

Research report

An assessment if the current scientific environment in the United Kingdom
is contributing to the development and adoption of stratified medicines

MSc (Med) in Pharmaceutical Affairs

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ABSTRACT

Introduction: In October 2010 the Stratified Medicines Innovation Platform (SMIP) was created under the oversight of the Technology Strategy Board (TSB) to help accelerate the rate of development and uptake of stratified medicine in the UK. The SMIP aim to bring together the private sector, policymakers and researchers in an initiative drawing on government funding of over £50 million, along with matched funding from industry the total investment might be in the order of £100 million for innovative research and development. The ultimate goal of the SMIP is to accelerate the development and uptake of stratified research in the UK and thus make the UK a world leader in the development and adoption of stratified medicines.

Study Objectives: The primary objective of the research project is to determine if the current scientific environment in the United Kingdom is contributing to the (1) development and (2) adoption of stratified medicine. The secondary objective is to determine which of the key factors required for the development and adoption of stratified medicine is experienced by the key stakeholders to be the biggest obstacles in the current scientific environment.

Methods: A qualitative assessment were conducted via a questionnaire which was distributed to the attendees of the 7th Annual Clinical Outsourcing & Partnering World Europe and Disruptive Innovation in Clinical Trials Conferences on the 4th and 5th of March 2014 at the Victoria Plaza in London.

Results and discussion: The study sample size was the 251 attendees of the conferences and the respondents the 48 who completed their questionnaire and return it. The results indicated that a more senior and experienced individual attended the conferences. Nobody with less than 5 years of experience attended. The overall majority (85%) of respondents had 10 or more years of experience in their respective industries.

The primary objective assessed the respondent's level of agreement with statements that the current scientific environment in the UK is contributing to the development and adoption of stratified medicine in the UK. A high score was indicative of a higher level of agreement with the relevant statement. There was a significant difference in the average for development at 6.9 ($\sigma = 1.5$) and adoption at 3.7 ($\sigma = 1.6$). The

respondents were definitely of the opinion that the environment in the UK is more favourable for the development than adoption of stratified medicine.

The secondary objective was to determine which key factors are the most and least obstructive for the development and adoption of stratified medicine in the UK. The most obstructive key factors for both development and adoption had in common the lack of communication and collaboration among the respective stakeholders, and the financial environment which is not contributing to for the development and adoption of stratified medicine. The least obstructive key factors for both development and adoption were the science, the scientist ability and knowledge to development and adopt stratified medicine.

Conclusion: The outcome of the primary measurement clearly indicates that the respondents definitely assessed the environment in the UK to be much more conducive for the development of stratified medicine than for the adoption of stratified medicine. The average score for development being 6.9 ($\sigma = 1.5$) compare to 3.7 ($\sigma = 1.6$) for adoption.

Limitation: The conferences focused on outsourcing, partnering and disruptive innovation, which is processes and building blocks required for stratified medicine, but the focus on stratified medicine could have been more concentrated if the conferences were exclusively addressing stratified medicine. Secondly the project would have benefitted from distributing the questionnaires at regular intervals over a period of time. The first distribution should have occurred as close as possible to the SMIP launch in October 2010. This would have allowed the researcher to explore any trends that might have revealed it.

LIST OF ABBREVIATIONS AND DEFINITIONS OF TERMS

ABPI	Association of the British Pharmaceutical Industry
SMIP	Stratified Medicines Innovation Platform
TSB	Technology Strategy Board
UK	United Kingdom
NICE	National Institute for Health and Clinical Excellence
MRC	Medical Research Council

Stratified medicine:

The ability to classify individuals into subpopulations that differ in their susceptibility to a particular disease or their response to a particular treatment” (ABPI White Paper 2009).

Qualitative research:

Research dealing with phenomena that are difficult or impossible to quantify mathematically, such as beliefs, meanings, attributes, and symbols.

1 INTRODUCTION

The last few decades has seen a significant number of new medicines and treatments discovered and developed by the pharmaceutical industry and approved for patient use by the regulatory authorities. The Association of the British Pharmaceutical Industry (ABPI) believes that driving more rapid progress in the adoption of disease stratification and personalized medicine could make a significant contribution to improving the cost effectiveness and precision of the pharmaceutical research and development process. The healthcare community in the United Kingdom (UK) has subsequently over the last number of years identified stratified medicine (*“the ability to classify individuals into subpopulations that differ in their susceptibility to a particular disease or their response to a particular treatment”*, ABPI White Paper 2009) as one of the key areas where significant gains can be made for the benefit of the patients and providing a more cost effective healthcare system (*Technology Strategy Board, 2011*). The Stratified Medicines Innovation Platform (SMIP) was created in October 2010 under the oversight of the Technology Strategy Board (TSB) to help accelerate the rate of development and uptake of stratified medicine in the UK. The SMIP is a five year partnership program that aim to facilitate a series of activities at national level to address the challenges of stratified medicine for the benefit of business, healthcare providers and the wider economy. The SMIP aim to bring together the private sector, policymakers and researchers in an initiative drawing on government funding of over £50 million over the next five years, along with matched funding from industry the total investment might be in the order of £100 million for innovative research and development (*Mansell, 2010*). Competitions were launched in January 2011 for the best proposals for funding.

The TSB has also signed up seven public and charity sector organizations who have agreed to work together and combine resources. The partners are the TSB, the National Institute for Health and Clinical Excellence (NICE), Arthritis Research UK, Cancer Research UK (CRUK), Scottish Executive Health Directorate, Department of Health England and the Medical Research Council (MRC). These bodies will variously supply funding, expertise, advice, research support and infrastructure to help move the initiative forward.

The ultimate goal of the SMIP is to accelerate the development and uptake of stratified research in the UK and thus make the UK a world leader in the development and adoption of stratified medicines.

The rationale for this study is to assess if the SMIP (and the associated competitions and funding) provided the necessary profile in the healthcare community and motivation to create the environment in the UK for the development and adoption of stratified medicine over the last few years.

2 LITERATURE REVIEW

Robert Langreth and Michael Waldholz were the first to announce the “New Era of Personalized Medicines” (*Langreth, 1999*), that will treat people based on their individual genetic makeup in the Wall Street Journal in 1999. They were however only the first to coin the phrase “Personalized Medicines”, but more individualized pharmacotherapy was already undertaken during the 1960 and 1970 with the discovery of the oestrogen receptor, and the introduction of the anti-oestrogen tamoxifen. Some success were achieved since 1999, most notably in the field of oncology (*Trusheim, 2007*), but the wider adoptions in pharmacotherapy and funding of treatment have not yet materialized.

Currently the search terminology “stratified medicine” will reference more than 15,000 hits on Pubmed (<http://www.ncbi.nlm.nih.gov/pubmed/?term=stratified+medicine>). The literature search for this report has focused on publication reporting specifically on the activities of the SMIP and the TSB, both of which organizations aim to accelerate the rate of development and uptake of stratified medicine in the UK.

Several publications preceded the formation of the SMIP. These articles were published in the build up to the formation of the SMIP and set some of the key milestone and scientific foundations leading to the formation. The Academy of Medical Sciences, Roche and GE Healthcare (2007) addressed some the scientific and economic issues regarding the optimization of stratified medicine. Blair. Clarke and O’Neill (2008) adjusted these scientific and economic arguments specific for the development of stratified medicine in United Kingdom. Cressey (2011) reported on the first pilot project led by the charity Cancer Research UK which conducted a mass screening of various types of cancer tumors in the UK. Under this program data on the tumor samples and the patients from whom they came was analyzed in a national database. This pilot program was part of a wider movement in the UK leading towards the development and adoption of stratified medicine in the UK.

The publication PharmaTimes (<http://www.pharmatimes.com/AboutUs.aspx>) reported on the SMIP from its formation in October 2010 (Mansell, 2010), and provided ongoing reporting of the SMIP activities (Mansell, 2011), funding and progress (Megget, 2011). The journalist Peter Mansell was responsible for the majority of the PharmaTimes

articles. The researcher had the pleasure of meeting Mr Mansell at the targeted conference (7th Annual Clinical Outsourcing & Partnering World and Disruptive Innovation in Clinical Trials) and discussed the progress of the SMIP.

The Technology Strategy Board (2010) released an Output Document reporting on the workshop held in 2010. During this workshop some of the key factors required for the development and adoption of stratified medicine were identified. They also discussed some of the collaborative models between pharmaceutical companies and diagnostic companies that had been successful in the past. One of the key issues highlighted during this workshop was the need for networking and team work between academics and the industry to successfully develop stratified medicine. The Technology Strategy Board (2011) subsequently ran two road mapping workshops in May and June of 2011 to accelerate the development and uptake of stratified medicine in the UK. The UK Pharmacogenetics and Stratified Medicine Network (2012) were also established and subsequently funded by Innovate UK through the Knowledge Transfer Network to further support UK world leadership in the development of stratified medicine.

Trusheim (2011) addressed the co-development of a drug with a diagnostic and clarified the key factors required for the development and subsequent adoption of stratified medicine. They also illustrated the influence of these key factors on the economic feasibility of stratified medicine and how this impact on public policy makers.

Based on these publications the researcher subsequently formulated seven key factors required for the development and adoption of stratified medicine and conducted a qualitative assessment, via a questionnaire, on the attendees of the 7th Annual Clinical Outsourcing & Partnering World Europe and Disruptive Innovation in Clinical Trials Conferences.

3 RATIONALE AND BACKGROUND

Since 2009 stratified medicine has began to attract substantial public and private research and development investment. Progress made in the last five years has been possible through the creation of strong alliances within the industry due to the creation of the SMIP. The researcher aimed to assess the progress made over the last few years within the UK healthcare community to achieve the aims of the SMIP to develop and subsequent adoption of stratified treatment methods.

The researcher was invited to present at the 7th Annual Clinical Outsourcing & Partnering World, Europe conference in London, and with the permission of the event organizers (Health Network Communication) distributed a questionnaire to the delegates. The aim of the questionnaire was to conduct a qualitative assessment of how the attendees experience the healthcare environment is contributing to the development and adoption of stratified medicine in the UK. The conference was held on the 4th and 5th of March 2014 at the Victoria Plaza in London.

4 RESEARCH QUESTIONS AND OBJECTIVES

4.1 Primary study objective

The primary objective of the research project is to determine if the current scientific environment in the United Kingdom is contributing to the (1) development and (2) adoption of stratified medicine.

4.2 Secondary study objective

The secondary objective is to determine which of the key factors required for the development and adoption of stratified medicine is experienced by the key stakeholders to be the biggest obstacles in the current scientific environment.

5 METHODS

A qualitative assessment were conducted with a questionnaire which was distributed to the attendees of the 7th Annual Clinical Outsourcing & Partnering World Europe and Disruptive Innovation in Clinical Trials Conferences on the 4th and 5th of March 2014.

5.1 Methodology

The distributed questionnaire consisted out of 5 sections.

Section 1 consists out of four questions which assess the respondent's experience in their respective industry, in their current role, collect some detail regarding their role and which stakeholder group the respondent represent.

Section 2 consists out of three questions assessing the respondent's prior involvement with stratified medicine.

Section 3 consists out of two questions assessing the respondent's opinion of the current scientific environment in the UK, and how this is contributing to the development and adoption of stratified medicine respectively.

Sections 4 and 5 list the respective key factors that impact on the development and adoption of stratified medicine, and asks the respondents to rate the factors from least to most obstructive. The key factors for each respective process (development and adoption) were selected from the literature utilized (*Technology Strategy Board, 2010 and 2011*)

The 7th Annual Clinical Outsourcing & Partnering World Europe (in Victoria Suite 1) and Disruptive Innovation in Clinical Trials Conferences (in Victoria suite 2) were held in parallel at the Victoria Plaza, London on the 4th and 5th of March 2014. The study questionnaires were distributed during lunch, as a chair drop, on day two in both the Victoria Suite 1 (to the attendees of the 7th Annual Clinical Outsourcing & Partnering World Europe sessions) and Suite 2 (to the attendees of the Disruptive Innovation in Clinical Trials sessions). As the delegates returned from lunch they were asked to complete the study questionnaire and leave the completed questionnaire on their seats as they leave for the afternoon tea break.

5.2 Study population

The study population can be defined as the healthcare community with an interest or are working in the pharmaceutical industry in the UK.

5.3 Study sample

All attendees of the 7th Annual Clinical Outsourcing & Partnering World Europe and Disruptive Innovation in Clinical Trials Conferences were allowed to participate and complete a study questionnaire. The study sample is therefore defined as all the delegates at said conferences, which were 251.

5.3.1 Inclusion criteria

The following inclusion criteria were applied:

- o All attendees (including the speakers) of the 7th Annual Clinical Outsourcing & Partnering World Europe conference on the 4th and 5th of March 2014.
- o All attendees (including the speakers) of the Disruptive Innovation in Clinical Trials conference on the 4th and 5th of March 2014.

5.3.2 Exclusion criteria

The following exclusion criterion was applied:

- o Personnel from the event organizer (Health Network Communications) were asked not to complete a study questionnaire.
- o The audio visual production team for the conferences was asked not to complete a study questionnaire.

5.4 Data collection

Data were collected on the study questionnaire (appendix 2) as approved by WITS Ethics (appendix 1). The speakers allowed about 5 to 7 minutes prior to the start of the presentations for the delegates to complete the questionnaires.

6 RESULTS AND DISCUSSION

The study sample size was the 251 attendees of the two conferences and the respondents the 48 attendees who completed and returned their questionnaires.

6.1 Demography

The first two questions collected more information about the experience of the individual completing the questionnaire. It addresses the experience of the respondent in their respective industries (question 1.1) and how many years experience the respondent has in their current role (question 1.2).

Question 1.1: How many years of experience do you have in your industry?

Participants could choose one from five experience levels in years, starting at 0 to 5 years increasing in multiple of 5 years. The results are listed in Table 1.

Table 1: Years of experience in industry

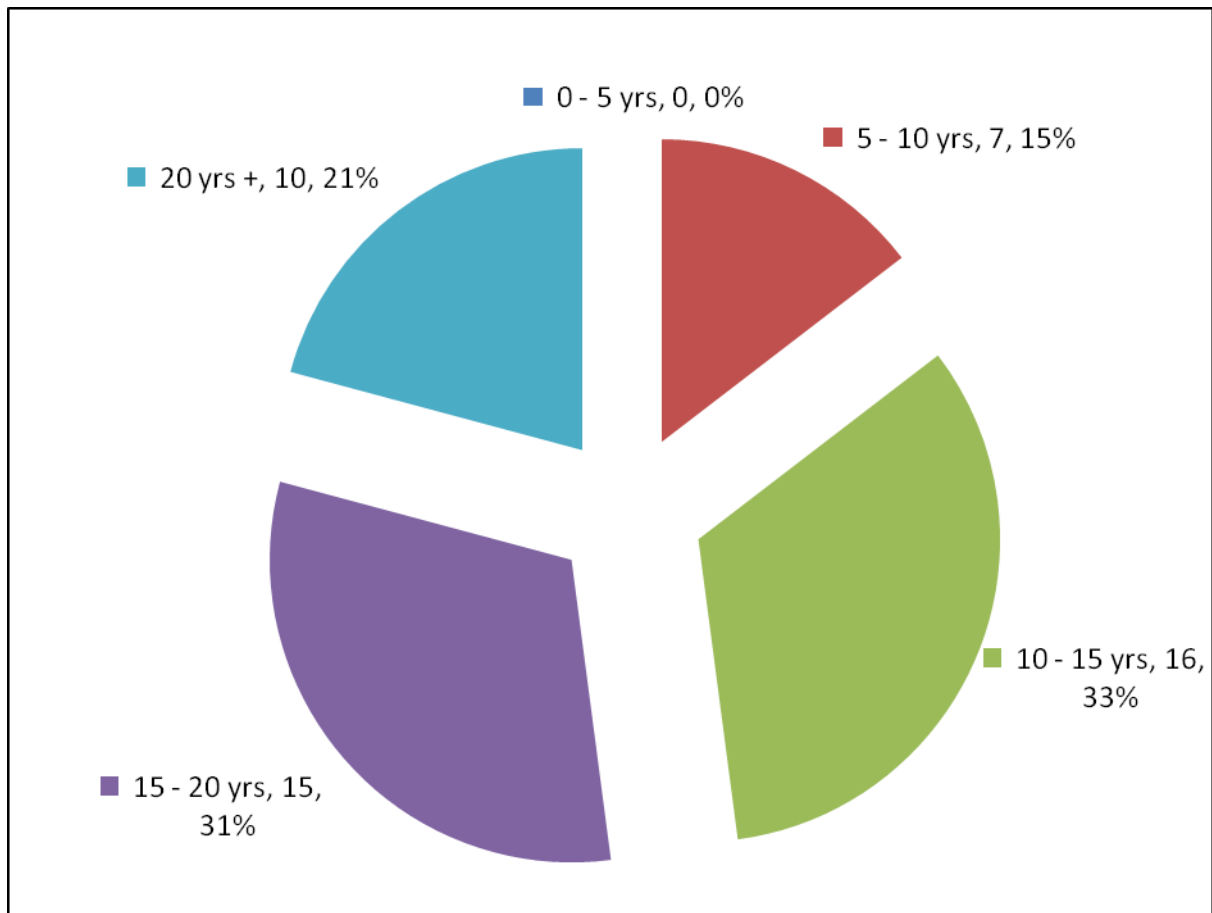
Experience	0 - 5 yrs	5 - 10 yrs	10 - 15 yrs	15 - 20 yrs	20 yrs +
Respondents	0	7	16	15	10
%	NA	15%	33%	31%	21%

$n = 48$

The results indicated that a more senior or experienced individual attended the conferences. Nobody with less than 5 years of experience attended. The overall majority, 85% (33% + 31% + 21%) of respondents, had 10 or more years of experience in their respective industries. This is as expected for a conference that concentrated on outsourcing and partnering. The same apply for disruptive innovation in the pharmaceutical industry. These activities are normally undertaken by more experienced employees, or individuals in senior decision making positions in their respective industries.

Graph 1 illustrates the experience of the respondents in their respective industries in a pie chart format.

Graph 1: Years experience in your industry



Question 1.2 addressed the level of experience the respondents have in their current role.

Question 1.2: How many years of experience do you have in your current role?

Participants could choose one from five experience levels in years, starting at 0 to 2 years increasing in multiple of 2 years. The results are listed in Table 2.

Table 2: Years of experience in current role

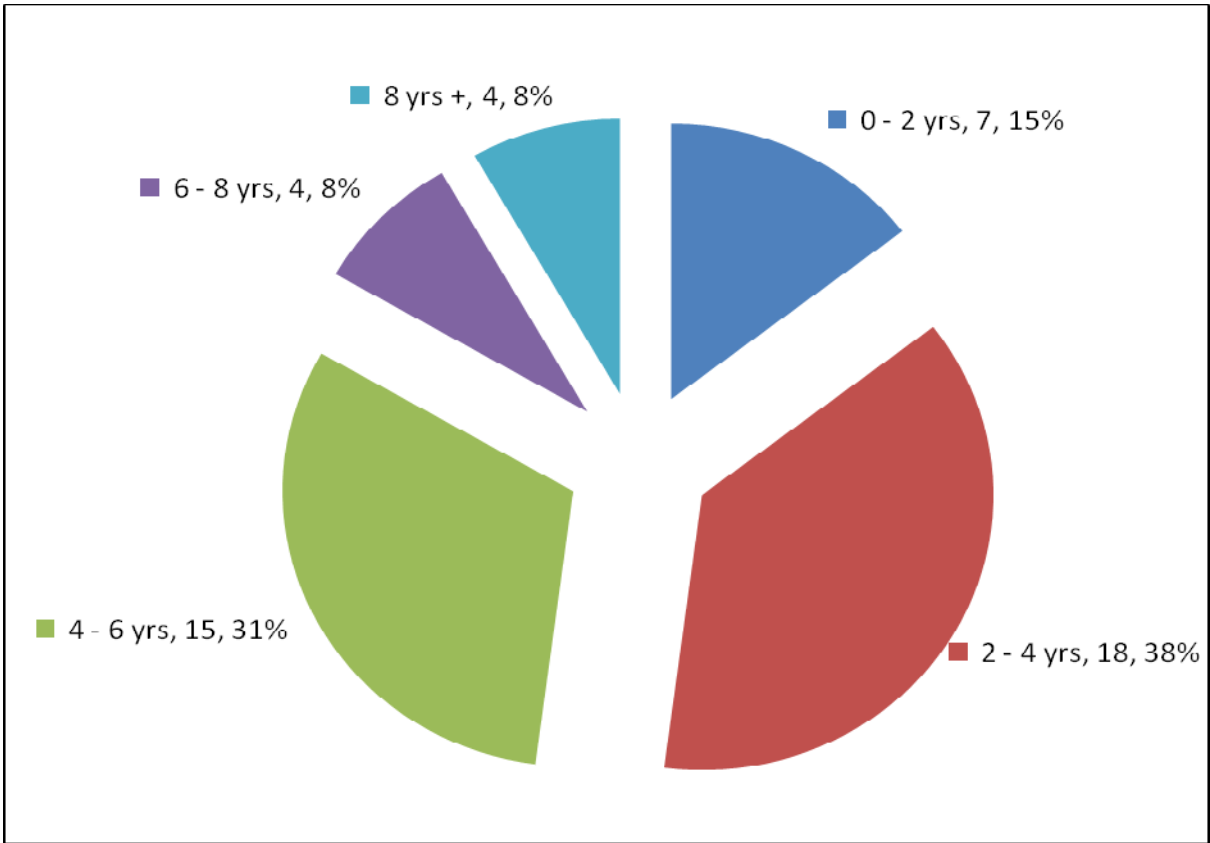
Experience	0 - 2 yrs	2 - 4 yrs	4 - 6 yrs	6 - 8 yrs	8 yrs +
Respondents	7	18	15	4	4
%	15%	38%	31%	8%	8%

n = 48

The level of experience of the respondents in their current role is more evenly distributed than the experience level of respondents in their respective industries. There is however clearly more respondents with less experience (4 years or less, groups 0 to 2 years and 2 to 4 years, which represent 53% of respondents) than 6 years or more (groups 6 to 8 years and 8 years plus, which represent 16% of respondents).

Graph 2 illustrates the experience of the respondents in their current role in a pie chart format.

Graph 2: Years experience in your current role.



It is difficult to draw a definitive conclusion from this uneven distribution between the levels of experience of respondents in their current role.

6.2 Primary objective measurements

The primary objective of this research project was to assess if the attendees at the selected two conferences experience the scientific environment in the UK was contributing to the (1) development and (2) adoption of stratified medicine. Due to the different key factors required for development and for adoption, these two processes were explored and analysed separately. Questions 3.1 and 3.2 assessed these two processes respectively.

For both questions 3.1 and 3.2 a statement was provided for which the attendees were asked to indicate their level of agreement. A score of 1 indicated that you strongly disagree and 10 that you strongly agree with the provided statement.

The results for question 3.1 (addressing development) is listed in Table 3.

Question 3.1:

*“The current scientific environment in the United Kingdom is contributing to the **development** of stratified medicine.”*

(1 = I strongly disagree and 10 = I strongly agree)

Table 3: Current scientific environment in UK contributing to the development of stratified medicine.

Number of respondents	41
Sum	284.5
Average	6.9
Standard deviation (σ)	1.5

The results for question 3.2 (addressing adoption) is listed in Table 4.

Question 3.2: “The current scientific environment in the United Kingdom is contributing to the adoption of stratified medicine.”

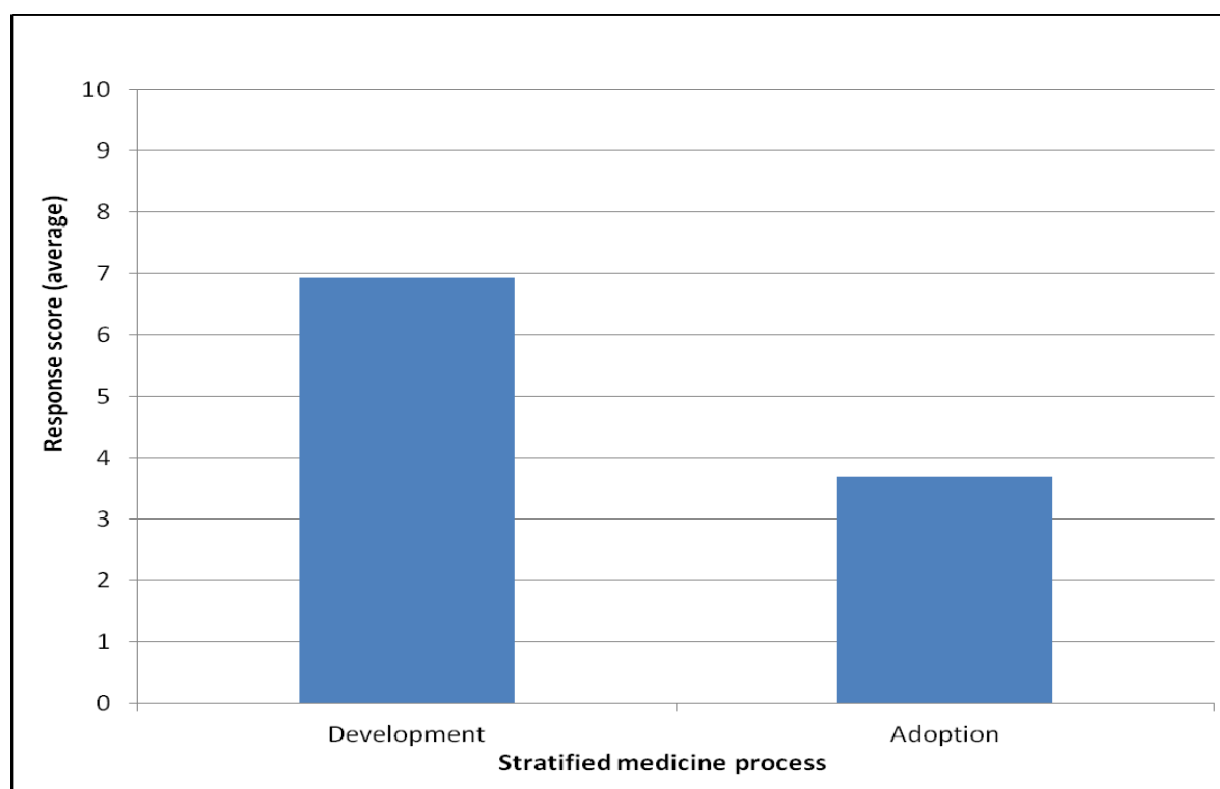
(1 = I strongly disagree and 10 = I strongly agree)

Table 4: Current scientific environment in the UK contributing to the adoption of stratified medicine.

Number of respondents	41
Sum	151.5
Average	3.7
Standard deviation (σ)	1.6

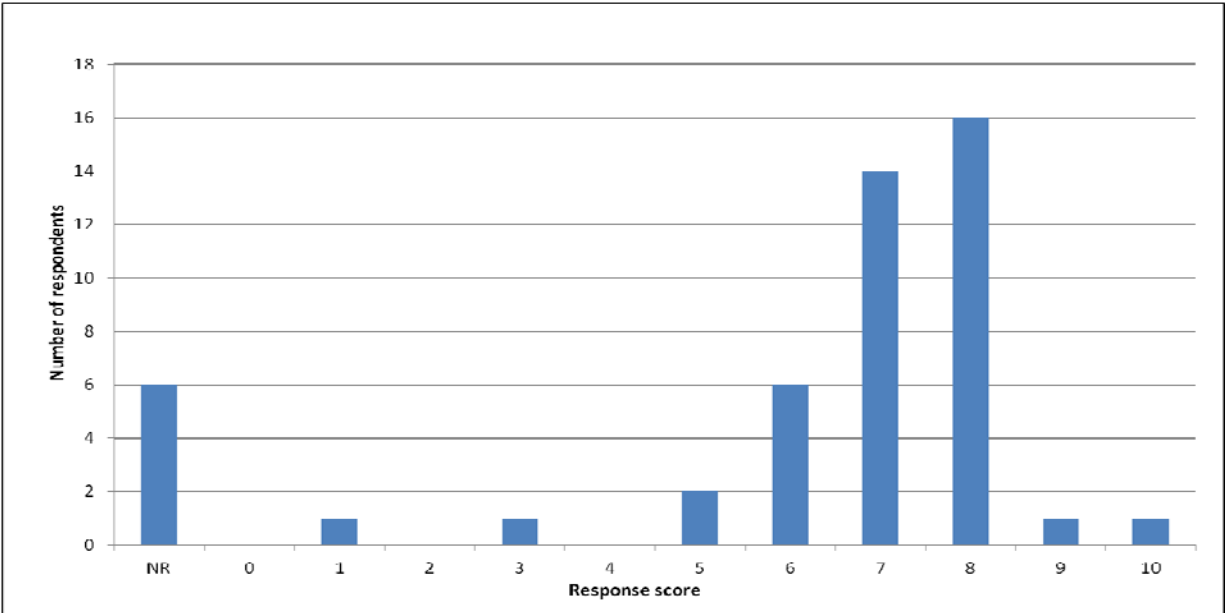
There was a significant difference in the average for development at 6.9 ($\sigma = 1.5$) and adoption at 3.7 ($\sigma = 1.6$). The respondents were clearly of the opinion that the environment in the UK is more favourable for the development than adoption of stratified medicine. Graph 3 compares the averages in a bar chart format.

Graph 3: Average score for development and adoption for all the respondents.

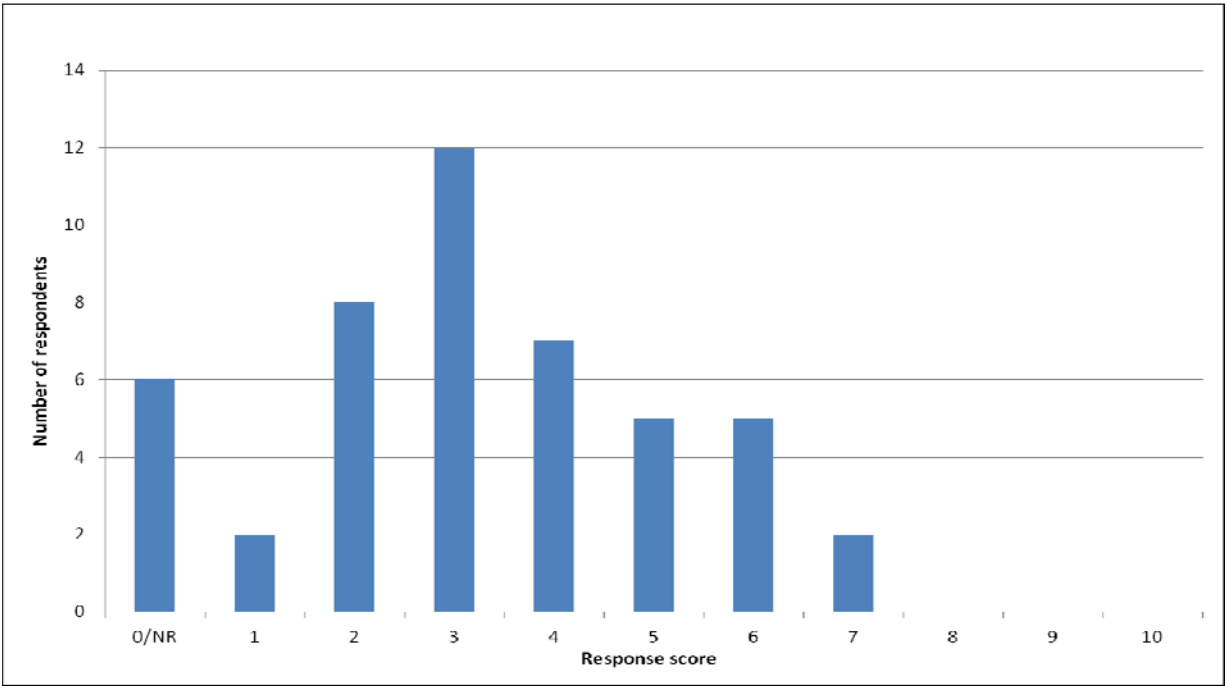


Graph 4 and 5 contain more detail and provide the number of respondents for each response score for development and adoption.

Graph 4: Scientific environment in the UK is contributing to the development of stratified medicine.



Graph 5: Scientific environment in the UK is contributing to the adoption of stratified medicine.



There is an obvious and significant difference between development and adoption, in both the averages as well as the distribution of the individual scores for each process.

93% (38 out of 41) of the respondents rated the scientific environment in the UK to be contributing to the development of stratified medicine with a score of 6 or higher. For the adoption of stratified medicine only 17% (7 out of 41) of the respondents scored the environment 6 or higher.

70% (29 out of 41) of the respondents rated the scientific environment in the UK to be contributing to the adoption of stratified medicine with a score of 4 or lower. For the development only 5% (2 out of 41) of the respondents scored the environment 4 or lower.

It is also interesting to note that no respondent scored the scientific environment as contributing to the adoption with a score higher than 7.

A plausible reason for the higher average and concentration of higher scores for development of stratified medicine by the respondents is because development correlates directly with research and development in the pharmaceutical industry. The respondents are well familiar with those functions as a significant number of respondents have research and development responsibilities. The development of stratified medicine, and development as a process is also more introspective within the pharmaceutical industry and less dependent on collaboration, or at most a limited number of carefully selected external partners. Adoption of stratified medicine only occurs after the development processes have been completed and the acceptance of evidence based outcomes and results. A regulatory authority and numerous independent groups, which were unlikely to have been involved during the development process, are required to endorse and adopt the relevant new stratified treatment regimen. This is a more complex process with require change from the current accepted procedure and might also encounter vested interest to not change. There is also less control over the adoption process than there is during the development process.

A second reason for the significant difference might be the slower pace at which regulatory authorities adjust to new development or treatment regimens in the pharmaceutical market. New stratified treatment might have been developed, but the delay in evaluating and adopting new treatment regimens is probably expressed by

the respondents as a more negative perception of the scientific environment in the UK regarding the adoption of stratified medicine.

6.3 Secondary objective measurements

The secondary objective of this research report was to determine which of the key factors required for the development and adoption of stratified medicine was experienced to be the biggest obstacles in the current scientific environment. Due to different key factors required for development and for adoption, these two processes will be explored and analysed separately.

Questions 4.1 and 5.1 provided a list of known key factors required for the development and adoption of stratified medicine. Questions 4.2 and 5.2 gave the respondents the opportunity to provide additional key factors if they were of the opinion not all factors were addressed in the lists provided with questions 4.1 and 5.1.

Question 4.1:

Please rate below mentioned established key factors according to their obstacle value in the development of stratified treatment options in the UK.

(rating of 1 = least obstructive, rating of 10 = most obstructive)

The responders could choose from the following key factors required for the development of stratified medicine.

Key Factors
Availability of suitable technology and engineering
Sufficient skill base in certain medical disciplines
The lack of a collaborative relationship across the healthcare industry
The lack of an approach of prediction and prevention in the healthcare industry
The current reimbursement environment
The lack of communication and dialogue between regulatory authorities
Challenges in the assessment of clinical effectiveness of stratified medicine

The results for question 4.1 (addressing the key factors require for development) are listed in Table 5.

Table 5: Key factors required for the development of stratified medicine.

Key factors	Availability of technology & engineering	Medical skill base	Lack of collaboration in industry	Lack of prediction & prevention	Reimbursement environment	Lack of comm & dialogue among RA	Assessment of clinical effectiveness
Respondents	40	40	40	39	40	40	39
Average	3.5	3.6	7.2	6.8	7.6	7.6	4.1
Standard deviation	1.8	1.6	1.7	1.7	1.1	1.7	1.4

Three key factors scored lower than 5, and are therefore considered to be the least obstructive. The remaining four factors all scored higher than 6 and are considered to be the more obstructive key factors. It is noticeable that the three least obstructive factors (listed below) all have technology or technical ability in common.

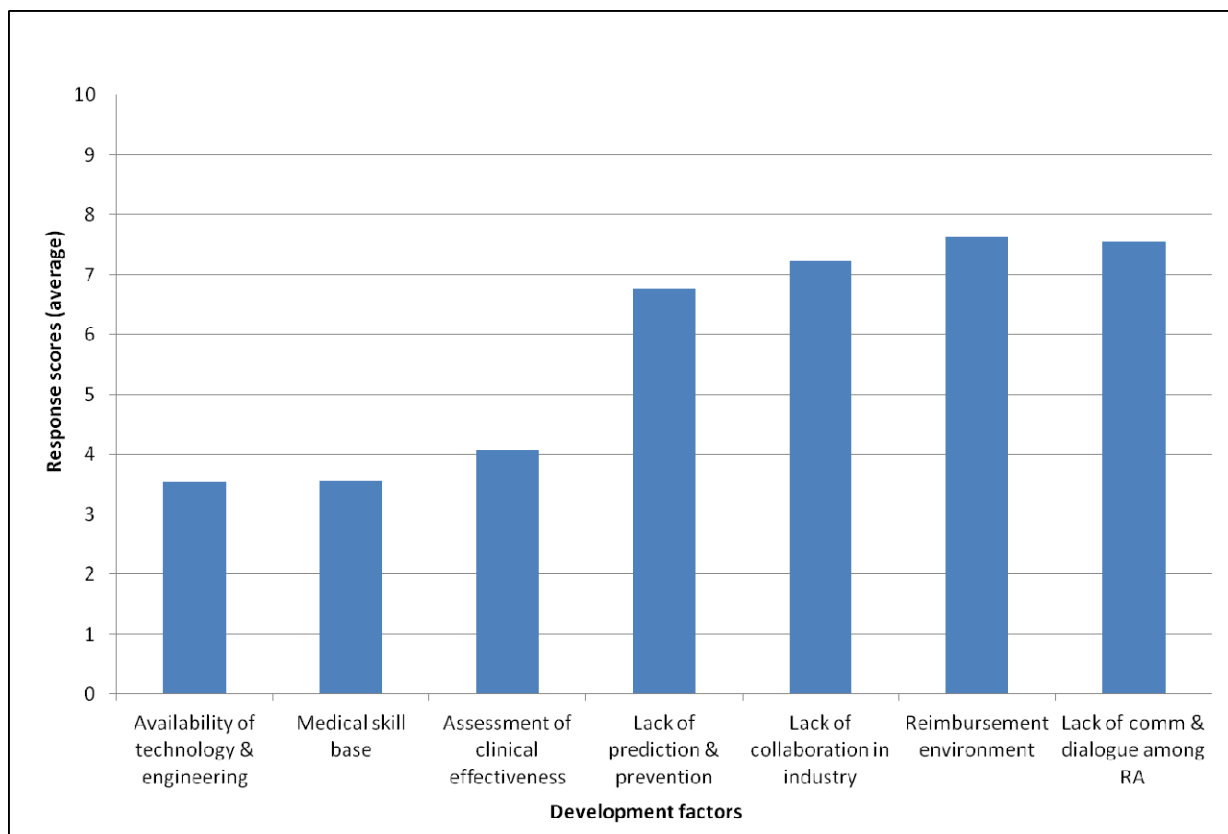
- Availability of suitable technology and engineering, score of 3.5.
- Sufficient skill base in certain medical disciplines, score of 3.6.
- Challenges in the assessment of clinical effectiveness of stratified medicine, score of 4.1.

This indicates that respondents were of the opinion that the technology to develop stratified medicine is not considered an insurmountable obstacle.

The remaining four factors that scored a higher obstacle value all have in common the lack of communication, collaboration and effective transfer of information among the respective key stakeholders.

Graph 6 present the key factors required for development from least obstructive to most obstructive in a bar chart format.

Graph 6: Factors that impact development of stratified medicine (least to most obstructive).



Only 6 respondents provided additional key factors as requested in questions 4.2. These are listed below with the obstacle value in brackets.

- NHS (10)
- Admin red tape (8)
- Cost (no value)
- Diagnostic procedure for validation (3.5)

- Not enough useful research generic code to identify patient stratification (7)
- Not enough collaboration between big/med pharm and diagnostic companies to develop (7)

Question 5.1 provided the list of known key factors required for adoption and asked the respondents to assign obstacle value to each.

Question 5.1:

Please rate below mentioned established key factors according to their obstacle value in the adoption of stratified treatment options in the UK.

(rating of 1 = least obstructive, rating of 10 = most obstructive)

The responders could choose from the following key factors required for the development of stratified medicine.

Factors
The lack of the required skill base in health economics and associated skills
The lack of an approach of prediction and prevention healthcare approach
Increased treatment complexity is not reimbursed for the healthcare provider
A focus on short term cost and not long term savings
The lack of a collaborative relationship across the different stakeholders
The lack of a robust link between evaluation and procurement
The lack of an accurate assessment and valuation of stratified medicine and the companion diagnostic

The results for question 5.1 (addressing the key factors required for adoption) are listed in Table 6.

Table 6: Key factors required for the adoption of stratified medicine

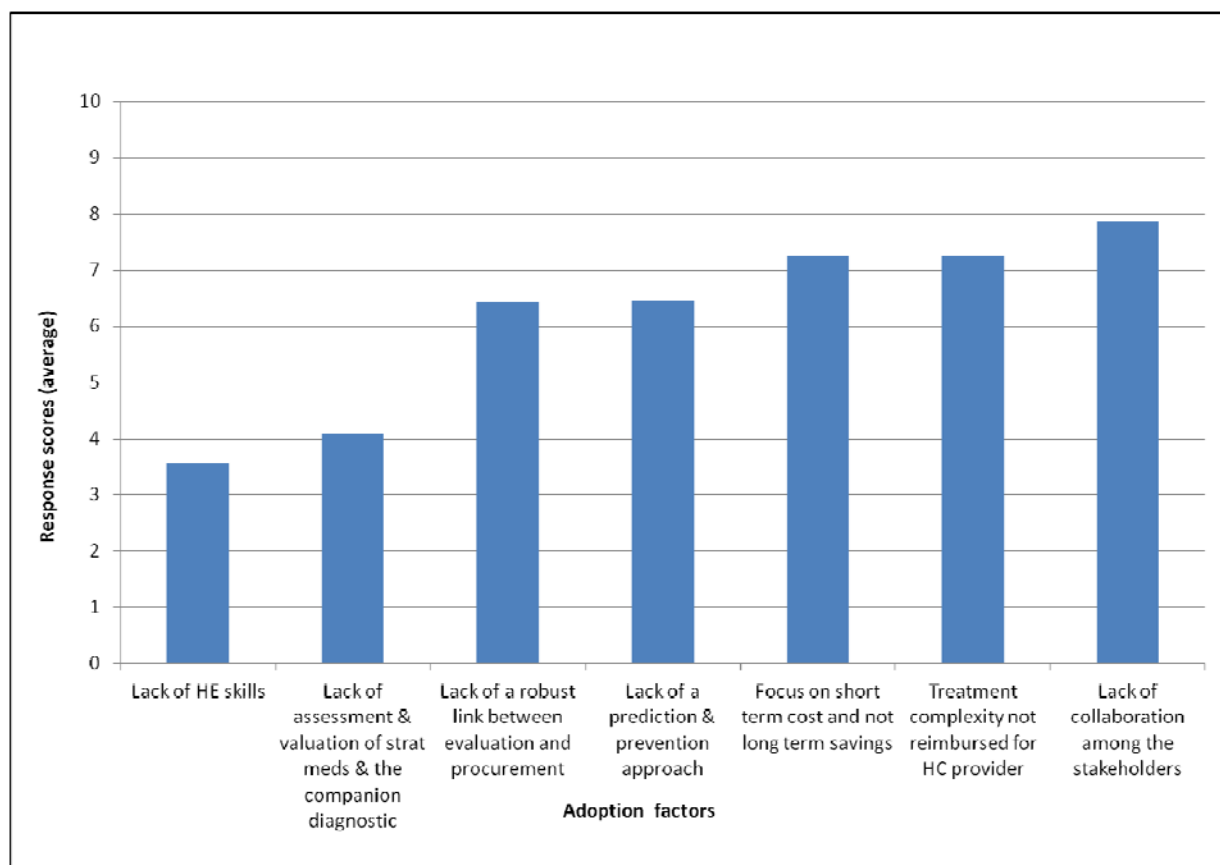
Key factors	Lack of HE skills	Lack of a prediction & prevention approach	Treatment complexity not reimbursed for HC provider	Focus on short term cost and not long term savings	Lack of collaboration among the stakeholders	Lack of a robust link between evaluation and procurement	Lack of assessment & valuation of stratified medicine & the companion diagnostic
Respondents	37	37	36	37	37	37	37
Average	3.6	6.5	7.3	7.2	7.9	6.4	4.1
Standard deviation	1.6	1.6	1.3	1.5	1.2	1.2	1.7

Based on the average obstacle value the key factors can be divided into two clearly defined groups. The less obstructive group scoring lower than 5, and the more obstructive group scoring higher than 6. It is noticeable that the two least obstructive factors (listed below) all have technology or technical ability in common. Similar to the least obstructive factors required for the development of stratified medicine.

- The lack of the required skill base in health economics and associated skills, score 3.6.
- The lack of an accurate assessment and valuation of stratified medicine and the companion diagnostic, score 4.1.

Graph 7 present the key factors required for adoption from least obstructive to most obstructive in a bar chart format.

Graph 7: Factors that impact adoption of stratified medicine (least to most obstructive).



The remaining four factors that scored a higher obstacle value all have in common the lack of communication, collaboration and effective transfer of information between the respective stakeholders involved in the adoption of stratified medicine.

Only 2 respondents provided additional key factors as requested in questions 5.2. These are listed below with the obstacle value in brackets.

- NHS (10)
- Admin red tape (8)

The least obstructive three key factors for development and the two least obstructive key factors for adoption is similar in the sense that it can be interpreted that “the sciences and scientist is not the problem”.

The most obstructive key factors for both development and adoption all have in common the lack of communication and collaboration and the financial environment that is not contributing to for the development and adoption of stratified medicine.

7 CONCLUSION

The outcome of the primary measurement clearly indicates that the respondents definitely assess the environment in the UK to be much more favourable for the development of stratified medicine than for the adoption of stratified medicine. The average score for development is 6.9 ($\sigma = 1.5$) compare to 3.7 ($\sigma = 1.6$) for adoption, where the higher average indicate an agreement from the respondents that the environment in the UK is contributing to either development or adoption.

The secondary measurement clearly indicated the respondents assessed the science, the scientist ability and knowledge were the least obstructive factors for both development and adoption processes of stratified medicine. The three least obstructive factors for development were (1) availability of suitable technology and engineering, (2) sufficient skill base in certain medical disciplines and (3) challenges in the assessment of clinical effectiveness of stratified medicine. The two least obstructive factors for adoption were (1) the lack of the required skill base in health economics and associated skills and (2) the lack of an accurate assessment and valuation of stratified medicine and the companion diagnostic. All of these least obstructive factors for both development and adoption have science (ability and knowledge) as a common factor. The secondary measurement also clearly identified a common factor for the most obstructive key factors for both development and adoption as the lack of communication, collaboration and effective information sharing among the key stakeholders.

The secondary measurement outcomes (science is the least obstructive factors for both development and adoption) therefore support the primary measurement outcome (the environment is more favourable for the development than for adoption) because the science is integral for the development of stratified medicine. The secondary

measurement outcomes provide further support by indicating that communication, collaboration and effective information sharing is the most obstructive key factors, all of which is essential for the adoption of stratified medicine.

The primary and secondary measurement outcomes thus indicate that the scientific environment in the UK is more favourable for the development of stratified medicine than for the adoption. The highest rated obstructive key factors are all related to adoption and not development.

8 LIMITATIONS

The project had the following limitations and shortcomings.

8.1 Sample selection

The selected sample could have been more representative and focused on the scientific environment in the UK regarding stratified medicine if the following conditions could have been met.

The conference held on the 4th and 5th of March 2014 at the Park Plaza Victoria in London also had attendees from outside of the UK. This might have only been a relative small number of attendees, but it still diluted the focus of the responses which was as a result not exclusively focused to the scientific environment only in the UK.

The conferences focus on outsourcing, partnering and disruptive innovation, which is process and building blocks required for stratified medicine, but the focus on stratified medicine could have been more concentrated if the conferences were exclusively focused on stratified medicine.

8.2 Study design

The project could have been more representative of the study population if the study questionnaire were distributed at more than two parallel run conferences. The project would have benefitted from distributing the questionnaires at regular intervals. The

first sample should have been taken as close as possible to the SMIP launch in October 2010. An annual distribution at an appropriate conference would have allowed the researcher to identify and explore any trends that might have revealed it.

9 RECOMMENDATIONS

The researcher has made the following recommendations for future projects regarding the development and adoption of stratified medicine in the UK.

- o It is highly recommended that more and dedicated time is allowed for the conference attendees to complete the questionnaire. This will result in more attendees responding and a more representative sample.
- o If more time is available to complete the questionnaire it would also be recommended that questions addressing and exploring solutions of how to improve the environment for the development and adoption of stratified medicine are included in the questionnaire.
- o It would be highly beneficial to collaborate with the SMIP in projects of this nature in the future. The SMIP might be sensitive regarding the specific questions, but the benefits of working with the SMIP and conductive objective research should prevail.

8 REFERENCES

- Academy of Medical Sciences, Roche and GE Healthcare. (2007) Optimizing stratified medicines R & D: addressing scientific and economic issues. Available: <http://www.acmedsci.ac.uk/download.php?file=/images/event/stratifi.pdf> [Accessed: 30.08.2011]
- Blair, E.D, Clarke, B.R and O'Neill, T. (2008) Developing stratified medicines in the UK. Available: www.onenucleus.com/download.aspx?id=1308 [Accessed: 30.08.2011]
- Cressey, D. (2011) Britain to launch personalised medicine project. *Nature News*. Available: <http://www.nature.com/news/2011/110826/full/news.2011.508.html> [Accessed: 17.09.2011]
- Langreth, R and Waldholz, M. (1999) New are of personalised medicine. *The Oncologist*: 4, 426-427.
Available: http://people.bu.edu/mfk/person_med.pdf [Accessed: 17.09.2011]
- Mansell, P. (2010) UK launches Stratified Medicines Innovation Platform. Available: http://www.pharmatimes.com/Article/10-10-14/UK_launches_Stratified_Medicines_Innovation_Platform.aspx [Accessed: 30.08.2011]
- Mansell, P. (2011) Technology Strategy Board awards £5.8 million for stratified medicine projects. Available: http://www.pharmatimes.com/Article/11-06-14/Technology_Strategy_Board_awards_£5_8_million_for_stratified_medicine_projects.aspx [Accessed: 30.08.2011]
- Megget, K. (2011) Clinical trials need an overhaul for personalised medicine to advance. Available: http://www.pharmatimes.com/Article/11-03-08/Clinical_trials_need_an_overhaul_for_personalised_medicine_to_advance.aspx [Accessed: 30.08.2011]
- Technology Strategy Board. Stratified Medicine Workshop. (2010) Stratified Medicine: Pathways to Partnership in Therapeutic-Diagnostic Development. Available:
<http://www.bing.com/search?q=Stratified+Medicine%3A+Pathways+to+Partnership>

+in+Therapeutic-Diagnostic+Development.&src=IE-SearchBox&FORM=IE8SRC

[Accessed: 30.08.2011]

- Technology Strategy Board. (2011) Stratified Medicine in the UK. Vision and Roadmap. Available: http://www.innovateuk.org/assets/pdf/publications/roadmap_stratifiedmedintheuk%20final.pdf [Accessed: 21.01.2012]
- Trusheim, M.R, Berndt, E.R and Douglas, F.L. (2007) Stratified medicine: strategic and economic implications of combining drugs and clinical biomarkers. *Nature Reviews Drug Discovery*, 6, 287-293.
- Trusheim, M.R., Burgess, B., Hu, S.X., Long, T., Averbuch, S.D., Flynn, A.A., Lieftucht, A., Mazumder, A., Milloy, J., Shaw, P.M., Swank, D., Wang, J., Berndt, E.R., Goodsaid, F. & palmer, M.C. (2011) Quantifying factors for the success of stratified medicine. *Nature Reviews Drug Discovery*, 10, 817-833.
- UK Pharmacogenetics and Stratified Medicine Network. Available: <http://www.uk-pgx-stratmed.co.uk/> [Accessed: 25.08.2012]
- The stratification of disease for personalized medicine. Vision paper, September 2014. Available: http://www.abpi.org.uk/our-work/library/medical-disease/Documents/strat_med.pdf [Access: 06.09.2015]
- Unlock Your Global Business Potential. UK Stratified Medicine, April 2013. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/301775/UK_Stratified_Medicine.pdf [Access: 13.09.2015]

9 APPENDICES

Appendix 1: WITS ethics approval

Appendix 2: Study questionnaire

Appendix 3: Information document

Appendix 4: Approval from conference organisers



R14/49 Mr van Zyl D. Engelbrecht

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M140270

NAME: Mr van Zyl D. Engelbrecht
(Principal Investigator)

DEPARTMENT: Pharmacy and Pharmacology
7th Annual Clinical Outsourcing & Partnering World Europe
and Disruptive Innovation in Clinical Trials
Conferences held in London at the Victoria

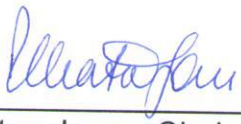
PROJECT TITLE: An Assessment if the Current Scientific Enviroment in
the United Kingdom is contributing to the development and
adoption of stratified medicines

DATE CONSIDERED: 28/02/2014

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR: Prof Andries Gous

APPROVED BY: 
Professor PE Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 26/03/2014

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.**

Principal Investigator Signature _____

Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Development and adoption of stratified medicine questionnaire

1. Questions about the individual and who you represent.

1.1. How many years of experience do you have in your industry?

0 - 5yrs	5 – 10yrs	10 – 15yrs	15 – 20yrs	20yrs +

1.2. How many years of experience do you have in your current role?

0 - 2yrs	2 – 4yrs	4 – 6yrs	6 – 8yrs	8yrs +

1.3. How would you describe your current role?

--

1.4. Which stakeholder do you represent? (Mark all that apply)

Academia (you are primarily engaged in higher education and research)	
Industry (biotechnology, pharmaceutical, contract research organisation, vendor or diagnostic company)	
Healthcare professional (doctor, nurses, pharmacists and other providers of healthcare to patients)	
Healthcare regulator (ethics committee, regulatory authority or other healthcare regulatory capacity)	
Other (please provide details).....	

2. Questions regarding your involvement in the United Kingdom stratified medicine initiatives.

Please draw a circle around your response.

2.1. Have you heard or work with the UK Technology Strategy Board (TSB)? Yes / No

2.2. Have you heard or work with the Stratified Medicine Innovation Platform (SMIP) Yes / No

2.3. Are you aware that the SMIP is a five-year programme that aim to accelerate the development and uptake of stratified medicine in the UK? Yes / No

3. Questions assessing your opinion of the current scientific environment in the United Kingdom.

3.1. Please indicate your level of agreement with the below mentioned statement.

1 = I strongly disagree and 10 = I strongly agree.

“The current scientific environment in the United Kingdom is contributing to the development of stratified medicine.”

My response =

3.2. Please indicate your level of agreement with the below mentioned statement.

1 = I strongly disagree and 10 = I strongly agree.

“The current scientific environment in the United Kingdom is contributing to the adoption of stratified medicine.”

My response =

4. Your experience of which key factors impact on the DEVELOPMENT of stratified medicine in the United Kingdom.

4.1. Please rate below mentioned established key factors according to their obstacle value in the development of stratified treatment options in the UK.

(rating of 1 = least obstructive, rating of 10 = most obstructive)

Key Factors	Obstacle value
Availability of suitable technology and engineering	
Sufficient skill base in certain medical disciplines	
The lack of a collaborative relationship across the healthcare industry	
The lack of an approach of prediction and prevention in the healthcare industry	
The current reimbursement environment	
The lack of communication and dialogue between regulatory authorities	
Challenges in the assessment of clinical effectiveness of stratified medicine	

4.2. Please provide any other key factors that impact on the DEVELOPMENT of stratified medicine in the UK and assign an obstacle value.

(rating of 1 = least obstructive, rating of 10 = most obstructive)

Key Factors	Obstacle value

5. Your experience of which key factors impact on the ADOPTION of stratified medicine in the United Kingdom.

5.1. Please rate below mentioned established key factors according to their obstacle value in the adoption of stratified treatment options in the UK.

(rating of 1 = least obstructive, rating of 10 = most obstructive)

Factors	Obstacle value
The lack of the required skill base in health economics and associated skills	
The lack of an approach of prediction and prevention healthcare approach	
Increased treatment complexity is not reimbursed for the healthcare provider	
A focus on short term cost and not long term savings	
The lack of a collaborative relationship across the different stakeholders	
The lack of a robust link between evaluation and procurement	
The lack of an accurate assessment and valuation of stratified medicine and the companion diagnostic	

5.2. Please provide any other key factors that impact on the ADOPTION of stratified medicine in the UK in order of their obstacle value.

(rating of 1 = least obstructive, rating of 10 = most obstructive)

Factors	Obstacle value

INFORMATION DOCUMENT

Study title: An assessment if the current scientific environment in the United Kingdom is contributing to the development and adoption of stratified medicines.

Dear Sir / Madam

Introduction:

I am doing research on the development and adoption of stratified medicine in the UK. In this study I want to learn about the factors that impact on the development and adoption of stratified medicine in the UK.

Invitation to participate:

As a participant at the 7th Annual Clinical Outsourcing & Partnering World, and Disruptive Innovation in Clinical Trials conference, I am asking you to please complete the attached questionnaire consisting out of 13 questions.

What is involved in the study:

If you choose to participate you would be required to complete the attached questionnaire. It consists out of 13 questions and should take approximately 5 minutes to complete. The questionnaire asks about your experience in the clinical research industry and your perception of factors impacting on the development and adoption of stratified medicine in the UK.

Participation is voluntary:

Refusal to participate will involve no penalty or loss of benefits which you might receive as attendee of this conference.

Reimbursements:

You will not be reimburse to complete the questionnaire.

Confidentiality:

No personal identification information is collected and no effort will be made to identify any individual that completed the questionnaire.

From: Engelbrecht, Van Zyl
Sent: 08 October 2013 16:10
To: 'Christopher Sanders'
Subject: RE: Clinical Outsourcing and Partnering World 2014 : Presentation brief

Dear Chris

Delighted to hear that.

I am fine with the questionnaire being on the tables / chairs.

Regards

Van Zyl Engelbrecht

From: Christopher Sanders [<mailto:csanders@healthnetworkcommunications.com>]
Sent: 08 October 2013 11:24
To: Engelbrecht, Van Zyl
Subject: RE: Clinical Outsourcing and Partnering World 2014 : Presentation brief
Importance: High

Dear Van Zyl,

Having spoken to management here at HNC I am delighted to let you know that we would be happy to help distribute your questionnaire at the conference. We would prefer to have the questionnaire either on tables or on the chairs of delegates rather than inside the welcome pack itself. This is due to the fact that our sponsors often pay to have their branding on the welcome pack and might object to having something included in it "for free" from another party.

Do let me know your thoughts on this.

Also when you have a moment please could you send through a short biography of yourself and a photograph for use in our brochure.

Kind regards,

Chris

From: Christopher Sanders
Sent: 02 October 2013 10:24
To: 'Engelbrecht, Van Zyl'
Subject: RE: Clinical Outsourcing and Partnering World 2014 : Presentation brief

Dear Van Zyl,

Thank you for your email – I look forward to receiving your photo and bio in the near future.

I will check with my management regarding the possibility of including a questionnaire on translational medicine – I am not sure we have done this for a speaker previously.

Kind regards,
Chris

APPROVAL
✓

ZZ