RESEARCH ARTICLE

Final year pharmacy students' opinions on teamwork: A questionnaire-based study from a UK School of Pharmacy

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Abstract

Introduction: The study aimed to investigate Queen's University Belfast (QUB) pharmacy students' opinions about teamwork within the degree programme including inter-professional activities they have completed. This is pertinent given accrediting (regulator) organisation requirements about team-based learning and engagement in multidisciplinary teams.

Methods: Following ethical approval, all final year pharmacy students except the research student were invited to participate in this single institution study (n=95). Data were collected via a self-completed, pre-piloted, questionnaire (largely closed-style questions and non-identifiable data requested). Data analysis generated descriptive statistics with tests such as the Mann Whitney U-Test employed for inferential statistical analysis.

Results: The response rate was 96.8% (92/95). Most pharmacy students respondents (81.5%, n=75/92) found teamwork valuable and 76.7% (69/90) deemed it essential to ensure they became safe and effective pharmacists. Males wanted more teamwork in comparison to females (*p*=0.02). Only 53.8% (49/91) liked peer evaluation. Formative activities (particularly one with medical students about prescribing and dispensing) were more popular than summatively assessed activities.

Conclusion: While opinions about teamwork were positive, more work is required on peer evaluation (given its importance for professional development) and summative team-based assessment.

Keywords: *Pharmacy, Undergraduate Students, Teamwork, Views*

Introduction

Teamwork has been described as "including two or more people interacting with each other and interdependently working together to achieve specific objectives" (Young & Henquinet, 2000: p.56). It can encompass various teaching approaches such as problem-based learning (PBL), inter-professional learning (IPL), collaborative and cooperative learning, and active learning (Gagnon an& Roberge, 2012). It relies largely on social factors (including inter-team relationships), in addition to attributes offered by individual members (Young & Henquinet, 2000). It may foster various skills such as leadership and effective communication, enhance personal and professional development, encourage student involvement in the discovery and sharing of knowledge through peer interactions, and facilitate deep learning (Lee *et al.*, 2015; Bridges, 2018).

From a professional perspective, being able to work effectively in a team is an essential requirement of United Kingdom (UK) Master of Pharmacy (M.Pharm.) degree programmes. The M.Pharm. accrediting organisation (regulator), the General Pharmaceutical Council (GPhC), has published standards for the initial education and training of future pharmacists which must be met to achieve accreditation of the degree; team-working is seen as a core skill (GPhC, 2011). Future pharmacists are expected to know how to "engage in multidisciplinary team working" and show how they "contribute to the education and training of other members of the team, including peer review and assessment" (Standard 10.1); know how to "collaborate with patients, the public and other healthcare professionals to improve patient outcomes," and know

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how to "work effectively within teams to ensure that safe and effective systems are being followed" (Standard 10.2.3) (GPhC, 2011). The use of the words "know how" and "show how" above is deliberate. This relates to levels in Miller's pyramid (a framework for clinical assessment) to which the standards are aligned (Miller, 1990). The United States of American (USA) pharmacy education accreditation standards have been revised to ensure graduating students are "practice-ready" and "team-ready," i.e. "prepared to directly contribute to patient care working in collaboration with other healthcare providers". (Accreditation Council for Pharmacy Education, 2016). With the evolving role of the pharmacist and changing population in the UK, it is likely that these future pharmacists will serve a diverse population and work within multi-disciplinary teams to an increasing extent to advance healthcare (GPhC, 2019).

Research about teamwork has been conducted on medical students (Searle *et al*., 2003; Steinert, 2004; Singaram *et al*., 2008; Parmelee *et al*., 2009; Koles *et al*., 2010; Parker *et al*., 2018). Searle *et al*. (2003) rolled out team learning within medical education in one institution in the USA and, as it was successful, nine other institutions implemented it soon after. Parmelee *et al*. (2009) conducted a questionnaire-based study in the USA to ascertain how medical students' attitudes about team-based learning changed between first and second year. Another study conducted in a USA school of medicine by Koles and colleagues (2010) determined the impact of team-based learning on students' academic performance using examination results. Likewise, Parker *et al*. (2018) conducted work in the UK to explore the link between medical students' academic ability and teamworking using examination results, and Steinert *et al*. (2004) used focus groups in Canada to glean medical students' opinions on effective small group teaching. Similarly, Singaram *et al*. (2008), in South Africa, established medical students' views about PBL group tutorials via a questionnaire.

There are also studies involving nursing students (Gagnon & Roberge, 2012; Beccaria *et al*., 2014; Smith & Rogers, 2014; Lee *et al*., 2015; Forehand *et al*., 2016; Wong, 2018). Gagnon and Roberge (2012) investigated the student experience about collaboration in a nursing school in Canada. Beccaria *et al*. (2014) explored teamwork skills development via pre- and post-activity questionnaires. This was done among first year nursing students at a university in Australia. Also in Australia, Smith and Rodgers (2014) explored nursing students' views of grading team-based assessments by using a questionnaire. In a Hong Kong university, Wong (2018) sought to understand about students' learning through small group work, using focus group interviews involving nursing students and staff. Furthermore, in the USA, while Lee *et al*. (2015) explored benefits and barriers to teamwork from nursing student and faculty perspectives, Forehand and colleagues' work (2016) focussed on concerns about teamwork.

In terms of research conducted on pharmacy students, the majority of the published work seems to have been carried out in USA universities. Sharma *et al*. (2017) conducted a pilot study in a USA-based university to examine pharmacy students' opinions and engagement with team-based learning compared to lectures for pharmacotherapy. Gallegos and Peeters (2011) also focussed on pharmacotherapy in a larger capacity, assessing pharmacy students' perceptions of team-based learning in a university in the USA using pre- and post-module questionnaires. Similarly, and also in the USA, Elmore and colleagues (2014) used a team-based learning approach in a self-care course with an evaluation (by the pharmacy students undertaking the course) done using before and after questionnaires. Miller *et al*. (2017) investigated pharmacy students' opinions of team-based learning across different years of the degree programme in a USA-based university, via a questionnaire administered to two classes. Khansari and Coyne (2018) gained second year pharmacy students' views via a questionnaire about the value of having a team assessment prior to a summative assessment in a university in the USA. Also in the USA, Nelson *et al*. (2013) used a team-based learning approach to deliver three years of the pharmacy curriculum in a university; opinions about this approach and its impact were assessed via a questionnaire. Likewise, Remington and colleagues (2015) openly described their experiences and the lessons they learnt through integrating team-based learning into the curriculum in their USA-based university. Elsewhere than the USA, Eksteen and colleagues (2018) explored fourth year pharmacy students' experiences with team-based learning at a South African university. With regard to the UK-based research specifically, Bridges (2018) focused on the role of teamwork in facilitating professional identity formation, and Nation and Rutter (2015) examined summative examination performance in the context of team-based, problem-based and more traditional didactic learning methods such as lectures.

Many findings were positive with students gaining, or perceiving they had gained, knowledge (Koles *et al*., 2010; Khansari & Coyne, 2018), confidence (Bridges, 2018), problem solving and teamwork skills (Nelson *et al*., 2013), mutual learning and respect for others (Singaram *et al*., 2008; Elmore *et al*., 2014; Bridges, 2018). However, challenges included unequal contributions to the task by the team members (Forehand *et al*., 2016; Wong, 2018), lack of communication among the team (Bridges, 2018), and disagreements as to how team-based assessments should be graded (Smith & Rodgers, 2014).

Having undertaken a robust literature review, there appears to be no studies focussing on pharmacy students' opinions about a wide range of team-based activities undertaken throughout the degree programme. This study adds to the current body of literature by providing broad insight into various teamwork activities and from a UK pharmacy standpoint, given the majority of published studies have been conducted in the USA. It explores views on inter-professional (with medical and nursing students) and interdisciplinary (with law students) activities, in addition to those involving pharmacy students only. It investigates opinions about peer and staff assessment, suggested weighting for grades, and peer evaluation. Moreover,

differences in male and female, and international and non-international students' responses and links views to self-reported academic performance are included. Lastly, the teamwork activities across the QUB four-year degree programme are outlined so that readers can contextualise the findings. It is hoped that this paper prompts other educators to review their current teamwork provision to enhance the student experience and ultimately prepare them for their future role.

Aims and objectives

The aim of this study was to investigate QUB pharmacy students' opinions on team-based activities and assessments.

The objectives were to ascertain pharmacy students' views on teamwork in general; determine their preferred types of team-based M.Pharm. activities and grading of these;

gain their opinions on perceived skills gained and professional development through teamwork; and determine whether parameters such as gender, self-reported academic performance, and being an international or non-international student affected responses.

To help contextualise the work, Table I provides details about where team-based activities are employed (including information about assessment) within the QUB degree programme. QUB is one of the leading universities in the UK and a member of the Russell Group of UK research intensive universities. QUB School of Pharmacy has been training pharmacists for over 40 years and is consistently ranked as a top UK school of pharmacy. All universities in the UK are independent bodies (i.e. there are no government owned universities) but they receive funding from the government in addition to having other income-generating sources.

Table I: An outline of team activities within the QUB M.Pharm. degree programme

Year	Degree programme content	Assessment: summative and/or formative or none	Assessor: staff and/or peers or none	Assessment: group and/or individual grade or none
1	Laboratory-based practical about formulation and analysis	Summative assessment only	Staff only	Group grade only
	Inter-professional workshop about numeracy (with nursing and potentially medical students)	Formative assessment only	Staff and peers provide feedback in the session	None
2	Ethical debates	Summative assessment only	Staff and peers (60:40 split)	Group grade only
	Laboratory-based practicals on physiology, molecular modelling, synthesis, isolation, analysis	Summative assessment only	Staff only	Individual grade only for an individual report prepared after working in a team
	Inter-professional workshop about pharmacokinetics	Formative assessment only	Staff and peers provide feedback in the session	None
3	Laboratory-based practicals on pharmaceutical analysis and drug delivery	Summative assessment only	Staff only	Individual grade only for an individual report prepared after working in a team
	Oral presentation about medicinal chemistry	Summative assessment only	Staff only	Group grade only
	Publishing a leaflet for patients on one of fifteen allocated health promotion topics	Summative assessment only	Staff only	Group grade only
	Interdisciplinary workshop (with law students) about legislation	None	None	None
	Inter professional workshop (with medical students) about prescribing and dispensing	None	None	None
	Peer evaluation about Objective Structured Clinical Examination (OCSE) performance	Formative assessment only	Peers only	None
	Peer review of patient counselling ability	Formative assessment only	Peers only	None
4	Inter-professional workshop (with nursing and medical students) about medicines governance	None	None	None
	Oral presentation on medicines optimisation	Summative assessment only	Staff only	Group grade only
	Poster and oral presentation on one of sixteen allocated 'Role of the pharmacist in…' topics	Summative assessment only	Staff only	Group grade and monetary prize of £500 for the top scoring group (memorial sponsorship)
	[Not covered at time of data collection: Entrepreneurial Dragon's Den type-workshop]	[Summative assessment only]	Staff and peers (60:40 split)	[Group grade and £20 Amazon voucher for each of three individuals deemed to have the best ideas]
	[Not covered at time of data collection: hospital placement group activity e.g. clinical audit]	[Summative assessment only]	Staff only	[Group grade only]

Methods

Study participants and data collection

All QUB final year M.Pharm. students (n=95 excluding the research student) were invited to participate in the study. Final year students were chosen as they were the only year group to have undertaken almost the full range of team-based activities offered within the M.Pharm. degree programme at the time of data collection and hence were able to provide valid opinions and insight about all team-based activities. Data were collected by means of a paper-based self-completed questionnaire which was distributed at a compulsory class near the end of 2018 (Semester 1). Please note that while attendance at the class was mandatory, participation in the study itself (i.e. completion of the questionnaire) was voluntary.

Questionnaire development

The questionnaire was developed with reference to previous published work in the area (Searle *et al*., 2003; Singaram *et al*., 2008; Parmelee *et al*., 2009; Koles *et al*., 2010; Gallegos & Peeters, 2011; Smith & Rogers, 2014; Remington *et al*., 2015; Forehand *et al*., 2016; Miller *et al*., 2017; Sharma *et al*., 2017; Wong, 2018). It consists of four sections: the first (Section A) related to satisfaction with the team experience (13 statements); Section B focussed on preferred team activities and assessment, including views on peer and staff evaluation (five questions, with varying number of parts per question); Section C related to perceived skills and professional development (ten statements); and Section D sought to collect demographic information (only non-identifiable data requested) about gender and international or non-international status. The country where students received most of the education prior to enrolling on the QUB M.Pharm. degree programme could not be ascertained as this would have potentially uniquely identified one student. Similarly, age (or age range) could not be sought as it would also have uniquely identified a few students. Information about academic performance was also ascertained i.e. students were asked to self-report their current degree classification or grade. Using their actual grade would have been a more robust measure but this would have compromised individual anonymity. For the benefit of an international readership these degree classifications are: first-class (1st; grade of ≥70%), second class degree, first division (2,1; grade of 60% - <70%), second class degree, second division (2,2; grade of 50% - <60%) or a third class degree (3rd; grade of 40% - <50% which is highly unlikely given many components of the M.Pharm. degree have a pass mark of 50). The questions and statements from the questionnaire are provided in the Results section of this paper. Additionally, a comparison of actual (using ratified results presented at a relevant Exam Board) versus self-reported grades is included in the Results section in case this is of interest to readers.

To maximise response rates, the questionnaire was not time-consuming to complete. The research team had considered the number and type of questions in the context of completion time when developing the questionnaire and it took pilot participants around eight minutes to complete. The questions were largely in a closed-question type style (Dillman, 2014); in many cases, respondents were asked to select an option from a 5-point rating scale and, on occasion, they also had to rank three options. In total, there were 37 Likert or rating questions (with five options) and two ranking questions (with three options). There was space to record other information about teamwork, should respondents wish to do so (Sections B and D). The cover sheet outlined the purpose of the research, gave an estimated completion time, provided assurance that participation was voluntary and had no bearing on grades, academic standing, or progression on the course, and explained how the data (which were non-identifiable) would be used and where it may be presented.

In terms of questionnaire content, two of the authors have collectively been involved in the development of most M.Pharm. team-based activities so they have expertise and experience in this area. They are also aware of student feedback about M.Pharm. teamwork provision from other 'student voice' sources such as module and programme review data. They reviewed questions and statements prepared by the research student for validity. The questionnaire was also piloted on pharmacist postgraduate students and postdoctoral staff at the QUB School of Pharmacy (n=10 in total) for face validity. As a result, an estimated completion time was ascertained ("estimated" was used for the questionnaire cover sheet information and meant the authors anticipated, but could not be sure, that it would take the study participants around the same time to complete the questionnaire as the pilot participants, which was eight minutes), and several minor amendments were made to the questionnaire. One pilot participant suggested that a question could be included about keeping or changing team members for each different team-based task (so a new statement was added; Section A, Question 12). Two considered that the question about staff and peer contribution to the grade would be enhanced if it included boxes for respondents to enter the staff contribution and peer contribution (so this was amended to include boxes; Section B, Question 2b).

Data analysis

The responses from the completed questionnaires were numerically coded and entered into Microsoft Excel (Microsoft Corporation, USA) in January 2019. The analysis (generated using R programming language, The R Foundation for Statistical Computing, Austria) mainly took the form of descriptive statistics, such as frequencies and percentages. Since the quantitative data were largely non-parametric in nature (nominal or ordinal), inferential statistical analysis (such as comparisons of responses by gender) used appropriate statistical tests such as the Mann Whitney U-Test, Chi-squared test and McNemar's test. The two ranking questions were not included in the inferential statistical

analysis since the nature of the data obtained meant it was difficult to analyse these robustly. Therefore, only descriptive statistics are reported for these two questions. The comparators (such as male versus female and international versus non-international student responses) were chosen based on long-standing interest to the authors and their institution. One question asked for a suggested staff and peer contribution to assessments as a value from 0 to 100 for each (analysis of this question took the form of summing the provided numerical values that respondents provided for staff and for peer, and calculating a mean value for each). Significance was set at $p<0.05$ a priori. The open-response questions were analysed using thematic analysis (Nowell *et al*., 2017).

Ethical approval for the questionnaire study was granted by the QUB School of Pharmacy Ethics Committee on 20th November 2018 (Ref: 017PMY2018).

Results

Response rate

A response rate of 96.84% (92/95) was achieved i.e. there were 95 students (excluding the research student) who attended the compulsory class, and of those 92 opted to complete the voluntary questionnaire. Out of the 92 questionnaires that were completed, nineteen were partially completed (i.e. participants left one or more parts of questions unanswered, therefore both 'n' and '%' is provided throughout). *P*-values of less than 0.05 and the other relevant test values for the inferential statistics are reported throughout the results section.

Demographic information, including self-reported academic performance (Section D)

Out of 92 students respondents, there were 23 (25.00%) males, 67 (72.83%) females, 1 (1.09%) who preferred not to say and 1 (1.09%) who left the gender question blank. Furthermore, 73 (79.35%) were UK/Ireland ('non-international') students, 18 (19.57%) were international and 1 (1.09%) left this question blank. In terms of self-reported degree classifications to date, 30 (32.61%) reported they were currently achieving a 1st, 41 (44.57%) a 2.1, 9 (9.78%) a 2.2 or 3rd, and 12 (13.04%) left this question blank.

NB: In terms of the actual rather than self-reported current degree classifications (obtained from examination board ratified results for the cohort), 36 (37.89%) were currently achieving a 1st, 39 (41.05%) a 2.1 and 20 (21.05%) a 2.2 or 3rd. There was no significant difference between actual and self-reported values (x^2=3.5079, df=2, p=0.1731). This information (both self-reported and actual) refers to degree classifications up to the end of third year since students had not yet completed final (fourth) year assessments at the time of data collection.

Table II: Respondents' level of satisfaction with the M.Pharm. degree programme team experience and views on team characteristics

	SA* (5) n (%)	A* (4) n (%)	NAD*(3) n (%)	D* (2) n (%)	SD* (1) n (%)	IM
a. In most cases, I have found M.Pharm. teamwork activities to be a valuable experience	15 (16.30)	60 (65.22)	8 (8.70)	9 (9.78)	0 (0.00)	3.98
b. In most cases, I have found M.Pharm. teamwork activities to be a good use of degree programme time	14 (15.22)	51 (55.43)	13 (14.13)	13 (14.13)	1 (1.09)	3.87
c. I would like to have more teamwork activities within the degree programme	10 (10.87)	25 (27.17)	24 (26.09)	27 (29.35)	6 (6.52)	3.04
d. In most M.Pharm. teamwork activities, the other team members have contributed as much as I have	21 (22.83)	38 (41.30)	12 (13.04)	15 (16.30)	6 (6.52)	3.84
e. In most M.Pharm. teamwork activities, I have contributed more than the other team members	9 (9.78)	20 (21.74)	39 (42.39)	20 (21.74)	4 (4.35)	3.06
f. In most M.Pharm. teamwork activities, my team has worked well together	31 (34.07)	49 (53.85)	10 (10.99)	1 (1.10)	0 (0.00)	4.20
g. In most M.Pharm. teamwork activities, I have felt respected by the other team members	35 (38.04)	42 (45.65)	10 (10.87)	5 (5.43)	0 (0.00)	4.24
h. In most M.Pharm. teamwork activities, the group size has been appropriate to the task	22 (23.91)	51 (55.43)	8 (8.70)	10 (10.87)	1 (1.09)	4.03
i. I think the M.Pharm. teamwork activities benefit low academically-achieving students more than high academically-achieving students	14 (15.22)	34 (36.96)	24 (26.09)	18 (19.57)	2 (2.17)	3.56
j. In most cases, the marks I have been awarded in relation to M.Pharm. teamwork activities have been fair	18 (19.57)	52 (56.52)	16 (17.39)	6 (6.52)	0 (0.00)	3.96
k. In general, I prefer to be allocated to a team rather than choosing my own team members	23 (25.00)	28 (30.43)	20 (21.74)	16 (17.39)	5 (5.43)	3.68
l. If I was being allocated to a team, I would prefer that the team members changed for each different teamwork activity	15 (16.30)	19 (20.65)	23 (25.00)	31 (33.70)	4 (4.35)	2.98
m. We need to learn more about how to work effectively in a team before we can be expected to undertake any M.Pharm. teamwork activities	8 (8.70)	29 (31.52)	25 (27.17)	22 (23.91)	8 (8.70)	3.14

*SA = Strongly Agree; A = Agree; NAD = Neither Agree nor Disagree; D = Disagree; SD = Strongly Disagree; IM = Interpolated Median
† n=92 respondents but there was one missing response for statement 'f'

Satisfaction with M.Pharm. degree programme team experience (Section A)

Table II outlines the statements and corresponding results for all respondents for this section of the questionnaire.

Many student respondents considered teamwork to be a good use of degree programme time (65/92, 70.65%), with typically fair marking (70/92, 76.09%), and that other team members contributed as much as them (59/92, 64.13%), showing mutual respect (77/92, 83.70%). Approximately half (48/92, 52.17%) thought that the team activities benefitted low academically-achieving students more than high achievers.

A greater proportion of international students (than non-international students) strongly agreed or agreed that they needed to learn more about how to work effectively in a team before being expected to undertake teamwork activities (72.22% [13/18] international students versus 32.88% [24/73] non-international students). The response distribution across the five Likert options for international versus non-international students was found to be significantly different (U=989.5, *p*<0.001).

While 79.35% (73/92) thought group sizes (which range from four-ten) were appropriate to the task, 55.43% (51/92) preferred to be allocated to a team rather than choosing team members. The response frequencies for each of the five Likert options is provided in Table II. A greater proportion of females (than males) strongly disagreed or disagreed that they would like to have more teamwork activities within the degree programme (41.79% [28/67] females versus 21.74% [5/23 males]). The response distribution across the five Likert options for female versus male students was found to be significantly different (U=529.0, *p*=0.02).

Moreover, student respondents who reported currently achieving a 1st (in comparison to those who reported not achieving a 1st) considered teamwork activities were less valuable (McNemar's x^2=19.446, df=1, *p*=<0.001).

The most prevalent qualitative comments were: "*some members of the team do more or put more effort in than others, which negatively impacts upon the grade*" (n=15 respondents); "*how well a team works largely relies on who you are working with; smaller groups generally work better as work can be more equally distributed*" (n=4 respondents); "*groups should be rearranged more regularly so students can learn from, and interact with, more people*" (n=4 respondents).

Preferred team activities (first part of Section B)

Students were asked to rate various M.Pharm. teamwork activities from 5 to 1, were 5 equalled 'really liked it' to 1 being 'really disliked it' (see Figure 1). A greater proportion of males (in comparison to females) really disliked or disliked peer review of patient counselling (47.83% [11/23] males versus 19.40% [13/67] females). The response distribution across the five Likert options for female versus male students was found to be significantly different (U=997.0, *p*=0.03).

A greater proportion of males also really disliked or disliked peer evaluation in relation to Objective Structured Clinical Examinations (OSCEs) (47.83% [11/23] males versus 22.73% [15/66] females). The response distribution across the five Likert options for female versus male students was found to be significantly different (U=986.0, *p*=0.03).

A greater proportion of international students (than non-international students) really disliked or disliked the interdisciplinary activity with law students (55.56% [10/18] international versus 21.92% [16/73] non-international students). The response distribution across the five Likert options for international versus non-international students was found to be significantly different (U=380.0, *p*=0.005).

Figure 1: Students' opinions on how much they liked various team activities (interpolated median scores shown; maximum score of 5 for 'really liked it' to a minimum score of 1 for 'really disliked it').
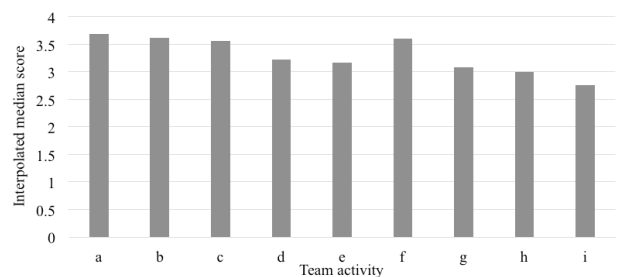
a. Prescribing/dispensing with medical students (no summative assessment)
b. Legislation with law students (no summative assessment)
c. Medicines governance with nursing & medical students (no summative assessment)
d. Peer review of patient counselling (no summative assessment)
e. Peer evaluation about Objective Structured Clinical Examinations (no summative assessment)
f. Laboratory-based practicals (summative assessment; individual grade only)
g. Ethical debates (summative assessment; group grade only)
h. Generating a poster or leaflet (summative assessment; group grade only)
i. Oral presentations (summative assessment; group grade only)

Assessment including views on peer evaluation (second and final part of Section B)

Respondents were asked about their views on peer and staff evaluation. Many (64/92, 69.57%) strongly agreed or agreed that peer evaluation is a fair way to assess a team member's contribution to the team activity. Over half (50/91, 54.95%) were in agreement that being evaluated by peers motivates them to work harder within the team. Similarly, 53.85% (49/91) strongly agreed or agreed that, in general, they liked peer evaluation. One-fifth (19/91, 20.88%) did not feel they had the necessary skills to undertake peer evaluation effectively.

Respondents were asked to rank their preference from 1 to 3 (1 being most preferred and 3 being least) in relation

Table III: Respondents' opinions on a team environment for skills and professional development

	SA* (5) n (%)	A* (4) n (%)	NAD*(3) n (%)	D* (2) n (%)	SD* (1) n (%)	IM
a. Teamwork helps me learn course content more than if I had just studied alone	17 (18.68)	39 (42.86)	15 (16.48)	13 (14.29)	7 (7.69)	3.77
b. Teamwork improves my understanding of concepts more than if I had just studied alone	22 (24.18)	42 (46.15)	12 (13.19)	10 (10.99)	5 (5.49)	3.94
c. Teamwork facilitates mutual learning	23 (25.56)	60 (66.67)	4 (4.44)	2 (2.22)	1 (1.11)	4.13
d. Teamwork is essential to ensure I become a safe and effective pharmacist	25 (27.78)	44 (48.89)	14 (15.56)	3 (3.33)	4 (4.44)	4.05
e. M.Pharm. teamwork activities have helped me develop decision-making skills	22 (24.18)	47 (51.65)	14 (15.38)	6 (6.59)	2 (2.20)	4.00
f. M.Pharm. teamwork activities have helped me develop problem-solving skills	19 (20.88)	56 (61.54)	11 (12.09)	3 (3.30)	2 (2.20)	4.03
g. M.Pharm. teamwork activities have helped me develop leadership skills	21 (23.08)	51 (56.04)	14 (15.38)	2 (2.20)	3 (3.30)	4.02
h. M.Pharm. teamwork activities have helped me to be able to work collaboratively	34 (37.36)	48 (52.75)	6 (6.59)	2 (2.20)	1 (1.10)	4.26
i. M.Pharm. teamwork activities have helped me develop more respect for the opinions of others	30 (32.97)	45 (49.45)	11 (12.09)	4 (4.40)	1 (1.10)	4.16
j. M.Pharm. teamwork activities have helped me develop communication skills	35 (38.46)	44 (48.35)	8 (8.79)	4 (4.40)	0 (0.00)	4.26

*SA = Strongly Agree; A = Agree; NAD = Neither Agree nor Disagree; D = Disagree; SD = Strongly Disagree; IM = Interpolated Median
† n=92 respondents but there were two missing responses for statements 'c' and 'd' and one missing response for the remaining statements

to staff and peer evaluation. The top ranked option was "evaluated/graded by both staff and peers" (selected as 1st preference by 46.74% [43/92]), closely followed by "evaluated/graded by staff only" (selected as 1st preference by 44.57% [41/92]) with "evaluated/graded by peers only" last (selected as 1st preference by 8.70% [8/92]). Respondents were also asked to record what they considered to be a fair weighting for staff and peer contributions to grades. The mean weightings (calculated from the numerical values provided by n=92 respondents for each of the two options) were 73.26% staff and 26.74% peer contributions.

In addition to staff and peer contributions to the grade, students were asked how they would like group activities to be graded in the context of an individual mark and/or a group mark. The top ranked option was "both an individual and a group mark to be awarded" (chosen as first preference by 64.84% [59/91]), followed by "group mark only to be awarded" (chosen as first preference by 19.78% [18/91]), with the bottom ranked option being "individual mark only to be awarded" (chosen as first preference by 15.38% [14/91]). An open response question sought possible reasons for these preferences. For those who preferred "both an individual and a group mark to be awarded," the most common reason was that it takes into account how the group has performed and also recognises how you worked/contributed within the team (n=29/59 respondents). For those who preferred "an individual mark only to be awarded", the most commonly reported reason was that they considered it unfair for their marks to be affected by passive team

members especially when work was not divided equally (n=5/14 respondents). For those who preferred "group mark only to be awarded," the most commonly reported reason was that provided work is equally distributed, then everyone should get the same mark (n=10/18 respondents).

Perceived skills and professional development (Section C)

Table III outlines the statements and corresponding results for all respondents for this section of the questionnaire.

In terms of M.Pharm. teamwork activities facilitating skills and professional development, the following interpolated median scores (maximum possible score is 5) were obtained: working collaboratively (4.26); communication skills (4.26); developing respect for the opinions of others (4.16); problem-solving skills (4.03); leadership skills (4.02) and decision-making skills (4.00). In addition, many respondents (69/90, 76.67%) considered teamwork to be essential to ensure they became safe and effective pharmacists.

Those reporting a lower degree classification (rather than a 1st) considered to a greater capacity that teamwork improves understanding of concepts more than if they study alone. Interpolated median scores for this statement were: 4.60 (for students self-reporting a 2.2/3rd); 4.02 (for students self-reporting a 2.1); and 3.50 (for students self-reporting a 1st). Put another way, student respondents who reported currently achieving a 1st (in comparison to those not reporting achieving a 1st) were

less inclined to agree that teamwork improved understanding more than individual study (McNemar's x^2=10.473, df=1, *p*=0.001).

Discussion

The majority of respondents expressed satisfaction with teamwork within the M.Pharm. degree which is similar to that found in other literature (Searle *et al*., 2003; Singaram *et al*., 2008; Parmalee *et al*., 2009; Nelson *et al*., 2013; Remington *et al*., 2015; Miller *et al*., 2017; Bridges, 2018; Khansari & Coyne, 2018). Many students also held positive opinions on skills and professional development obtained as a result of teamwork which, again, echoes findings of other research (Nelson *et al*., 2013; Elmore *et al*., 2014; Lee *et al*., 2015; Remington *et al*., 2015; Bridges, 2018; Wong, 2018) and is encouraging in terms of meeting the regulator's standards and readiness for their future roles and responsibilities within a healthcare context.

Researchers have previously reported that nursing students prefer to choose their groups (Lee *et al.*, 2015; Wong, 2018) whereas this current study found that many (pharmacy) students wanted to be allocated to groups. Additionally, in the current study, students preferred the staff contribution to be greater (i.e. more heavily weighted) than peer assessment. Being allocated to groups (and having minimal contribution to grades) could mean they are less likely to offend their peers and have reduced accountability although the reasons should be explored in more depth in further studies. For example, if a student is allocated to a group, rather than choosing group members, then the decision is out of their hands and their peers will not be offended if they are not in the same team. Similarly, if the grade a student awards their peer has minimal weighting in comparison to the staff contribution, this will not have a big impact even if the student scores their peer harshly (so the student is not accountable if their peer does not get their desired grade). From a staff perspective, allocation of groups is quicker and easier to organise and provides a truer reflection of the working environment. Respondents' views of peer evaluation were mixed in terms of the level of confidence to undertake the task. Searle and colleagues (2003) reported the most controversial aspect of team-learning (from the medical students' perspective) was the use of peer assessment as part of grade determination and Parmalee and colleagues (2009) reported that medical students' satisfaction with peer evaluation decreased from the first to second year. Subsequently, Parmalee and Michaelsen (2010) have developed team-based learning tips and reassurance that there are several ways to implement an effective peer evaluation process (with a caveat that it might require trial and error to find the most suitable one for an individual degree course).

Students typically preferred teamwork activities that were formative rather than summative, and particularly inter-professional activities with other healthcare students. The reasons for this may be multifactorial: they could be considered valuable and relevant to their future careers (Kiersma *et al*., 2018; Theodorou *et al*., 2018); little work is required in advance of the session; there is limited pressure to contribute and not much at stake in terms of academic grades if the team does not function particularly well (since formative only). Students also liked teamwork in laboratories, which, again may be linked to the assessment (typically an individual report submitted after the practical and individual grade, therefore less risk with teamwork in this context) and it protects those who lack confidence conducting experiments independently. The least preferred team activities were generating a poster, oral presentations and debates. These activities require extensive work as a team, are summatively assessed, and result in a group mark only. Views on teamwork appear to depend on the nature of the activity (including if it is an authentic team task that would be done in the workplace) and whether it is linked to academic grades. Further work would need to be done before firm conclusions about this can be reached.

In terms of gender, only a few studies have investigated whether this impacts on views about teamwork (Singaram *et al*., 2008; Gallegos & Peeters, 2011) and found no significant difference exists. This current study showed males were more likely to want more teamwork activities in their degree than females However, males disliked evaluating and providing feedback to peers (their patient counselling ability and OSCE performance) more than females. It is difficult to provide a satisfactory explanation for these differences.

International students were more likely to consider that they needed to learn more about how to work effectively in a team before being expected to undertake teamwork activities which would be worth investigating further in the future. International students disliked the interdisciplinary activity with law students more than non-international students. Perhaps the simulated court room creates a challenging environment and fast-paced tasks requiring extensive verbal communication have previously being identified as problematic for non-native English-speaking students (Hall *et al*., 2017) and is something that should be considered further by QUB School of Pharmacy as part of the evaluation of this learning activity. While not directly gathered as questionnaire data, the authors can confirm that the majority of international students in this cohort were non-native English-speakers. Alternatively, maybe this could be related to the perceived relevance of this activity as it is not as obvious as activities with healthcare students would be. There are many benefits of having diverse student teams, for example, a study involving medical students found small-group work with diverse teams was useful for overcoming cultural barriers and promoting collaborative learning (Singaram *et al*., 2008), but it is crucial that certain student groups are not disadvantaged.

Those performing better academically through self-reported degree classification generally viewed teamwork as less valuable than their lower-academically performing peers. Higher-performers were less likely to agree that teamwork improved their understanding of

concepts more than if they had studied alone. Similar sentiments have been expressed in other literature (Sisk, 2011; Elmore *et al.*, 2014; Smith & Rogers, 2014; Garí & Iputo, 2015; Lee *et al.*, 2015). Perhaps this relates to a dislike of factors that have the potential to jeopardise marks, including working with peers and having to rely on them in an assessment, and is an area that could be further explored.

Implications for educators and future considerations

Peer evaluation was not viewed particularly favourably in this study. Therefore, more attention should be given to this (i.e. students learning how to do this effectively and facilitating them to have ample opportunities to apply this learning), particularly in light of its importance in professional development and the UK regulator's revalidation requirements.

This study revealed differences in opinion depending on the team activity. Qualitative research could help establish a deeper understanding about why students prefer some team tasks to others and explore what evidence-based measures could be taken to make them more equitable (although primarily any revisions in the curriculum should focus on ensuring students meet the required learning outcomes for the degree through appropriate learning techniques and assessments).

A lack of individual grading within the current M.Pharm. degree programme team activities has been revealed, as it is predominantly group grading only. In addition, it is now apparent that QUB School of Pharmacy summative assessment tends to be related to an output such as a presentation or poster. This requires greater focus to ensure that students' ability to work in a team is being measured and demonstrated. Getting a high grade for a poster does not necessarily equate to a cohesive and effective team.

Limitations and delimitations of the study

This study appears to be the first to establish a broad overview of students' opinions on teamwork throughout a pharmacy degree programme and investigate whether gender, international status, and self-reported academic performance affect responses. However, as twelve respondents failed to provide information on their current degree classification and this was self-reported information gathered in December 2018 (prior to the completion of several outstanding assessments by April 2019), differences in responses linked to academic performance should be viewed with caution.

At the time of questionnaire development, the authors anticipated students would provide this information readily; they are typically cognisant of grades and degree classifications when their final assessments are pending. Moreover, the two ranking questions were not included in the inferential statistical analysis as the nature of the data obtained means it was difficult to analyse these robustly. The validity of the research is strengthened by a high response rate (96.8%) but the importance of the findings is greatly limited due to the work being

conducted at a single site, and on a relatively small population. The questionnaire was primarily tested for face validity whereas further validity and reliability testing of the questionnaire could have been undertaken. There is potential to expand this investigation to encompass other year groups and pharmacy schools and the questionnaire could also be adapted to suit other degree programmes. The authors consider that the paper should prompt others to review teamwork provision within their own degree programmes or other educational setting.

Finally, it should be noted that this study represents a low-level or first stage evaluation (gaining views about an activity or approach) rather than a comprehensive and robust evaluation which should be done using an evidence-based framework such as the Kirkpatrick model (Bates, 2004).

Conclusions

While it is positive that these future pharmacists recognised the importance and benefits of teamwork, more attention is required at QUB School of Pharmacy in relation to peer evaluation (for professional development and revalidation). QUB School of Pharmacy should use this study as the impetus to further evaluate the teamwork provision within the degree programme, including reviewing associated assessment. Views on teamwork depended on the nature of the activity and whether it was linked to grades and/or professional socialisation i.e. team activities that directly linked to work-based practice (such as the prescribing and dispensing with medical students), and posed no risk to academic grades due to their formative nature, were viewed most favourably as depicted in Figure 1.

Conflicts of interest

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