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The effect of the new rescue helicopters on the rescue service's mission profile

SHORT REPORT

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BACKGROUND

The change of rescue helicopter type from the Sea King to the SAR Queen has been controversial. Some hospitals can no longer receive rescue helicopters because of the stronger rotor downwash from the SAR Queen. For the same reason, it has been unclear whether the SAR Queen would be able to land near patients for air ambulance missions. The objective of the study was to investigate whether the change of helicopter type has changed the rescue service's mission profile.

MATERIAL AND METHOD

Mission data from the first eight months with the SAR Queen at Ørland Air Base (14 May 2021–14 January 2022) were compared with the last equivalent period with the Sea King (14 May 2020–14 January 2021).

RESULTS

The number of requests increased from 249 to 349 (40 %) after the introduction of the new rescue helicopter. Response time increased from 11 to 13 minutes (18 %), while the on-scene time remained unchanged at 10 minutes for primary missions and search and rescue missions. The patients' average degree of severity, assessed by NACA scores, remained unchanged at 3.7. The proportion of missions where hoisting of a rescue paramedic or a doctor was required to gain access to the patient remained unchanged.

INTERPRETATION

The study showed that the use of the rescue helicopter at Ørland Air Base increased after the phasing-in of the SAR Queen. The service's mission profile remained the same. The unchanged proportion of missions that involved hoisting indicates that suitable landing sites close to the patients were found to the same extent as with the Sea King.

Main findings

The study showed that the mission profile remained virtually unchanged after the change of helicopter type at Ørland Air Base.

The patients' degree of medical severity remained unchanged.

The response time increased by two minutes, while the on-scene time remained unchanged for primary missions and search and rescue missions, and decreased for secondary missions.

The need to hoist down a rescue paramedic or a doctor to gain access to the patient remained unchanged after the change of helicopter type.

The Air Force's rescue helicopter service has search and rescue missions as its main remit, but it is also included as a secondary resource in the air ambulance service (1). In 2007, the Ministry of Justice initiated a project to replace the old Sea King helicopters. The choice fell on the Leonardo AW101 (hereafter referred to as the SAR Queen). The new helicopter was phased in at Ørland Air Base in Trøndelag in mid-May 2021.

The SAR Queen has been met with a variety of expectations. One the one hand, a new, modern helicopter might have fewer technical problems and operate better in poor weather. On the other hand, the SAR Queen is significantly heavier than the old Sea King helicopters (2–4). Many landing sites are therefore inaccessible to the SAR Queen because of the stronger rotor downwash under the helicopter, which potentially can cause injury to people and damage to infrastructure (5). In the catchment area of Ørland Air Base, the landing sites at the hospitals in Kristiansund, Molde and Namsos are therefore no longer used.

Stronger rotor downwash can also limit the possibility of finding a landing site in the terrain. In such cases, the mission is usually resolved by hoisting. There has therefore been a widespread expectation that missions with the new helicopter will rely more frequently on hoisting. Moreover, it has been noted as a problem that the SAR Queen can take longer to become airborne than the Sea King.

The objective of this study was to investigate whether the introduction of the new rescue helicopter at Ørland Air Base has changed how the service operates.

Material and method

This was an observational study that analysed retrospective mission data. The patient population for the rescue helicopter service at Ørland Air Base includes all of Trøndelag county and the Nord-Møre and Romsdal districts, with a total of 730 000 inhabitants over an area of approximately 56 000 km^2 (6).

We compared data from the first eight months of operating the SAR Queen (14 May 2021–14 January 2022) with the equivalent eight-month operational period for the Sea King (14 May 2020–14 January 2021). All requests for emergency missions by the rescue helicopter at Ørland Air Base were included in the study. Data were retrieved from LABAS (Normann IT, Trondheim), a documentation system where the air ambulance doctor documents requests for air ambulance services from the Emergency Medical Communications Centre (EMCC) or a Joint Rescue Coordination Centre.

We registered the types of missions that the rescue helicopter undertook during the study period, divided into primary missions, search and rescue missions and secondary missions.

Primary missions are regular air ambulance missions where the patient is located outside of a hospital, while secondary missions are missions involving transfer of a patient from one hospital to another (from a lower to a higher care level). Search and rescue missions involve search for or evacuation of persons from areas that are difficult to access, for example in mountain areas or at sea.

Furthermore, we registered the number of missions that were either aborted or rejected. We were especially interested in studying whether the proportion of missions that were rejected because of adverse weather or technical problems with the aircraft had changed after the introduction of a new, modern helicopter, with facilities such as automatic de-icing of the rotor blades.

We also registered the helicopter's response time, i.e. the time from receipt of the alert until the helicopter is airborne. In addition, we registered the time from landing to departure in cases where a patient was picked up, be it from a site of injury, a hospital or an airport – here jointly referred to as *on-scene time*. The new helicopter type sometimes needs to land at the nearest airport instead of at the hospital. We therefore undertook an isolated investigation of any changes to the on-scene time for secondary missions, and for primary missions and search and rescue missions combined, that resulted in patient contact. The rescue helicopter also flies missions that do not end in patient contact, typically because the patient cannot be found after a search, or because the patient has been found by ground search teams.

The frequency with which a rescue paramedic or a doctor was hoisted down to undertake the mission was recorded. Hoisting is used to reach patients when landing in the vicinity is difficult. The analyses of the frequency of hoisting were undertaken only for primary missions and search and rescue missions with patient contact. Hoisting is not relevant during secondary missions transporting a patient from one hospital to another.

Finally, we registered the degree of severity of the patients' clinical condition. We used NACA scores (*National Advisory Committee for Aeronautics*), a well-established method for scoring the degree of severity in emergency medicine outside of hospitals (7, 8), which are registered for all air ambulance missions in Norway. We defined patients with a NACA score of 4–7 as seriously ill or injured (Table 1).

Table 1

NACA scores (National Advisory Committee For Aeronautics) for the degree of severity of disease or injury (7).

NACA score	Definition	Examples
0	No injury or disease	
1	Slight injuries/diseases without any need for acute medical care	Transient hypotension, abrasions
2	Injuries/diseases requiring medical treatment, but hospital admission not indicated	Moderate soft-tissue injury; normal birth; discharged patient transferred to another hospital for care
3	Injuries/diseases that are not life-threatening but requiring hospital admission	Mild concussion; fractures; large wounds; mild asthma, non-specific chest pain; cancer without organ failure
4	Injuries/diseases that are potentially life-threatening	Acute coronary syndrome; fracture of large tubular bones; burns 20–30 %
5	Life-threatening injuries/diseases requiring immediate treatment	Suspected internal cranial pressure; large, complicated fractures; suspected rupture of the viscera with circulatory effects
6	Injuries/diseases transported after successful resuscitation of vital signs	Injury to the central nervous system with disturbed respiration or circulation; thoracic injury; respiratory or circulatory arrest
7	Dead on site or within the period that the service is responsible for treatment, after resuscitation attempts.	

The study was submitted to the Central Norway Regional Committee for Medical and Health Research Ethics (REK Midt), which considered it as quality assurance and hence not subject to approval. Approval by the data protection officer at St. Olavs Hospital was also obtained prior to implementation of the study.

Descriptive statistics were produced using IBM SPSS Statistics 27 (IBM Corporation, Armonk, NY, USA).

Results

We found an increase from 249 to 349 requests (40 %) after the change of helicopter from Sea King to SAR Queen. We saw a parallel increase in the number of missions undertaken, evenly distributed among primary, secondary and search and rescue missions (Table 2).

Table 2

Comparison of the period before the change of helicopter (Sea King, 14 May 2020–14 January 2021) with the period after (SAR Queen, 14 May 2021–14 January 2022). Number of requests and missions, the patient's degree of severity, response time and on-scene time, missions that involved hoisting of a rescue paramedic or doctor, and rejected and aborted missions.

Variable	Sea King	SAR Queen
Requests and missions		
Number of requests	249	349
Completed missions in total	159	231
Completed primary missions, n/N (%)	87/159 (55 %)	126/231 (55 %)
Completed secondary missions, n/N (%)	8/159 (5 %)	16/231 (7 %)
Completed search and rescue missions, n/N (%)	64/159 (40 %)	89/231 (38 %)
Patients' degree of severity (NACA score)		
Average NACA score (95 % CI)	3,7 (3.4 to 4.0)	3,7 (3.5 to 4.0)
Proportion of patients with NACA scores 4–7, n/N (%)	54/128 (42 %)	96/179 (54 %)
Response time and on-scene time (in minutes)		
Response time for all emergency missions, median (quartiles)	11 (7, 15)	13 (8, 18)
On-scene time, primary missions and search and rescue missions with patient contact, median (quartiles)	10 (6, 21)	10 (6, 19)
On-scene time, secondary missions, median (quartiles)	28 (18, 57)	10 (5, 22)
Hoisting of personnel, primary missions and search and rescue missions with patient contact (percentage)		
Missions involving hoisting of a rescue paramedic, n/N (%)	29/122 (24 %)	42/164 (26 %)
Missions involving hoisting of a doctor, n/N (%)	12/122 (10 %)	18/164 (11 %)
Rejected and aborted missions (percentage)		

Variable	Sea King	SAR Queen
Total number of rejected and aborted missions, n/N (%)	90/249 (36 %)	118/349 (34 %)
Number of missions rejected or aborted due to weather, n/N (%)	9/249 (4 %)	8/349 (2 %)
Number of missions rejected or aborted due to technical problems with the aircraft, n/N (%)	4/249 (2 %)	9/349 (3 %)

The average NACA scores were unchanged at 3.7 (95 % CI 3.4 to 4.0) and 3.7 (95 % CI 3.5 to 4.0) respectively, before and after the introduction of the new rescue helicopter. 42 % of the patients from the Sea King period had a NACA score of 4–7, compared to 54 % in the SAR Queen period.

The median response time for all emergency missions increased by 18 % from 11 minutes in the period with the Sea King to 13 minutes in the period with the SAR Queen. The on-scene time during primary missions and search and rescue missions with patient contact overall remained unchanged with a median time of 10 minutes. On the other hand, the on-scene time during secondary missions was shorter in the period with the new rescue helicopter (median 10 minutes with the SAR Queen, compared to 28 minutes with the Sea King).

A rescue paramedic was hoisted down in 24 % (29 out of 122 missions) and 26 % (42 out of 164) of the primary missions and search and rescue missions with patient contact with the Sea King and SAR Queen respectively. The corresponding numbers for hoisting of a doctor were 10 % (12 out of 122) and 11 % (18 out of 164) respectively. In other words, the proportion of hoisting operations remained virtually unchanged after the introduction of the SAR Queen. The proportion of missions that were rejected or aborted because of adverse weather conditions or technical problems with the aircraft were unchanged at 5 % during both periods (13 out of 249 missions with the Sea King, 17 out of 349 missions with the SAR Queen).

Discussion

The reason for the increased mission volume is uncertain, but could be related to the lower than normal activity with the Sea King in 2020 due to the COVID-19 pandemic. However, the nearest adjacent base, the air ambulance base in Trondheim, received a stable number of requests in the first and second data collection period, 697 and 689 respectively (E. Skjærseth, local medical director, personal communication). Therefore, a general increase in the activity of the air ambulance services in the region seems not to explain the increased mission volume at Ørland Air Base. The study shows that in our region, the SAR Queen is used to fly the same volume of regular air ambulance missions as the Sea King.

Most likely, the increased response time of the SAR Queen is primarily due to the fact that the personnel have only recently been trained to operate this aircraft, and that the pre-flight checklist is more comprehensive. However, the SAR Queen can fly at higher speed, and all or part of the time lost at the start-up stage can be regained before arrival at the patient's location – the longer the distance to the patient, the more time can be regained. To put this time use into perspective:

The average time from alert of the rescue helicopter until the patient is reached is 26 minutes for primary emergency missions. In search and rescue missions, several hours of searching through an area may be needed before the patient is found.

The analyses show that during secondary missions, the SAR Queen has shorter on-scene time than the Sea King. The explanation is that patients are transported from the local hospital to the nearest airport, instead of having a doctor from the rescue helicopter brought by ambulance from the airport to the hospital to pick up the patient. The reason for this practice could be that since the introduction of the new helicopter, the rescue helicopter service is primarily contacted in cases where it is practically feasible and medically appropriate to transport the patient to a local airport. However, it might also be that the discharging hospital increasingly finds solutions to transport the patient to a local airport when the alternative involves a delay for the patient. Although such solutions may save time, they could be associated with less intensive-care competence among the accompanying personnel as well as information loss, in addition to an increased resource use for the hospitals (9).

The unchanged proportion of missions that involve hoisting is interpreted as indicating that since the change of helicopter type, a suitable landing site can be found in the vicinity of the patient at the site of injury as often as previously.

All data stemmed from periods during the COVID-19 pandemic. This may have been a contributory factor in our identification of an increased mission volume after the change of helicopter type. The findings in the study are not necessarily representative for other regions, where a greater population density may restrict the availability of sites where the SAR Queen can land.

The number of secondary missions is low, and it is difficult to draw any conclusions from these.

The article has been peer reviewed.

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