

Rural and Remote Intubations in An Australian Aeromedical Retrieval Service: A Retrospective Cohort Study.

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Abstract

Objective

Critically unwell patients in rural and remote areas of Queensland, Australia, often require airway management with rapid sequence intubation (RSI) prior to retrieval to a tertiary centre. Retrieval Services Queensland (RSQ) coordinate retrievals and support rural hospitals, including via telehealth. We aimed to describe the demographics of patients intubated in Queensland hospitals requiring subsequent aeromedical retrieval. This retrospective cohort study compared patients intubated by a retrieval team, including a LifeFlight Retrieval Medicine (LRM) doctor, to those intubated by the local hospital team.

Methods

Retrospective cohort study of all patients intubated in hospitals in Queensland, Australia, requiring subsequent aeromedical retrieval (including an LRM doctor) between January 2019 and December 2019. Data collected included: time of day, mission priority, geographical location of hospital, rurality, diagnosis, failure/assistance with intubation. Descriptive statistics were complemented by logistic regression analyses.

Results

In 2019, 684 patients were intubated in hospitals in Queensland, Australia, requiring subsequent aeromedical retrieval by a team including an LRM doctor. 131 (19.2%) were intubated by the retrieval team, and 553 (80.8%) were intubated by the local hospital team. The retrieval team was more likely to intubate as the age of the patient increased. In the most rural and remote areas, 64 (43.2%) of patients were intubated by the retrieval team, compared with 84 (56.8%) by the local team. In this subgroup of rural and remote patients, the composite diagnosis of 'injuries, poisons, toxicology and drugs' was significantly more likely to be associated with the local team intubating.

Conclusion

A retrieval team is more likely to be required for intubation of patients in rural and remote hospitals in Queensland, Australia. Service provision for critically unwell patients, coordinated by RSQ, is effective and well-managed. Rural and remote hospitals should be given special preference and consideration for timely dispatch of the retrieval team for assistance with these cases.

Trial Registration

Ethical approval for this project was granted by the Royal Brisbane and Women's Hospital Human Research Ethics Committee (LNR/2020/QRBW/64917). A waiver of consent was granted given the retrospective and deidentified nature of the study.

Background

LifeFlight Retrieval Medicine (LRM) is the major provider of aeromedical retrieval doctors in the State of Queensland, Australia. LRM retrieval doctors work in a medical team along with a critical care paramedic or flight nurse. The retrievals that these teams perform include primary responses and interhospital transfers, and are conducted with a number of agencies throughout the state including: Queensland Government Air (QGAir), the Royal Flying Doctor Service (RFDS) Queensland Section, Capricorn Helicopter Rescue, CQ Rescue, Queensland Ambulance Service (QAS) and LifeFlight Australia.

Retrieval missions are coordinated and tasked by Retrieval Services Queensland (RSQ), a part of Queensland Health, the state's governing health service. RSQ Medical Coordinators are critical care specialists with experience in prehospital and retrieval medicine. In addition, RSQ provides a 24/7 telehealth service to 162 rural and remote sites in Queensland to help hospital staff manage urgent and critical cases locally, until a retrieval team arrives.(1) As well as the 'general' retrieval teams which move patients of any age, Queensland also has dedicated specialised paediatric and neonatal retrieval services.(2)

Queensland is a large state covering 1.853 million km², with the majority of the population concentrated down the east coast, particularly in the south east corner including the major cities of Brisbane and Gold Coast.(3) As a result, larger specialist hospitals are predominantly located in these areas (Appendix 1: Location of Hospitals).(4) RSQ coordinates the aeromedical retrieval of patients from rural or remote hospitals to these facilities when clinical need surpasses available resources and services.

Patients who are critically unwell may require endotracheal intubation and mechanical ventilation prior to transfer.(5) This can either be done by the local hospital team or by the retrieval team. There are a number of standard indications for this procedure that are well recognised within a hospital setting including: failure to ventilate, failure to oxygenate, reduced consciousness level and inability to protect airway patency.(6) In addition, a patient may be intubated for reasons specific to aeromedical retrieval. These include pre-emptively securing the airway of a patient requiring transport on an aircraft due to the challenges and risks of undertaking the procedure while airborne.(6)

In Queensland, it is unknown what proportion of patients are intubated in rural and remote hospitals by local teams, compared to those intubated by the retrieval team. This retrospective cohort study reviewed all intubated patients who required subsequent retrieval by medical teams including an LRM doctor in Queensland in 2019. The aim of the study was to gain a general understanding of the proportion of patients intubated by a local hospital team compared with those intubated by the retrieval team, and then to review associated demographic and diagnostic factors.

Methods

Study Design and Setting

Retrospective cohort study of all intubations documented in LRM medical records from January 2019 to December 2019 requiring subsequent retrieval by a retrieval team in Queensland, Australia.

Ethical approval for this project was granted by the Royal Brisbane and Women's Hospital Human Research Ethics Committee (LNR/2020/QRBW/64917). A waiver of consent was granted given the retrospective and deidentified nature of the study.

Data Collection

LRM clinical notes are uploaded to AirMaestro (Avinet, Australia), an electronic record database. A search of all patients transported in 2019 was conducted, with attention to those patients who were intubated and required mechanical ventilation (Figure 1). Clinicians must indicate via a checked box if a patient has been intubated on entering electronic data. Permission was granted by both LRM and RSQ to access the database.

Study investigators reviewed all patients flagged as having been intubated during this period. Inclusion criteria were patients intubated in Queensland hospitals requiring subsequent aeromedical retrieval including an LRM doctor. Exclusion criteria were patients intubated overseas, those intubated in another state in Australia and those intubated at a primary response i.e. outside of hospital. As the study utilised LRM clinical records, intubations provided by other services were not included.

Patients were grouped in two cohorts: those intubated by a retrieval team, including LRM doctor, and those intubated by the local hospital team. Data collected included: date, age, weight, gender, hospital geographical location, mission priority, time of day (day or night), diagnosis and any failure or assistance required during intubation.

There are multiple classification systems for defining hospitals based on geographical location used by both the Australian College for Emergency Medicine (ACEM) and the Australian Government.(7-9) The authors have chosen to use the Modified Monash Model (MMM) which the Australian Government uses to define a location as a city, rural, remote or very remote. The model measures geographical remoteness and population size on a scale of Modified Monash (MM) category MM 1 to MM 7. MM 1 is a major city and MM 7 is very remote. Distribution Priority Areas (DPAs) correspond to MMM category 5-7 and indicate an area where the needs of the community may not be met by available access to doctors.(7)

Mission priority is defined on a scale from 1 (urgent) to 5 (least urgent) related to urgency of dispatch of medical assets, as defined by RSQ.(10) Diagnosis was classified as per the ICD-10 classification selected when data are entered into AirMaestro.

Data Analysis

Data were anonymised and de-identified. Data were stored on a password-protected Excel (Microsoft, v16.39, USA) spreadsheet. Analysis was conducted using Statistical Product and Service Solutions (SPSS, version 26, IBM, USA). Researchers were not blinded.

Medians and proportions were used to describe patient characteristics. Chi-squared test was used for binary and categorical variables to identify differences between the retrieval and local intubation cohorts.

Mann-Whitney U-test was used for differences in age, weight and MMM category. A p-value of less than 0.05 was considered significant.

A backwards conditional logistic regression model was built with the dependent variable: intubator retrieval team or intubator local team. Potential independent predictors included those variables that were univariately significantly associated with intubator with a p-value <0.1: MMM category, age, sex, priority and the most frequently occurring diagnoses categorised as diagnosis vs all other diagnoses. The Nagelkerke R square statistic was used to describe the amount of variation explained in the model.

To investigate any differences in the most remote areas, analysis was repeated as above, limiting the sample to only those patients intubated from Distribution Priority Areas (MMM 5-7).

Results

In 2019, 684 patients were intubated at hospitals in Queensland and subsequently transferred by a retrieval team that included an LRM doctor (Figure 1).

Of the 684 intubated patients, 131 (19.2%) were intubated by the retrieval team, and 553 (80.8%) were intubated by the local hospital team. Median age was higher for intubations done by the retrieval team (retrieval: 56 years [IQR 35-70], local: 50 [years IQR 35-63] $p < .05$), (Table 1). When patients were classified into age groups, the retrieval team was statistically more likely to intubate as the age of the patient increased (Table 1). Males made up over two thirds of total patients and there was no difference in sex between groups (Table 1).

In both cohorts, intubations were equally likely to occur during the day or night (Table 1). Sixty-six (50.4%) patients intubated by the retrieval team were categorised as priority 1, compared to 214 (38.7%) patients intubated by the local team. Overall, there was a significant trend towards the retrieval team intubating priority 1 and 2 patients (p-value 0.029) (Table 1).

Although the local team intubated the majority of patients from all areas (Figure 2), patients from more rural areas (MMM 5-7) were significantly more likely to be intubated by the retrieval team (Table 1). The most common diagnoses in both groups were neurological; major trauma; respiratory; the composite 'injuries, poisons, toxicology, drugs'; and cardiovascular (Table 1).

Intubations in MMM 5-7 Areas:

Table 2 demonstrates the characteristics of patients intubated in the most rural and remote locations, MMM 5-7 (DPAs). 148 patients were intubated in these regions, 64 (43.2%) by the retrieval team and 84 (56.8%) by the local team (Table 2).

A retrieval team was statistically more likely to intubate older patients (median age 52.5 vs 45.0 for local team) and male patients (retrieval: n= 46 [72%], local: n=47 [56%], $p = 0.047$) (Table 2).

Intubations were conducted in similar numbers during the day and at night (Table 2). There was no difference in mission priority between the two cohorts (Table 2). In the retrieval group, two intubations were unsuccessful, compared with three in the local group (Table 2). A retrieval team was statistically less likely to be involved in intubation of patients presenting with the composite diagnosis of 'injuries, poisons, toxicology, drugs' (retrieval: n=5 [7.8%], local: n=22 [26.1%], p 0.005).

Multivariable Modelling:

In logistic regression modelling for all patients, after adjusting for age and 'injury, poisons, toxicology and drugs' diagnosis, MMM category 5-7 remained a significant predictor of retrieval team intubation. Retrieval teams were 17.5 times more likely to intubate patients in this category, with a 95% CI of 5.2-59.0, and an overall predictive ability of R^2 0.18 (Appendix 1).

When analysing the most remote categories (MMM 5-7) alone, the only variable that remained statistically significant in multivariable modelling was the composite diagnosis 'injury, poisons, toxicology and drugs', compared to other diagnoses. (OR 0.24 95% CI 0.09-0.67). The R^2 was 0.08 for this sub-analysis.

Discussion

A retrieval team was more likely to be required for intubation of critically unwell patients in the most rural and remote areas of Queensland, Australia. This corresponds with services removed from the coastal and city regions. In the MMM remoteness category 5-7 (Distribution Priority Areas), nearly half of patients were intubated by a retrieval team. Patients in urban and regional areas were far more likely to be intubated by the local team prior to transfer.

A number of factors may influence this finding. Medical and nursing staff in MMM 5-7 facilities may be less likely to have current advanced airway skills and may be less comfortable to proceed with intubating patients when it is safer to await the arrival of the retrieval team.(11) Smaller facilities are more likely to be nurse only clinics or rural hospitals with doctors less experienced with intubation.(12, 13) Patients may also be intubated for transport considerations such as anticipated clinical course, risk of deterioration in flight and difficulties associated with managing an unprotected airway.(6) It is also a consideration that in remote areas, deterioration of the patient's condition by the time a retrieval team arrive may necessitate intubation.(14)

While this finding is not unexpected, it reinforces the critical role played by retrieval teams in supporting local hospital staff in more rural locations in Queensland. Services in regional and urban centres are more likely to be staffed with teams able to manage the process of intubation independent to a retrieval service.(11) Our results suggest that in remote settings, the hospital teams often wait for a retrieval team, , despite the increased distance and time taken for a team to reach these locations, a finding supported in other recent literature.(2) The findings support the current coverage and provision of critical care in the state.

When comparing the patients intubated by the retrieval team to those intubated by the local team, advancing age was associated with the retrieval team intubating the patient. It is difficult to determine the reasoning for this finding, which is likely to be multifactorial. The decision to intubate any patient involves a risk/benefit assessment, and advancing age is likely to adjust the balance.(15) The frequency of chronic disease and polypharmacy increases with advancing age, further complicating the decision to intubate. The arrival of the retrieval team, and the additional of current airway skills may then readjust the risk assessment, including consideration of the possibility of airway compromise in flight. The process of intubation in a helicopter or aeroplane is high risk and should be avoided.(16)

Experience and literature suggests that reluctance to intubate might occur more with children.(2) While some paediatric intubations were included in this study, it should be noted that a significant proportion of paediatric retrievals in Queensland are managed by a specialised paediatric retrieval team and not included in this data. Nonetheless, our data suggests that local teams will intubate paediatric cases when required prior to the arrival of the retrieval team.

Missions involving patient intubation were equally likely to occur during the day or night and time of day was not associated with the retrieval team intubation. It is recognised that most hospitals, particularly in tertiary centres, run a reduced service at night. Our data suggests that in more rural and remote regions, particularly MMM 5-7, time of day does not impact significantly on a retrieval team being required for intubation.(17)

The most common diagnostic classifications were: cardiovascular, respiratory, major trauma, neurological, and the composite 'injuries, poisons, toxicology and drugs.' This is in keeping with existing literature.(5) In the cohort of all intubated and transferred patients, no diagnosis was associated with an increased likelihood of the retrieval team being required for intubation. In fact, patients requiring intubation due to 'injuries, poisons, toxicology and drugs' remained significantly less likely to be intubated by the retrieval team in multivariable modelling and regardless of remoteness region. This suggests that local teams are prepared to intubate irrespective of presentation when required.

It is of note that while there were instances of intubation failure in both the retrieval team cohort and the local cohort, these were low in number and not of significance. This again supports the current model of care in Queensland, and reinforces the work done in particular by RSQ. RSQ provides critical care support to clinics and facilities throughout Queensland, including through the use of telehealth. RSQ is able to guide and advise clinicians in real time during critical procedures such as intubation, and this process has been streamlined with the state-wide implementation of a Standardised and Safe Intubation Package (SSIP) that is available to all Emergency Departments in Queensland Health. The clinical and technological support afforded by telehealth is crucial and demonstrates a tangible and real benefit to patients in remote communities that would otherwise be less well supported at times of need.(18, 19)

In the multivariable analysis of all patients, only the MMM 5-7 category remained statistically significant as a predictor for the retrieval team intubating. Therefore, all factors considered, retrieval teams are important in the support of rural and remote locations. This finding supports the practice of prioritising

the retrieval of patients from these locations, particularly where RSQ might anticipate a patient requiring intubation, or in the instance where a patient's condition deteriorates in real time.

In the subgroup analysis of rural and remote patients alone, MMM 5-7 (DPAs), the group intubated by the retrieval team were significantly older than those intubated by the local team. For patients with the composite diagnosis 'injuries, poisons, toxicology and drugs', the retrieval team were significantly *less* likely to be involved in the intubation of these patients compared to the local team, a finding that persisted in the multivariable analysis. It is unclear why this composite diagnosis should favour earlier intubation by the local team.

Our findings are generalisable to other large states and countries where medical care is focused in tertiary centres, but a population distributed over large areas. This is the case for other states in Australia, and also for countries like the United States of America, Canada and more remote parts of the United Kingdom.⁽¹⁴⁾ Preference should be given to a small hospital undertaking a critical procedure or caring for an unwell patient, over areas where staffing is likely to be better.

Limitations

This was a retrospective study and as such cannot show causation. Biases are an inherent risk in retrospective reviews. Data were entered by the treating clinician and are thus open to bias. It should be noted that LRM operate a weekly audit of cases, and that all cases involving intubation are reviewed by senior consultants. The LRM governance team review the airway registry once a month.

This study focused on the demographic and diagnostic data surrounding intubated patients. It was beyond the scope of the work to analyse the specific process of intubation, and any errors or harm that may have occurred in this process. The authors sought more to obtain an overview of distribution of care. Extensive research already exists on the process and outcome of intubation itself.

The diagnostic classifications used in this study are a replica of the drop-down menu that doctors select when entering patient data into the AirMaestro clinical notes. As such, they contain composite diagnoses and may not represent the most effective way of grouping patients.

The authors only examined missions that involved LRM doctors. The 'general' retrieval teams that were not represented in this study include RFDS teams that operate out of RFDS Queensland Section Traditional Bases (Cairns, Mt Isa, Charleville). The total number of intubations performed by RFDS doctors from Traditional Bases are likely to be significantly less than those performed by LRM doctors, who work across a number of providers throughout the state including RFDS bases.

This study does not consider the specialised paediatric and neonate retrieval services that exist in the state and the missions they perform on this subset of patient groups, while noting recent publication in this area.⁽²⁾

Future Work

This study gives an estimate of rural and remote intubations based on LRM doctor records for aeromedical services in Queensland, Australia. A more collaborative study involving the major providers of aeromedical retrieval teams in Queensland, including LRM, RFDS and the specialised paediatric and neonatal services would give more generalised information and could further aid RSQ/Queensland Health with health resource training and planning.

We also plan to perform a detailed review of the 131 cases where intubation was done by the retrieval team in an attempt to extract rationale for it not being performed by the local team. This review will expand to use data held by RSQ, which should capture the decision making that occurred prior to the team's arrival.

Conclusions

In Queensland, Australia, LRM doctors, as part of an aeromedical retrieval team, are more likely to intubate patients in a rural and remote setting. Service provision should account for this and act to support smaller health clinics. Local teams are able to manage critically unwell patients prior to the arrival of the retrieval team, with support and guidance from RSQ.

Declarations

Ethics Approval and Consent to Participate

Ethical approval for this project was granted by the Royal Brisbane and Women's Hospital Human Research Ethics Committee (LNR/2020/QRBW/64917). A waiver of consent was granted given the retrospective and deidentified nature of the study.

Consent for Publication

Consent for publication was not applicable.

Availability of Data and Material

The datasets used for analysis have been provided in a supplementary Excel spreadsheet. They are not intended for publication.

Competing Interests

The authors (RP, RB, AS, CG and JO) declare no conflicts of interest.

Funding

This study was unfunded. LifeFlight is a charitable organisation.

Authors' Contributions

JO, RP and RB conceived of the study. RB and RP were involved in data collection. RP and AS conducted statistical analysis. JO was the supervising author. CG provided expert opinion and direction and information on the role of RSQ. All authors contributed substantially to drafting and revising the manuscript for publication.

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Authors' Information

Not applicable.

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Tables

Table 1: Characteristics of retrievals requiring intubation by intubator: retrieval team vs local team.

	Total sample n= 684	Intubator: Retrieval n=131 (19.2%)		Intubator: Local n=553 (80.8%)		p- value
Distribution statistics						
Age: Median and [Interquartile range] - years	50 [35-65]	56 [35-70]		50 [35-63]		0.035
Weight: Median and [Interquartile range] - kgs	80 [70-95]	80 [70-90]		80 [70-95.5]		0.45
MMM: Median and [Interquartile range] — remoteness score	3.0 [2.0-4.0]	4.5 [4.0-5.0]		3.0 [2.0-4.0]		<.001
Frequencies	n (%)	n	%	n	%	
Age group — no. of presentations (%)						0.004
≤5 years	11 (1.6)	0	0.0	11	2.0	
6-17	31 (4.5)	8	6.1	23	4.2	
18-49	278 (40.6)	45	34.4	233	42.1	
50-69	245 (35.8)	42	32.1	203	36.7	
70+	119 (17.4)	36	27.5	83	15.0	
Sex^						
Female	246 (36.0)	39	29.8	207	37.5	0.098
Male	437 (63.9)	92	70.2	345	62.5	
Indeterminate	1 (0.1)					
Weight						0.413
<40kg	22 (3.2)	1	0.8	21	3.8	
40-69kg	137 (20.0)	30	22.9	107	19.3	
70-109kg	436 (63.7)	83	63.4	353	63.8	
110-149kg	81 (11.8)	16	12.2	65	11.8	
150+kg	8 (1.2)	1	0.8	7	1.3	
Time of day						0.946

Day	348 (50.9)	67	51.1	281	50.8
Night	336 (49.1)	64	48.9	272	49.2
Day of week	0.947				
Monday - Friday	482 (70.5)	92	70.2	390	70.5
Saturday, Sunday	202 (29.5)	39	29.8	163	29.5
Mission priority	0.029				
1	280 (40.9)	66	50.4	214	38.7
2	270 (39.5)	51	38.9	219	39.6
3	97 (14.2)	9	6.9	88	15.9
4	34 (5.0)	5	3.8	29	5.2
5	3 (0.4)	0	0.0	3	0.5
Location (Modified Monash Model)^	<.001				
1	58 (8.5)	3	2.3	55	9.9
2	213 (31.1)	10	7.6	203	36.7
3	90 (13.2)	5	3.8	85	15.4
4	170 (24.9)	46	35.1	124	22.4
5	89 (13.0)	39	29.8	50	9.0
6	44 (6.4)	17	13.0	27	4.9
7	15 (2.2)	8	6.1	7	1.3
Missing	5 (0.7)				
Modified Monash Model Category^	<.001				
Metropolitan (1)	58 (8.5)	3	2.3	55	9.9
Regional but not deemed a remoteness area (2-4)	473 (69.2)	61	46.6	412	74.5
Distribution priority area (5-7)	148 (21.6)	64	48.9	84	15.2

Missing	5 (0.7)	3	2.3	2	0.4	
Failure/ assistance						
Retrieval	2 (0.3)	2	1.5	0	0.0	
Local	7 (1.0)	2	1.5	5	0.9	
Both	2 (0.3)	0	0.0	2	0.4	
Local with Retrieval present	3 (0.4)	0	0.0	3	0.5	
<i>Any</i>	<i>14 (2.0)</i>	<i>4</i>	<i>3.1</i>	<i>10</i>	<i>1.8</i>	<i>0.321</i>
<i>None noted</i>	<i>670 (98.0)</i>	<i>127</i>	<i>96.9</i>	<i>543</i>	<i>98.2</i>	
Diagnosis						0.022
Cardiovascular	73 (10.7)	14	10.7	59	10.7	
Respiratory	91 (13.3)	24	18.3	67	12.1	
Neurological	188 (27.5)	34	26.0	154	27.8	
Digestive	14 (2.0)	3	2.3	11	2.0	
Hepatobiliary	7 (1.0)	0	0.0	7	1.3	
Musculoskeletal	1 (0.1)	1	0.8	0	0.0	
Skin	4 (0.6)	0	0.0	4	0.7	
Endocrine /Metabolic	3 (0.4)	0	0.0	3	0.5	
Kidney and urinary tract	3 (0.4)	1	0.8	2	0.4	
Ear, Nose, Throat	15 (2.2)	3	2.3	12	2.2	
Childbirth	6 (0.9)	0	0.0	6	1.1	
Infectious	28 (4.1)	7	5.3	21	3.8	
Psychiatric	13 (1.9)	6	4.6	7	1.3	
Major trauma	123 (18.0)	20	15.3	103	18.6	
Alcohol and drug induced mental disorders	17 (2.5)	7	5.3	10	1.8	
Injuries, poisons, toxicology, drugs	84 (12.3)	10	7.6	74	13.4	
Burns	10 (1.5)	0	0.0	10	1.8	
No diagnosis/ other	4 (0.6)	1	0.8	3	0.5	

Diagnosis-Singular						
Cardiovascular	73 (10.7)	14	10.7	59	10.7	0.995
Else	611 (91.3)	117	89.3	494	89.3	
Respiratory	91 (13.3)	24	18.3	67	12.1	0.060
Else	593 (86.7)	107	81.7	486	87.9	
Neurological	188 (27.5)	34	26.0	154	27.8	0.662
Else	496 (72.5)	97	74.0	399	72.2	
Major trauma	123 (18.0)	20	15.3	103	18.6	0.368
Else	561 (82.0)	111	84.7	450	81.4	
'Injuries, poisons, toxicology, drugs'	84 (12.3)	10	7.6	74	13.4	0.071
Else	600 (87.7)	121	92.4	479	86.6	

Table 2: Characteristics of retrievals requiring intubation by intubator, Modified Monash Model 5-7 only: retrieval team vs local team.

	Total sample (n=148)		Intubator: Retrieval n=64 (43.2%)		Intubator: Local n=84 (56.8%)		p- value
Distribution statistics							
Age: Median and [Interquartile range] years	46 [31-62.75]		52.5 [31.75-69.75]		45.0 [30.25-55.75]		0.05
Weight: Median and [Interquartile range] kgs	80.0 [70.0-90.0]		80.0 [70.0-94.5]		77.5 [65.0-89.50]		0.105
Frequencies	n	%	n	%	n	%	
Age group — no. of presentations (%)							0.024
≤5 years	2	1.4	0	0.0	2	2.4	
6-17	7	4.7	4	6.3	3	3.6	
18-49	73	49.3	26	40.6	47	56.0	
50-69	42	28.4	18	28.1	24	28.6	
70+	24	16.2	16	25.0	8	9.5	
Sex							
Female	55	37.2	18	28.1	37	44.0	0.047
Male	93	62.8	46	71.9	47	56.0	
Weight							0.439
<40kg	4	2.7	0	0.0	4	4.8	
40-69kg	31	20.9	13	20.3	18	21.4	
70-109kg	94	63.5	41	64.1	53	63.1	
110-149kg	17	11.5	9	14.1	8	9.5	
150+kg	2	1.4	1	1.6	1	1.2	
Time of day							
Day	69	46.6	30	46.9	39	46.4	0.957
Night	79	53.4	34	53.1	45	53.6	
Day of week							
Monday - Friday	117	79.1	49	76.6	68	81.0	0.516
Saturday, Sunday	31	20.9	15	23.4	16	19.0	

Mission priority							
1	81	54.7	35	54.7	46	54.8	0.849
2	54	36.5	22	34.4	32	38.1	
3	7	4.7	4	6.3	3	3.6	
4	6	4.1	3	4.7	3	3.6	
5	81	54.7	35	54.7	46	54.8	
Diagnosis							
Cardiovascular	16	10.8	7	10.9	9	10.7	NA
Respiratory	25	16.9	13	20.3	12	14.3	
Neurological	36	24.3	16	25.0	20	23.8	
Digestive	1	0.7	1	1.6	0	0.0	
Hepatobiliary	1	0.7	0	0.0	1	1.2	
Ear, Nose, Throat	2	1.4	2	3.1	0	0.0	
Childbirth	2	1.4	0	0.0	2	2.4	
Infectious	2	1.4	1	1.6	1	1.2	
Psychiatric	4	2.7	3	4.7	1	1.2	
Major trauma	24	16.2	12	18.8	12	14.3	
Alcohol and drug induced mental disorders	7	4.7	4	6.3	3	3.6	
Injuries, poisons, toxicology, drugs	27	18.2	5	7.8	22	26.2	
Burns	1	0.7	0	0.0	1	1.2	
Diagnosis-singular							
Cardiovascular	16	10.8	7	10.9	9	10.7	1.0
Else	132	89.2	57	89.1	75	89.3	
Respiratory	25	16.9	13	20.3	12	14.3	0.38
Else	123	83.1	51	79.7	75	85.7	
Neurological	36	24.3	16	25.0	20	23.8	1.0
Else	112	75.7	48	75.0	75	76.2	
Trauma	24	16.2	12	18.8	12	14.3	0.505

Else	124	83.8	52	81.3	75	85.7	
'Injuries, poisons, toxicology, drugs'	27	18.2	5	7.8	22	26.2	0.005
Else	121	81.8	59	92.2	75	73.8	

Figures

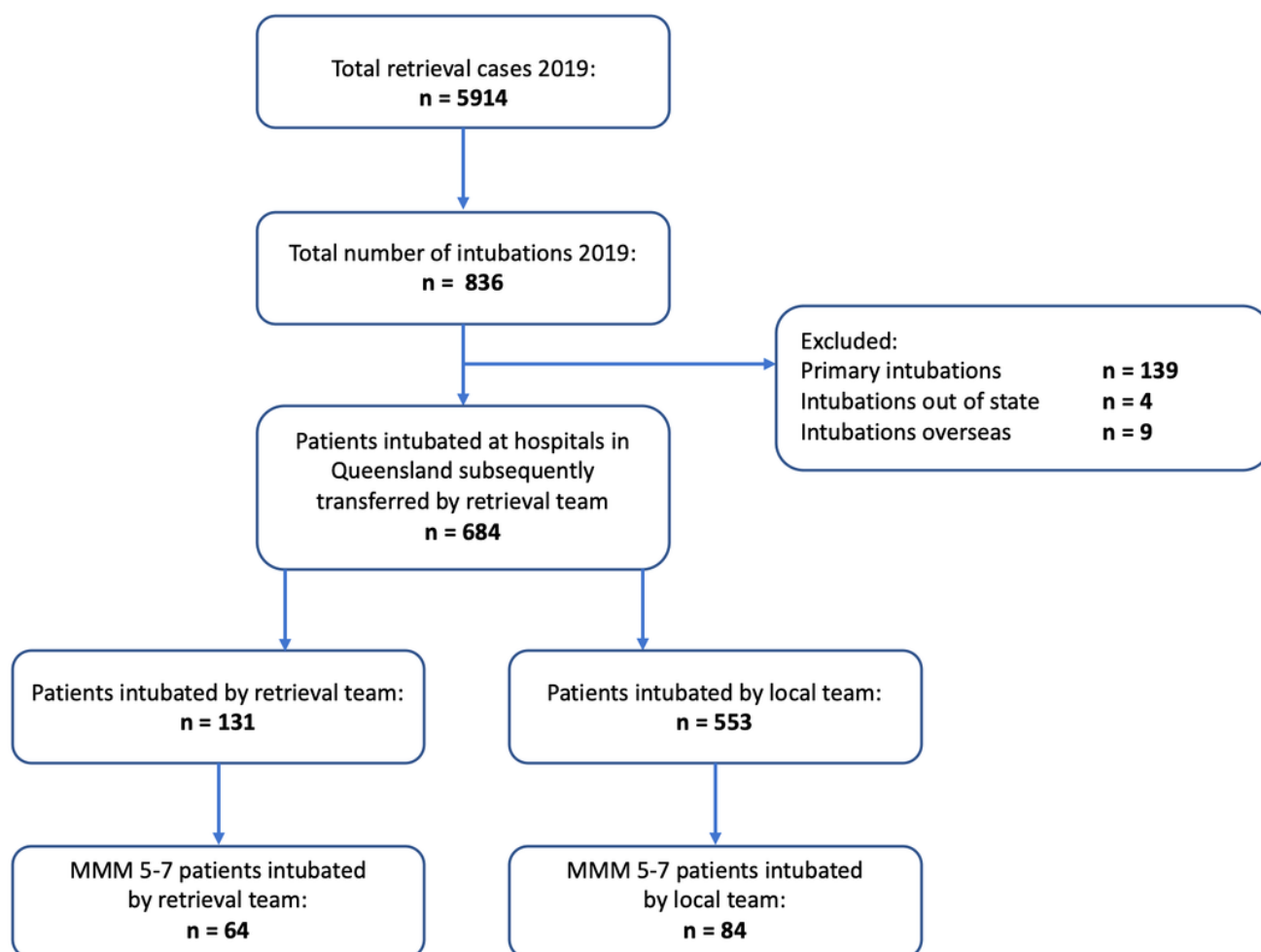


Figure 1

Flow Diagram.

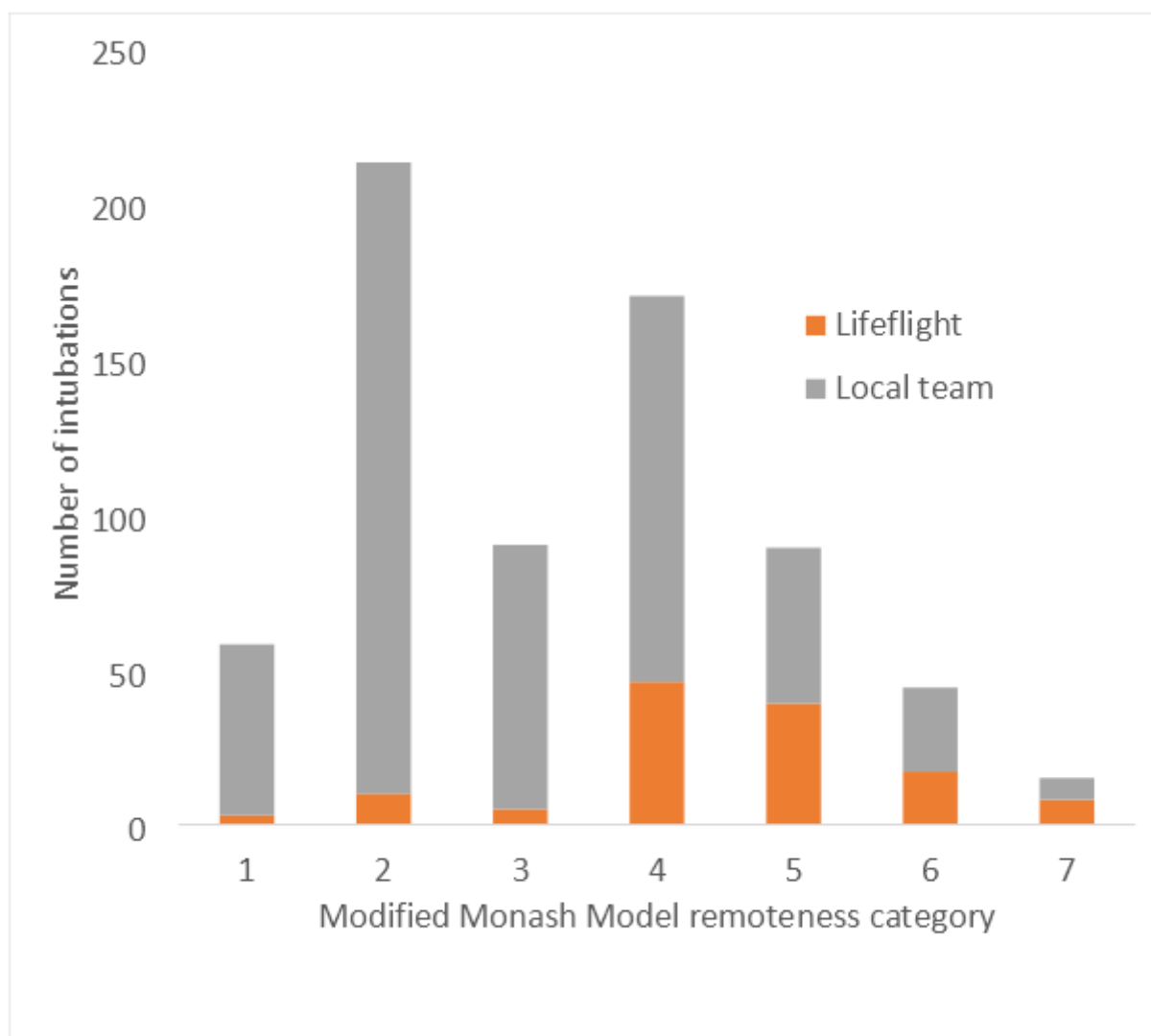


Figure 2

Number of intubations by Modified Monash Model remoteness category indicator.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [floatimage2.png](#)
- [RuralandRemoteIntubationsPellattDataSet.xlsx](#)