Quantifying the Effects of Training in Lung Transplantation: Lessons from NASA

N.J.S. Chilvers, A. W. Clark, M. I. Mydin, S. Clark.
Cardiothoracic Centre, Freeman Hospital, Newcastle upon Tyne, UK

The Newcastle upon Tyne Hospitals NHS
NHS Foundation Trust

Introduction / Aim

- Bilateral lung transplantation (BLT) is a complex, time sensitive procedure.
- Training trainees can be challenging technically and the case volumes are low.
- In-theatre training and delegation of part, or all, of the surgery has remained the traditional model for knowledge and skill transfer.
- Currently there is little evidence on the effects that this has on surgical trainers in transplantation.
- We aimed to use the NASA Task Load Index (TLX) to quantify the demands of training trainees.

Background – The NASA TLX

- Widely used, subjective, multidimensional assessment tool that rates perceived workload in order to assess a task, system or team's effectiveness and performance[1].
- Developed by the Human Performance Group at NASA Ames Research Center over a three-year development cycle that included more than 40 laboratory simulations.
- Perceived workload is assessed by rating six subjective subscales; mental demand, physical demand, temporal demand, performance, effort and frustration.
- Subscales are compared pairwise to generate the individual weightings used to generate an overall score.
- Cited in over 4,400 human factors research studies.
- Used in a variety of scenarios, including aviation, healthcare and other complex socio-technical domains.
- The NASA TLX is the most commonly applied self-reporting method of assessing cognitive workload in surgery[2,3,4,5,6]

Methods

- Prospective study collecting NASA-TLX data after BLT.
- 60 patients studied:
  - 30 performed solely by senior surgeon (SS)
  - 30 senior surgeon implanted right lung (SSR) and trainee the left (TL)
- Subjective NASA-TLX assessment completed by senior surgeon at the end of the procedure using mobile app.
- Same trainer for all cases.
- All trainees were post CCT Fellows of similar experience.

Results

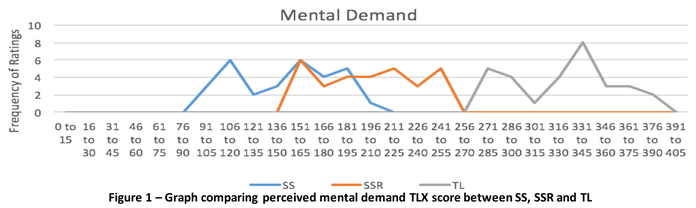

Figure 1 – Graph comparing perceived mental demand TLX score between SS, SSR and TL

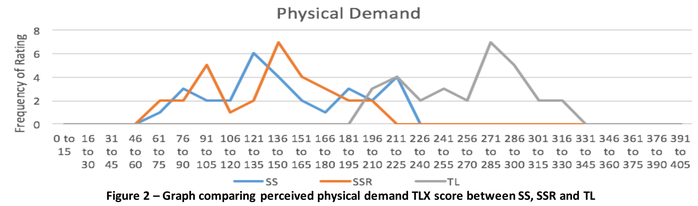

Figure 2 – Graph comparing perceived physical demand TLX score between SS, SSR and TL

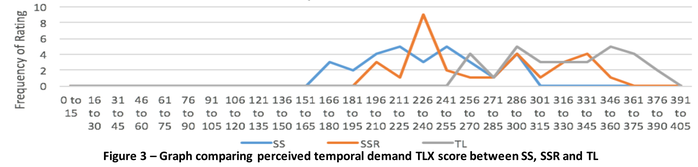

Figure 3 – Graph comparing perceived temporal demand TLX score between SS, SSR and TL

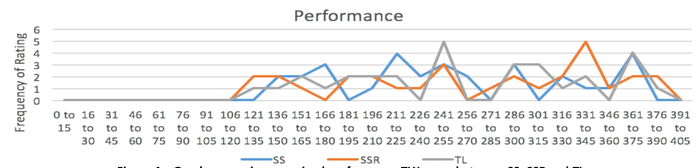

Figure 4 – Graph comparing perceived performance TLX score between SS, SSR and TL

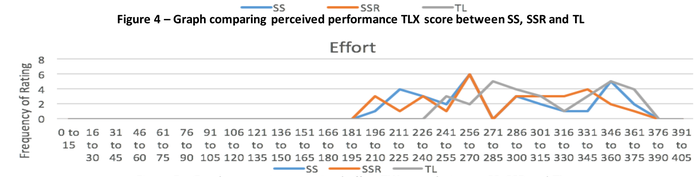

Figure 5 – Graph comparing perceived effort TLX score between SS, SSR and TL

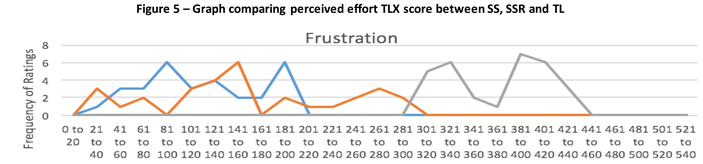

Figure 6 – Graph comparing perceived frustration TLX score between SS, SSR and TL

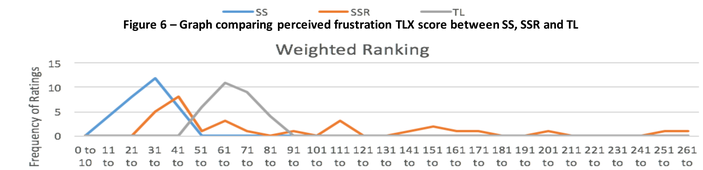

Figure 7 – Graph comparing overall perceived workload TLX weighted score between SS, SSR and TL

Parameter	SS	SSR	TL	P value SS vs SSR	P value SS vs TL	P value SSR vs TL
Mental demand	150.1	200.8	326.3	**P<0.001**	**P<0.001**	**P<0.001**
Physical demand	146.2	136.8	264.7	P=0.365	**P<0.001**	**P<0.001**
Temporal demand	232.1	270.6	322.5	**P<0.002**	**P<0.001**	**P<0.001**
Performance	253.1	268.5	263.8	P=0.485	P=0.813	P=0.619
Effort	282.5	285.3	311.2	P=0.823	**P<0.05**	**P<0.05**
Frustration	121	158.3	368.6	**P<0.05**	**P<0.001**	**P<0.001**
Overall weighted	32.3	95	68.8	**P<0.001**	**P<0.001**	**P<0.05**

Table 1 – overall results

Discussion

- The NASA TLX demonstrates the effects on surgeons of training trainees in lung transplantation
  - Increased mental and temporal demands, and frustration
  - Less effect on other parameters e.g. perceived performance
- This data should provide senior surgeons with confidence to teach and train.
- The TLX offers a means to reflect and improve training performance.
- Appreciation of factors that increase perceived workload can allow pre-operative planning to mitigate or reduce their effects.

Conclusions

- The NASA TLX provides a useful tool to quantify the effects of training trainees in lung transplantation.
- The TLX can be used to improve the standard of training.

References

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