A natural language processing approach of global survey results on what the embryologist thinks and faces.

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Study question: What are the major problems faced by embryologists at 1) Clinic level, 2) Professional level, 3) Personal level, and 4) What are their career goals?

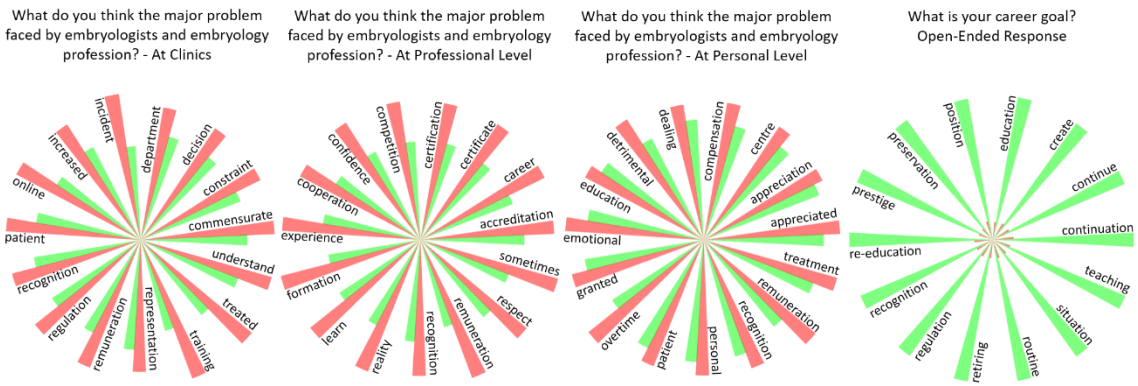
Summary answer: Embryologists, essential professionals of Fertility Centres, are less satisfied in many quantifiable aspects, but they love their profession and have many aspirational goals.

What is known already: IVF success depends in part on embryologists' skills. The need to recognize clinical embryology as a specialty and clinical embryologists' educational level, responsibilities, and workload have been addressed by a few national societies. However, data are lacking from the embryologists' viewpoint at a global level about their profession. Qualitative data-analysis methods provide thick, rich descriptions of subjects' thoughts, feelings, and lived experiences but can be time-consuming, labor-intensive, and prone to bias.

Study design, size, duration: A questionnaire was prepared using SurveyMonkey online software (SurveyMonkey, Inc., USA) and distributed to IVF lab professionals through embryology societies, online social media, and email databases. The questionnaire consisted of open-ended questions focused on identifying problems faced by embryologists at the clinic, in the profession, and in a personal level, as well as questions about their career outlook. The survey was active from May 2016 until February 2017. From 73 countries, 720 responses were obtained.

Participants/materials, setting, methods: Using natural language processing (NLP), the top 15 most frequently used keywords were identified and correlated with each other. Stronger correlation (≥0.5) between semantically similar words expressing a strong signal from each answer, and their usage was further analyzed for positive versus negative sentiment.

Fig 1: Sentiment Wheels



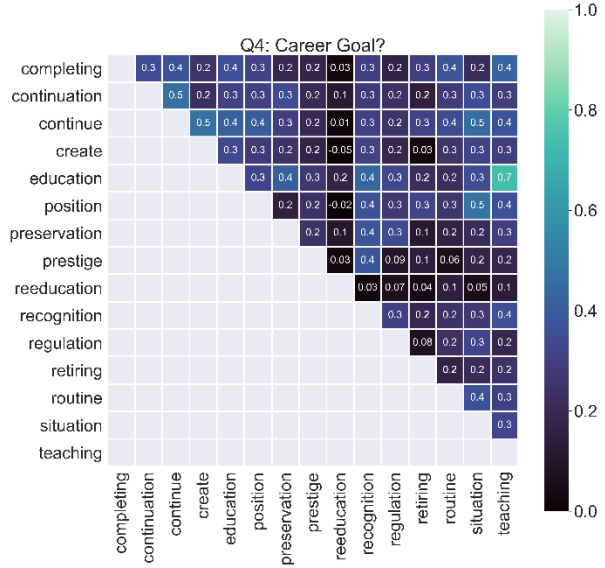


Fig 2: Heatmap analysis of NLP

By normalizing the frequency of positive/negative samples for each keyword as a percentage, "sentiment wheels" were produced, identifying the key concepts that respondents answered and quantifying how they felt about them (**Fig 1**).

Main results and the role of chance: The responses received were from 80% private, 17% public and 3% other ART settings distributed all over the world. From the embryologists' viewpoints reported and after the NLP processing (**Fig 2**) it was shown that the common topics related to strong negative sentiments were: embryologists' remuneration (0.6) at the Clinic level; certification (0.7), recognition (0.5), respect (0.5), learn (0.5) and experience (0.5) at the Professional level; and remuneration (0.7), emotional (0.5) dealing (0.5) at the Personal level. Renumeration was reported and strongly related to embryologists' viewpoint at both the clinic and personal level in combination with the need for certification, recognition and ongoing development at the Professional level. Moreover, the NLP processing demonstrated that the common topics on career goal analysis related to strong positive sentiments were: teaching (0.7), education (0.7), and continuation (0.5) all three topics are compatible with a professional orientation open to ongoing development and practice advancement. The NLP and the manual data analysis project an image of the typical embryologist as a knowledge seeking professional who is deeply dedicated to the job but feels the need for professional development and suffers some lack of recognition and feels in some cases not fairly treated as an employee.

Limitations, reasons for caution: The data obtained is limited. Only one natural language processing model was used to analyze the results. Different analysts using other methods may have different results. For these reasons, the results should be interpreted with caution.

Wider implications of the findings: It is important to focus on the lab as an organization and not just a service for the patients in treatment at the moment. The NLP results ultimately obtained may help streamline professional satisfaction efforts, and guide future quality management strategies.

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