

Abstract

With the aging population and increase in chronic disease conditions, innovation to transform treatment pathways and service delivery will be necessary. The innovation adoption process however, can take 15 years before widespread adoption occurs in most healthcare systems. Current UK government policies to increase the facilitation of innovation adoption are under way. The aim of this study is to explore perceptions of tri-sectoral collaborations in the healthcare sector. The data in the study are drawn from a cross-sectional survey conducted in 2015 of professionals in academia, industry and the healthcare sectors in England, focusing on Diabetes care. Academia and healthcare respondents had the least work experience outside of their sectors compared to the industry respondents. Healthcare and academia respondents rated the industry sector less trustworthy, unethical, having different goals and less understanding of the other sectors. Industry respondents had a more positive perspective towards potential collaborators. The results from the study demonstrate greater potential challenges to tri-sectoral collaborations and the government's knowledge translation policy, due to pre-conceived notions and lack of understanding of other sectors. The purely structural approach of establishing government mandated translational networks may be insufficient without active attempts to improve collaborative relationships. Mechanisms to facilitate trust building and collaboration are proposed.

Keywords: tri-sectoral collaboration; knowledge translation; knowledge broker; innovation adoption; diabetes care; perceptions

1. Introduction

The UK National Health Service (NHS) is recognised for its invention of treatments and products, however the adoption and sustainability of inventions within the NHS has been relatively poor and many innovations fail to achieve widespread use [1]. Faced with a healthcare funding crisis to provide service and care to a growing, aging population, the technological deficit in the NHS remains apparent [2]. Innovation adoption has been a recent focus in English health policy to promote innovation and efficient knowledge translation to effectively adopt and sustain promising innovations across the healthcare sector. Recent English health policy has sought to address these gaps in translation [3] and consequently, government organised initiatives have established tri-sectoral collaborations between the academic, industrial and healthcare sectors, notably the Academic Health Science Networks (AHSNs). These have the potential to transform care delivery in the long-term through a more efficient process

from laboratory to bedside. Investment in and development of tri-sectoral collaborations has grown in the UK, making them an important focus of attention. However, previous research has predominantly focused on bi-sectoral partnerships, such as between the university and the healthcare sectors [4, 5]. This article addresses this research gap by exploring the perceptions of members of academia, industry and healthcare to collaborate in innovation adoption.

1.1. Knowledge translation policy and inter-sectoral collaboration initiatives in healthcare

The 2006 Cooksey report for the UK government examined a linear model from research to bedside and identified two translational gaps in the process, namely the translation of clinical and basic research to product development and the implementation of products to clinical practice [3]. In particular, government attention focused on the slow rate of delivery from proven efficacy to widespread adoption, taking up to 15 years [6]. There have been numerous attempts to address both these translational gaps through mandated policies to create translational networks with designated responsibilities to improve collaboration and innovation adoption by facilitating inter-sectoral partnerships.

Academic Health Science Centres (AHSCs) (and variants of it) were early examples of networks to partner academic institutions with healthcare providers to promote research, teaching and education. The formation of AHSCs is an international phenomenon and can be found in the Netherlands [7], US [8], Canada [9] and Australia [10] as well as the UK demonstrating the international significance of collaboration between sectors. In the context of the translational gap, AHSCs are focussed on the first translational gap from research to product development to encourage collaboration during the earlier translational research processes, however researchers suggest the organisational infrastructure to achieve the mission is unclear [8, 11].

In the UK, government has issued a series of policies intended to address the slow uptake of innovation in healthcare, pointing out the potential for such adoption to actively contribute to wealth creation [1, 12]. Significant changes were introduced into the NHS infrastructure through the “Health and Social Care Act 2012” [13] and bodies previously responsible for innovation in the healthcare system were abolished. The Innovation, Health and Wealth report [1] proposed novel networks to facilitate innovation and collaboration, such as the Collaborations for Leadership in Applied Health Research and Care (CLAHRCs) and Academic Health Science Networks (AHSNs). AHSNs were given flexibility and had no mandated governance structures. Drawing on models such as the ‘triple helix’ model [14] which

emphasized that innovations in many sectors are increasingly co-produced, the government's clear intention was that these newly created networks should enable inter-sectoral collaboration, including with the private sector. The strategic national importance of life sciences was at the forefront in these policies.

1.2. Knowledge translation and the potential complexities of tri-sectoral collaborations

A considerable body of recent research on innovation diffusion and knowledge mobilization in healthcare builds on prior research. Ferlie, Crilly, Jashapara and Peckham [15] offer a useful review of this research, which identifies the varied phases of the innovation process from the earlier phases of knowledge creation through phases of development to later processes of innovation adoption and diffusion. It is the attributes and dimensions of these latter phases of adoption and diffusion with which this article is concerned. Innovation diffusion involves the transfer of ideas and practices from one context to another, described as knowledge translation. What works well in one context may not work well in another. So, adaptation, knowledge sharing and knowledge translation are core elements of diffusion and transfer. Many issues inherent in the diffusion and implementation of innovations relate to the capacity of the healthcare system to adapt and utilize knowledge. Thus knowledge mobilization is more than the dissemination of research evidence; it is the active implementation of knowledge into practice [16]. Knowledge translation “..takes place within a complex system of interactions between researchers and knowledge users which may vary in intensity, complexity and level of engagement...” (pg. 46) [17]. Predominantly, research on innovation diffusion and knowledge translation in healthcare has focused within the health sector or on bi-partite collaboration between health and academia. The literature review from a recent study on AHSNs [18] reinforces this point. Our research project sought to explore a broader and more diverse set of collaborators in focusing on the perceptions of academia, industry and healthcare to collaboration in innovation adoption. Collaboration between individuals and groups from assorted backgrounds and experience presents challenges especially where as in this case, they have limited prior experience of working together. One prime challenge is the existence of epistemic boundaries between groups and within networks and this theme is discussed in the next section.

Epistemic cultures are ones in which similar values and socialization in groups means knowledge flows easily within the group [19, 20]. However, these same knowledge bases create ‘epistemic boundaries’

between different professional groups through lack of understanding and differing interpretations of ideas [21, 22]. Such epistemic boundaries lead to the non-spread of innovation due to a lack of collaboration between key parties [22]. Research thus underlines that collaboration is necessary for innovation diffusion. Studies of the CLAHRCs examined bi-sectoral collaboration and suggested professionals may experience 'psychological conflicts to identity' both on an individual and organisational level [23]. Bridging the epistemic boundaries requires a redistribution of power and the provision of knowledge outside of the professional network, and may face challenge for political and professional reasons [24-26]. Epistemic gaps were evident between clinical scientists and social scientists; emphasizing that inter-sectoral *and* inter-disciplinary collaboration adds greater complexity to processes of effective knowledge translation [27, 28]. Smith and Ward [29] and Fitzgerald and Harvey [27] have argued for the co-production of priorities between collaborators taking into account organizational strategies as well as innovation objectives.

If research on bi-sectoral collaboration evidences that there are significant challenges in driving effective collaboration between diverse disciplines, differing organizations and sectors driven by profit and public motives, what responses are beneficial? Knowledge brokering emerges from research findings as one method to facilitate knowledge translation and overcome epistemic boundaries [30-33]. Knowledge brokers have the potential to combine knowledge management, capacity building and linkages between varied professional groups [34, 35]. They aid knowledge transfer from one disciplinary group to another, and they can transform that knowledge from theory into practice through the range of activities in which they could be involved (i.e. identification and localisation of knowledge, redistribution and dissemination of knowledge and rescaling and transformation of knowledge) [36]. Knowledge brokers are potentially useful to bridge the knowledge gap, rather than relying on developing new skill sets to facilitate knowledge translational processes among the communities [37, 38].

In this paper, we offer exploratory research to address the gap in the literature regarding tri-sectoral collaborative relationships, which include the private sector in the innovation adoption process. We present empirical results from a questionnaire among respondents in industry, academia and healthcare.

2. Methods

The questionnaire was developed by combining information from two sources – a review of themes emerging from research on innovation adoption and knowledge translation and qualitative interviews that were conducted with key opinion leaders from healthcare, academia and industry. The interviews were coded and the results used to develop the quantitative questionnaire. The questions relating to potential barriers and facilitators sections result from the review of research and the analysis of the interviews. The questionnaire is constructed in five sections that explored on a rating scale, attitudes toward tri-sectoral collaborations and perceptions of each sector. The survey instrument first asked for respondents' demographic data, experience of collaboration and experience working in other sectors. The second section incorporated 5-point Likert scales asking respondents to score on a strongly disagree to strongly agree scale their views of potential barriers and facilitators to tri-sectoral collaboration. The third section used a 7-point semantic differential scale to rate the attitudes of respondents toward each sector. Lastly, the questionnaire asked open-ended questions about respondent's previous innovation collaboration experience. Some questions focused on Diabetes Mellitus (T2D), as a tracer issue. This chronic condition requires an estimated £14 billion per year in treatment and services for a 3.5 million patient population [39, 40]. The authors chose T2D as it requires a broad range of care and due to increased demand, it was attracting innovations such as the creation of specialist, patient self-help APPS. [41]. Open-ended questions were coded and analysed using the Framework method [42].

2.1. Ethics and recruitment

Ethical approval was granted by the Medical Sciences Interdivisional Research Ethics Committee (Reference Number: MS-IDREC-C1-2015-086). All participants read the study information sheet and gave informed consent prior to accessing the online questionnaire.

Participants from academia, industry and primary care in England were recruited through non-random sampling approaches. Academic respondents were recruited using purposive sampling techniques from Academic Health Science Centres and universities. Industry respondents were recruited using convenience sampling techniques from industry bodies and known contacts. NHS respondents were recruited using snowball sampling techniques from known contacts.

2.2. Sample size

The sample size was calculated based on an 80% power calculation for a large effect size ($f = .40$). The minimum number of respondents per group is 22 at 80%. All three groups exceeded the minimum number of respondents required for the study. The total number of respondents for each group was: academia ($n = 27$), industry ($n = 28$) and the NHS ($n = 26$).

2.3. Analysis

The demographics of the group and the 5-point Likert scales were analysed using descriptive statistics. A section of the administered questionnaire asked respondents to rate on a 7-point semantic differential scale their perception of attitudes by sector. The Kruskal-Wallis H test, was run to determine if there were differences in the sector attribute ratings between the three groups of respondents, separated by sector. The statistically significant mean ranks are reported in the results. Pairwise comparisons were performed using Dunn's procedure with a Bonferroni correction for multiple comparisons. Adjusted p-values are presented. Values are mean ranks unless otherwise stated.

A section of the administered questionnaire asked respondents to rate on a 7-point semantic differential scale their perception of attributes by individual sector. The semantic differential rating scale asked respondents to rate a set of 14 attributes for each sector. The reported means are converted from a 1-7 scale. The mid-point of 4 was changed to 0 and the scale was modified to -1 to -3 and 1 to 3. The results of the ratings were analysed and are reported in the Results section.

3. Results

3.1. Demographic background

The total number of respondents was 81. The age of the respondents ranged from 25 to 65+ years old. The largest age group was 35-44 year olds (40% of the total sample). The second largest age group was 45-54 year olds (28% of the total sample). When broken down by sector, the largest age groups for each sector were: industry (35-44 year olds, $n = 13$), academia (35-44 year olds, $n = 13$) and the NHS (45-54 year olds, $n = 10$).

Analysed by sex, the groups of male and female respondents were approximately equal. Males made up a slightly larger group of respondents, with 44 out of 81 respondents (54%). The female respondents were 37 out of 81 (46%). Males from industry and females from academia were the largest groups of respondents (16 and 14 respondents, respectively).

3.2. Previous collaboration and work experience

Respondents were asked about their previous collaboration experiences (see Figure 1). Nearly all the industry respondents had collaboration experiences with the NHS. The majority of NHS respondents had collaboration experience within their own sector. Approximately half of the NHS respondents had collaboration experience with either the academic or industrial sectors. Academic respondents had proportionately the most previous collaboration experiences with the NHS, followed by their own sector and industry. The industry sector had the largest number of respondents who collaborated with more than one sector.

Respondents were asked about their previous work experiences in another sector (see Figure 2). Industry respondents had the most work experience outside their sector. Most academic respondents had work experience in healthcare, with little experience in all three sectors. NHS respondents had the least experience outside their own sector and the least experience across all three sectors. Both the NHS and academic respondent groups had low numbers of respondents with industry work experience. It is evident from these findings that industry respondents had by far the broadest experience base whilst the NHS respondents had a narrow experience base.

Respondents reported considerable doubts and identified differences in motivations and understanding of other sectors:

“Greater transparency. Commercial and academic aims often differ considerably.”

(Academic respondent, M, 45-54)

“It would help if academics had more experience of the front line – sometimes it seems they have no idea at all.” (General Practitioner, Diabetes Lead for Clinical

Commissioning Groups, M, 55-64)

3.3. Attribute ratings for each sector

Respondents were asked about perceptions of each sector. Academic and NHS respondents' ratings of the industry sector significantly differed from industry respondents' rating of their own sector.

3.3.1. Perceptions of Academia

Overall, the sectors reported a similar rating in their perception of Academia. Most of the sector ratings were not statistically significant. The statistically significant attribute for Academia was 'Process focussed – Results focussed' [$\chi^2(2) = 8.479, p = .014$]. Industry respondents saw Academia as more process focussed (Mean = .83, 95% CI = $\pm .97$), while academia perceived their own sector as results focussed (Mean = 1.20, 95% CI = $\pm .86$). The sector pair Industry – Academia was also significantly different in their attribute rating scores [Industry (26.32), Academia (42.00), $p = .011$].

3.3.2. Perceptions of Industry

The industry sector had more statistically significant sector attributes than the other two sectors. Eight attributes were statistically significant and of those, five attributes were $p < .001$. NHS and Academic respondents had similar perceptions of the industry sector and were significantly different from the industry respondents' view of their own sector (see Table 1). Academic and NHS respondents' perceptions of the industry sector were more aligned with the neutral or negative side of the attribute scale for nearly all the statistically significant attributes (see Figure 3).

An overall pattern of the industry sector's attribute ratings identified similarities in the perspectives of the academic and NHS respondents that were statistically significant compared to industry respondents. As Figure 3 illustrates, academic and NHS respondents held generally more negative views of the industry sector especially regarding trustworthiness and ethical behaviour of industry employees.

Existing pre-conceived notions of the sectors were apparent in respondents' comments. Respondents described perceptions of the collaborative context and the motivations of the sectors:

"Acknowledgement that Pharma are more than a cheque book and realisation that partnerships can come in many forms." (Industry respondent, F, 35-44)

"Need independent review of industry input – industry by definition is trying to increase sales which may not be the best thing for the NHS." (Clinical Consultant, M, 35-44)

"True partnership and acknowledgement of skills and experience of each partner as opposed to pre-conceived ideas that Industry do the funding, academia take the credit and NHS do the work." (Head of Professional Relations, Diabetes, F, 35-44)

3.3.3. Perceptions of the NHS

Many of the perceptions of the healthcare sector were aligned, however operational attributes revealed significant differences among the respondents. The mean ranks of the attribute rating for the NHS sector were statistically significant for only three attributes, namely: 'short-term focus – long-term focus' [$X^2(2) = 10.332, p = .006$], 'finance focussed – patient focussed' [$X^2(2) = 17.881, p < .001$] and 'doesn't understand my sector – understands my sector' [$X^2(2) = .8.676, p = .013$]. Industry and NHS respondents rated the NHS sector leaning to the finance focussed end of the scale [(Mean = $-.17$, 95% CI = $\pm.99$) (Mean = -1.04 , 95% CI = $\pm.75$), respectively], while academia rated the sector patient focussed (Mean = 1.39 , 95% CI = $\pm.72$). The sectors pairs that were statistically significantly different were 'NHS – Academia' and 'Industry – Academia' [$p = .040, p < .001$, respectively].

3.4. Barriers to tri-sectoral collaboration

A majority of respondents agreed that multiple barriers exist in tri-sectoral collaborations. The highest percentage of agreement on specific barriers were - 'Short-term nature of funding', 'A lack of knowledge or understanding of how other sectors work' and 'Time constraints'. The health service was perceived as working on short, normally annual, time cycles of funding which generated short term planning cycles. The short-term nature of funding may potentially pose issues to collaboration by creating an additional barrier to project management and funding coordination.

NHS respondents described time and financial remuneration as a major problem for their involvement in collaborations despite their interest:

"Reaching out to the NHS...remembering that NHS has no protected time for academic work and (in general practice). Where work is a 'business', there needs to be financial incentives or appropriate locum cover provided to take clinicians such as GPs away from core business – they cannot lose money to get involved with academia, however much they may wish to be involved." (Consultant Nurse/Advanced Nurse Practitioner, General Practice, F, 45-54).

"Time [is] a major issue for NHS clinicians." (Clinical Consultant, M, 35-44)

Respondents disagreed with one potential barrier to tri-sectoral collaboration. Most respondents disagreed with the statement, 'Collaboration is beyond most people's job remit' ($n = 38, 50.7\%$).

3.5. Facilitators to tri-sectoral collaboration

The highest percentage of agreement for facilitators to tri-sectoral collaborations were: 'Face-to-face meetings', 'People with experience in multiple sectors', 'Regular meetings across professional boundaries', 'Perceived value in collaboration for each sector', and 'Support from institutions'.

Many respondents mentioned the need for open discussions, meetings, focus groups and workshops that built trust and encouraged collaboration:

"Invite [sector partners] to meetings to present and share ideas." (Health Solutions Manager, F, 35-44)

"Let's sit down together and talk about it!" (General Practitioner, Diabetes Lead for CCGs, M, 55-64)

"Meeting: highlight benefits of collaborations" (Group Leader/Primary Investigator, F, 35-44)

4. Discussion

The overall aim of the study was to explore the perceptions of members of academia, industry and healthcare to tri-sectoral collaborations in innovation adoption. Initially we discuss here two overarching themes identified in the findings: trust issues and industry perceptions.

4.1. Underlying trust issues that affect relationship building

The data from this study display some fundamental issues of trust especially in terms of building closer collaborative relationships with industry. Critically, the data illustrate low levels of trust between individuals in academia, healthcare and especially towards industry. If members of academia, industry and healthcare do not trust each other, collaboration will be limited and innovation diffusion will be slow or non-existent. Overall, the data illustrate differences in the perceptions of the way these three sectors operate. Industry respondents saw academia as more process focussed, while academia perceived their own sector as results focussed. All the other sectors perceived the NHS as having a 'short-term focus' and being 'finance focussed'. The other sectors perceived the NHS as introverted and as not understanding other sectors. Most critically for the development of the tripartite networks like the AHSN, the academic and NHS respondents' perceptions of the industry sector were aligned with the neutral or

negative side of the attribute scales over a greater number of scales. With these variations in views and negative perceptions, it is difficult to imagine that trust between the sectors can be readily built.

NHS and academic respondents had the least previous work experiences in industry and in all three sectors. So, individuals may not understand how the other sectors work or understand the cultural differences between the sectors. Limited knowledge and heterophily (differences in cultural values, norms and ways of working) may cause problems that limit the potential and dynamics of any partnership. Without knowledge of a sector, individuals must rely on pre-conceived notions of the sector or indirectly reported experiences. From previous literature, building shared vision and goals influences the effectiveness of collaborations [43-47].

A majority of respondents referred to multiple barriers to tri-sectoral collaboration. The barriers with the highest agreement ratings were: a lack of knowledge or understanding of how other sectors work, short-term nature of funding and time constraints. Whilst funding and time constraints are important pragmatic issues, the lack of knowledge of other sectors requires urgent attention. If the potential contributions of partners are unclear and the roles of the collaborators become blurred, this results in insecure commitment from partners [48]. One potential solution to funding constraints is increased private sector funding, but authors have expressed concern that altering the funding base from state-funded programmes to private sector funding may change the nature of academic research by decreasing long-term research and focusing on commercialisation of academic research results in a post-evaluation approach [49, 50]. Whilst funding bodies may encourage collaboration and inter-disciplinarity, collaborations require investments in time, finances and management [51].

Despite the reported barriers, many respondents believed collaboration was not outside of their job remit. For innovation processes to be effective, participants must be motivated to engage. Collaboration incentives for clinicians have been absent and workloads may create a challenge in engaging clinicians and academics [24].

4.2. Perceptions of the Industry sector

From the results of the study, academic and NHS respondents held largely negative perceptions of industry, despite limited contact. Academic and NHS respondents reported that the industry sector is slightly unethical and neutral or slightly untrustworthy, while also seen as more competitive, with unclear motivation. The industry sector image from an external sector's perspective potentially poses

fundamental problems to building relationships and cooperation in tri-sectoral collaborations. The significant results on industry attributes indicate potential challenges in motivating people to engage, in developing collaborations and in building trust. However, since academic and NHS respondents lack experience of working in industry and exposure to the industry sector, it is unclear on what evidence these perceptions of industry were established.

Sector perceptions may linger over time. Interactions between sectors can leave a lasting impression of the workings and culture of a sector. According to previous studies of the pharmaceutical industry and its image, clinicians were the primary promotional targets for pharmaceutical companies and distinct images of pharmaceutical companies were formed [52]. Thus, the industry sector's image may be affected by previous activities and partial exposure to only sales departments that in turn, cause difficulties for other types of relationships where trust and communication are important. Specifically, doctors' exposure to direct product promotion may cause them to see all industry activities as marketing. Financial relationships among industry and academia were described as 'pervasive'; that industry funded research can influence the research process [53], while academic investigators may be influenced by holding equity in the financial sponsor [54]. Financial conflicts of interest in physician-industry relationships may cause changes in behaviour through psychological drivers that can unconsciously bias an individual's perspective [55].

4.3 Implications for translational networks

Translational networks are mandated to assist and locate potential partners for tri-sectoral collaborations within the local region in healthcare programmes to increase innovation adoption and knowledge translation. The Department of Health's and/or NHS England's strategy to date has centred on establishing a translational infrastructure, predominantly through the creation of such translational networks – a structural response. Our findings indicate that this policy needs strengthening with active mechanisms, which essentially need to include direct contact and joint task forces with non-marketing members of industry. Participants in this study proposed - open discussions, focus groups and workshops - to respond to the need to build tri-sectoral trust.

To effectively accomplish their objectives of rapidly translating innovations into widespread use, tri-partite collaborations will need to use Evans and Scarbrough [37] on the 'bridging' and 'blurring' approaches to enable relationship building, which is essential to building trust. Evidence from the UK

CLAHRCs also illustrates how an organisational learning approach may be efficacious and co-production of improvement targets and specific skill development may yield positive progress [4, 56-58]. Furthermore, attention to governance issues may aid inclusion [27, 28].

4.4. Practice implications to encourage collaborative relationships

The results of our survey underline a lack of knowledge of other sectors, a lack of work experience in other sectors and attitudes founded on preconceptions rather than evidence. These issues are especially prevalent in healthcare. To address these factors, greater opportunities for placements between industry and other sectors would develop understanding, and facilitate communication. Middle level managers with experience in more than one sector may have an important role as boundary spanners who cross organizational, professional frontline and managerial domains [59]. As a more cost effective and temporary measure, establishing part-time, cross sector project teams to resolve focused dilemmas can build social networks, aid innovation and build trust through direct contacts.

Whilst knowledge brokering is not new, knowledge translation will need to also take into account the role of social networks in circulating knowledge [45]. The broker must be seen as a trust worthy intermediary to effectively broker knowledge [33]. Ward, Smith, House and Hamer [60] identified knowledge brokering as an inductive activity that captured broad processes of knowledge exchange to define and tailor knowledge in the field; translational networks can build upon the existing framework developed by Ward et al. to utilise and tailor in practice. There is evidence that brokers are needed in areas that require social mechanisms to combine service delivery with clinical governance [61, 62].

In the medium to longer term, thought needs to be given to offering career incentives to encourage broader work experience. These incentives would have to demonstrate that alternative career paths produce beneficial outcomes.

5. Conclusions

To date, there is limited research evidence of tri-sectoral collaborations between academia, healthcare and industry in the innovation adoption process and our indicative findings demonstrate that healthcare faces challenges, particularly in the management of tri-sector networks to encourage knowledge translation. All the evidence suggests that there is a fundamental need to actively develop trust between the three sectors, and especially with the private sector. In order to accomplish this, translational

networks will have to agree priorities across the three sectors and develop close lateral communications. This will be difficult to achieve, when these results indicate a lack of trust and significant gaps in inter-sectoral understanding. Healthcare in particular, is a “collaborative endeavour in which multiple gaps exist” (pg. 12) [33]. Knowledge brokerage can be a productive and rich method to overcome sector barriers and build effective knowledge exchange. Liaising between the groups and building up synergy in partnerships can be achieved through sharing of knowledge, ideas and information.

6. Limitations of the study

This exploratory study presents indicative findings on a research topic that has limited previous literature. Whilst the questionnaire was specifically designed for the study, there was no pilot stage or validation of the questionnaire itself. We provide initial findings from the study. The respondents' sample size, though above 22, failed to reach the calculated sample size for the 7-point semantic differential section due to incomplete responses. The validity of the findings has a diminished effect size for the 7-point semantic differential section.

Recruitment bias through non-random sampling techniques does exist in the current study. The results of the study are not generalizable. A larger-scale study with a formal pilot stage will be required to verify and test these findings.

A future qualitative study is required to elucidate how the value laden views are reached and negative perceptions formed.

Tables and figures with captions

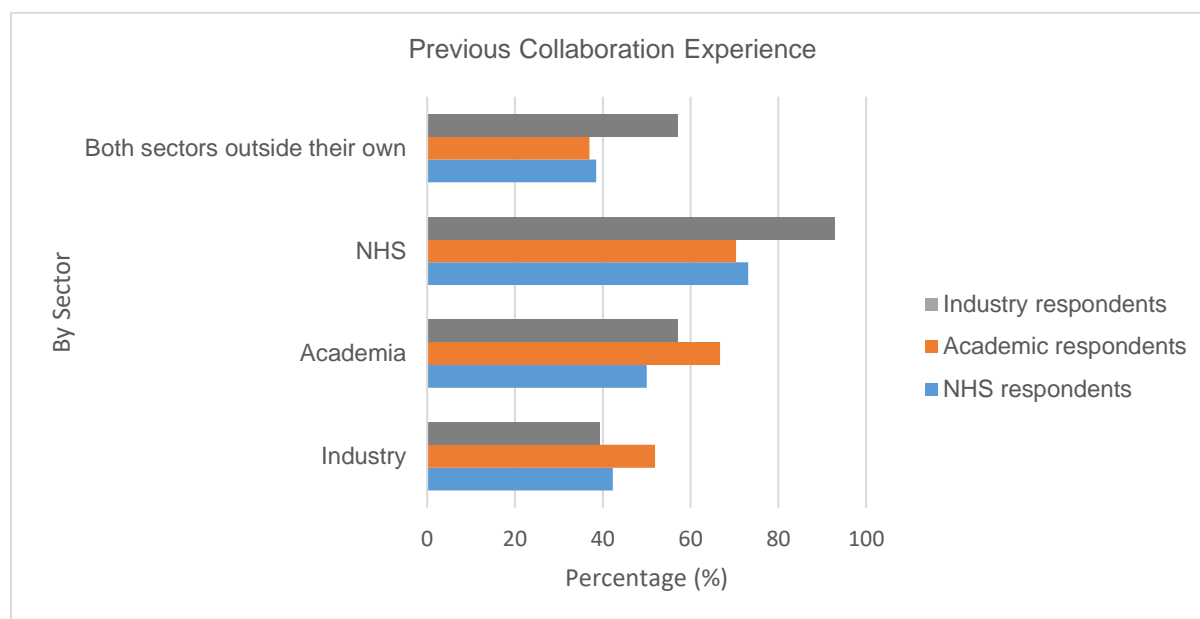


Figure 1 Previous collaboration experience (by sector)

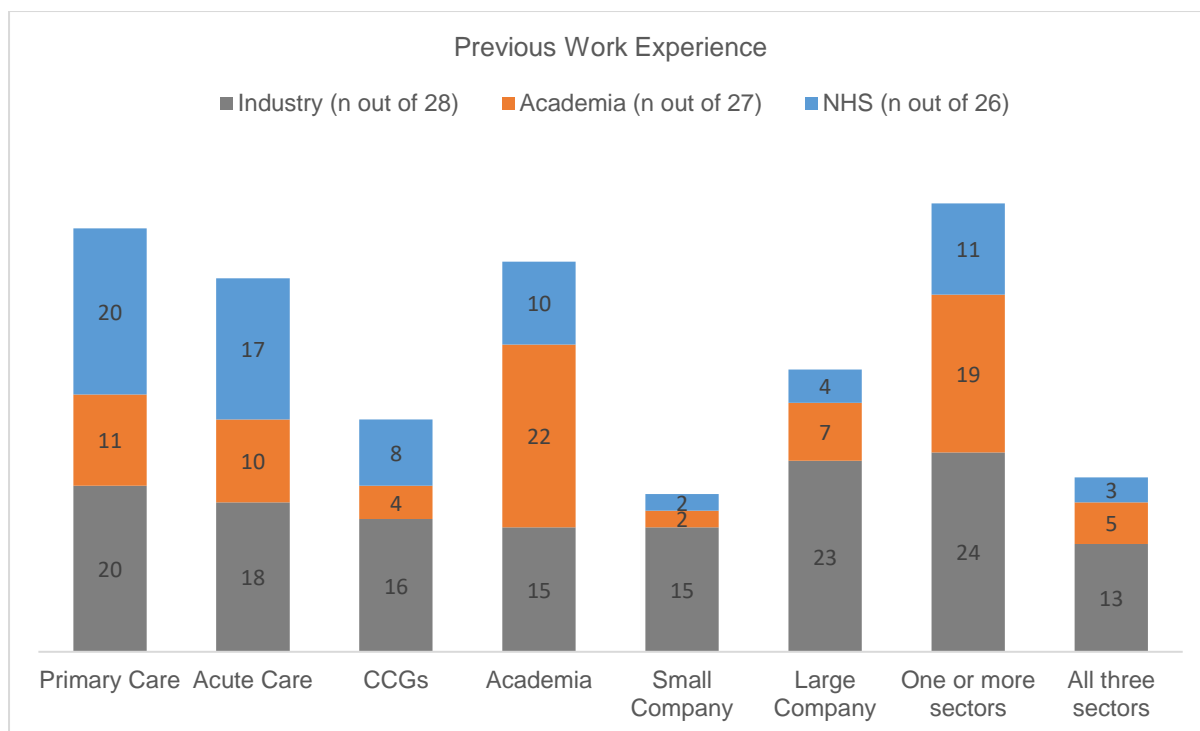


Figure 2 Previous work experience (by sector)

Attribute	Sector Pairs	Mean Ranks	p-value
Finance focussed – Patient focussed	NHS - Industry	NHS (19.27) Industry (37.33)	.004
	Academia - Industry	Academia (19.27) Industry (42.98)	< .001
Not trustworthy – Trustworthy	Academia - Industry	Academia (21.52) Industry (38.91)	.004
	NHS - Industry	NHS (21.52) Industry (39.31)	.005
Unethical – Ethical	NHS – Industry	NHS (21.92) Industry (48.02)	< .001
	Academia - Industry	Academia (24.23) Industry (48.02)	< .001
Unclear motivation – Transparent motivation	NHS - Industry	NHS (25.04) Industry (38.42)	.058
Competitive - Collaborative	Academia - Industry	Academia (23.40) Industry (40.43)	.005
Different goals – Shares my goals	NHS - Industry	NHS (21.17) Industry (35.53)	.035
	Academia - Industry	Academia (21.17) Industry (42.39)	< .001
Doesn't understand my sector – Understands my sector	NHS - Industry	NHS (20.62) Industry (38.78)	.005
	Academia - Industry	Academia (20.62) Industry (40.32)	.001
Project focussed – People focussed	NHS - Industry	NHS (20.85) Industry (36.53)	.017
	Academia - Industry	Academia (20.85) Industry (41.91)	< .001

Table 1 Post-hoc analysis of mean ranks to determine pairwise comparisons (Industry sector) ($p < .05$)

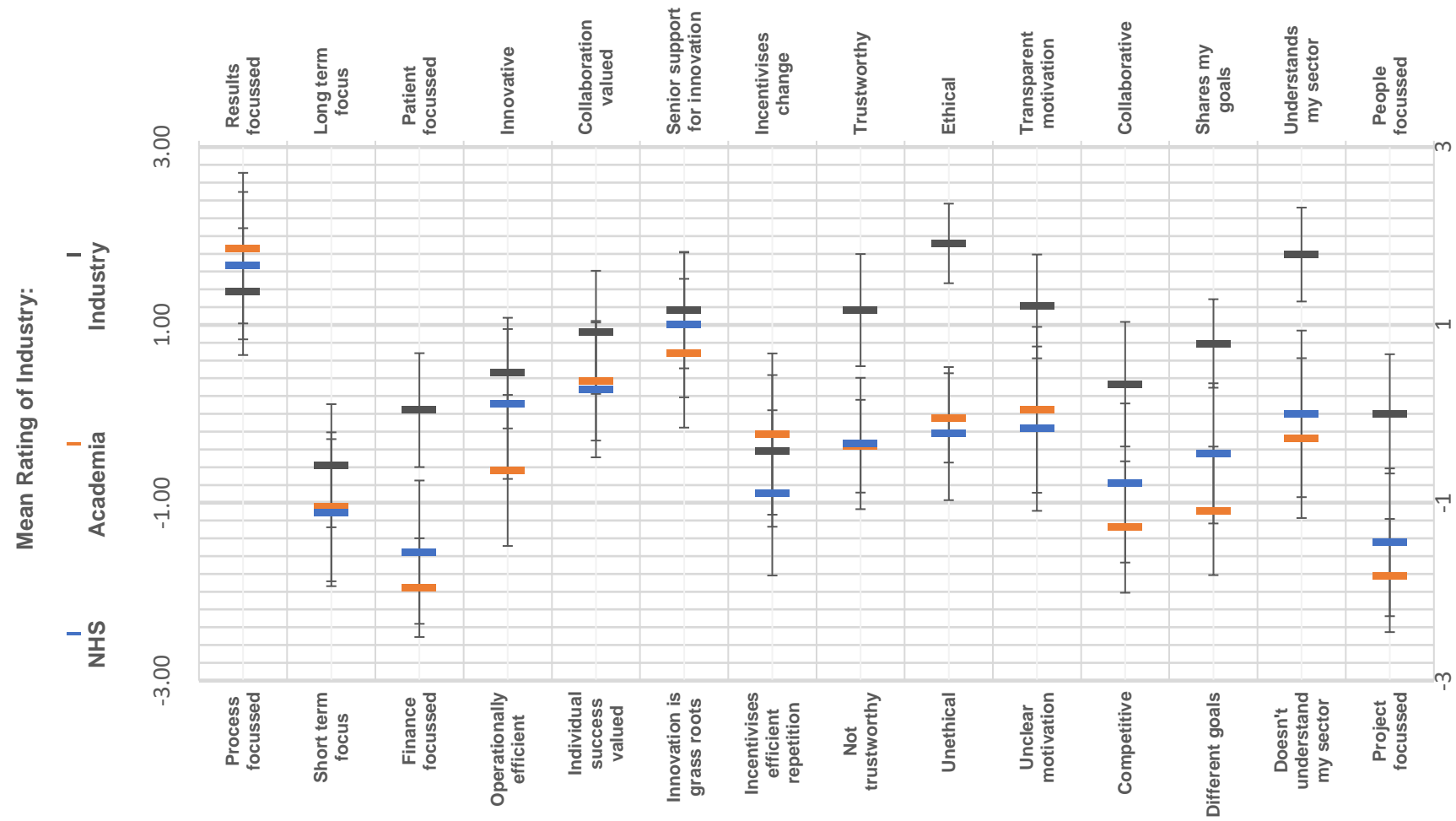


Figure 3 Sector attribute ratings for Industry

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