

# OIE educational twinning RVC-JUST

Activity report Year 3 (January 2017 – December 2017)

## 1 ACCOMPLISHMENTS/NEW FINDINGS

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Of the three components of the project (undergraduate, postgraduate and professional education), the main focus during the second year of implementation has been on the post-graduate education component. The postgraduate element is an important and ambitious part of the project which was successfully completed during year 3. This component of the project involved very intense educational exchange between a large team of around 20 people, including students and supervisors from the UK and Jordan. During the third year of the project, there have been several country visits, face-to-face meetings and coordinated work on a number of specific research topics that were used as a vehicle for postgraduate education by research. The outcomes of this project component are remarkable. It has resulted in the successful graduation of 9 students (with an additional student expected to graduate shortly), through an innovative program of paired projects across the two countries. The degrees attained by the students are MRes (Master of Research) degree from the RVC (five students), Master of Science in Microbiology from JUST (three students), Master of Science in Public Health from JUST (one student) and Master of Science in Theriogenology from JUST (one student). It has generated high-quality research outcomes in the broad fields of livestock and veterinary public health that are aligned with Jordan's priorities. Furthermore, it has resulted in very active exchange between staff of the two twinned institutions. A highlight of the postgraduate component has been the award to Zain Shaheen of an MSc in Wild Animal Health after a year of studies at the RVC. Zain is the first Jordanian Veterinarian to achieve a postgraduate degree at Masters level in wild animal health and now combines her position at Princes Alia Foundation with delivery of teaching in wild animal medicine at JUST. The twinning project has therefore made another contribution towards enhancing the provision of veterinary education at JUST by addressing their identified need in the field of wildlife animal health.

Although the main emphasis in year 3 has been the postgraduate component, there have also been progress with the undergraduate component of the project. This includes a visit of 8 undergraduate JUST students to the RVC, the delivery of the 2<sup>nd</sup> undergraduate education intervention, the development of interactive web Apps to be used in the 3<sup>rd</sup> and last undergraduate education intervention and the publication of the book "Veterinary Clinical Skills Manual" edited by one of the RVC academics directly engaged with the twinning program with JUST academics co-authoring a chapter that features JUST clinical skills lab.

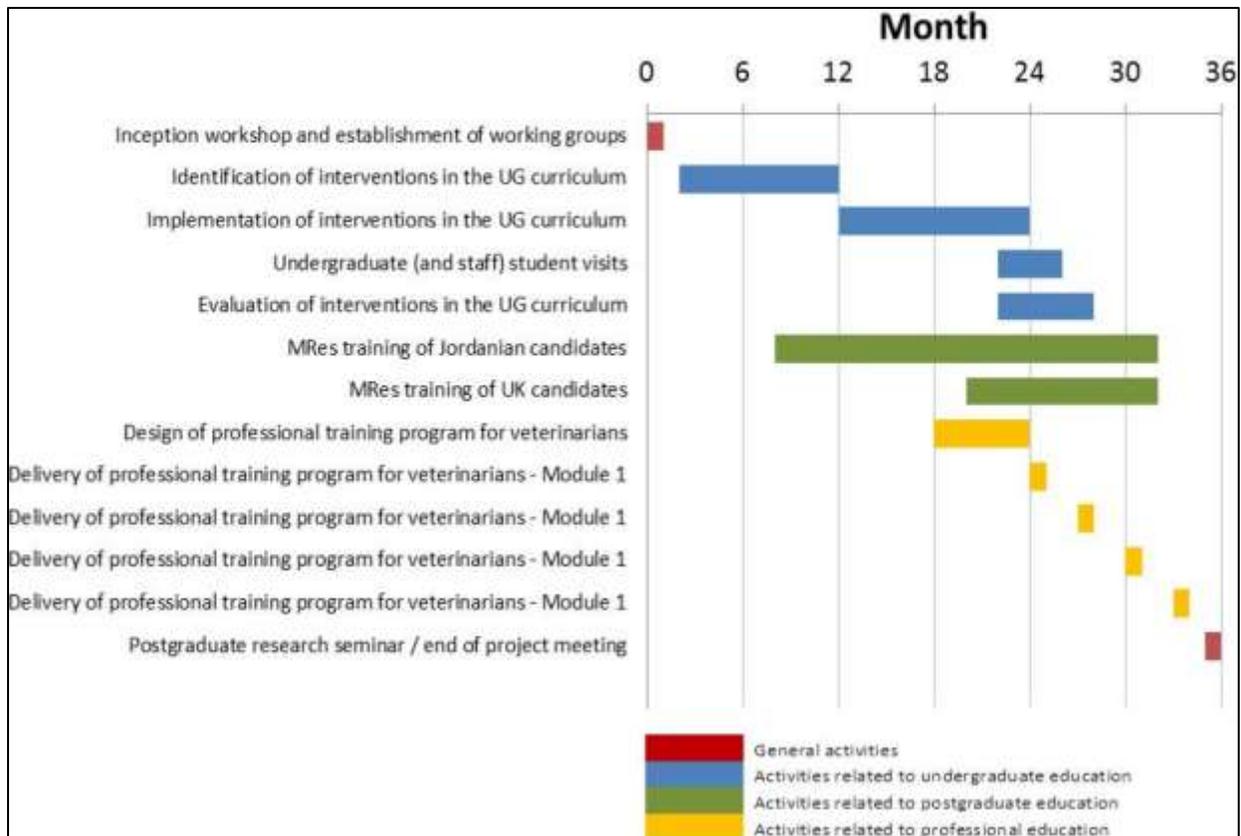
The third element of the project is professional education; we have not progressed with this component during the third year as other activities have been prioritized. This component will be the main focus of activity in the final year of the project, during which we will also finalize some of the outstanding elements of the undergraduate education component.

As explained in our previous report, a major achievement during the 2<sup>nd</sup> year of the project was the award to the two organizations of significant additional funding (US\$ 600,000) from the UK's Medical Research

Council to carry out collaborative research on MERS-CoV. During the 3<sup>rd</sup> year of the twinning project, some of the RVC and JUST academics have been involved in research activities related to this project. These activities are contributing to consolidate the RVC-JUST partnership and will greatly contribute to its long-term sustainability. Proof of the potential for long term engagement between RVC and JUST beyond the duration of the twinning project is the involvement of RVC and JUST in two consortiums that have submitted bids for competitive funding in the fields of animal health and public health in Jordan: a project on poultry diseases led by The Pirbright Institute that was unsuccessful, and a project on human campylobacter infection, led by University of Melbourne and currently under consideration by the Bill and Melinda Gates Foundation.

#### **OIE Educational twinning RVC-JUST: highlights from the 3<sup>rd</sup> year of the project**

- Nine post-graduate students successfully graduated through innovative program of paired (RVC-JUST) projects with shared supervision; 5 MRes graduates at RVC and 4 MSc graduates at JUST with a 5<sup>th</sup> JUST student expected to graduate in the 4<sup>th</sup> year of the project.
- Zain Shaheen becomes the first Jordanian veterinarian with a postgraduate qualification in Wild Animal Health at MSc level and joins the JUST faculty to deliver teaching in wildlife medicine.
- A group of 8 JUST senior undergraduate students visit RVC and participate in a number of rotations and activities of clinical services.
- The book “Veterinary Clinical Skills Manual” edited by Ayona Silva Fletcher (Professor of Veterinary Education at RVC and directly engaged with the twinning program), is published by CABI. JUST academics co-authored a chapter featuring JUST clinical skills lab.
- Second undergraduate teaching intervention delivered and well received by undergraduate students providing evidence of student engagement with problem-based learning.
- Innovative interactive Apps developed to teach concepts such as risk and uncertainty in the context of food safety as part of the 3<sup>rd</sup> and last undergraduate teaching intervention. The potential use of these Apps for undergraduate teaching was summarized in an abstract accepted for oral presentation at the International Symposium on Veterinary Epidemiology and Economics (ISVEE) in November 2018.
- The Principal of the RVC, Professor Stuart Reid, conferred a certificate of completion on Zain Shaheen at Princess Alia Foundation, during a ceremony attended by Her Royal Highness Princess Alia bint Hussein of Jordan.



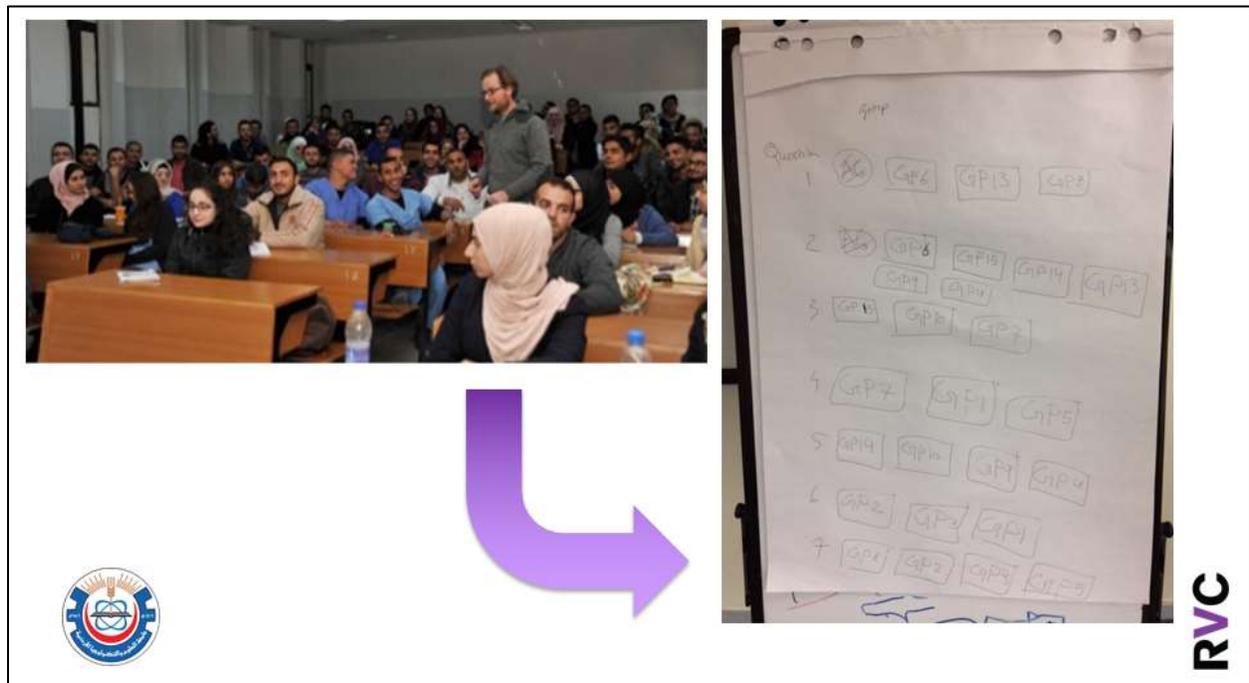
Gantt chart showing activities planned during months 24 to 36, namely: i) undergraduate student visits, ii) evaluation of interventions, iii) MSc training of JUST students, iv) MRes training of RVC students and v) Delivery of a professional training program for veterinarians.

## 1.1. UNDERGRADUATE EDUCATION

### 1.1.1. *Design and implementation of curriculum interventions (ongoing)*

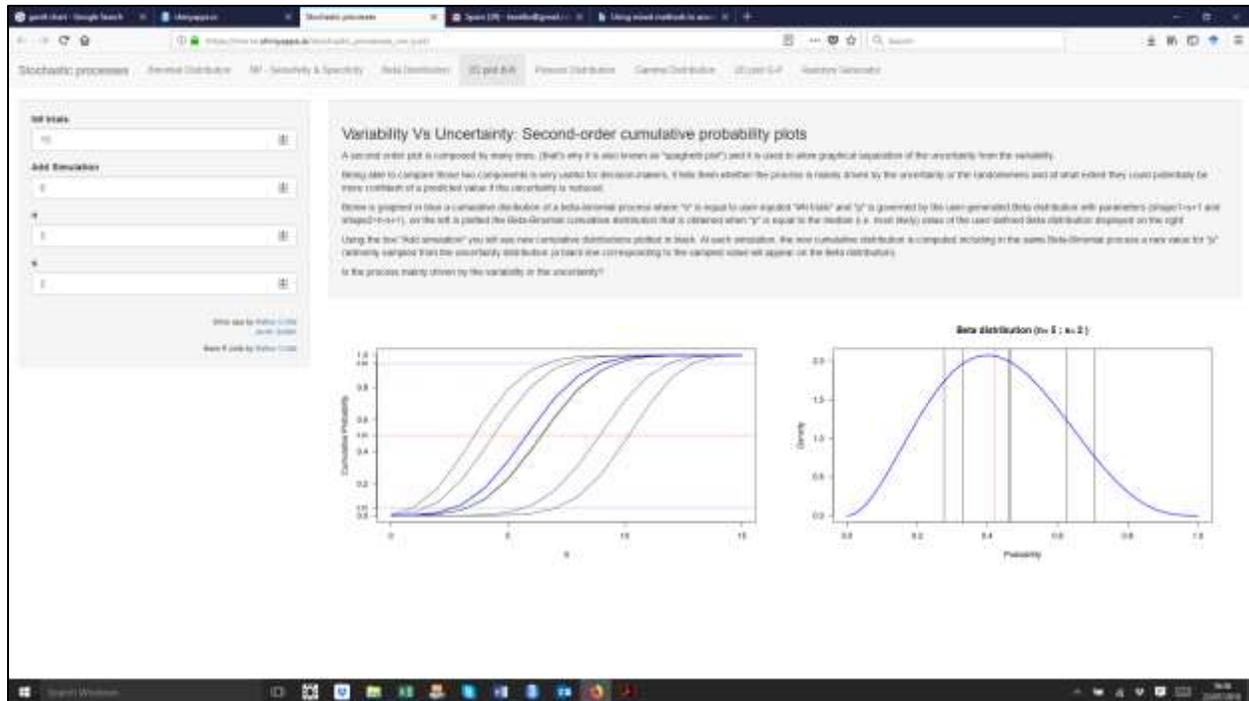
This activity involves the delivery of 3 interventions in the JUST curriculum. The three interventions consist in the introduction of a combination of didactic and problem-based sessions in the undergraduate curriculum of JUST. The sessions are delivered during a week and have two aims: i) to promote integration between different elements of the curriculum that have traditionally been addressed independently and ii) to facilitate the introduction of problem-solving teaching methods (recommended by EAEVE) in the undergraduate curriculum of JUST. Once developed, the materials become available for JUST to run in the future so that these novel elements, upon revision based on feedback, become integral components of the JUST curriculum. This activity has been spread over a longer period of time than originally planned. The reason for the delay of this activity is the JUST academic calendar and the opportunity of delivering the interventions to the same cohort of students if they are introduced in consecutive years, as this will enhance their evaluation. In the 3<sup>rd</sup> year of the project, the 2<sup>nd</sup> intervention was delivered. The 3<sup>rd</sup> and last intervention is planned to be delivered in the 4<sup>th</sup> (final) year of the project. The first intervention focused on herd health/livestock medicine and the second one on control of a zoonotic disease with the dual effect of compromising livestock production and causing human infection (brucellosis). The topics have been

selected as they are ideal to highlight links between livestock health, livestock welfare and public health. Pre and post-delivery questionnaires are used to gather students' perceptions of the teaching methods and the learning activity. Analysis of the feedback from the two interventions conducted so far strongly suggests that the interventions were very successful at enhancing student learning and promoting discussion and in-depth learning. Furthermore, the evaluation provides strong evidence that students, despite not being used to these types of sessions, do enjoy learning this way. The main challenges towards increasing the amount of problem-based learning in the JUST curriculum appear to be logistics as these sessions are staff-intensive and should ideally be delivered in a number of small rooms that may not always be available.



*Dr. Steven van Winden delivering problem-based session to undergraduate students at JUST.*

The last planned activities as part of this component of the project are i) the delivery of the 3<sup>rd</sup> and last intervention and ii) the development of video materials on porcine health. Both activities will be completed in the last year of the project. The 3<sup>rd</sup> and last intervention will make use of innovative interactive Apps to teach concepts such as risk and uncertainty in the context of food safety. The first versions of these teaching Apps have already been developed using the R package “Shiny”, as user-friendly, web applications. They will become freely accessible upon conclusion of the twining project. The potential use of these applications for undergraduate teaching has been summarized in an abstract accepted for oral presentation at the International Symposium on Veterinary Epidemiology and Economics (ISVEE) in November 2018. The development of video materials on porcine health was identified earlier in the project as a priority need for JUST towards future accreditation. This topic is currently not being covered in the JUST curriculum given the low relevance of swine production in Jordan for cultural and religious reasons. However, in order for JUST to have their veterinary program accredited by EAEVE elements of porcine health must be incorporated into the curriculum. At early stages of the project we identified an opportunity to develop high quality video resources to cover this need of JUST.



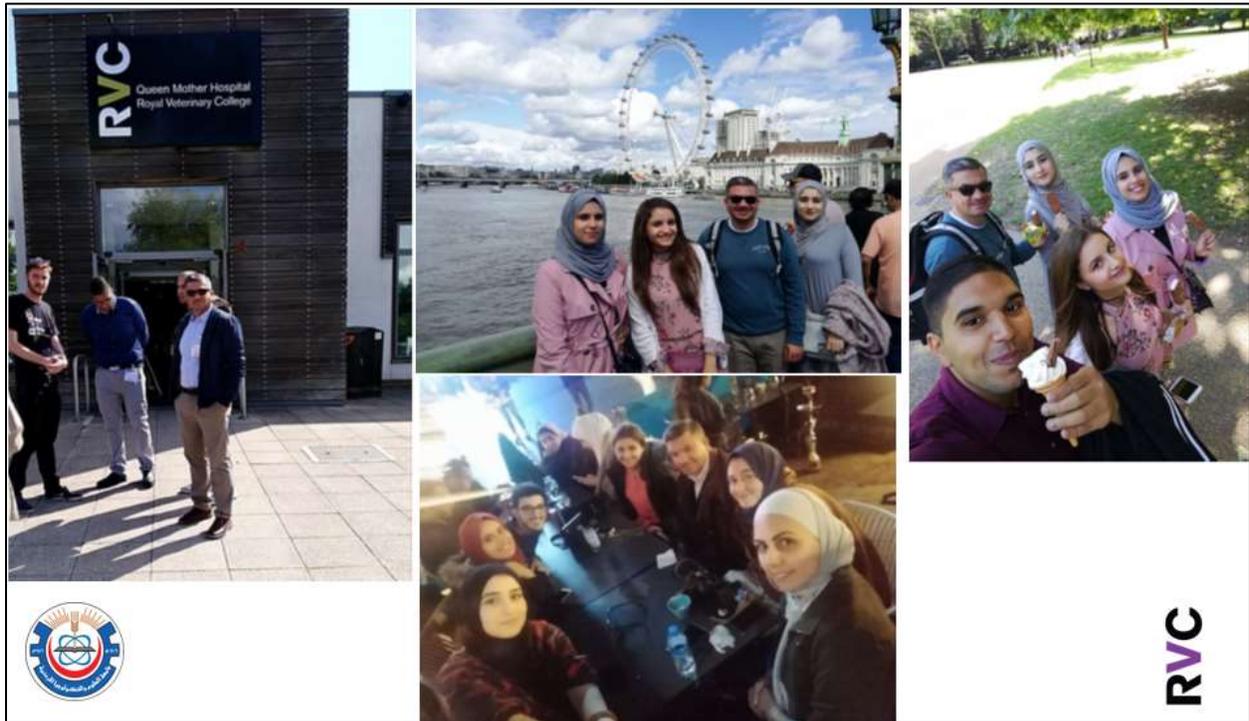
Screen capture of an interactive App developed for the delivery of the 3<sup>rd</sup> and last undergraduate teaching intervention.

### 1.1.2. Evaluation of interventions and reporting (ongoing)

The evaluation is ongoing as additional data becomes available after the delivery of each intervention. The final analysis will be carried out after the delivery of the 3<sup>rd</sup> intervention in the final year of the project. During the third year of the project the evaluation of interventions continued gathering of additional data by means of pre- and post- intervention surveys administered to the students after the second intervention, in a similar way to what was done with the first intervention. A total of 50 sets of matching pre- and post- session questionnaires were obtained and initial analysis of the results corroborates the findings of the first intervention, showing that i) when given the opportunity to engage with this type of learning students enjoy it and are very interactive and ii) this type of learning is successful at increasing students' knowledge of a specific topic and of its links with other aspects traditionally taught separately. Final evaluation of the effectiveness of the educational interventions to enhance student skills in developing and integrating knowledge in the context of public health, animal production and welfare and the students' perception of the interconnectedness (or integration) of the teaching will be completed after delivery of the 3<sup>rd</sup> intervention in the final year of the project.

### 1.1.3. Student visits (months 22-26)

During the 3<sup>rd</sup> year of the project, 8 senior undergraduate students from JUST visited the RVC for two weeks. We are very pleased that we were finally able to carry out this activity as there have been considerable difficulties associated with student visa and insurance issues. The students were able to join a number of activities in the different clinical services and rotations. Feedback from the students shows that this was a very valuable experience to strengthen their medical knowledge, diagnostic abilities, communication skills and patient care skills.



*JUST senior undergraduate students in London as part of their 2-week visit to RVC*

**1.1.4. Alignment with OIE recommendations on the competencies of graduating veterinarians and OIE guidelines on Veterinary Education Core Curriculum (ongoing across entire duration of the project)**

As reported in the 2<sup>nd</sup> year report, this component of the project has exceeded our initial aspirations. The project has developed:

- i) JUST day 1 competencies and a veterinary skills logbook aligned with EAEVE and OIE competencies
- ii) An approach to map day 1 skills of a curriculum and competences defined by accreditation bodies

**1.1.4.1. JUST day 1 competencies and veterinary skills logbook**

At the inception of the project, and under the leadership of Dr Abdelsalam Talafha, JUST was developing day 1 competences and a veterinary skills logbook. This was a priority for JUST given its importance for EAEVE accreditation and it was identified by the project team as one of the key areas where the twinning project could assist JUST in enhancing their undergraduate curriculum and aligning it with OIE guidelines on Veterinary Education Core Curriculum. Teams from RVC and JUST under the leadership of Dr. Talafah

(JUST) and Dr. Silva-Fletcher (RVC) worked closely together on the development of the logbook, a task that was completed at the end of the 2<sup>nd</sup> year of the project. The logbook is based on Day 1 competencies that are expected from a DVM graduate from JUST and is mapped to the OIE and EAEVE day 1 competencies. The logbook was reviewed and agreed by the project team and benefitted from educational expertise from Dr. Silva-Fletcher, a renowned expert in veterinary education and pedagogy and member of the RVC's Centre for Excellence in Teaching and Learning, the LIVE center. The logbook contains three sections with 79, 138 and 108 skills in each section that were divided into three expected levels of achievement as follows:

- Category 1. Student is expected to have performed the skill him/herself
- Category 2. Student is expected to have observed the skill performed by faculty course instructors
- Category 3. Student is expected to have knowledge of the skill

A major outcome of this twinning project has therefore been the development and introduction of the logbook. Student feedback on the use of the logbook has been gathered and the analysis of these data will be completed in the final year of the project so that the logbook can be further refined.

#### 1.1.4.2. Approach to map day 1 skills of a curriculum and competencies defined by accreditation bodies

During the second year of the project we developed an approach to map day 1 skills of a curriculum and competencies defined by accreditation bodies. This work was completed and applied to RVC curriculum and the results were presented at the 4th OIE Global Conference on Veterinary Education. A manuscript has been written for submission to a peer-review educational journal but has not yet been submitted for publication as we have been incorporating suggestions for colleagues. We expect this outcome of the project to undergo peer review in the final year and, potentially, to have considerable impact for future mapping of sets of competencies defined by different accreditation bodies.

## 1.2. POSTGRADUATE EDUCATION

### 1.2.1. Selection of research projects (completed)

### 1.2.2. Implementation of research projects (completed)

The postgraduate component of the RVC-JUST educational twinning program aims at training, by means of supervised research activities, a cohort of paired RVC-JUST students. A modification was requested to the original plans and two of the planned JUST MSc scholarships were replaced by one scholarship for a Jordanian veterinarian to study an MSc in Wild Animal Medicine. The scholarship was offered to Dr. Zein Shaheen, a veterinarian working for Princess Alia Foundation. The postgraduate component of the RVC-JUST twinning is an ambitious part of the project and has been the main focus of activity during the 3<sup>rd</sup> year. The component has been successfully finalized pending graduation of one of the 11 students in 2018. As explained in previous yearly reports, project topics were selected in previous phases of the project because of their relevance for Jordan and JUST, their alignment with OIE priority areas and the existence of complementary expertise in the two institutions. Due to the lack of expertise on wildlife diseases at JUST and the strategic importance of training a future JUST academic in this area, it was decided that one of two of the Jordan scholarships would be used to support MSc training in wildlife health. This component of the twinning program has therefore aimed at training a total of 10 paired students (5 UK and 5 Jordan) at MRes (UK) and MSc (Jordan) level and a further Jordanian Veterinarian at MSc level. The main outcomes of this component are:

- Five RVC MRes student have successfully completed their year of studies, defended their projects and graduated with distinction (2 students) and merit (3 students). All five students traveled to Jordan to work with their Jordanian counterparts, in some cases several times during the year.
- Four of the five paired JUST MSc students have successfully graduated; the 5<sup>th</sup> students registered later than the others and is expected to successfully graduate in during 2018.
- Zain Shaheen, Jordanian Veterinarian who registered at RVC, has successfully completed her MSc Wild Animal Health graduating with Merit. She is now working in Jordan for Princess Alia Foundation and contributing to teaching of wildlife medicine in JUST.
- High quality research outputs have been generated in areas of strategic importance of Jordan:
  - Infectious causes of abortions and use of abortion records for syndromic surveillance
  - Drug resistant E coli in poultry
  - Predictive mapping of vector-borne diseases
  - Management of meat-borne pathogens
  - Antibiotic resistance in *Staphylococcus aureus* and mastitis
- This component of the twinning project has resulted in a very significant exchange of students and academics with around 20 students and academics travelling to the partner country and around 30 students and supervisors involved in the activities.

The project team considers this component of the project a major undertaking and success of the partnership. It was an innovative but complex plan and it has been successfully completed delivering outcomes that are beyond our initial expectations. We summarize below the profiles of the students and their current destinations which demonstrates the impact that the twinning has had for their careers.

**Emi Takahashi** (RVC MRes student paired with Lina Masoud); graduated with Merit.

- **Background:** BSc in Zoology; MSc in Wild Animal Biology.
- **Research project:** *“Predictive mapping of the cutaneous leishmaniasis vector (Phlebotomus papatasi) in Jordan using multi-criteria decision analysis.”*
- **Supervisors:** Kim Stevens (RVC), Javier Guitian (RVC), Rami Mukbel (JUST)
- **Other project outputs:**
  - Presentation at British Federation of Women Graduates conference (Prize-Best Presentation): *Identifying areas at risks of disease outbreaks using geographical information systems*
  - First draft of manuscript to be submitted to PLOS Neglected Tropical Diseases: *“Modelling habitat suitability for the distribution of the cutaneous leishmaniasis vector (Phlebotomus papatasi) in Jordan using spatial multi-criteria decision analysis.”*
  - Poster presentation at GeoMed conference: *“Predictive mapping of the cutaneous leishmaniasis vector (Phlebotomus papatasi) in Jordan using multi-criteria decision analysis.”*
- **Destination after completion of project:** Epidemiologist at MSF/Doctors Without Borders working with Myanmar refugees in Bangladesh.

**Lina Masod** (JUST MSc student paired with Emi Takahashi).

- **Background:** DVM.
- **Research project:** *“Modelling the distribution of mosquitoes and sandflies in Northern Jordan and the Jordan Valley”*

- **Supervisors:** Rami Mukbel (JUST), Kim Stevens (RVC), Javier Guitian (RVC)
- **Other project outputs**
  - Co-author of the manuscript to be submitted with RVC student Emi Takahashi: *“Modelling habitat suitability for the distribution of the cutaneous leishmaniasis vector (Phlebotomus papatasi) in Jordan using spatial multi-criteria decision analysis.”*

**Margarida Arede** (RVC MRes student paired with Haneen Abubaker); graduated with Merit.

- **Background:** DVM and MSc in Veterinary Medicine.
- **Research project:** *“Evaluating potential data sources for syndromic surveillance of abortion in cattle and sheep in Great Britain.”*
- **Supervisors:** Julian Drew (RVC), Steven Van Winden (RVC), Mohamed Ababneh (JUST)

**Haneen Abubaker** (JUST MSc student paired with Margarita Arede); project ongoing.

- **Background:** DVM
- **Research project:** *“Syndromic surveillance of abortions in sheep in Jordan”*
- **Supervisors:** Mohamed Ababneh (JUST), Julian Drew (RVC), Steven van Winden (RVC).

**M. Inês Neves** (RVC MRes student paired with Esmaeel Malkwai); graduated with Distinction.

- **Background:** DVM and MSc in Veterinary Medicine.
- **Research project:** *“Quantifying Campylobacter transmission among broilers and the day of first infection in semi-commercial conditions in Jordan.”*
- **Supervisors:** Javier Guitian (RVC), Damer Blake (RVC), Matteo Crotta (RVC), Akram Alaboudi (JUST) and Mohammad Obidate (JUST).
- **Other project outputs:**
  - Manuscript submitted for publication to Epidemiology and Infection: *“Quantifying Campylobacter transmission among broilers and the day of first infection in semi-commercial conditions in Jordan.”*
- **Destination after completion of project:** currently doing a PhD at the RVC: *“Modelling the spatial and zoonotic epidemiology of schistosomiasis in an elimination landscape”.*

**Esmaeel Malkawi** (JUST MSc student paired with Maria Inês Neves).

- **Background:** DVM.
- **Research project:** *“Prevalence and genotypes of Campylobacter jejuni and Campylobacter coli among local and imported chickens, food handlers and human patients in Northern Jordan”*
- **Supervisors:** Akram Alaboudi (JUST), Mohammad Obidate (JUST), Javier Guitian (RVC), Damer Blake (RVC), Matteo Crotta (RVC)
- **Other project outputs:** Co-author of the manuscript to be submitted with RVC student M. Inês Neves: *“Quantifying Campylobacter transmission among broilers and the day of first infection in semi-commercial conditions in Jordan.”*

**Tillie Cryer** (RVC MRes student paired with Rekaz Ibrahim); graduated with Distinction.

- **Background:** BSc in Veterinary Sciences.
- **Research project:** *“Invasive properties of Escherichia coli strains isolated from chickens in a human CaCo-2 gut epithelia cell culture model,”*
- **Supervisors:** Liam Good (RVC), Ana Mateus (RVC), Yaser Tarazi (JUST), Ehab Abo Basha (JUST)
- **Other project outputs:**

- First draft of manuscript in preparation: “Invasive properties of Escherichia coli strains isolated from chickens in a human CaCo-2 gut epithelia cell culture model”.
- Poster presentation at BSAC Spring Conference, March 2017: *“Invasive Properties of Extraintestinal Strains of Escherichia coli Isolated from Poultry in Jordan”*
- **Destination after completion of project:** Currently working for SpringerNature Publishing, London office, as an editorial assistant, with a focus on infection and animal health.

**Rekaz Ibrahim** (JUST MSc student paired with Tillie Cryer); finishing dissertation.

- **Background:** DVM.
- **Research project:** *“Identification of Escherichia coli from broiler chickens in Jordan, their antimicrobial resistant and the associated risk factors”*
- **Supervisors:** Yaser Tarazi (JUST), Ehab Abo Basha (JUST), Liam Good (RVC), Ana Mateus (RVC)

**Winnie Ntow-Boahene** (RVC MRes student paired with Dima Almomani); graduated: Merit.

- **Background:** BSc in Biomedical Sciences.
- **Research project:** *“Genotypic characterisation of Staphylococcus aureus isolates recovered from bovine milk of cows with mastitis in Jordan.”*
- **Supervisors:** Steven Van Winden (RVC), Liam Good (RVC), Maysseer Alakash (JUST) and Ehab Abo Basha (JUST)
- **Other project outputs:**
  - Co-author of publication that used methods developed during MRes: Kamaruzzaman, NF, Chong, SQY, Edmondson-Brown, KM, Ntow-Boahene, W, Bardiau, M, Good, L. (2017) Bactericidal and Anti-biofilm Effects of Polyhexamethylene Biguanide in Models of Intracellular and Biofilm of *Staphylococcus aureus* Isolated from Bovine Mastitis. Front. Microbiol., 11 August 2017 | <https://doi.org/10.3389/fmicb.2017.01518>
- **Destination after completion of project:** Currently doing a PhD at the RVC, fully funded by a BBSRC-UK/industrial partner, iCASE, 4 year studentship grant.

**Dima Almomani** (JUST MSc student paired with Winnie Ntow-Boahene), dissertation submitted.

- **Background:** DVM
- **Research project:** *“AMS, Phenotyping and Genotyping of Staphylococcus aureus Isolated From Cases of Subclinical Mastitis in Dairy Cows in Northern Jordan”*
- **Supervisors:** Maysseer Alakash, Ehab Abo Basha (JUST), Steven van Winden (RVC), Liam Good (RVC)

**Zain Shaheen** (student of MSc Animal Health); graduated with Merit.

- **Background:** DVM.
- **Research project:** *“Survey on gastrointestinal parasites in semi-wild arabian oryx oryx leucorix (pallas, 1777) on two reserves in the hashemite kingdom of Jordan.”*
- **Supervisors:** Michael Waters and Tony Sainsbury.
- **Other project outputs:** First draft of manuscript in preparation: *“Survey on gastrointestinal parasites in semi-wild arabian oryx oryx leucorix (pallas, 1777) on two reserves in the hashemite kingdom of Jordan”*

Because of the different start dates and program duration in Jordan and UK, the outputs from the work of MSc students in Jordan (publications) are less advanced than those from UK MRes students and are expected to be produced in the final year of the project.

1.2.3. Training in wildlife medicine (completed)

1.2.4. Research seminar (month 36)

No progress to report as this activity will take place at the end of the project.

1.3. PROFESSIONAL EDUCATION (months 18-36)

This activity is delayed as it was felt strategic to focus on the undergraduate and postgraduate education components given the opportunities that emerged (e.g. development of the JUST day 1 skills log book). The activity will be carried out in the 4<sup>th</sup> and final year of the project.

## 2 INTERACTIONS

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The level of interactions between RVC and JUST students and academics during the 3<sup>rd</sup> year of the project has been particularly high, with approximately 30 students plus academics travelling to the partner country, around 20 of them for purpose of the postgraduate component and the remaining for the undergraduate component. Since the commencement of the project, around 50 staff and students have been directly involved in the twinning project activities and 40 of them have visited the partner institution at least once. Interactions have mostly related to the postgraduate component, although there has also been an undergraduate student visit to London during the 3<sup>rd</sup> year of the project.



*RVC and JUST postgraduate supervisors during JUST visit to RVC-Camden.*



*The Principal of the RVC, Professor Stuart Reid, conferred a certificate of completion on Zain Shaheen at Princess Alia Foundation, during a ceremony attended by Her Royal Highness Princess Alia bint Hussein of Jordan.*



Ceremony at Princes Alia Foundation to confer a certificate of completion to Zain Shaheen.

### 3 PUBLICATIONS AND REPORTS

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During the third year of the project several scientific presentations were delivered by postgraduate students, including:

- Emi Takahashi's presentation at British Federation of Women Graduates conference (Prize-Best Presentation): *Identifying areas at risks of disease outbreaks using geographical information systems.*
- Emi Takahashi's poster presentation at GeoMed conference: *"Predictive mapping of the cutaneous leishmaniasis vector (Phlebotomus papatasi) in Jordan using multi-criteria decision analysis."*
- Tillie Cryer's Poster presentation at BSAC Spring Conference, March 2017: *"Invasive Properties of Extraintestinal Strains of Escherichia coli Isolated from Poultry in Jordan"*

Furthermore, several papers have been prepared based on the work of the postgraduate students, among them:

- Kamaruzzaman, NF, Chong, SQY, Edmondson-Brown, KM, Ntow-Boahene, W, Bardiau, M, Good, L. (2017) Bactericidal and Anti-biofilm Effects of Polyhexamethylene Biguanide in Models of Intracellular and Biofilm of *Staphylococcus aureus* Isolated from Bovine Mastitis. *Front. Microbiol.*, 11 August 2017 | <https://doi.org/10.3389/fmicb.2017.01518>

- Neves et al. Quantifying Campylobacter transmission among broilers and the day of first infection in semi-commercial conditions in Jordan. *Epidemiology and Infection*. Under Review.

Also, the book “Veterinary Clinical Skills Manual” edited by Ayona Silva Fletcher, RVC academics directly engaged with the twinning program, is published by CABI. JUST academics co-authored a chapter featuring JUST clinical skills lab.

Several other papers have been drafted and are expected to be submitted for publication during the final year of the project, among them two papers focusing on educational aspects of the project.

## 4 COURSES TAUGHT/TRAINING PROVIDED

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*Undergraduate:* The second teaching intervention was delivered (see above), and feedback gathered from students reinforces the potential of strengthening problem-based learning at JUST. Undergraduate students from JUST carried out a study visit to RVC which strengthened in particular their clinical skills. The final undergraduate teaching intervention is planned for the 4<sup>th</sup> year of the project and will make use of innovative teaching Apps some of which have already been developed.

*Postgraduate:* The entire component has been finished, resulting in the training of 11 students at Master’s level, all except one have already graduated, the last one is expected to graduate in the final year of the project.

## 5 MAJOR EVENTS ANTICIPATED IN THE NEXT 6 MONTHS

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The last 6 months of the project will be used to finalize all remaining project activities. The postgraduate component is almost completed, the undergraduate component is pending the 3<sup>rd</sup> teaching intervention and completion of the evaluation and of the porcine health video materials. The main component in which we are working in the final year is the professional education component with training planning to take place in October in Jordan in parallel with development of materials for distance learning.