, mode and standard deviations) were calculated from quantitative data collected during Likert-scale scoring. Themes and descriptive statistics derived from the first questionnaire were reported back to the panel in the second questionnaire (Fig. 2).

The second questionnaire asked participants to give their level of agreement with themes from the first questionnaire relating to the definition of PHIs, gave the opportunity to review and suggest changes to mean panel scores on possible PHIs, and on agreement with statements about innovation and PHIs. Some responses from the first questionnaire were presented back to the panel in the second questionnaire for information, others to aid consideration. The second questionnaire was sent to all responders of the first questionnaire. Reminder emails were sent after 2 weeks. Again, results were coded and themes extracted from questionnaire responses. Results were further analysed using descriptive statistics.

The original definition of PHIs was altered and the definition of innovative PHIs formed after participants gave their thoughts and suggestions in questionnaire 1. Questionnaire 2 gave panellists the opportunity to provide levels of agreement with amendments or additions suggested in questionnaire 1. Additions were made to the final definition of PHIs when panel members collectively gave a mean level of agreement of ≥6 in each questionnaire (suggesting a modest to strong level of agreement).
1.1 Would you like to change or add to this definition of public health interventions? If so, please outline what you would change or add:

Public health interventions (PHIs) in the UK are intended to improve or protect health, or prevent ill health in many, most or all members of a community. PHIs include policies of governments and non-government organisations; laws and regulations; organisational development; community development; education of individuals and communities; engineering and technical developments; service development and delivery; and communication, including social marketing.

PHIs typically emphasise preventive, behavioural, environmental, social, and systems-oriented interventions rather than medically oriented ones.

1.2) Do you or your organisation use a different definition of PHIs?

1.3) Which of the following interventions would you classify as a PHI on a scale of 1 (disagree) to 9 (agree).

- Zyban to aid smoking cessation
- Vaccine for the prevention of atherosclerosis
- Early diagnostic test to identify breast cancer in those at high risk
- Genomic based test for Parkinson’s disease
- Street lighting to improve feeling of safety within a community
- Provision of insulation for the prevention of hypothermia in the elderly
- Programme to promote a reduction in consumption of fatty foods to reduce heart disease
- Post-treatment log book for cancer patients — information for health professionals about susceptibility to further health problems

1.4) In your opinion, what are the three most important public health interventions implemented in the UK in the last 10 years?

2.1) What do you think an innovative PHI is?

For example pharmaceutical innovation may include a leading compound drug for a poorly controlled disease.

2.2) On a scale of 1 (fully disagree) to 9 (fully agree), please score your level of agreement with the following statements regarding innovative PHIs.

- Novel approach where alternatives do not already exist
- Novel approach where alternatives already exist
- Old and proven, with poor implementation and use
- Variation of current public health practice

2.3) Do you actively identify innovative PHIs?

2.4) How do you or your organisation identify innovative public health interventions? Please include details of sources that you may or could use (e.g. websites, journals, word of mouth, etc.).

2.5) How would you go about identifying innovative public health interventions if asked? Please include details of sources that you may or could use (e.g. websites, journals, word of mouth, etc.).

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Results

Thirty-five responses (33%) to the first questionnaire were received from 17 Directors of Public Health, public health consultants and trainees (28% response), 9 NICE consideration panel members (35% response) and 9 EuroScan agencies (45% response). Twenty-five responses (71%) to the second
1.1) Based on first round responses, additional components of public health interventions are given below. Please score your agreement with each component according to the 9 point scale:

- Support those with an existing issue
- Include evaluation and research
- Need to operate above member state governments such as at the EU level
- Include disease surveillance and prevention through vaccination
- Involve intersectoral approach within the government and between different organisations
- Exclude population screening
- Include population screening
- Include software developments such as algorithms
- Need to be equitable
- Need to tackle inequalities
- Need to consider ethical and cultural issues
- Can work at an individual, community or population level
- Involve the organized efforts and informed choices of society, organisations, public and private, communities and individuals.

1.2) Which of the following do you think are public health interventions? Please consider the mean and modal panel score, and your original score. If you wish to revise your score, please use the boxes provided.

<table>
<thead>
<tr>
<th>Type of intervention</th>
<th>Drug</th>
<th>Prophylactic vaccine</th>
<th>Diagnostic test (blood based)</th>
<th>Screening</th>
<th>Community intervention</th>
<th>Environmenal intervention</th>
<th>Health promotion</th>
<th>Patient information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>Zyban to aid smoking cessation</td>
<td>Vaccine for the prevention of atherosclerosis</td>
<td>Early diagnostic test to identify breast cancer in those at high risk</td>
<td>Genomic based test for Parkinson’s disease</td>
<td>Street lighting to improve feeling of safety within a community</td>
<td>Provision of insulation for the prevention of hypothermia in the elderly</td>
<td>Programme to promote a reduction in consumption of fatty foods to reduce heart disease</td>
<td>Post-treatment lag book for cancer patients information for health professionals about susceptibility to further health problems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean panel score</th>
<th>6</th>
<th>7</th>
<th>6</th>
<th>6</th>
<th>7</th>
<th>7</th>
<th>8</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modal panel score</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>5</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>6</td>
</tr>
</tbody>
</table>

Your original score

Do you wish to revise your score? Yes/No

Your new score

Comments or reasons for differing from mean or modal panel score

2.1) Listed below are characteristics of innovative PHIs that were suggested by participants. Please score each characteristic according to the scale.

<table>
<thead>
<tr>
<th>Characteristics of innovative PHIs</th>
<th>Your score</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>New intervention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing intervention utilised in a different way</td>
<td></td>
<td></td>
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<tr>
<td>Different to established models</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good evidence base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence base not essential</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost effective</td>
<td></td>
<td></td>
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<tr>
<td>Equitable</td>
<td></td>
<td></td>
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<tr>
<td>Applicable to all in a population</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requires a need for an intervention</td>
<td></td>
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<tr>
<td>Reducing inequalities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Addresses health determinants in the non-health sector of society</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
questionnaire were received from 11 Directors of Public Health, public health consultants and trainees (18% final response), 7 NICE consideration panel members (27% final response) and 7 EuroScan agencies (35% final response). Twenty-five respondents (24%) completed both questionnaires.

Almost half (42%) of respondents agreed with the PHIs definition provided or did not wish to add anything, 40% suggested characteristics to add to the definition, 20% did not like the implied exclusion of medically orientated interventions. Characteristics of PHIs suggested by participants in questionnaire 1 and participants scoring of suggested characteristics in questionnaire 2 (using a 9 point Likert scale; 1 = no agreement, 9 = total agreement) are shown in Table 1. The exclusion of population screening from a PHIs definition was suggested in the first questionnaire, but the mean panel score of 2.74 in questionnaire 2 suggested strong disagreement with any exclusion. Another suggestion in the first questionnaire was that PHIs need to operate above EU member state governments. Participants gave this a mean score of 5.19, indicating uncertainty about this point.

The original definition of PHIs presented in the first questionnaire was modified after the second questionnaire:

Public health interventions (PHIs) in the UK are intended to improve or protect health, or prevent ill health in populations (i.e. groups of people defined or identified by particular characteristics). PHIs include policies of governments and non-government organizations; laws and regulations; organizational development; community development; education of individuals and communities; engineering and technical developments; service development and delivery; communication, including social marketing; disease surveillance and prevention through vaccination; and population screening.

PHIs aim to reduce health inequalities whilst considering ethical and cultural issues. They typically emphasize behavioural, environmental, social or systems-oriented interventions and may also include evaluation and research.

Participants next suggested which PHIs had been the most important over the decade prior to 2008. The five most frequently suggested interventions or intervention groups were:

- ban on smoking in public places and public policies to reduce smoking (e.g. cigarette taxation, ban on tobacco advertising);
- screening initiatives (e.g. breast cancer, cervical cancer);
- smoking cessation (e.g. increased emphasis on smoking cessation support);
- poverty reduction and equality interventions (e.g. welfare to work, tax credits);
- obesity interventions (e.g. restricting advertising unhealthy foods to children, childhood BMI surveillance).

These interventions relate well to the definition of PHIs above, and if this definition were used to identify topics, there is a good chance that all of the above interventions or intervention categories would be included.

Suggested characteristics of innovation in public health are summarized in Table 2. In questionnaire 1, although two-thirds of participants thought that innovative PHIs should be entirely new interventions, there was little agreement beyond that. One-third thought that innovative PHIs should be different from established models, and around a quarter of respondents thought that innovative PHIs should have a good evidence base, and that they should be applicable to all in a population. The panel gave a good level of agreement for these four suggestions in questionnaire 2. Three other characteristics were included in the final definition, which very few participants suggested in the first round questionnaire, but which achieved high levels of agreement following the second questionnaire. These were

<table>
<thead>
<tr>
<th>Suggested detail in questionnaire 1</th>
<th>Questionnaire 2: level of panel agreement with each aspect (score out of 9)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Sample mean</td>
</tr>
<tr>
<td>Include disease surveillance and prevention through vaccination</td>
<td>8.40</td>
</tr>
<tr>
<td>Can work at an individual, community, or population level</td>
<td>7.86</td>
</tr>
<tr>
<td>Include evaluation and research</td>
<td>7.52</td>
</tr>
<tr>
<td>Need to tackle inequalities</td>
<td>7.43</td>
</tr>
<tr>
<td>Need to consider ethical and cultural issues</td>
<td>7.38</td>
</tr>
<tr>
<td>Include population screening</td>
<td>7.19</td>
</tr>
<tr>
<td>Involve the organized efforts and informed choices of society,</td>
<td>7.10</td>
</tr>
<tr>
<td>organizations, public and private, communities and individuals.</td>
<td></td>
</tr>
<tr>
<td>Involve intersectoral approach within the government and between</td>
<td>7.00</td>
</tr>
<tr>
<td>different organizations</td>
<td></td>
</tr>
<tr>
<td>Need to be equitable</td>
<td>6.86</td>
</tr>
<tr>
<td>Include software developments such as algorithms</td>
<td>6.10</td>
</tr>
<tr>
<td>Support those with an existing issue</td>
<td>6.00</td>
</tr>
<tr>
<td>Need to operate above member state governments such as at the EU level</td>
<td>5.19</td>
</tr>
<tr>
<td>Exclude population screening</td>
<td>2.74</td>
</tr>
</tbody>
</table>
that PHIs should be equitable (mean score 7.1), should address health determinants in the non-health sector of society (mean score 7.2), and that an evidence base is not essential (mean score 6.7). Two characteristics with heterogeneity in scores and levels of agreement were included in the definition of innovative PHIs: ‘good evidence base’ (score: 6.4), and ‘evidence base not essential’ (score: 4.9). We included both characteristics to reflect the possibility that evidence may or may not be available for a given PHI.

Of the four statements on innovation, the two most highly scored by participants were ‘novel approach where alternatives do not already exist’ (mean score: 7.94, SD: 1.15) and ‘novel approach where alternatives already exist’ (mean score 7.71, SD: 1.25). The other statements scored considerably lower: ‘variation of current public health practice’ (mean score: 5.03, SD: 2.55), and old and proven with poor implementation and use (mean score: 4.00, SD: 3.00).

The following definition of innovation in public health was subsequently developed:

**Innovative public health interventions (PHIs)** are generally new and different to established interventions. They should be equitable, applicable to all in a population, cost-effective and may address health determinants in the non-health sector of society. A good evidence base is ideal, but sometimes it may be necessary to consider PHIs lacking evidence.

Participants suggested sources where PHIs may be identified including: search engines (e.g. Google, Medline), peer reviewed and electronic journals (e.g. Lancet, British Medical Journal, Health Service Journal), websites (e.g. Faculty of Public Health, public health observatories), online discussion groups and blogs, email bulletins (e.g. National Electronic Library for Medicine) and national guidance (Department of Health, NICE).

**Discussion**

**Main finding of this study**

We have developed a definition of innovation as applied to PHIs, and suggested sources where such interventions may be identified. This definition and new sources will add to the NHSC’s previously limited sources and literature on PHIs, and may lead to the development of new selection criteria.

**What is already known on this topic**

Definitions of PHIs have previously been reported but to our knowledge innovation has not been addressed. This study aims, not to replace previous working definitions of PHIs, but rather to complement them by adding a definition of innovation.

Although our definition of innovative PHIs states that ‘sometimes it may be necessary to consider PHIs lacking evidence’, some respondents did not fully agree. When identifying and implementing PHIs with uncertain efficacy, the possibility should not be overlooked that they could harm rather than benefit populations. Furthermore, some PHIs require many years of use to show efficacy, e.g. effects of diet and exercise on coronary heart disease.

One problem is that there is a discrepancy between public health goals and political and economical cycles. Short-term time constraints used by politicians and commissioners may not facilitate the successful evaluation and uptake of long-term effective public health strategies. Rather than an ‘upstream focus’, interventions are generally more acceptable to decision-makers if benefits are evident soon after implementation.11

**What this study adds**

The NHSC may have found the identification of innovative PHIs difficult because of the lack of a working definition.

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**Table 2** Characteristics of innovation in public health suggested by participants in questionnaire 1 and level of agreement in questionnaire 2

<table>
<thead>
<tr>
<th>Innovative PHI characteristic</th>
<th>Questionnaire 1: Percentage of panel suggesting characteristic</th>
<th>Questionnaire 2: level of agreement with characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample mean</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>New intervention</td>
<td>60.00</td>
<td>7.63</td>
</tr>
<tr>
<td>Different to established models</td>
<td>31.43</td>
<td>7.12</td>
</tr>
<tr>
<td>Good evidence base</td>
<td>25.71</td>
<td>7.20</td>
</tr>
<tr>
<td>Applicable to all in a population</td>
<td>22.86</td>
<td>6.40</td>
</tr>
<tr>
<td>Existing intervention utilized in a different way</td>
<td>14.29</td>
<td>4.92</td>
</tr>
<tr>
<td>Requires a need for an intervention</td>
<td>14.29</td>
<td>5.84</td>
</tr>
<tr>
<td>Cost-effective</td>
<td>8.57</td>
<td>6.44</td>
</tr>
<tr>
<td>Reducing inequalities</td>
<td>5.71</td>
<td>4.36</td>
</tr>
<tr>
<td>Equitable</td>
<td>5.71</td>
<td>7.09</td>
</tr>
<tr>
<td>Addresses health determinants in the non-health sector of society</td>
<td>2.86</td>
<td>7.17</td>
</tr>
<tr>
<td>Evidence base not essential</td>
<td>2.86</td>
<td>6.67</td>
</tr>
</tbody>
</table>
Current definitions of PHIs do not include consideration of significance or innovation and our main objective was to define and describe the distinction between innovative and non-innovative PHIs. We note that the final definition of innovative PHIs incorporates being ‘applicable to all in a population’, which may appear initially to be contrary to the usual focus of public health initiatives, which are aimed at specific groups. However, a more flexible definition of a population is ‘a group of people defined or identified by particular characteristics’. In addition, although around 25% of respondents agreed with the suggestion that a good evidence base should form part of the definition of innovative PHIs, and 9% suggested innovative PHIs should be cost-effective, the level of evidence is often poor and proof of cost-effectiveness not available at the point of identification by horizon scanning organizations. Nevertheless, we believe that other EAA systems and those with responsibility for the selection, guidance, and implementation of PHIs will benefit from our new definition of innovation in public health.

A diverse range of sources for the identification of PHIs were suggested ranging from peer-reviewed journals to personal blogs and discussion groups. Early identification of interventions may sometimes necessitate the use of non-conventional sources, such as blogs, and these should be evaluated for their usefulness in the identification process.

**Limitations of this study**

This quasi-Delphi study was limited to two questionnaire rounds and limited by a small sample population. It is unclear if sampling from a larger pool of public health and policy professionals (or even the public) would have led to any different themes emerging.

Although the overall response rate was only 24%, there was still balanced representation from each group of public health and horizon scanning professionals. Of course, studies investigating the effects of responder and non-responder bias\(^\text{12}\) and the effects of attrition rates on the validity of the study\(^\text{13}\) could be cited, but whether a higher response rate and lower rate of attrition in this study has had a significant impact is unknown. Methods were used to try and improve the response rate, including re-contacting non-responders, sending a covering letter jointly signed by the NHSC and NICE and personalizing all correspondence.

Advantages of a Delphi method are that it is relatively quick and easy to gain the views of anonymous experts who can work towards consensus uninfluenced by others. Possible limitations are that pressure from the group can still lead to group conformity,\(^\text{14}\) experts responding may not be representative of any group, and the results may not be reliable or repeatable.

**Conclusions**

The NHSC together with other systems and organizations wishing to identify innovative PHIs now have a definition and a starting point in this quest. However, since goals, objectives and remits often differ between organizations, our definition may not suit the needs of all agencies and the impact of the attrition of respondents and the views of non-respondents are unknown. In practice selecting elements from this definition of innovative PHIs may help meet individual needs and requirements.

Our findings, within the limitations of our study, may help distinguish innovative from non-innovative PHIs, but the implementation and application of our definition may be difficult in practice.

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