Mise en place et évaluation d’un
Enseignement International de Maladies Infectieuses
pour les étudiants en Médecine de deuxième cycle

Mémoire soutenu par Caroline Charlier

Travail encadré par Pr Claire LE JEUNNE

Soutenu le 20 Octobre 2017
Summary

Context
The emerging global-health paradigm requires medical teaching to be continuously redefined and updated; to this end, transnational approaches should be encouraged, and medical training harmonized. Infectious diseases (ID) teaching in the current context of emerging infections, fast-increasing bacterial resistance, and large-scale human migration, was chosen to develop a common international course.

Objective
We report the successful implementation of a joint European undergraduate course called I3DC (International Intensive Infectious Diseases Course) aiming to (i) develop a common ID core curriculum among European medical students; (ii) promote mobility among teachers and students (iii) promote international cooperation among European teachers.

Methods
The course is built around on teachers’ mobility. It is provided in English by a team of European medical educators from Paris Descartes University, Università Cattolica del Sacro Cuore in Roma, University of Edinburgh and also now by the University of Edinburgh to groups of 25-30 undergraduate medical students at each university. Partner Institutions officially recognize the course as substitutive of/or additive to the regular curriculum.

Results
The course is offered for 4 years, and receives excellent satisfaction scores by students and staff as regards to scientific content, pedagogy, and international exchanges. It led to the implementation of a broader pedagogical cooperation program called IDEAL (Infectious Diseases Europe Africa Learning) now involving 3 more partners (University Antwerpen, Mother Kevin Postgraduate Medical School in Nsambya, Kampala, Uganda and Saint Mary’s Lacor Hospital in Gulu, Uganda) over 3 complementary approaches : the I3DC course, an annual summerschool (first year in Paris in August 2017) and the development of collaborative e-learning teaching approaches with Ugandan partners in Uganda.

Conclusion
This cooperative approach demonstrates the feasibility of a harmonized European undergraduate medical education, having ID as a text experiment for future developments.

Key words
Harmonized curriculum, interactive course, infectious diseases, Europe
Introduction

Unmet pedagogical needs
Our traditional medical teaching approach is currently shattered by an array of new parameters. First students display an increasing loss of interest for traditional frontal lectures delivered in large lecture halls, usually described as too time-consuming when compared to online-sources and disconnected to their practice. Also, the global health context requires more than ever both continuous updates and departioning of our current teaching. Stronger cooperation between European medical schools characterized by different approaches and methodology appears instrumental to address these needs. Among medical specialties, undergraduate Infectious Diseases (ID) teaching is particularly relevant to develop strong international cooperation, for complementary reasons. First, ID remain the third most common cause of death worldwide. (1) Major unexpected threats have emerged in the past years, like Ebola virus disease, West Nile virus infection, Middle East Respiratory Syndrome (MERS) or Zika virus infection. (2-4) Emerging infections directly affect European health in the context of large-scale people migration, multicultural societies and increasing ease of international air travel. Inappropriate use of antibiotics has also fueled the emergence of antimicrobial resistance that challenges our antibiotic armory. World Health Organization (WHO) identifies education of medical students in ID as key to control such multi-resistant pathogens. (5, 6) (7) These ever-increasing issues make it mandatory for tomorrow’s doctors to master a wide array of knowledge and novel medical skills. Because ID is intrinsically a transversal discipline encountered in most medical specialties, all medical students — and there are currently estimated around 14,000 throughout Europe (8) — will benefit from comprehensive ID teaching regardless of their ultimate choice of specialty.

Second, ID is a transversal specialty because it requires a wide array of knowledge including epidemiology, pathophysiology, microbiology and therapeutics. It is hence delivered in many different – fragmented ways that are not always effective or sufficient to ensure relevant medical training. For instance, microbiologists, infectious diseases physicians, paediatricians and also lung specialists all provide teaching about tuberculosis, hardly providing a global perspective about a global infection.

A global overview and a perspective of the interrelations between facts are crucial for a strong education, as emphasized by Edgar Morin in his report for the UNESCO in 1999: “We should develop the natural aptitude of the human mind to place all information within a context and an entity. We should teach methods of grasping mutual relations and reciprocal influences between parts and the whole in a complex world”. (9)

Emergence of novel infections demands early training in communication and information skills that foster a concerted global approach (10) ; such training is currently lacking.

Finally, ID teaching perfectly illustrates the persisting heterogeneity in European medical education with great cultural and social barriers hampering harmonization, as advocated by the Bologna process (11). As stated by the European Society for Clinical Microbiology and Infectious Diseases Professional Affairs Workshop group in 2011, “it should be possible to train in any region of the European Community, enjoying equivalent standards (...) with equivalent terms and conditions” . (12) This is still not the case, and ID teaching heterogeneity
in terms of content, duration and teaching approaches, mirrors the current heterogeneity in professional profiles and official recognition of ID as a medical specialty. (12)

The MEDMOTION programme

In line with the Bologna process (11), the European Union (EU) Life Long Learning programme MED-MOTION was developed. It aimed at removing barriers between European medical curricula, by several means like designing common courses for EU medical schools (www.med-motion.be) : like a Joint Summerschool dedicated to Emergency medicine with Charité-Universitätsmedizin Berlin, and Université Paris Descartes (Claire Le Jeunne) in 2013. Infectious diseases was identified as the medical specialty most urgently requiring internationalized teaching among others such as emergency medicine, according to a poll performed in 2012 among a panel of students from the Seven European Universities involved in Med-MOTION (Universiteit Antwerpen, Charité-Universitätsmedizin Berlin, Karolinska Institutet Stockholm, Université Paris Descartes, Università Cattolica del Sacro Cuore, Roma, Semmelweis University, Budapest, University of Edinburgh) (www.med-motion.be).

Objectives

We therefore implemented a joint European undergraduate course of Infectious Diseases together with Università Cattolica del Sacro Cuore, Roma, and the University of Edinburgh who were also part of the Medmotion Programme (Dr Federica Wolf in Roma and Dr Ingo Johanessen in Edinburgh), aiming at:

(i) developing a common ID core curriculum among European medical students;
(ii) promoting mobility among teachers and students
(iii) promoting international cooperation among European teachers.

We here present:

• The implementation of this common course of Infectious Diseases called I3DC Standing for International Intensive Infectious Diseases Course (Methods section)
  • Tts evaluation
  • Recent perspectives.

This course has been the subject of an article recently published in Medical Teacher (https://www.ncbi.nlm.nih.gov/pubmed/28552022) enclosed in the Appendix.
Methods

Briefly, the course was built around on teachers’ mobility. It was provided in English by a team of European medical educators from Paris Descartes University, Università Cattolica del Sacro Cuore in Roma and the University of Edinburgh to groups of 20-25 volunteer undergraduate medical students at each university. Partner Institutions officially recognize the course as substitutive of/or additive to the regular curriculum.

Course content

Two scientific meetings were organized among the project managers (Claire Le Jeunne and Federica Wolf) and the volunteer international ID specialists (Roberto Cauda, Caroline Charlier and Ingo Johansen) to discuss and build up a core curriculum that met global health demands. Reaching a consensus between teachers after these face-to-face meetings turned out to be the most critical point. Teachers’ meetings were organized annually to revise and update this core curriculum according to (i) students’ feedback and (ii) ID “hot topics” and emerging issues. Teaching materials are shared among partner institutions and made available to students (i.e. learning outcomes, teacher’s profile and handouts, single best answers trainings and clinical cases).

Course agenda and course recognition

I3DC delivers 30 hours of learning outcome-led teaching over an intensive 5-day week. It comprises theoretical lectures (20 hours; in a mixed format including the ‘flipped classroom’) and practical tutorial sessions covering core topics (10 hours). Tutorial sessions include interactive clinical cases, discussion on films, bed-side and bench-side teaching (when possible), quizzes (using online tools) and example single best answer questions. Sessions are video-recorded; teaching materials (including handouts) are made available online at outset through a dedicated web-interface (for example, see https://moodle.medecine.parisdescartes.fr/login/index.php). All lectures are updated on an annual basis; attendance at all sessions is mandatory.

The I3DC course is delivered annually in English since 2014 in the three partner universities (Université Paris Descartes (Paris, France, organizers Caroline Charlier and Claire Le Jeunne), Università Cattolica del Sacro Cuore (Rome, Italy; organizers Federica Wolf and Roberto Cauda) and University of Edinburgh (Edinburgh, United Kingdom; organizers Ingo Johannessen, Claire Mackintosh and David Wilks). Upon approval of Deans and local medical schools’ committees, I3DC is recognized by all institutions as a part of their curricula and carries educational credits in Paris and Rome where it substitutes for the regular course. In Paris Descartes, it therefore constitutes a recognized alternative curriculum to the traditional teaching, that consists in Paris Descartes in 100 hours of frontal and tutorial lectures split in 5 themes (Infectious Diseases, Bacteriology, Virology, Parasitology and Nosocomial Infections). Since Edinburgh University did not have a regular ID course in its curriculum, I3DC was there offered as an optional course.
Student selection
I3DC is aimed at students from the 3rd (Paris and Rome) or 4th year (Edinburgh) of study (over the 6-year duration of the European undergraduate medical curriculum) having the required scientific background in microbiology and general pathology. Students apply on a voluntary base. The course is offered to 25-30 students / University / year. Selection criteria include: academic performance, personal motivational statements and English proficiency. Students’ mobility between partner institutions is also offered as hospitals elective placements of two weeks. Application procedure is facilitated for I3DC students.

Pedagogical Team
Voluntary medical educators with complementary expertise from the three partner Institutions participate to the teacher’s team (‘internationalization at home’) in association with local teachers who take care of practical training and interactive sessions.

Figure 1. I3DC logo

Results

Implementing a common course
- I3DC commenced in 2014 and took place annually since then. Over the past 3 years, a total of 198 European medical students (77 in Paris, 60 in Roma and 61 in Edinburgh) have been trained in I3DC. All (100%) of them passed the final exam (1 upon re-sit).
- The content of the course was updated annually according to students’ assessment of every single lecture: this evaluation provided a real-time feedback that turned out very useful to fine tune the course contents and provide teachers an accurate perception of students needs (See supplement information as an example).
- I3DC is now a part of the regular curricula in Paris and Rome as an optional intensive alternative to the regular ID course as it fulfills students’ needs and expectations. In Edinburgh, the course is also still regularly offered.
- I3DC was demonstrated so successful that it laid the foundations for a new Infection Module of the undergraduate Edinburgh medical program that did not exist previously (starting September 2016).
Figure 2. I3DC promotion in Roma 2016 (left) and Paris 2014 (right)

Students satisfaction
- Nine evaluation survey sets were performed (one per university annually) to provide a global evaluation of the course: 2% of the students consider I3DC ‘satisfactory’, 21% ‘good’ and 77% ‘excellent’; no student ever assessed the course as ‘poor’ or ‘unsatisfactory’. Furthermore, 98% of the students thought the course met their professional needs, and all stated that they would recommend it to colleagues. Interestingly, despite the differences between the student groups from the three participating Institutions, characterized by different medical curricular approach and year of study, (e.g. 3rd in Paris and Rome vs. 4th year students in Edinburgh), evaluation outcomes were homogeneous over time and in all partner institutions (Figure 3).

-In Paris Descartes, an estimated 100-120 students of a promotion of 400 students apply annually for the course.

Figure 3. Summary of students’ evaluation of the I3DC course

Fostering students’ mobility
The course fostered students’ mobility since a total of 30 students (11%) sought additional clinical training abroad (2-3 weeks) in one of the other partner Institutes from 2014 to 2017. Such focused short-term clinical electives with fast-track application procedures, proved very popular and successful.
Evaluation of the students

The first 2014 Paris Descartes I3DC promotion was evaluated to assess the long-term benefits of these intensive international interactive teaching modalities.

SBA questionnaire evaluation

Students who attended the first I3DC promotion in 2014 (DFGSM3 at that time) were in DFASM3 at the moment of evaluation. Evaluation relied on 30 single-best-answer questions that were submitted to the whole DFASM3 promotion at the beginning of a dedicated therapeutic lecture.

The questions covered the whole National Ranking exam program in Infectious Diseases. They were specifically prepared for this exam, and had not been proposed before neither in the setting of the I3DC course nor in the traditional curriculum or in any exam (See Appendix). They were proposed in French to allow comparison with the rest of the promotion. Students were aware of this test that was presented as a training session.

Results are presented in Table 1.

Briefly, there was a non-significant trend toward higher results in the I3DC group (p= 0.27, Student’s T test). This suggests that 3 years after having completed a 1-week intensive course with a team of international teachers from Edinburgh, Rome and Paris, these students did not exhibit weaker results that the rest of the promotion who was offered a 120-hours curriculum. This result is strengthened by the large proportion of students attending this exam (both from I3DC and from the rest of the promotion).

Table 1. Results of I3DC students’ evaluation

<table>
<thead>
<tr>
<th></th>
<th>I3DC students N=19/26 (73%)</th>
<th>Students with traditional curriculum N=260/392 (66%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean mark (SD)</td>
<td>10.77/20 (2.47)</td>
<td>10.43/20 (2.42)</td>
</tr>
</tbody>
</table>

Similar results were noted when final ranking exam’s results were compared between I3DC students and students who received the traditional curriculum (Table 2).

Table 2. Final ranking exam results for I3DC students and for students attending the general curriculum

<table>
<thead>
<tr>
<th></th>
<th>I3DC students N=21*</th>
<th>Students with traditional curriculum N=377</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median rank</td>
<td>1646</td>
<td>2754</td>
</tr>
<tr>
<td></td>
<td>P=0.47**</td>
<td></td>
</tr>
<tr>
<td>Number of students in 1st - 100th range</td>
<td>0/21 (0)</td>
<td>21/377 (6)</td>
</tr>
<tr>
<td></td>
<td>P=0.61 #</td>
<td></td>
</tr>
<tr>
<td>Number of students in 100th - 1000th range</td>
<td>6/21 (29)</td>
<td>69/377 (18)</td>
</tr>
<tr>
<td></td>
<td>P=0.25 #</td>
<td></td>
</tr>
<tr>
<td>Number of students in &gt; 6000th range</td>
<td>1/21 (5)</td>
<td>43/377 (11)</td>
</tr>
<tr>
<td></td>
<td>P=1 #</td>
<td></td>
</tr>
</tbody>
</table>

* 5 did not pass the final ranking exam
** Mann-Whitney
# Fisher exact test
New developments

The success of the program led to the recent successful application for further EU higher education funding to support its development under the banner of an EU project now called IDEAL (Infectious Diseases Europe Africa Learning, Erasmus+ program “Strategic partnerships for higher education”, with new enrolling partners (2016-1-FR01-KA203-024171).

IDEAL aims at

- Pursuing the I3DC course, with the enrollment of new partners that will participate in the constant reshaping of the course. We look forward to seek new collaborations with Madrid and Berlin Universities in the coming year. We have also been contacted by the Hadassah-Hebrew University Medical Center in Jerusalem.

- Developing an annual summer school to offer advanced undergraduate Infectious Diseases teaching, focusing on specific topics, such as emerging infectious diseases or emergencies in infectious diseases, with a global health perspective. These summer schools are based on the same practical approach, with simulation games, clinical cases, round-tables. They are animated by an international team of teachers from the six partners, including the team of Ugandan academic physicians from two University hospitals in Gulu and Nsambya, who share their unique field-experience of Infectious Diseases. Exchanges of practices and experiences between countries are favored, in a small-group interactive approach. The first session took place in Paris, 28th August – 1st September 2017, at the Paris Descartes Simulation platform (www.ilumens.org). It involved 22 students from 6 European countries (Greece, Spain, Switzerland, Scotland, Italy and France). It was focused on Emergencies in Infectious Diseases and was much appreciated by students. We aim to move forward IDEAL summer school in a different country each year.

- Developing a dedicated open-source web interface that aims at covering the main topics of Infectious Diseases and will regularly be implemented and updated. Specific online lectures will also be added by experts from all areas.

- Developing teaching collaboration with Ugandan partners.

Figure 4. IDEAL logo
Conclusion

Infectious Diseases proved to be the winning topic to developing a successful joint common course among European medical schools and with other Partners.

More importantly, in a wider perspective, we believe this approach can be applied to other medical specialties like Emergency Medicine, as a model for harmonized medical education across Europe and beyond.

References
1. WHO. The top 10 causes of death 2012 [http://www.who.int/mediacentre/factsheets/fs310/en/].

Appendix

1. Medical teacher article with Appendix.
Supplementary Material

This appendix has been provided by the authors to give readers additional information about their work
International infectious diseases teaching to undergraduate medical students: A successful European collaborative experience*

Caroline Charlier, Ingólfur Johannessen, Claire L Mackintosh, David Wilks, Roberto Cauda, Federica I Wolf & Claire Le Jeunne

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International infectious diseases teaching to undergraduate medical students: A successful European collaborative experience

Caroline Charlier, Federica I Wolf, Claire Le Jeunne

Context: The emerging global-health paradigm requires medical teaching to be continuously redefined and updated; to this end, transnational approaches should be encouraged and medical training harmonized. Infectious diseases (ID) teaching in the current context of emerging infections, fast-increasing bacterial resistance and large-scale human migration, was chosen to develop a common international course.

Objective: We report the successful implementation of a joint European undergraduate course aiming to (i) develop a common ID core curriculum among European medical schools; (ii) promote mobility among teachers and students (iii) promote international cooperation among European teachers.

Methods: The course was built around teachers’ mobility. It was delivered in English by a team of European medical educators from Paris Descartes University, Università Cattolica del Sacro Cuore, Necker-Enfants Malades University Hospital, Institut Imagine, Assistance Publique-Hôpitaux de Paris, Paris, France; Institute Pasteur, French National Reference Centre and WHO Collaborating Centre for Listeria, Biology of Infection Unit, Inserm U1117, Paris, France; Centre for Infection Medicine, University of Edinburgh, Edinburgh, UK; Laboratory Medicine NHS Lothian, Edinburgh, UK; Institute of Infectious Diseases Department, Western General Hospital, NHS Lothian, Edinburgh, UK; Institute of Infectious Diseases, Università Cattolica del Sacro Cuore, Facoltà di Medicina, Rome, Italy; Institute of General Pathology, Università Cattolica del Sacro Cuore, Facoltà di Medicina, Rome, Italy; Internal Medicine Department, Cochin Port Royal University Hospital, Assistance Publique – Hôpitaux de Paris, Paris, France

Results: The course has been running for 3 years and received excellent satisfaction scores by students and staff as regards to scientific content, pedagogy and international exchanges.

Conclusion: This cooperative approach demonstrates the feasibility of a harmonized European undergraduate medical education, having ID as a test experiment for future developments.

Practice points

- Core-curriculum in a global health context can be set upon agreement of a group of international expert teachers.
- Teacher’s exchange at European level can provide excellent “internationalization at home” for students and foster teaching cooperation among international medical schools.
- The successful strategy of the I3DC course can be implemented to other topics fostering harmonized international undergraduate medical training.

Inappropriate use of antibiotics has also fueled the emergence of antimicrobial resistance; World Health Organization (WHO) identifies education of medical students in ID as key to control such multi-resistant pathogens. (WHO 2012; Woerther 2013; Dheda 2015) ID teaching illustrates the persisting heterogeneity in European medical
education (Education 1999). In 2011, ESCMID, the European Society for Clinical Microbiology and Infectious Diseases, Professional Affairs Workshop group specifically pointed out the discrepancies in medical education in this field and the urgent need for more homogenization: “it should be possible to train in any region of the European Community, enjoying equivalent standards (…) with equivalent terms and conditions” (Read 2011).

The European Union (EU) Life Long Learning program MED-MOTION (www.med-motion.eu) was aimed at removing barriers between European medical curricula. One of the action consisted in designing common courses for EU medical schools. ID were identified as the specialty most in need of harmonization according to a survey performed by the International Federation of Medical Students Association. In 2012, three European medical schools therefore developed a common course that was named I3DC, International Intensive Infectious Diseases Course (Figure 1).

Methods

Course content

Two scientific meetings were organized among the project managers (CLJ and FW) and the volunteer international ID specialists (RC, CC and UJ) to discuss and build up a core curriculum that met global health demands. Teachers’ meetings were organized annually to revise and update this core curriculum according to (i) students’ feedback and (ii) ID “hot topics” and emerging issues. Teaching materials were shared among partner institutions and made available to students (i.e. learning outcomes, teacher’s profile and hand-outs, single best answers trainings and clinical cases).

Course agenda and course recognition

I3DC delivers 30h of learning outcome-led teaching over an intensive 5-day week (Figure 2). It comprises theoretical lectures (20 hours; in a mixed format including the “flipped classroom”) and practical tutorial sessions covering core topics (10h). Tutorial sessions include interactive clinical cases, discussion on films, bed-side and bench-side teaching (when possible), quizzes (using online tools) and example single best answer questions. Sessions are video-recorded; teaching materials (including handouts) are made available online at the outset through a dedicated web-interface (for example, see https://moodle.medecine.parisdescartes.fr/login/index.php). All lectures are updated on an annual basis; attendance at all sessions is mandatory.

The I3DC course (first issue in 2014) is delivered annually in English at the three partner universities (Université Paris Descartes (Paris, France, organizers CC and CLJ), Università Cattolica del Sacro Cuore (Rome, Italy; organizers FW and RC) and University of Edinburgh (Edinburgh, United Kingdom; organizers UJ, CM and DW). Upon approval of Deans and local medical schools committees, I3DC is recognized by all institutions as a part of their curricula and carries educational credits in Paris and Rome, where it substitutes for the regular course. Since Edinburgh University did not have a regular ID course in its curriculum, so far I3DC has been offered as an optional course.

Student selection

I3DC is aimed at students from the 3rd (Paris and Rome) or 4th year (Edinburgh) of study (over the 6-year duration of the European undergraduate medical curriculum). A scientific background in microbiology and general pathology is required. Students apply on a voluntary base. The course is offered to 20–30 students/University/year. Selection criteria include academic performance, personal motivational state-ments and English proficiency. Students’ mobility between partner institutions is offered as two-week hospital elective placements; application procedure is facilitated for I3DC students.

Teacher team

Voluntary medical educators with complementary expertise from the three partner Institutions participate to the teachers’ team in association with local teachers who take care of practical training and interactive sessions.

Student assessment

Final assessment is based on 40 online single best answer questions in 1 h and takes place two weeks after the course. The pass mark is 50% success, without negative marking. Students failing their I3DC examination can resit during the next session in one of the other partner institutions (only one student from Rome resat over the study period). Diplomas validating attendance and exam results are awarded upon successful completion of the course.

Teacher/course assessment

Students’ feedback on each single lecture is gathered, evaluated and fed back into the course in real time using a
International Intensive Infectious Diseases Course (I3DC)
Chancellor’s Building, University of Edinburgh Medical School, 23-27 May 2015

<table>
<thead>
<tr>
<th>Mon 13 May</th>
<th>Tue 24 May</th>
<th>Wed 25 May</th>
<th>Thu 26 May</th>
<th>Fri 27 May</th>
</tr>
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<tbody>
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<td>UG(1) Med Teach (Rm)</td>
<td>UG(1) Med Teach (Rm)</td>
<td>UG(1) Med Teach (Rm)</td>
<td>UG(1) Med Teach (Rm)</td>
<td>Lecture/Final Exam</td>
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<td>Welcome &amp; Introduction</td>
<td>Pneumonia 1</td>
<td>Antibiotics</td>
<td>Urinary Tract Infections</td>
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<tr>
<td>10:00:00</td>
<td>Emerging Infections</td>
<td>Pneumonia 2</td>
<td>Skin Infections</td>
<td>Sexually Transmitted Diseases</td>
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<tr>
<td>11:00:00</td>
<td>Viral &amp; Haemorrhagic Fever</td>
<td>HIV Infection</td>
<td>Bites &amp; Scratches</td>
<td>Ear, nose &amp; throat Infections</td>
</tr>
<tr>
<td>12:00:00</td>
<td>Influenza &amp; MERS-CoV Infections</td>
<td>Tuberculosis</td>
<td>Sepsis</td>
<td>Food-borne Infections</td>
</tr>
<tr>
<td>13:00:00</td>
<td>Lunch</td>
<td>Lunch</td>
<td>Joint Lunch</td>
<td>Students &amp; academic staff</td>
</tr>
<tr>
<td>14:00:00</td>
<td>Pathology of Infection</td>
<td>Neurological Infections 1</td>
<td>Endocarditis</td>
<td>Antimicrobial Stewardship</td>
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<tr>
<td>15:00:00</td>
<td>Viral Hepatitis</td>
<td>Neurological Infections 2</td>
<td>Nosocomial Infections</td>
<td>Fever in the Returning Traveller</td>
</tr>
<tr>
<td>16:00:00</td>
<td>Infections in Solid Organ Transplantation</td>
<td>Cases</td>
<td>Cases</td>
<td>Cases</td>
</tr>
</tbody>
</table>

Figure 2. Timetable of the International Intensive Infectious Diseases course curriculum from Edinburgh 2015 issue.

semiquantitative evaluation form delivered twice per day. An additional questionnaire at the end of the whole course allowed to collect overall comments (including content, delivery, time for discussion and practice, overall quality, addressing of needs and areas for improvement) (See additional information in the appendix).

Financial support
In the first year, scientific meetings to set up the I3DC were financed by the MED-MOTION European project. Subsequently, the local Faculties supported practical organization of I3DC. Teachers’ mobility expenses were supported by Erasmus Teacher’s mobility grant.

Results
Implementing a common course
- I3DC commenced in 2014 (Figure 1) and has taken place annually since then. Over the past 3 years, 198 European medical students (77 in Paris, 60 in Roma and 61 in Edinburgh; see Table 1) have been trained in I3DC. All of them (100%) passed the final examination (1 upon resit; Figure 3).
- The content of the course was updated annually according to students’ assessment of every single lecture: this evaluation provided a real-time feedback that turned out very useful to fine-tune the course contents and provide teachers with an accurate perception of students’ needs (See Supplement information).
- Nine evaluation survey sets were performed (one per university annually) to provide a global evaluation of the course: 2% of the students considered I3DC “satisfactory”, 21% “good” and 77% “excellent”. Furthermore, 98% of the students thought the course met their professional needs, and all stated that they would recommend it to colleagues (Figure 3).

Interestingly, despite the differences between the student groups from the three participating Institutions, characterized by different medical curricular approach and year of study, (e.g. 3rd in Paris and Rome vs. 4th year students in Edinburgh), evaluation outcomes were homogeneous over time and in all partner institutions (Table 1 and Figure 3).
- I3DC is now a part of the regular curricula in Paris and Rome as an optional intensive alternative to the regular ID course.
- In Edinburgh, I3DC demonstrated so successful that it laid the foundations for a new Infection Module of the undergraduate medical program that did not exist previously (starting September 2016), and I3DC is still offered in addition to the new curricular course.

Fostering mobility
The course fostered teachers’ mobility, and 28 international teaching missions were set over the 2014–2016 period to deliver the course. The number of teachers involved in international teaching increased from 4 to 12 over the 3 years. All teachers found their experience rewarding, they appreciated student’s active participation and curiosity for a guest teacher.

The course also fostered students’ mobility: a total of 22 students (11%) sought additional clinical training abroad (2–3 weeks) in one of the partner Institutions. Such focused short-term clinical electives with fast-track application procedures proved very popular and successful.

Fostering international cooperation
The success of the program led to the recent successful application for further EU higher education funding to support its development under the banner of an EU project now called IDEAL (Infectious Diseases Europe Africa Learning, Erasmus + program “Strategic partnerships for higher education”, with new enrolling partners (2016-1-FR01-KA203-024171, Figure 4).

Discussion
Challenges posed by globalization, multicultural societies and population migration require strong collaboration
between European medical schools to ensure the alignment of curricula to the ever-changing landscape of global health. The European I3DC course is a pilot course that demonstrates the feasibility of a shared teaching among European medical universities that effectively promotes mobility among teachers and students. Importantly, it also demonstrates the success of overcoming barriers in terms of divergent curricula, language, geography and institutions. To our knowledge, I3DC is one of the first teachers’ mobility-based medical educational programs at the undergraduate level in Europe. The key of the success of I3DC course is the strong engagement of teachers from intrinsically different European medical schools, and their willingness to challenge themselves at the European level. Person-to-person contacts (i.e. teachers interacting with small groups of students and among them in face-to-face meetings) make this course so successful, emphasizing personal engagement as essential for training undergraduate medical students, learning from real life educators. The teachers appreciated this experience, as reflected by the expansion of the international teaching team (from 4 to 12). From a very pragmatic viewpoint, moving around Europe a dozen teachers is much easier and cost effective than moving a whole cohort of students (teacher/student ratio about 1:7), providing an effective process of “internationalization at home”.

<table>
<thead>
<tr>
<th>Medical school</th>
<th>2014</th>
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<th>2016</th>
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<tbody>
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<td></td>
<td></td>
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*including one student upon re-sit.

**Table 1. Students’ evaluation of the International Intensive Infectious Diseases Courses.**

**Figure 3.** Summary of students’ evaluation of the International Intensive Infectious Diseases course curriculum (2014–2016).
The limits of this approach should be pointed out. First, the profile of the students, their enthusiasm for the topic together with English proficiency reflecting open-mindedness and curiosity for experiencing different teaching methods also provided fertile ground for success. Second, I3DC being a pilot program, it only targeted 75 European students per year, over an average 200-400 students enrolled per year in European medical schools (Eurostat 2015), accounting for about 8.0% of each group (Table 1). Considering the success of I3DC, more students should be given the choice between the regular and the international course. By running this course twice a year in each institution, we would involve up to 20% of students from the same year, a percentage compatible with the objectives stated by EU Strategic framework – Education & Training 2020 on internationalization of higher education graduates. (European Commission strategic framework 2020).

The number of students completing the assessment forms appeared heterogeneous over time and between universities (<50–90%) (Table 1). Upon stressing the crucial importance of students’ opinion to shape the course, we evidenced a clear improvement in the rate of responses. The substantial increase in responses over the years and similar comments collected from different groups of students, underlined polls’ reliability and students’ sustained satisfaction.

Finally, the duration of the course is arguable. A two-week course would have allowed a less tight schedule with more time for discussion and practical sessions; it would have jeopardized the success of the experience, as it would have interfered with other regular courses or exam sessions.

The success of I3DC allowed us to develop the broader Erasmus-founded IDEAL program, which enrolls new partners from Europe and beyond: two Ugandan universities (Mother Kevin Postgraduate Medical School, Kampala and the University of Gulu, Gulu) and the University of Antwerp (Antwerp, Belgium). The new program will be reinforced with an annual Summer School program and a collaborative open-source e-learning web interface in partnership with the Ugandan universities.

Overall, our course represents a model that can be applied to other specialties to successfully harmonize European medical teaching.

Conclusions
Infectious Diseases proved to be the winning topic to developing a successful joint common course among European medical schools. The I3DC course addressed the challenge of global health context providing coherent up-to-date ID undergraduate training. It represents a strong answer to Read’s and coll.9 call in 2011: “Infectious disease physicians and clinical microbiologists need to move forward together as we face difficult clinical and professional challenges”.

More importantly, in a wider perspective, we believe that this approach can be applied to other medical specialties as a model for harmonized medical education across Europe and beyond.

Acknowledgements
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Disclosure statement
No potential conflict of interest was reported by the authors.

Glossary
Joint common course: A course on a specific topic organized and taught by international Teachers at different schools.

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David Wilks, MD, qualified from University of Cambridge and Middlesex Hospital London in 1982. Consultant physician at the Regional Infectious Diseases Unit in Edinburgh since 1995, primarily looking after patients with HIV and community acquired infections. Since 2009 he has been lead clinician for the NHS Lothian Antimicrobial Management Team, with a broad range of activities in the field of antibiotic stewardship.

Roberto Cauda, MD, is the Chairman of ID and Director of Specialisation School in ID and Tropical Medicine at UCSC. Adjunct Professor at the University of Alabama at Birmingham, and Texas Tech University. Visiting Professor in Slovak Universities; honorary fellow of ESCMID, Royal Society of Tropical Medicine and Hygiene, ESBIIC. Research: antibiotic resistance and nosocomial infections, clinical and epidemiological aspects of HIV infection/disease, viral hepatitis, herpetic and tropical diseases.

Federica I Wolf, PhD, is a Professor of General Pathology, teaching at medical school, Biotechnology, and other BS degrees. Delegate for International Programs for UCSC medical faculty, coordinator of EU programs (Erasmus, MEDNET, CHarME, MED-MOTION, MUMEENA, IDEAL) focusing on modernization and internationalization of medical curricula. President of the International Society for the Development of Research on Magnesium (SDRM) and Editor of “Magnesium Research”.

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Funding

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References


International Infectious Diseases teaching to Undergraduate Medical Students:

A Successful European Collaborative Experience

Online Supplemental Materials

**TABLE OF CONTENTS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
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<tbody>
<tr>
<td>LEARNING OUTCOMES</td>
<td>3</td>
</tr>
<tr>
<td>DAILY FEEDBACK TEMPLATE</td>
<td>4</td>
</tr>
<tr>
<td>OVERALL COURSE EVALUATION</td>
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<td>EXAMPLE OF SINGLE COURSE EVALUATION</td>
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Learning outcomes

Fundamentals of Infection
Following the lecture, the student should be able to
- Outline the main classes of pathogens and their basic biology;
- Describe broadly the different stages of infection and host response;
- Describe the main patterns of worldwide antibiotic resistance
- Discuss common clinical manifestations of infection;
- Outline key laboratory diagnostic approaches to infection;
- Give a broad overview of key prevention and therapeutic strategies.

Sepsis
Following the lecture the students should be able to:
- Identify the etiologic agents the risk factors and their role in the pathogenesis and the epidemiology
- Describe the pathogenic mechanisms
- Recognize the signs, symptoms and complications
- Suggest the best diagnostic approach and therapy (empiric/specific)

Endocarditis
Following the lecture the students should be able to:
- Outline the etiologic agents, the epidemiology and risk factors in relationship to particular groups of patients
- Describe the pathogenic mechanisms
- Recognize the signs, symptoms and complication
- Suggest the best diagnostic approach and therapy (empiric/specific)
- Describe the prevention and the prophylaxis

Food-borne infections
Following the lectures the students should be able to:
- Identify risk associated with water / food consumption
- Diagnose brucellosis, listeriosis, salmonellosis and typhoid fever and know the basic principle of their treatment and prevention
- Diagnose collective alimentary toxi-infection and know the principles of prevention

Urinary tract infections
Following the lecture the students should be able to:
- Diagnose the main urinary tract infections
- Know the main pathogen involved in urinary tract infections
- Know the principle of treatment and follow-up of urinary tract infections

Sexually transmitted diseases
Following the lecture the students should be able to:
- Diagnose syphilis, to know the complications and principle of treatment and prevention of syphilis,
- Diagnose urethritis and genital ulceration, to identify the main pathogens involved and describe the basics of treatment and prevention
- Diagnose genital feminine infections including pelvic inflammatory disease
- Know the pathogens involved in genital feminine infections and the principles of treatment and prevention

**Nosocomial infection**
Following the lecture the students should be able to:
- Describe the burden of antibiotic-resistant bacteria, and methicillin-resistant *Staphylococcus aureus*
- Identify risk factors for the emergence of multiresistant bacteria and the principles of antibiotic stewardship
- Describe and diagnose the main nosocomial infections including *C. difficile* infection
- Describe and apply the rules for prevention of dissemination of pathogens

**Skin infections**
Following the lecture the students should be able to:
- Diagnose the main bacterial skin infections: impetigo, cellulitis, necrotizing cellulitis
- Know the pathogens involved and the principle of treatment of the main pathogens involved, including *Mycobacterium leprae*, scabies, anthrax and leishmaniosis
- Diagnose *Candida* and dermatophytic superficial infections

**Ear, nose and throat infections**
Following the lecture the students should be able to:
- Diagnose and know the pathogens involved and principle of treatment of sinusitis
- Diagnose and know the pathogens involved and principle of treatment of otitis
- Diagnose and know the pathogens involved and principle of treatment of tonsillitis

**Infections transmitted by bites and scratches**
Following the lectures the students should be able to:
- Diagnose and know the pathogens involved, complications and principle of treatment of Lyme disease
- Diagnose and know the pathogens involved and principle of treatment of tetanus
- Diagnose and know the pathogens involved and principle of prevention of rabies

**Pneumonia**
Following the lectures the students should be able to:
- Describe the common causes of infection and their epidemiology
- Outline agent biology, pathogenesis, pathology of the disease and the manner in which infectious agents manifest clinically
- Recognize signs, symptoms and complications
- Suggest the diagnostic approach, comprehensive of the imaging techniques
- Suggest the appropriate therapy (empiric/specific)

**Tuberculosis**
Following the lecture the students should be able to:
- Outline broadly the main groups of patients according to the phase of infection
- Recognize the epidemiologic and risk factors
- Identify the pathogenesis in relationship to the pathology
- Recognize the signs and symptoms according to the phase of infection
- Suggest the diagnostic approach comprehensive of the imaging techniques
- Suggest the appropriate therapy according to the phase and type of the disease
- Describe the prevention and the prophylaxis

HIV
Following the lecture, the students should be able to:
- Describe the pathogenic agents, the epidemiology and the pathogenesis
- Outline the phases of the infection in relationship to pathogenesis
- Suggest the best diagnostic approach
- Recognize the signs and symptoms in relationship to the phase of the infection
- Outline the appropriate diagnostic tools for the different phase of the infections
- Describe the appropriate antiretroviral therapy and the therapy of the opportunistic diseases
- Outline the prevention and the counseling

Central nervous system infections
Following the lecture, the students should be able to:
- Describe common causes of CNS infections with particular reference to meningitis and encephalitis, including HSV encephalitis
- Outline agent biology, pathogenesis of disease and the manner in which infections manifest clinically;
- Suggest diagnostic approaches as part of the management plan that includes specific therapy, if available, as well as infection prevention and control/public health measures.
- Recognize and know the principles of treatment of purpura fulminans in meningococcemia.

Emerging Infections
Following the lecture, the student should be able to
- Explain what constitutes an emerging/re-emerging infection;
- Discuss the factors that promote the emergence of a novel infection;
- Give an overview of infections that are currently emerging/re-emerging and their potential global impact;
- Describe broadly the local, national and international surveillance mechanisms in place to detect (and diagnose) novel infections;
- Give a broad overview of the resources available to prevent and control new infections, with the example of Ebola infection.

Bone and joint infections
Following the lectures, the student should be able to
- Diagnose spondylodiscitis septic arthritis including prosthetic joint infections and brucellosis
- Know the principles of treatment and follow-up

The Immunocompromised Patient
Following the lecture, the student should be able to
- Outline broadly the main groups of immunocompromised patients;
- Describe common causes of infection in these patient groups and their epidemiology;
- Outline agent biology, pathogenesis of disease and the manner in which infections manifest clinically;
- Suggest diagnostic approaches as part of a management plan that includes specific therapy (if available) as well as infection prevention and control/public health measures.

**Viral Hepatitis**
Following the lecture, the student should be able to:
- Describe viral causes of hepatitis (with particular reference to hepatitis A-E viruses as well as viral causes of non-A-E viral hepatitis) and their epidemiology;
- Outline agent biology, pathogenesis of disease and the manner in which infections manifest clinically;
- Suggest diagnostic approaches as part of a management plan that includes specific therapy (if available) as well as infection prevention and control/public health measures.

**Exanthema**
Following the lecture, the student should be able to:
- Outline rashes of infectious origin and their classification;
- Describe common infectious causes of such rashes and their epidemiology;
- Outline agent biology, pathogenesis of disease and the manner in which infections manifest clinically;
- Suggest diagnostic approaches as part of a management plan that includes specific therapy (if available) as well as infection prevention and control/public health measures.

**Infectious Lymphadenopathy**
Following the lecture, the student should be able to:
- Describe common infectious causes of lymphadenopathy;
- Outline agent biology, pathogenesis of disease and the manner in which infections manifest clinically;
- Suggest diagnostic approaches as part of a management plan that includes specific therapy (if available) as well as infection prevention and control/public health measures.
- Know the basics of mumps as a differential diagnosis of lymphadenopathy

**Fever in the Returning Traveler**
Following the lecture, the student should be able to:
- Describe common infectious causes of fever in the returning traveler/fever of unknown origin with particular reference to emerging/re-emerging infections and their epidemiology, including dengue, typhoid fever and malaria
- Outline agent biology, pathogenesis of disease and the manner in which infections manifest clinically;
- Suggest diagnostic approaches as part of a management plan that includes specific therapy (if available) as well as infection prevention and control/public health measures.

**Basics of antibiotic prescription**
Following the lecture, the student should be able to:
- Know the main pharmacokinetic and dynamic features of antibiotics
- Know the principles of empiric/curative treatment
- Know the main rules of prescription and contra-indication of antibiotics

**Mononucleosis**
Following the lecture, the student should be able to:
- Know the main clinical features of infection
- Suggest diagnostic approaches

**Flu and other respiratory infections**
Following the lecture, the student should be able to:
- Describe the main infections (epidemiology, clinical features, main complications)
- Suggest diagnostic approaches
- Outline treatment and prevention
# International Intensive Diseases Course (i3DC)

## Evaluation Form

**Friday, 19th February 2016**

**Topic:** ENDOCARDITIS  
**Teacher:** DR xxxxxxxxxxxx

For each item below, please circle the number in the appropriate box

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What was the most important thing you learned?

How could this session be improved?
### I3DC-2016 Overall Evaluation

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**THURSDAY (18.02.2016)**

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<tbody>
<tr>
<td><strong>Exanthema (RS)</strong></td>
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<tr>
<td><strong>Fever in the returning traveler (RS)</strong></td>
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<tr>
<td><strong>Nosocomial infections (CCW)</strong></td>
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<td><strong>Food borne infections (CCW)</strong></td>
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<td><strong>Bone and joint infections (RS)</strong></td>
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<tr>
<td><strong>Infective lymphadenopathy (RS)</strong></td>
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<tr>
<td><strong>Interactive clinical cases (SdG)</strong></td>
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FRIDAY (19.02.2016)

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<td>Endocardites (CCW)</td>
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<tr>
<td>Bites and scratches infections (CCW)</td>
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<tr>
<td>Mononucleosis (RS)</td>
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<td>Skin infections (CCW)</td>
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<tr>
<td>Sepsis (CCW)</td>
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Would you follow this course or a similar one (on another topic) again?

What would you suggest to change?

Schedule

Length

Topics
# Endocarditis

21 students

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<td>Overall Quality</td>
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**What was the most important thing you learned?**

1. Everything!

**How could this session be improved?**

1. Just perfect!

2. Great!

# Antibiotics

23 students

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<td>Sufficient time</td>
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<tr>
<td>Overall Quality</td>
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<td>39%</td>
<td>26%</td>
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<td>70%</td>
<td>13%</td>
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**What was the most important thing you learned?**

1. what to know and do before prescribing antibiotics
2. the role of different drugs

**How could this session be improved?**

- more time
- really too fast
- too many topics,
- need more time
I3DC : Mise en place d’un cours Intensif Européen de Maladies Infectieuses

Caroline Chartier1, Ingólfur Johannessen2, Claire Mackintosh3, David Wilks4, Roberto Cauda5, Federica Wolf6 et Claire Le Jeunne7

1 Université Paris Descartes, AP-HP, CHU Necker-Enfants Malades, Service de Maladies Infectieuses et Tropicales, Centre d’Infectiologie Necker-Enfants, Paris-France
2 Université d’Edinburgh, Labouratoire NHS Lothian, Edinburgh-Royaume Uni. ; Université d’Edinburgh, Département de Maladies Infectieuses, Western General Hospital, NHS Lothian, Edinburgh-Royaume Uni. ; Université Catholique Sacré cœur, Institut de Maladies infectieuses, Rome-Italie ; 3 Université Catholique Sacré cœur, Institut de Pathologie Générale, Rome-Italie ; 4 Université Paris Descartes, AP-HP, CHU Cochin Port Royal, Département de Médecine Interne, Paris-France

Introduction

L’enseignement facultatif des Maladies Infectieuses est confronté à des défis qui bouleversent notre pédagogie :
- la désaffection par les étudiants des enseignements classiques conduit à développer des approches plaçant l’étudiant dans un rôle d’apprentissage actif ;
- la prise en compte de la dimension transversale et internationale « one health » de la discipline nécessite une coopération entre enseignants de différentes spécialités et de différents pays.

Nous rapportons la mise en place depuis 2014 d’un enseignement Européen harmonisé de Maladies Infectieuses impliquant infectiologues, microbiologistes et pathologistes, de 3 universités Européennes :
- Paris Descartes,
- Université Catholique du Sacré Cœur de Rome
- Université d’Edinburgh

Méthodes

I3DC (International Intensive Infectious Diseases Course) est un programme conçu en commun à partir des programmes de chaque faculté.
- Son originalité est d’être assuré par une équipe d’enseignants des 3 universités, en Anglais, sur une semaine (35H) à 25-30 étudiants volontaires de chaque université.
- Le cours est réparti 3 fois/an (1/ville), et repose sur la mobilité des enseignants.
- Il est validé par un examen mené dans chaque Université, et reconnu comme équivalent au curriculum classique (à Paris Descartes et à Rome) ou additif au curriculum classique (pas d’enseignement Facultaire des Maladies Infectieuses à Edinburgh). Il est crédité de 5 ECTS.
- Le contenu, mis à jour annuellement alterne cours théoriques courts (45min) QCM, discussion de cas pratiques interactifs, d’imagerie et jeux de rôle.

Résultats

Le cours I3DC existe depuis 4 ans. Depuis 2014, I3DC a formé 277 étudiants de 3ème (Paris, Rome) ou 4ème année (Edinburgh). 1

Fig 3. Programme I3DC Paris 2017

<table>
<thead>
<tr>
<th>Etudiants</th>
<th>Etudiants I3DC</th>
<th>Autres étudiants</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N=192/26 (72%)</td>
<td>N=260/162 (69%)</td>
</tr>
<tr>
<td>Note moy (20) (SD)</td>
<td>10.77/20 (2.47)</td>
<td>10.43/20 (2.42)</td>
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<tr>
<td>P=0.27 (Test Student)</td>
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</table>

1. Structure
- Cours théoriques 45 minutes.
- QCM interactifs Moodle ou cas cliniques systématiques à la fin de chaque cours théorique.
- Cas pratiques.

2. Apprentissage
- Tous les étudiants ont réussi l’examen final (1 étudiant à la deuxième session).
- Evaluation « à l’avance » en Décembre 2016 3 ans après l’enseignement initial : 30 QCM posés sans préparation en DFASM3 aux étudiants ayant suivi le cours en 02/2014 et au reste de la promotion (120H). Pas de différence significative entre les 2 groupes.

3. Mobilité Etudiante
Vingt deux (11%) ont bénéficié par la suite d’un stage pratique dans une des institutions partenaires : Paris, Rome ou Edimbourg.

4. Satisfaction
- Le retour des étudiants est enthousiaste.
- 153 étudiants (77%) ont jugé le cours « excellent » et 42 (21%) l’ont jugé « bon ». Tous le recommandent.
- À P. Descartes, 120 candidats/an (25 places).
- À Edimbourg, implantation d’un enseignement de Maladies Infectieuses, qui n’existait pas dans leur curriculum.

5. Perspectives
- Le programme est financé depuis 2016 par un partenariat stratégique Erasmus+ et se renforce:
- Nouveaux partenaires en Ouganda (Lacor Hospital Gulu, et Mother Kevin Postgraduate Medical School Nsambya) et à Anvers.
- Création d’un cours d’été pour les étudiants Européens du 28 Aout au 1 Septembre sur les Urgences en Maladies Infectieuses à la Plate forme de Simulation de la Faculté Paris Descartes.
- Mise à disposition sur une plateforme en ligne des supports pédagogiques dans l’objectif d’élargir le cours à d’autres pays européens. Le programme s’appelle désormais IDEAL (Infectious Diseases Europe Africa Learning) (https://www.idealprogram.eu/).

Discussion-Conclusion

⇒ Cette modalité d’enseignement est plébiscitée par les étudiants, et par les enseignants qui ont développé des liens solides et des collaborations inédites.
⇒ Cette expérience montre la faisabilité d’un curriculum harmonisé Européen, attractif pour les étudiants, en Maladies Infectieuses.
⇒ Elle montre aussi la faisabilité de l’intégration de nouveaux partenaires Européens et au-delà : passage de 3 à 4 (Anvers) puis 6 (Ouganda) en 2016.
⇒ L’intégration de nouveaux partenaires Européens et Extra-Européens est programmée dans les prochaines années.
⇒ Il reste quelques places pour la Summer School en Août 2017 (https://www.idealprogram.eu/) !