Evaluating the contribution of a wildlife health capacity building program on orangutan conservation

Steve Unwin1 | Raffaella Commitante2 | Andrew Moss3 | Elinor Bridges3 | Kay H. Farmer4 | Ricko Laino Jaya1 | Yenny S. Saraswati5 | Citrakasih Nente5 | Indarjulianto Soedarmanto6 | Fransiska Sulistyo7 | Sumita Sugnaseelan8

1OVAG/School of Biosciences, University of Birmingham, Birmingham, UK
2OVAG/Orangutan Conservancy, California State University Fullerton Anthropology, Fullerton, California, USA
3Chester Zoo, Chester, UK
4Wildlife Impact, Leister, UK
5OVAG/Sumatran Orangutan Conservation Programme, Medan, Indonesia
6OVAG/Faculty of Veterinary Medicine Gadjah Mada University, Depok, Indonesia
7OVAG/Borneo Orangutan Survival Foundation (until 2018), Bogor, Indonesia
8OVAG/Dept. Animal Science, Faculty of Agriculture, Universiti Putra Malaysia, Serdang, Malaysia

Correspondence
Steve Unwin, c/o School of Biosciences, University of Birmingham, Edgbaston B15 2TT, UK.
Email: s.j.unwin@bham.ac.uk and s.unwin40@gmail.com

Abstract
One Health is increasingly being used as a tool in ecosystem protection. The Orangutan Veterinary Advisory Group (OVAG) is working to address One Health concerns in Pongo spp. (orangutan) welfare and conservation. Orangutans are vital contributors to the ecosystem health of their range areas. Strengthening national capacity is crucial to make a lasting difference in the currently bleak outlook for orangutan species survival. OVAG is a capacity strengthening and expertise network that brings together all those working with orangutans, in- and ex-situ, to share knowledge, skills, and to collectively learn. Using the One Health paradigm embedded to enhance professional development, the OVAG network is successfully supporting conservation outcomes and impact. As part of our adaptive management approach, and to assess individual and organizational change attributable to the capacity strengthening work of OVAG, we evaluated technical skill test data, program satisfaction data, and asked participants to complete a self-reflective survey. This pilot study of our work demonstrates statistically significant improvements in conservation medicine ($t = 5.481, p < 0.0001$) and wildlife clinical skills knowledge ($t = 3.923, p < 0.001$) for those in the OVAG program. Most consider OVAG participation to be either critical or very useful in their conservation medicine decision-making process, with a perceived positive impact on their skills at handling multiple situations. Additionally, participant feedback shows a sense of being able to drive positive change locally and nationally (within their own countries) as a consequence of OVAG participation. The authors hope the OVAG model including its associated capacity support mechanisms and pedagogical approaches can be used as a template for other One Health efforts.

Abbreviations: CPD, continuing Professional Development; GHSA, global health security agenda; IUCN, international union for conservation and nature; IVMA, Indonesian veterinary medical association (In Indonesian: PDHI or Perhimpunan Dokter Hewan Indonesia); NGO, non governmental organisation; OIE, World Organisation for animal health; OVAG, orangutan veterinary advisory group; WHO, World Health Organisation.
KEYWORDS
capacity building, conservation, orangutan, One Health

1 | INTRODUCTION

1.1 | Human and disease-based risk factors in the decline of pongo spp. (orangutan) populations and the role of one health education

All species of orangutan are listed as Critically Endangered on the IUCN Red List of Threatened Species (International Union for Conservation and Nature, 2018, Estrada et al., 2017). Recent reviews on the health of orangutan and other ape populations indicates habitat loss and fragmentation puts undue stress as access to food is reduced, mating opportunities decrease, and vulnerability to disease increases (Calvignac-Spencer et al., 2012; Kondgen et al., 2008; Utami-Atmoko et al., 2017). This is exacerbated by increasing population densities in remaining habitat which may trigger conflict between orangutans, increasing mortality, inbreeding, and facilitating disease outbreaks. Disease may also pose a risk at the individual population level where populations are small and isolated leading to genetic diversity loss. Where there is overcrowding (e.g., after fires), or regular disturbance from human-mediated activity on orangutan behavior (e.g., tourism, orangutan reintroduction/translocation), there may be an increased exposure to potential disease agents (Ditjen KSDAE, 2019, Dunay et al., 2018, Kilbourn et al., 2003, Mul et al., 2007).

The pace of new disease outbreaks has led to increasing recognition that emerging infectious diseases originate at the interface of human and animal ecosystems (Woldehanna & Zimicki, 2015). This recognition underscores the need for an inter-disciplinary approach in dealing with disease transmission in already threatened ape species (Estrada et al., 2017). The One Health paradigm continues to evolve (Gruetzmacher et al., 2020), but fundamentally integrates investigations of wildlife, livestock, crop, and human health and welfare in an ecosystemic context (Wallace et al., 2015). The approach convenes medical doctors, veterinarians, ecologists, and sociologists under the rubric that many species share infectious, chronic, and environmentally sourced illnesses.

Data on emerging diseases demonstrate the overlap between locations of emerging zoonotic diseases and biodiversity hotspots (Jones et al., 2008). This suggests that One Health practices go beyond human and animal biological surveillance and incorporate the human social and structural contexts where emerging zoonoses are most likely to occur, such as Indonesia and Malaysia (von Rintelen et al., 2017), the only two countries where orangutans are indigenous.

Due to its tropical climate, vast forested areas, and high human population, Indonesia is a global hotspot for zoonotic disease emergence from animals, especially wildlife (Wilks & Fenwick, 2009). With 60% of zoonotic diseases coming from wildlife, the role of veterinarians in wildlife medicine is imperative for disease surveillance. Launched in 2014, the Global Health Security Agenda (GHSA) brings together national governments, the WHO (World Health Organization), OIE (World Organization for Animal Health) and others, to provide a global mechanism for One Health collaboration and to enhance disease surveillance. GHSA identifies a critical lack of adequately trained public and wildlife health professionals (Wolicki et al., 2016, GlobalHealthSecurityAgenda, 2016). From personal observations and discussions with various veterinary faculty in Indonesia, wildlife medicine and orangutan health and welfare specifically, has not been a focus of Indonesian veterinary schools.

Calls to improve One Health tertiary education or community and clinical practitioner capacity have been made from the human medical field in different settings (Bolon et al., 2020; Rweyemamu et al., 2012), but there remains a need to identify effective pedagogical approaches.

1.2 | Introducing the OVAG program

The Orangutan Veterinary Advisory Group (OVAG, www.ovag.org) was established in Indonesia in 2009, as a technical capacity building and networking initiative. Most young veterinary clinicians working in orangutan range countries have limited wildlife training within the university system and have had to “learn on the job” often in isolation from external veterinary assistance. OVAG identified that investing in a capacity strengthening program for key individuals in orangutan health management would provide the much-needed support and platform for collaboration, increasing the impact of these individuals toward more successful efforts to effect orangutan welfare and conservation. The development of the OVAG community was designed to fill the veterinary led tier of the GHSA highlighted need for capacity development and advocacy for the inclusion of One Health principles in orangutan action plans. OVAG brings together those working with orangutans to share expertise, knowledge, and collectively learn to increase effectiveness of orangutan welfare and conservation. This community includes veterinarians, academics, researchers, project managers, and government authorities from Indonesia, Malaysia, and around the globe.

1.3 | Designing a capacity building program

Capacity development, as with any initiative, requires management principles to help build a strong foundation. Following Kern (2016) OVAG developed a six-step approach for wildlife veterinary education in Indonesia and Malaysia:

1. Identify the problem: In both Indonesia and Malaysia, there are a lack of science graduates in general versed in One Health to combat emerging and pandemic disease.
2. Targeted needs assessment: Define minimum competencies for specific disciplines, which in this case is wildlife health and welfare.

3. Setting goals and objectives: Developing a plan (outlined as OVAG Theory of Change, Commitante et al., 2017).

4. Developing an appropriate educational strategy: Holding annual workshops with a combination of didactic lectures, focus discussion groups, and hands-on trainings, bringing together multidisciplinary experts across university, medical and zoo veterinary networks, encouraging collaboration and increased hands-on experience and development of critical thinking skills through problem-based learning.

5. Curriculum review and design: Using ongoing participant evaluation and feedback, and annual review, keeping with the network's strategies.

6. Implementation, evaluation and feedback: Ongoing participant evaluation, online survey, annual workshops, and other outputs to ensure that findings from the feedback are integrated into the ongoing design of projects and initiatives.

The underlying assumption of evaluation is that better information on what does or does not work will drive better decision-making and in turn better conservation (Stem et al., 2005). This article presents a pilot evaluation of the current efficacy of OVAG activities on its participants where data were able to be collected (2015, 2016, 2017, and 2019). It presents a mixed evaluation approach that could be of use to the medical, One Health and conservation fields alike. As a pilot, these represent first steps to confirm OVAG is utilizing good pedagogical practice to effectively allow participants to learn, acquire, and implement knowledge gained. The next stage will be to include more quantitative measures for skill evaluation and confirm that program outputs also integrate modern One Health practice as per the Berlin principles (Gruetzmacher et al., 2020).

1.4 Pedagogical justification and evaluation limitations

A good learning environment engenders acceptance and a sense of empowerment via community-building through problem or scenario-based learning (Broom, 2015). This was especially relevant when creating OVAG which is a Continuing Professional Development (CPD) program for practitioners in a multicultural learning situation, where social etiquette and ways of understanding greatly varied among participants. An interdisciplinary, multinational approach also lends itself to the One Health approach from an educational point of view.

Bowden et al. (2019) provide recent support for our pedagogical approach as OVAG has evolved by discussing the four pillars of engagement—social, affective, behavioral, and cognitive—to manage expectations and outcomes and to guarantee program involvement.

1. 2009 Core team identified the need for a network (between educators and practitioners in UK, United States, and Indonesia)—Social engagement
2. 2010—2012 created the framework of capacity development, research, and advocacy—affective engagement
3. Set overarching learning objectives, evaluate and adapt based on feedback and evidence of knowledge and skill acquisition (from 2013—ongoing)—behavioral engagement.
4. Align learning outcomes with Theory of Change outcomes from 2017, to review in 2022, as per Biggs (2003).
5. Embed OVAG content into university modules at UGM (2020—ongoing)—cognitive engagement.

Like any tertiary academic teaching module, some OVAG participants change each year, but unlike a university course, others dip in—dip out, or have been there throughout. This produces audiences with different levels of capacity need. As such, evaluating the program must take the semi-quantitative approach as utilized. The underlying assumption of our pilot study is that better information on what does or does not work will drive better decision-making (Stem et al., 2005). Thus, we have focused on knowledge gained in conjunction with participant evaluation to semi-quantitatively assess the value of the program to One Health practice, in line with recognized best practice pedagogy. OVAG attempts to follow the aligned teaching model as described by Biggs (2003) where curriculum content and outcomes, teaching methods, and assessment tasks are aligned to each other, to guarantee these different audiences are catered for. This approach is further aligned with the orangutan veterinary sector's needs, via participant feedback, for producing interdisciplinary competent professionals (Amuguni et al., 2017).

Understanding which actions are effective or not and why, avoids wasted effort and funds, enables resources and funding to be prioritized, improves delivery, and provides accountability for participant employers, governments, and donors. To confirm success in learning outcomes and that participant support was being properly targeted, input was gathered over several sessions.

2 METHODS

All work conducted at the annual OVAG workshops was with an in-country partner (Gadjah Mada University) and was further accredited by the Indonesia Veterinary Medicine Association (IVMA) since 2015. For validity, OVAG utilized test–retest methodology to monitor knowledge stability over time as well as test reliability via equivalency (parallel forms), from Hecker & Violato (2009).

The evaluation approach of OVAG is divided into three sections: pre and posttest (quizzes) at workshops (2015, 2016, 2017, and 2019); feedback forms at the end of each workshop (matched with quiz data), and an online survey distributed in 2017 targeting all participants from 2009 to 2016.
2.1 Part I: Pre- and postworkshop quiz

Although OVAG was initiated in 2009, evaluation began in 2014 when we formatively collected and calculated evaluation results of the pre and postworkshop through to the subsequent workshops. For validity, test–retest methodology was used to monitor knowledge stability of participants over time as well as test reliability via equivalency (parallel forms) from Hecker & Violato (2009). This process was formalized from 2015. Quizzes were created (and later reviewed) by experts in their fields who led the training sessions and were designed to assess the effectiveness of 2019 each training session by comparing knowledge before and after each session. Quizzes consisted of 20 questions that covered a combination of conservation medicine and veterinary technical skill knowledge. The questions varied slightly year to year depending on the content of each workshop but assessment of underpinning principles such as risk analysis and biosecurity remained constant year after year to assess knowledge retention in key areas. The test was provided in both English and Bahasa Indonesia and participants responded in the language they felt most comfortable. Data were anonymized due to the focus on assessing use of the training materials overall, rather than individual knowledge or skill. This also helped ensure unbiased feedback. An example of the test, with corrected answers and differentiated between conservation medicine and clinical skills is in Supporting Information Appendix 1.

2.2 Part II: Participant feedback

A feedback form, based on Return on Investment (ROI) principles, was developed by the Discovery and Learning team at Chester Zoo, UK. This resulted in a semi-quantitative assessment using a five-level scale from strongly agree to strongly disagree, given to participants at the end of each workshop from 2014 to 2019. Participants were asked if they gained new knowledge or ideas, if they would use information gained, if they had been shown how to impart knowledge to colleagues, and finally if ideas and information provided at the annual OVAG workshops would improve the way they do their job and the health of the animals under their care. The second part of the form asked for comments on how to improve the workshops, and how they will use the information they have gained. Both parts of the form were in English and Bahasa Indonesia and participants responded in the language they felt most comfortable. An example of the feedback form is in Supporting Information Appendix 2.

2.3 Part III: Online survey

A series of survey questions were drafted, initially in English, by some of the authors of this article (S.U., A.M., and K.H.F.) then reviewed, updated, and translated by FS into Bahasa Indonesia to ensure they were comprehensible and all-encompassing. The survey was distributed online in English and Bahasa Indonesia via Survey Monkey in 2017 to current and past participants of OVAG workshops. A copy of the survey is in Supporting Information Appendix 3a (English) and Supporting Information Appendix 3b (Bahasa Indonesia). Questions focused on:

1. Demography of participants, including the level of participation in the OVAG network.
2. Data on importance of transferable skills development to participants.
3. Participant self-assessment of their contribution to orangutan conservation and health and the importance of OVAG involvement to this. Categorized as:
   a. Biosecurity b. Disease outbreak c. Reintroduction/translocation
   d. Scientific writing skill e. non governmental organisation (NGO) advisory f. Government advisory g. Surgical issue h. General medical issue
4. Limiting factors to progression and contribution to orangutan conservation at the country, organizational, and individual level.

2.4 Statistical analysis

The results of quiz answers were consolidated into “conservation medicine” and “clinical skills” aspects and analyzed using independent t tests to assess differences in knowledge between pre- and posttests. Tests were marked by the experts that wrote them and were validated by independent veterinary expertise at Chester Zoo, UK. An overall score was also assessed using the same methodology.

2.5 Methodology limitations

The purpose of this pilot evaluation is to confirm or deny that our pedagogical approach to capacity development is perceived by participants to be what is needed. As such, the OVAG network incorporated all opinions within the survey analysis, as there was no “conflict of interest” or bias as all opinions were considered valid. The quizzes were administered only to participants (and not facilitators). Some members of the OVAG committee, who did not devise or had access to any quiz before testing, but who work in orangutan centers and/or academia in orangutan range countries were categorized as participants. Therefore, most of the data presented here are based on self-reported feedback. The opportunity for participants to provide both positive and negative feedback anonymously was provided in the annual feedback form.

Data for points number two and three from the list above is collected semi-quantitatively in the survey to measure the effectiveness of OVAG’s capacity building programs. Options are provided on a continuum scale, ranging from (capacity) increased greatly to (capacity) decreased greatly. Further, we asked an open question on any contribution that the participants have made and how much...
OVAG affected those contributions. Data for point number four were also collected semi-quantitatively by providing scalable options ranging from not at all (as a barrier) to complete barrier of internal and external factors that may challenge participants in giving contributions to conservation and One Health.

### RESULTS

Results are presented according to the corresponding evaluation approaches as per the previous section.

#### 3.1 Part I: Pre- and postworkshop knowledge gain as a group

Because responses were anonymous to encourage participation, pre and postparticipation responses could not be matched to individuals (see Table 1), so data were analyzed using independent t tests.

Data showed a statistically significant improvement in knowledge from before to after tuition and participation (Figure 1). This improvement was seen in both areas under examination: general conservation medicine management (t = 5.481, p < 0.001) and wildlife clinical skills (t = 3.923, p < 0.001) for a total of t = 5.053, p < 0.001. Data were combined across 2015, 2016, 2017, and 2019 but each year showed a similar improvement, except for 2019 which showed a statistically significant improvement over previous years (Figure 2). This was in both general conservation medicine management knowledge, (t = 7.56, p < 0.001), and wildlife clinical skills (t = 4.01, p < 0.001), for a total of t = 6.9, p < 0.001.

#### 3.2 Part II: Participant feedback between 2014 and 2019

Table 1 presents the number and percentage of feedback responses grouped according to key themes under three question categories: (a) the best things about the workshop, (b) what needs improving, and (c) how information gained at OVAG workshops is intended to be used. All participants were asked to complete this questionnaire in each workshop (N ranged from 30 in 2014 to 69 in 2019). Almost half of the accumulative participant feedback (46.4%) identified the exchange of ideas and knowledge as the best aspect of the workshops (Table 2), and this sentiment remains constant over the time period. Just over 20% also identified that participating in the workshops gave them a sense of community and empowerment. Improvements were predominately focused (43.2%) on suggestions for future topics and sessions. Just over a third of participants (34.6%) highlighted the need for more hands-on training sessions on various technical skills. Over half of participants (54.4%) intended to share information both internally (with management and colleagues) and externally (with government and students), and just under half (42.6%) intended to use the knowledge and skills learned to improve how they do their job (this was often presented jointly with sharing knowledge).

#### 3.3 Part III: Participant online survey

The online survey was completed by 55 persons, with slightly more females than males (Table 3), in line with the general OVAG
Participant demographic. Participant age ranged from 23 to 67 with a mean age of 35. Over half of participants have achieved an undergraduate Bachelor’s level degree.

Figure 3 presents self-reported impacts of the OVAG program on survey participants across a range of six key criteria, a mixture of professional vital skills and technical abilities considered necessary by the authors as critical for successful conservation medicine and One Health management. These are personal development benefits; enhanced technical skills; ability to contribute to diversity conservation, wildlife welfare and One Health; ability to contribute to the organization; enhanced transferable skills; and employability and personal economic advantages (transferable skills are multidisciplinary related and in this context are aligned with communication, teamwork, and problem-solving skills enabling people to navigate their environment, work well with others, perform well, and achieve goals).

Subcategories that fall within the overarching criteria presented here can be found in the survey in Supporting Information Appendices 3a and 3b. Across all criteria, participants considered OVAG highly important in improving their skills, their ability to contribute, and to obtain other benefits and advantages.

Survey participants were asked to select three topics where they had contributed, and to self-assess the importance of their involvement in this contribution. The topics provided were general medical issues; reintroduction/translocation programs; biosecurity issues; government advisory; disease outbreaks; scientific writing; NGO advisory; and surgical issues.

Figure 4 shows the percentage of respondents for each topic. Almost a quarter of respondents (22.8%) chose a medical

| Table 2 | OVAG accumulative participant feedback (2014–2019) on the best things, things to improve, and how information gained at OVAG workshops are intended to be used |
| Category | Response grouping | N | % |
|------|-------------------|---|---|
| Best things | Exchange of ideas and knowledge | 39 | 46.4 |
| | Sense of community and empowerment | 18 | 21.4 |
| | Specific subjects | 16 | 19 |
| | Other | 11 | 13.2 |
| Total | | 84 | 100 |
| Things to improve | Suggested subjects for future workshops | 35 | 43.2 |
| | More time for practical sessions | 28 | 34.6 |
| | Other | 18 | 22.2 |
| Total | | 81 | 100 |
| Intended application | Share with others | 37 | 54.4 |
| | Improve job and practice in own organizations | 29 | 42.6 |
| | Other | 2 | 3 |
| Total | | 68 | 100 |

Abbreviation: OVAG, Orangutan Veterinary Advisory Group.

| Table 3 | Demographics of participants |
|--------|-----------------------------|
| Gender | N | % |
| Female | 30 | 54.5 |
| Male | 25 | 45.5 |
| Total | 55 | 100 |
| Highest Education Attainment | N | % |
| PhD | 9 | 16.4 |
| Clinical Diploma | 1 | 1.8 |
| Master | 8 | 14.5 |
| Bachelors (including DVM degree in Indonesia/Malaysia) | 31 | 56.4 |
| Other | 6 | 10.9 |
| Total | 55 | 100 |
issue, perhaps unsurprising in an animal health and welfare training situation. In second and third place came reintroduction and biosecurity. Figure 5 shows the self-reported influence of OVAG on their contribution. Over a third cited OVAG as critical to their contribution, over three-quarters cited it as critical or very helpful, and all participants considered OVAG as helpful in some form.

Questionnaire participants were also asked what they considered to be the top five most significant barriers to (a) their role in conservation health management; (b) improving their wildlife clinical skills; and (c) overall work on biodiversity conservation/wildlife welfare/One Health in their countries (Table 4).

4 | DISCUSSION

4.1 | OVAG’s pathways to change

OVAG was first staged in 2009 by the Orangutan Conservancy, a U.S.-based nonprofit. It was initiated in response to an urgent need for capacity building in wildlife health and management in Indonesia and Malaysia (Commitante et al., 2009). This need was identified from a questionnaire sent to veterinarians working with orangutans in-situ in 2008. As stated previously, veterinary clinicians had limited wildlife training.

OVAG is attempting to develop “Pathways to change” for the network’s mission through providing capacity building and orangutan health research and education opportunities, and by being actively engaged in policy and advocacy in relation to orangutans and their environment. Qualitative evidence of impact into this has been highlighted in the methods section. This process follows the principle of “build the movement from the bottom, strengthen it from the middle and top” (Reid et al., 2002). Veterinarians are often structurally positioned under the operational manager, who then reports to the director of the organization. Building the capacity of the veterinarians follows the hope that they would act as catalysts for scientific-based practice in their centers as well as encourage more collaboration at the organization level.

4.2 | Improvement in transferable and technical skills

The OVAG “model” is a multidisciplinary network that brings capacity development, research, policy, and advocacy together to improve orangutan health, welfare, and conservation. This article has focused on the beginnings of formally evaluating the impact of capacity development activities of the network on participants. Sarti et al. (2017) highlighted the paucity of studies focused on examining evaluated capacity building in medical practice. In conservation practice, Stephenson (2019) argues many projects struggle to demonstrate the impact of their activities, recommending a process linking goals with indicators and measuring aggregated impact. Making this type of monitoring the norm will require a culture change within the conservation community. Porzecanski et al. emphasize the importance this system-level evaluation of capacity

| TABLE 4 Most significant barriers perceived by participants for their own professional development and the general conservation/One Health work in their countries |
|---------------------------------------------------------------|
| Barriers to conservation health management role | Barriers to improving wildlife clinical skills | Barriers to overall work on biodiversity conservation, wildlife welfare, and one health work in own countries |
| 1. Lack of possibility of progression in their organization | 1. Lack of continuing professional development | 1. Inadequate public policy to support conservation |
| 2. Rigid organizational structure | 2. Lack of transferable skill development (e.g., management/communication etc) | 2. Lack of laws or regulations to support wildlife welfare |
| 3. Patriarchal bias for senior level positions | 3. Lack of technical skills | 3. Lack of funding to sustain conservation |
| 4. Lack of continuing professional development | 4. Lack of possibility for progression within the organization. | 4. Corruption |
| 5. Lack of networks/contacts | 5. Rigid organizational structure | 5. Inadequate scientific knowledge for biodiversity conservation planning |
building in conservation more generally has as a requirement to demonstrate conservation impact, and the authors use OVAG as a case study to demonstrate the approach.

Evaluation can be challenging due to the complexity of drivers and context, attribution (the influence of inputs originating from different sources) and extensive time frames are required to measure tangible change, particularly when trying to demonstrate change at the outcome level. PRISM is a toolkit designed by the conservation community to help support small/medium-sized conservation projects to evaluate the outcomes and impacts of their work (PRISM.2017-2021). PRISM includes a dedicated section for capacity development to help focus attention on this neglected area of evaluation. We can begin to assess the effectiveness of capacity development initiatives by proving improved knowledge, decision making, and actions. To assess how people improve their decision-making process and actions is very complex and this article offers a place to start.

There is statistically significant improvement in conservation and veterinary medicine knowledge and technical skills of participants in the OVAG community. Although a one-time measured increase in technical capacity may not equate to increase in long-term knowledge nor competency, at the very least it gives evidence that participants have been exposed to additional information and showed some level of understanding. This understanding is partially captured in participant assertions of OVAG importance in their decision making as most participants consider participation in a professional community such as OVAG to be either critical or very useful.

4.3 | Participant evaluation and feedback

Continuous feedback from participants of capacity building activities is needed to allow confirmation (or not) that the program is meeting participant needs. Continuous performance evaluation is needed to confirm effective transfer of knowledge and skills. This evaluation process is acknowledged to be time demanding and challenging (Britton et al., 2008). As an iterative process, and in line with the OVAG Theory of Change (Supporting Information Appendix 3), we will be continuing the evaluation annually with a follow-up survey in 2021, to help guide our strategy for the following 5 years.

The mandatory annual feedback form for all participants to fill in anonymously suggested that the most important trait of the annual workshops they most appreciated was the open environment where ideas and knowledge were exchanged. This indicates that all participants feel equally respected and that everyone has something to learn from one another. We acknowledge that the “experts” in orangutan conservation and health management are the local veterinarians who are working full-time in all 10 rehabilitation centers in Indonesia and Malaysia.

Just over 20% of participants experience a feeling of community and empowerment, which is in part helping lead to a reduction in the high turn-over of veterinarians working in the field. Eleven years after the beginning of our program, 50% of the original participants are still involved. Although many remain in orangutan health, some have moved away from being field veterinarians while some have been promoted or moved into decision-making positions. All still attend annual workshops at their own expense, highly suggestive that the OVAG community is a positive experience for professional and personal development.

After each workshop, the number of participants who asked for more practical sessions was significant (34.6%). This is consistent with topics requested for future workshops, which are heavy on technical veterinary skills such as radiography, dental examinations, ophthalmology, and surgeries (orthopedic, soft tissue, etc). This may reflect the lack of opportunities for hands-on training in a veterinary residency program. Indeed, such programs are rare to nonexistent in Indonesia, especially so for zoo and wildlife veterinarians. We have identified this gap and have helped with getting participants into training programs abroad. We actively look for collaborations to increase such opportunities for Indonesian and Malaysian wildlife veterinarians.

There was a strong will from the participants to share the knowledge and information they received from the workshops to their colleagues (54.4%), as well as using workshop materials to improve their daily practices (42.6%). Obviously, it is very challenging to measure how much OVAG has contributed to the improvement of veterinary and rehabilitation/husbandry practices in orangutan centers, however, it was confirmed from the online survey issued in 2017 that over 75% of respondents think that their participation has been either critical or very helpful to their contribution for the conservation of orangutans in general (Figure 4).

4.4 | Online survey results

Interestingly, personal development was highlighted by participants as the greatest contribution by OVAG. The personal development stemmed from networking and being able to build relationships at the annual workshops not just internationally but even between centers. This reinforces the “conservation is people” concept, one of the founding principles of OVAG. Whether this adds to a person’s ability to improve the welfare and conservation of the species remains to be concretely proven, but they are more likely to be able to take control of any given situation. An example would be orangutan nutrition. Typically, center veterinarians are not trained in orangutan nutrition, but often they are the ones required to manage it. Nutrition was a main topic at several workshops (2011 and 2019), and as a result, many centers report that they have an improved nutrition plan for their orangutans. Orangutan centers such as the Sumatran Orangutan Conservation Program, Frankfurt Zoological Society Sumatra, and the Borneo Orangutan Survival Foundation all have nutrition programs that were initiated or refined by the veterinarians empowered by the knowledge they received from the workshops. While there needs to be continuous evaluation on nutrition, these vets have put into practice what they have learned to improve the work done by their home organizations. An important outcome of
any capacity development is to increase participants belief that they
can effect change (Berrian et al., 2018; Copsey, 2017; Sarti
et al., 2017). This nutrition example illustrates the focus of empowering participants and creating ownership of the issues and work undertaken so that it remains relevant to them although we acknowledge that there is no data on the direct impact of the improve nutrition plan on orangutan health and welfare. The results presented here highlight their sense of ownership and that the OVAG community is strong. Participation and learning play heavily in their conservation medicine decision-making processes, increasing their ability to provide guidance.

4.5 | Barriers to success and pathways to resilience

Didactic lectures still form a large component of the OVAG workshops. Discussion times are often seen as too short and can easily lead to participant frustration at not being heard, especially in larger groups. The language barrier and cultural differences are also perceived to be challenges in delivering a comprehensive message in the topics presented, which is mirrored in the feedback form. The language barrier has always been mentioned by participants for future improvement. We are currently investigating purchasing handheld translation devices for the next workshop as a possible solution.

Every year, we receive a constantly increasing number of interested people who want to join. Although this could be reflective of the programs respect within the practitioner community, we must acknowledge that larger groups may also be a limiting factor to delivery in a workshop environment. Thanks to our growing network, through affiliates like the Universities of Minnesota and Birmingham, the Pan African Sanctuary Alliance and Chester Zoo, we have begun to address this issue by developing online delivery of content from 2020, which all 260-odd participants can access, alongside a week long online live workshop with over 90 attendees. Although within OVAG’s future program, the CoVid-19 pandemic forced us to bring forward this online delivery, as it did for many in the conservation sector. While acknowledging the power of in-person training, this new permanent blended format of delivery has made OVAG more resilient and has been shown to improve learning if technical difficulties can be avoided (Atkins et al., 2016).

Every annual workshop sees new veterinarians joining for the first time (many newly graduated). At the same time there are also those who have been working for over a decade in orangutan welfare and conservation and have attended our workshops consistently. This means that each year there is great variation between levels of competency, and the problems and challenges that each participant is faced with. This highlights the importance of getting continuous feedback from the community to keep presenting issues that are relevant for all participants at multiple levels of expertise. Many original participants are now facilitators, workshop organizers, and content creators/deliverers, which is not only aiding the relevance but also increasing the resiliency of the program.

It is widely accepted that successful conservation work is dependent on people (Clas et al., 2010, Scarlett & McKinney, 2016). As such any conservation capacity building program should support the mental health and well-being of its participants. An increasing area of concern in the animal health profession are issues of burn out and compassion fatigue (Hill et al., 2019; Lloyd & Campion, 2017; Volk et al., 2018). The participant feedback results indicate issues of mental health are a concern and the authors will be following this up with a targeted program to assess mental well-being which we will report on in a future paper.

4.6 | Pedagogical approach

The principal goal of teaching interdisciplinary approaches such as One Health is to cultivate scientific inquiry that requires coordination of both knowledge and skills simultaneously. By promoting inquiry and discovery in applied real world problems we can enhance the participants’ abilities to construct their own knowledge through the relevant hands-on and minds-on activities (Osman et al., 2013; Owen, 2015). An interdisciplinary approach also encourages a wide education network. Linking teaching with workshops, an online clinical advisory and CPD content, and research collaborations allows OVAG to follow the collaborative One health paradigm to enhance interdisciplinary focused learning outcomes combining Bigg’s (2003) aligned structure, with Amuguni et al. (2017) technical approach.

Although the aim was to cover long-term knowledge retention in key areas such as biosafety and disease risk, we acknowledge that this does not equate to confirmed increase in long-term knowledge. Future evaluation of this part of the program will incorporate year-round assessed assignments via an online tertiary learning platform (Canvas—https://umnadvet.instructure.com/courses/321) to mitigate this gap. Confirmation of clinical competencies have only been conducted in “case study” session discussions or in specific circumstances in areas such as parasitology and ultrasonography in “train the trainer” sessions designed specifically to pass on technical knowledge to others. Use of technology to allow for upload of videos of procedures for assessment via the Canvas platform, and clinical specific wet labs are being planned to help fill this evaluation gap.

By being involved in developing the curriculum themselves, participants can construct a matrix of the beliefs and values that OVAG holds, allowing ownership of the program by teachers and learners alike. This follows Amuguni et al., (2017) who state that capacity development, as with any initiative, requires management principles to help build a strong foundation for medical field focused teaching.

By utilizing a mixed activity approach, we were able to demonstrate that OVAG has provided an effective One Health learning environment. For example, OVAG encourages peer-to-peer learning and this pilot evaluation indicates participants have indeed taken ownership of the program, as clinical practitioners and postgraduates
are guiding the learning outcomes of the curriculum. In summary this has led to:

a) Increasing participants knowledge/skills leading to enhanced professional practice.
b) Quantitative and qualitative data evaluation of the OVAG program used as confirmation that the methods are sound and the goals are achievable.
c) An effective peer support network at the heart of this One Health program.

To confirm success in learning outcomes and that participant support was being properly targeted, time was needed to gather data over several sessions, to confirm consistency. OVAG is also focusing increasingly on evaluation, especially as we begin the process of Theory of Change review, as we need to be able to quantify indicators and confirm assumptions in line with activities and goals.

The critical characteristics of instruments in educational measurement are validity and reliability (Hecker & Violato, 2009). Multivariate analyses and procedures for investigating levels of analysis of validity need to be explored by OVAG as we continue to investigate impact.

Regarding reliability, these same approaches that involve retesting after some lapsed time (i.e., test–retest, parallel forms at different times) also estimate teaching reliability. As veterinary educators we need to improve our understanding of each of these concepts going forward because evaluation and performance measures provides evidence of the utility of assessment tools, informs future pedagogical practices, and will further guide OVAG’s curriculum development and revision going forward.

4.7 Welfare and conservation impact

We understand the link between welfare and conservation and the OVAG community has indirectly improved the welfare of the animals and the conservation focused decision process within its network organizations. However, directly linking OVAG’s capacity development with long-term welfare and conservation impact remains elusive. Assessing the impact of orangutan rehabilitation and release on conservation outcomes has only recently started to be externally investigated and evaluated (Sherman et al., 2020).

Although OVAG’s theory of change speaks to creating a "sustainable cadre of professionals" to provide this impact, the sector needs to improve its evaluation processes to confirm efforts lead to impact over the coming years. OVAG has run sessions on ethics, animal welfare and behavior, and encouraging participants to share their cases/problems related to behavioral issues. In 2014, a welfare statement we produced was adopted by our network organizations that care for wildlife (Commitante et al., 2015).

However, in the absence of robust welfare assessment (an issue faced by all captive ape institutions) data do not exist to be able to quantify this assumption.

All this training does have the potential of coming to nothing if the participants cannot see a pathway to a viable professional future. Lucas et al. (2017) assessed the global conservation job market and found that positions in nonprofit organizations, rather than governmental posts, were the most abundant. The most common skills required across sectors were a strong disciplinary background, followed by analytical and technical skills. Positions in countries with advanced economies focused on publication history and technical skills, whereas positions in developing countries emphasized language and interpersonal skills. Nonacademic jobs emphasized the need for excellent written and oral communication, as well as project-management experience. To help make future pathways possible, the annual workshops and the continuous year-round networking among the participants, has been able to foster the interactions involving field veterinarians in range countries, and academia and veterinary specialists from multiple countries, providing an effective platform to develop especially strong communication skills and opportunities. Topics covered in past workshops included husbandry, scientific writing, and risk analysis, all important traits to manage a project and secure a future. As a result, we have seen several of our long-term participants increase their career potential from veterinarians to managerial positions in their home organizations.

Education is highlighted as an effective mitigation strategy for conservation issues associated with health (Utami-Atmoko et al., 2017). Participants agreed that lack of CPD opportunities was a barrier to both conservation health management and clinical skills. Our workshops have helped in this issue, having been endorsed by the Indonesia Veterinary Medicine Association (IVMA) giving accreditation (CPD credit points) for workshop participants since 2015. This accreditation has allowed Indonesian vets who work in wildlife, especially orangutans, to renew their veterinary certification from the credit points received at workshops. This accreditation proves that workshop materials are acknowledged as professional development of wildlife veterinarians in Indonesia. By Indonesian and Malaysian law, all vets practicing in country must have a certain number of credit points to be able to hold their licence.

By providing a platform to support better coordination in the health aspects of orangutan conservation, we aim to set our community as an example of how to protect and sustain other taxa populations through collaboration. Protecting wild populations and environments can be done in a more effective way through collective education, networking, and trust. Our work within Indonesia and Malaysia with multiple veterinarians, researchers, universities, and governmental entities has shown that investing in capacity building will lead to a bigger and more comprehensive conservation impact.

We understand that the network’s future success is reliant on clear lines of succession planning. From 2015, the annual workshops have been run by an organizing committee whose members were formerly participants and some are Indonesian and Malaysian veterinarians working in NGO conservation management, academia or Government; while others not from orangutan range countries are active in education, orangutan health and management
5 | CONCLUSION

While we cannot provide evidence of the direct impact of the OVAG program on orangutan conservation, we can state that: orangutan range country members of OVAG no longer work in isolation, they are in constant contact with a support system that contains over 250 individuals, they can share successes and failures; they can get and give advice; they are building standardized protocols for care; they have been able to access international internship/work exchange opportunities to further their knowledge as well as share their knowledge with others; they have presented at conferences and coauthored published papers; and they have gained a seat at the table in government meetings regarding orangutan conservation (Commitante et al., 2009-2012). A Theory of Change has guided the current and future strategy and impacts (Supporting Information Appendix 3). This current research represents a pilot evaluation based on OVAG participant feedback trends to help validate both pedagogical approach and participant needs as we build better efficacy of One Health communities.

ACKNOWLEDGEMENTS

The authors would like to thank all OVAG participants, both individuals and institutions, who took part in providing data for this paper. They are the giants on whose shoulders we are calling their achievements out from. Publication of this paper provides evidence from. They are the giants on whose shoulders we are calling their respective areas on behalf of the network. This ethos recognizes the social dimension of conservation and welfare areas of One Health.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

REFERENCES

Amuguni, H. J., Mazan, M., & Kibuuka, R. (2017). Producing interdisciplinary competent professionals: Integrating one health core competencies into the veterinary curriculum at the University of Rwanda. Journal of Veterinary Medical Education, 44(4), 8–659. https://doi.org/10.3138/jvme.0815-133R

Atkins, S., Yan, W., Meragia, E., Mahomed, H., Rosales-Klintz, S., Skinner, D., Zwarenstein, M., & for the ARCADE consortium. (2016). Student experiences of participating in five collaborative blended learning courses in Africa and Asia: A survey. Global Health Action, 9, 1. https://doi.org/10.3402/gha.v9.28145

Berrian, A. M., Smith, M. H., Rooyen, J. V., Martínez-López, B., Plank, M. N., Smith, W. A., & Conrad, P. A. (2018). A community-based One Health education program for disease risk mitigation at the human-animal interface. One Health, 5, 9–20.

Biggs, J. (2003). Aligning teaching for constructing learning. https://www.advance-he.ac.uk/knowledge-hub/aligning-teaching-constructing-learning

Bolon, I., Mason, J., O’Keeffe, P., Haeberli, P., Adan, H. A., Karenzi, M. J., Osman, A. A., Thumbi, M. S., Chuchu, V., Nyamai, M., Martins, S. B., Wipf, N. C., Ruiz, & de Castañeda, R. (2020). One Health education in Kakuma refugee camp (Kenya): From a MOOC to projects on real world challenges. One Health, 10, 100158. https://doi.org/10.1016/j.onehlt.2020.100158

Bowden, J., Tickle, L., & Naumann, K. (2019). The four pillars of tertiary student engagement and success: A holistic measurement approach. Studies in Higher Education, 44, 1–18. https://doi.org/10.1080/03075079.2019.1672647

Britton, M., Letassy, N., Medina, M. S., & Nelson, E. (2008). A curriculum review and mapping process supported by an electronic database system. American Journal of Pharmaceutical Education, 72(5), Article 99.

Broom, C. (2015). Empowering students: Pedagogy that benefits educators and learners. Citizenship, Social and Economics Education, 14(2), 79-86. https://doi.org/10.1177/2047173415597142
Calvignac-Spencer, S., Leendertz, S. A. J., Gillespie, T. R., & Leendertz, F. H. (2012). Wild great apes as sentinels and sources of infectious disease. Clinical Microbiology and Infection, 18, 521–527. https://doi.org/10.1111/j.1469-0691.2012.03816.x

Claus, C. A., Chan, K. M. A., & Satterfield, T. (2010). The roles of people in conservation. In Sodhi, & Ehrlich (Eds.), Conservation Biology for All. http://ukcatalogue.oup.com/product/9780199554249

Commitante, R., Unwin, S. & Cress, D. (Editors). (2009). Estrada, A., Garber, P. A., Rylands, A. B., Roos, C., Fernandez, M., Mittermeier, R. A., Arregoitia, L. V., Guinea, M., Gouveia, S., Di Fiore, A., Nekaris, K., Nijman, V., Heymann, E. W., Lambert, J. E., Wang, C., & Leendertz, F. H. (2008). Pandemic human viruses cause decline of endangered Great Apes. Current Biology, 18, 260–264. https://doi.org/10.1016/j.cub.2008.01.012

Lloyd, C., & Campion, D. P. (2017). Occupational stress and the importance of self-care and resilience: Focus on veterinary nursing. Irish Veterinary Journal, 70, 30. https://doi.org/10.1186/s13620-017-0108-7

Lucas, J., Gora, E., & Alonso, A. (2017). A view of the global conservation job market and how to succeed in it. Conservation Biology, 31(6), 1223–1231.

Müller, I. F., Paembonan, W., Singleton, I., Wich, S. A., & van Bolhuis, H. G. (2007). Intestinal Parasites of Free-ranging, Semicaptive, and Captive Pongo abelii in Sumatra, Indonesia. International Journal of Primatology, 28(2), 407–420. https://link.springer.com/article/10.1007/s10764-007-9119-7

Osman, K., Hiong, L. C., & Vebrrianto, R. (2013). 21st century biology: An interdisciplinary approach of biology, technology, engineering and mathematics education. Procedia · Social and Behavioral Sciences, V102, 188–194. https://doi.org/10.1016/j.sbspro.2013.10.732

Owen, S. M. (2015). Teacher professional learning communities in innovative contexts: ‘ah hah moments’, ‘passion’ and ‘making a difference’ for student learning. Professional Development in Education, V4, 57–74. https://doi.org/10.1080/19415257.2013.869504

Porzecanski, A., Sterling, E., Copsey, J., Appleton, M., Barborak, J., Bruyere, B., Bynum, N., Farmer, K., Finchum, R., Rakotobe, D., Stanoss, R., & Valdes-Velasquez, A. (2021). A Systems Framework for Planning and Evaluating Capacity Development in Conservation: Recommendations for Practitioners. Oryx special edition.

PRISM. 2017. Toolkit for evaluating the outcomes and impacts of small/medium sized conservation projects. https://conservationevaluation.org/

Reid, J., Bonine, K., Dalzen, R., Randrianarisoa, B., Rivas, C., LaFranchi, C., & Hasenclever, L. (2002). Conservation strategy fund education and training for tropical ecosystem conservation. Moore-CABS Education Report.

Rweyemamu, M., et al. (2012). Development of a One Health national capacity in Africa. In J. Mackenzie, M. Jegg, P. Daszak, & J. Richt (Eds.), One Health: The human-animal-environment interfaces in emerging infectious diseases. Current topics in microbiology and immunology (Vol. 366). Springer. https://doi.org/10.1007/82_2012_244

Sarti, A. J., Sutherland, S., Landriault, A., DesRosier, K., Brien, S., & Cardinal, P. (2017). Understanding of evaluation capacity building in practice: A case study of a national medical education organization. Advances in Medical Education and Practice, 8, 761–767.

Scarlett, L., & McKinney, M. (2016). Connecting people and places: The emerging role of network governance in large landscape conservation. Frontiers in Ecology and the Environment, 14(3), 116–125. https://doi.org/10.1002/fee.1247

Sherman, J., Ancrenaz, M., & Meijaard, E. (2020). Shifting apes: Conservation and welfare outcomes of Bornean orangutan rescue and release in Kalimantan, Indonesia. Journal for Nature Conservation, 55, 125807. https://doi.org/10.1016/j.jnc.2020.125807

Sherman, J., Unwin, S., Travis, D., Preuschoft, S., Oran, F., Jaya, R., Voigt, M., Meijaard, E., Wich, S., & Ancrenaz, M. (IN PRESS). Orangutan translocations pose disease spillover and conservation risks. Frontiers Special Issue: Anthropogenic Wildlife Movements and Infectious Diseases: Health and Conservation Perspectives.

Stem, C., Margoluis, R., Salafsky, N., & Brown, M. (2005). Monitoring and evaluation in conservation: A review of trends and approaches. Conservation Biology, 19(2), 295–309.

Stephenson, P. J. (2019). The Holy Grail of biodiversity conservation management: Monitoring impact in projects and project portfolios.
Utami-Atmoko, S., Traylor-Holzer, K., Rifqi, M. A., Siregar, P. G., Achmad, B., Priadjati, A., Husson, S., Wich, S., Hadisiswoyo, P., Saputra, F., Campbell-Smith, G., Kuncoro, P., Russon, A., Voigt, M., Santika, T., Nowak, M., Singleton, I., Sapari, I., Meididit, A., ... Lees, C. M. 2017. Orangutan Population and Habitat Viability Assessment: Final Report. IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, MN.

Volk, J. O., Schimmack, U., Strand, E. B., Lord, L. K., & Siren, C. W. (2018). Executive summary of the Merck Animal Health Veterinary Wellbeing Study. JAVMA, 252(10), 1231–1238.

von Rintelen, K., Arida, E., & Häuser, C. (2017). A review of biodiversity-related issues and challenges in megadiverse Indonesia and other Southeast Asian countries. Research Ideas and Outcomes, 3, e20860. https://doi.org/10.3897/rio.3.e20860

Wallace, R. G., Bergmann, L., Kock, R., Gilbert, M., Hogerwerf, L., Wallace, R., & Holmberg, M. (2015). The dawn of structural One Health: A new science tracking disease emergence along circuits of capital. Social Science & Medicine, 129, 68–77 68e77.

Wilks, C. R., & Fenwick, S. G. (2009). Essential veterinary education in the virology of domestic animals, wild animals and birds: Diagnosis and pathogenesis of viral infections. Scientific and Technical Review of the Office International des Epizooties, 28(2), 567–573.

Woldehanna, S., & Zimicki, S. (2015). An expanded One Health model: Integrating social science and One Health to inform study of the human-animal interface. Social Science & Medicine, 129, 87e95.

Wolicki, S. B., Nuzzo, J. B., Blazes, D. L., Pitts, D. L., Iskander, J. K., & Tappero, J. W. (2016). Public health surveillance: At the core of the global health security agenda. Health Security, 14(3), 185–188. https://doi.org/10.1089/hs.2016.0002

Dunay, E., Apakupakul, K., Leard, S, Palmer, J. L., & Deem, S. L (2018). Pathogen transmission from humans to great apes is a growing threat to primate conservation. Ecohealth, 15(1), 148–162. https://link.springer.com/article/10.1007%2Fs10393-017-1306-1.

**SUPPORTING INFORMATION**

Additional Supporting Information may be found online in the supporting information tab for this article.

---

**How to cite this article:** Unwin, S., Commitante, R., Moss, A., Bridges, E, Farmer, K. H., Jaya, R. L, Saraswati, Y. S., Nente, C., Soedarmanto, I, Sulistyo, F, & Sugnaseelan, S. (2021). Evaluating the contribution of a wildlife health capacity building program on orangutan conservation. American Journal of Primatology, e23273. https://doi.org/10.1002/ajp.23273