Retrospective review of enquiries to the Québec diving medicine call centre: 2004 through 2018

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Key words
Diver emergency service; Diving incidents; Epidemiology; Hyperbaric facilities; Medical database; Telemedicine

Abstract
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Introduction: The Centre de Médecine de Plongée du Québec (CMPQ) established a bilingual 24-hour dive emergency call line and diving medicine information service in 2004. The toll-free number (888-835-7121) works throughout Canada. Calls and emails (cmpq.cisssca@ssss.gouv.qc.ca) are answered by a CMPQ coordinator or on-call hyperbaric physicians and other consultants as needed. We reviewed 15 years of activity.
Methods: Details of phone calls and email enquiries to the centre were reviewed individually and compiled into a database. Data were analysed to characterise contact volume and issues addressed. Contacts were categorised into five groups: information only (INF); medical opinion required (MOP); medical issue after the critical period of urgency had passed (PUR); current urgent but not immediate life-threatening issue (NLT); and immediate life- or health-threatening issue (ILT). Data presented as mean (standard deviation) or percentage.
Results: A total of 3,232 contacts were made from May 2004 through December 2018: 19 (SD 8) per month [215 (70) per year]. Primary issues of concern were: emergency planning (20%); technical (not medical/physiology) questions (16%); otorhinolaryngological (12%); and decompression sickness-related (7%). Categorisation was 52% INF, 28% MOP, 13% PUR, 7% NLT, and 0.1% ILT, with 0.2% lacking sufficient detail to categorise. The nature of the diving activity of interest was determined in 67% of cases: 48% (n = 1,039) professional; 46% (n = 1,008) recreational; and 1% (n = 11) breath-hold.
Conclusions: The call centre serves as a resource to the community, providing information on health and safety for diving in addition to being available to assist with emergent needs.

Introduction

Compressed gas diving is used worldwide for a range of recreational and professional activities. The former includes casual diving through to exploration activities, and the latter instruction, scientific, aquaculture, inspection, construction, demolition and a host of military and police work. While exposures can vary in intensity, for example, in depth, time, and ambient temperature, fundamental physiological hazards are shared, and in many ways distinct from those experienced in other non-diving activities. A number of services have been established to help address the health and safety needs of divers. The most well-known of these are the medical call services provided by Divers Alert Network (DAN) through DAN America,[1] DAN Suisse through DAN Europe,[2] and the Divers Emergency Service (DES) through DAN Asia Pacific.[3]

The Commission de la santé et de la sécurité du travail (CSST; renamed in 2014 Commission des normes, de l'équité, de la santé et de la sécurité du travail [CNESST]) reviewed practices following a concerning number of diving-related accidents in Québec, Canada. One of the recommendations made was to put in place a consultation service to ensure optimal care for victims of diving accidents.[4] The Centre de médecine de plongée du Québec (CMPQ) programme, located in Lévis, Province of Québec, Canada, was instituted in 2004 with a bilingual (French and English) 24-hour dive emergency call line and diving medicine information service. The goal was to meet the needs of professional and recreational divers, including emergency management and diving health information. The toll-free number (888-835-7121) works throughout Canada. Calls and emails (cmpq.cisssca@ssss.gouv.qc.ca) are answered by a CMPQ coordinator or on-call hyperbaric

physicians and other consultants as needed. Our goal was to review 15 years of call centre activity.

Methods

Approval for this retrospective review of data was obtained from the research ethics board of CISSS de Chaudière-Appalaches (number 2019-604). Data from May 2004 through December 2018 were reviewed.

DATA COLLECTION AND PROCESSING

CMPQ documentation of contacts was analysed and tabulated. The details of all incoming phone calls and email inquiries to the CMPQ were reviewed individually and compiled into a database. Individual contacts were assessed to characterise contact volume and issues addressed, separating them into categories according to issues of concern. If a contact involved multiple purposes, it was categorised based on the chief concern. Contacts with insufficient information to classify were put in the 'other' category.

Contacts were treated as independent and were distributed into five classes relating to the degree of urgency: information only (INF); medical opinion required (MOP); medical issue arising after a critical period of urgency had passed (PUR); currently urgent but not immediately life-threatening issue (NLT); and immediately life- or health-threatening issue (ILT). INF included requests for meetings, reports, current knowledge, and technical questions on diving or hyperbaric chamber operations. MOP included queries regarding medical contraindications relating to diving or hyperbaric activity, requests for expertise on cases encountered from doctors outside the CMPQ and questions relating to fitness to dive. Neither INF nor MOP contacts included a notion of medical urgency. PUR included requests for medical consultation, requiring intervention or not, with the point of contact being more than 48 hours after the reference event occurred. NLT included requests for intervention, aid, or medical consultation initiated within 48 hours of the reference event, but with no threat to life indicated. ILT included contacts referring to medical emergencies in which an imminent life threat was deemed possible.

Contacts were assessed for temporal patterns (daily, weekly, and seasonal presentation), the form of the contact (phone or email), point of origin (within or outside Canadian territory), and status (individuals involved or medical professionals providing care).

Descriptive data are presented as means and standard deviations (SD) with range, or percentages, as appropriate. Transformation operations were carried out for the main health issues of concern to evaluate contact patterns evolving over time. Averages for main health issues of concern were calculated based on the total number of annual requests. This yielded the observable share for each main health issue of concern per year, without the influence of the total number of requests. A weighted mean by year was then computed. The mean was then subtracted for each of the proportional averages (central operation). This allowed main health issues of concern to be observed on a comparable scale. Relative standard deviation (RSD) was computed to compare the degree of dispersion of centre contacts. RSD depicts the percentage of variation around the average to facilitate comparison of multiple averages with potentially different natures. Pearson χ^2 was used to assess the fluctuation of contacts over time. The probability of observing events at specific times or periods was predicted using Poisson's law. The lambda parameter was calculated as the average number of expected events for the period concerned. Statistical significance was accepted in all cases with $P < 0.05$.

Results

A total of 3,232 contacts were captured from May 2004 through December 2018 (Figure 1). There was insufficient detail to categorise in only 0.2% of the contacts. The frequency of contacts was 19 (SD 8) (range 2–42) per month, or 215 (70) (38–329) per year. Seasonal patterns were evident with 22 (5) (2–42) in the warmer months (May through October) and 15 (4) (4–29) contacts per month documented in the colder months (November through April). Over half of all contacts were for information only.

The form of contact was 73% (n = 2,353) telephone, 26% (n = 847) email, and one from mail, with < 1% (n = 31) with insufficient data to classify (Figure 1, Table 1). The mean annual telephone call volume was 2.8 times greater than the email volume, with a difference of 9% between the two RSDs (calls 35% and emails 44%). The fluctuation of calls and emails varied both year-to-year ($\chi^2 = 87.6$, df = 14, $P < 0.0001$) and monthly ($\chi^2 = 54.2$, df = 11, $P < 0.0001$).

Figure 1

Distribution of call centre contacts by year (2004 represents a partial first year of operation). The mean (standard deviation) (range) is presented in the legend for each form

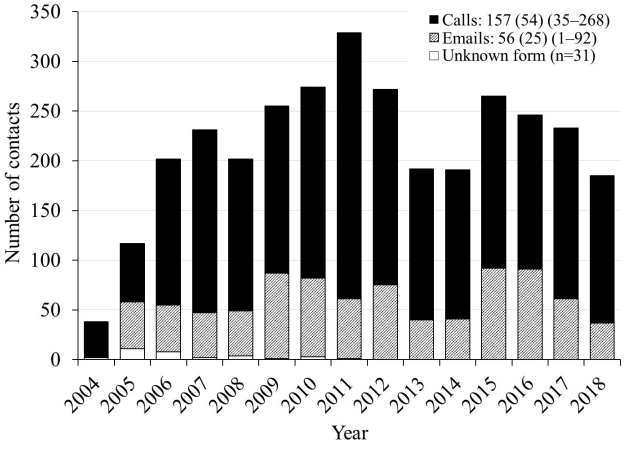

Table 1

Classification by form of contact. ILT – immediate life-threatening issue; INF – information only; MOP – medical opinion required; NLT – current urgent but not immediate life threatening issue; PUR – medical issues arising after the critical period of urgency had passed. The dash (–) means not applicable. * Seven calls did not have enough information to be classified

Form of contact	*n*	%	Classification of contacts									
			ILT		NLT		PUR		MOP		INF	
			n	%	*n*	%	n	%	n	%	n	%
Calls*	2,353	73	4	< 1	208	9	405	17	743	32	986	42
Emails	847	26	–	–	–	–	16	2	167	20	664	78
Mail	1	< 1	–	–	–	–	–	–	–	–	1	100
Unknown	31	1	–	–	4	13	4	13	8	26	15	48
Total	3,232	100	4	< 1	212	7	425	13	918	28	1,666	52

The dispersion of calls was evenly distributed among four classes of contacts (excluding ILT), while emails favoured information requests.

The distribution of contact concerns is summarised in Table 2. The five leading topics of concern for all contacts were: emergency planning (20%); technical questions not related to medicine or physiology (16%); otorhinolaryngologically-related (12%); decompression sickness-related (7%); and medical exam-related (7%). The emergency planning category included requests regarding dive emergency plans, reports of end-of-dive activity, and questions relating to the feasibility of emergency plans in a particular situation. Emergency planning captured both professional and recreational diving activities. The nature of technical questions varied dramatically. Examples include requests for a type of O-ring compatible with oxygen for a hyperbaric chamber, and how to make the type of gas mixture appropriate for a specific dive. Comparing the form of contact, the largest proportion of phone calls involved otorhinolaryngological issues (15%), and the largest proportion of emails concerned emergency planning (38%).

The classification of contacts is summarised in Table 3. It should be noted that multiple contacts related to individual events were sometimes received by the call centre in the days following the event. Repeated contacts were recorded as INF and then classified according to the subject.

A modest annual variation in the classification of contacts was observed, with an average variation difference of 5% between the RSDs (INF 37%, MOP 44%, PUR 32%, and NLT 43%; Figure 2). Seasonal patterns in contact classification varied considerably, as did the inter-class variability (Figure 3). INF contacts showed relatively little variation by month (RSD INF = 22%). MOP and PUR contacts showed greater variability (RSDs MOP = 31%, PUR = 43%). The share relating to emergencies had a very strong seasonal variation (RSD NLT = 78%). The warmer months, reflecting higher activity levels, showed the greatest variation within classes.

The first part of the week tended to be busiest for all telephone calls (all calls had available data). Monday–Tuesday contributed 43% of the call volume, and Monday–Wednesday 61% (data not shown). Weekends provided 9% of the call volume. Emails were distributed more uniformly between working days with a ratio of 18% per day, with a drop to 8% on weekend days. The proportions observed by weekday remained similar regardless of the month of the year. The pattern differed for emergency calls, with weekend calls representing 36% of the total. Seasonal patterns of emergency calls also emerged, with the number of calls per month doubling in the warmer months. Urgent calls (ILT and NLT) were split with 80% in the warmer months and 20% in the colder months. The numbers indicate a probability of receiving more than one emergency call as 0.1% during the week and 0.4% during the weekend in the warmer months; and 0.02% during the week and < 0.01% during the weekend in the colder months.

The pattern of call times differed between weekdays and weekends (66% of calls had available data). The contact time was 12:30 (0:40) on weekdays and 15:28 (2:37) on weekends. Approximately 10% of all calls were made between 18:00 and 08:00. Focusing on emergency calls with call time available (n = 159; 75% of emergency calls), 28% were made between 18:00 and 08:00. Weekday emergency calls came in at 13:57 (3:09), and weekend emergency calls at 15:09 (3:42).

The background of divers or divers-in-training making contact was determined in 67% of cases (n = 2,175). The distribution was 48% professional (n = 1,039); 46% recreational (n = 1,008); and 1% freediver (n = 11). Recreational divers tended to make telephone contact with CMPQ (90%; n = 906 in the known cases). Professional divers used telephones in 61% (n = 638) of their contacts. The majority of contacts from professional divers involved requests for information (86%). Contacts from recreational divers most commonly related to requirements for medical opinion and past urgent conditions (Table 4). Contacts related to an emergency condition made at least 48 hours after the situation developed were 8.5 times more

Table 2

Distribution and frequency of categories among the forms of contact. CMPQ – Centre de médicine de plongée du Québec. The dash (–) means not applicable. * One emergency planning contact was by post mail (not shown on table). # The seven cases with missing data were all phone calls

Category of contacts	*n*	%	Form of contact					
			Calls		Emails		Missing data	
			n	%	*n*	%	*n*	%
Emergency planning*	656	20	329	14	326	38	–	–
Technical questions	512	16	286	12	217	26	9	29
Otorhinolaryngology	385	12	355	15	25	3	5	16
Decompression sickness	230	7	206	9	19	2	5	16
Medical exam	212	7	161	7	50	6	1	3
Medication	165	5	142	6	22	3	1	3
Musculoskeletal	120	4	108	5	11	1	1	3
Information about CMPQ	88	3	59	3	28	3	1	3
Pulmonary	72	2	61	3	11	1	–	–
Search for diving physician	67	2	53	2	11	1	3	10
Cardiovascular	60	2	49	2	11	1	–	–
Asthma	47	1	36	2	11	1	–	–
Vertigo	36	1	34	1	2	< 1	–	–
Thoracic pain	30	1	29	1	1	< 1	–	–
Headache	25	1	25	1	–	–	–	–
Contamination	24	1	22	1	2	< 1	–	–
Skin	24	1	22	1	2	< 1	–	–
Head trauma	21	1	19	1	2	< 1	–	–
Eye	20	1	17	1	3	< 1	–	–
Pregnancy	19	1	17	1	2	< 1	–	–
Teeth	16	< 1	12	1	3	< 1	1	3
Abdominal region	15	< 1	14	1	1	< 1	–	–
Panic	11	< 1	10	< 1	1	< 1	–	–
Marine life-induced injuries	10	< 1	9	< 1	1	< 1	–	–
Nausea	9	< 1	7	< 1	2	< 1	–	–
Cold	5	< 1	4	< 1	1	< 1	–	–
Pollution	4	< 1	1	< 1	3	< 1	–	–
Drowning	4	< 1	4	< 1	–	–	–	–
Other	338	10	255	11	79	9	4	13
Missing data#	7	< 1	7	< 1	–	–	–	–
Total	3,232	100	2,353	73	847	26	31	1

frequent for recreational divers than for professional divers (Table 4). For example, recreational divers made contact more than eight days after an event in 29 cases, with the longest delay involving an individual who waited eight months to consult for chronic pain in the abdomen that appeared post-dive. In contrast, only two cases of contact after eight days were identified for professional divers. It should be noted that a substantial portion of contacts were made by 'divers prior to beginning training', both professional and recreational, inquiring about medical conditions or skills necessary to start the practice of diving. These contacts were classified as having an undetermined background (recreational or professional).

The breakdown of class of contacts associated with the most commonly raised health problems is summarised in Figure 4. The frequency of contacts regarding specific issues was fairly stable, with annual fluctuations around 2% (Figure 5).

Table 3

Distribution and frequency of categories among classes for all contacts. CMPQ – Centre de médecine de plongée du Québec; DCS – decompression sickness; ILT – immediate life- or health-threatening issue; INF – information only; MOP – medical opinion required; NLT – current urgent but not immediate life threatening issue; PUR – medical issues arising after the critical period of urgency had passed. The dash (–) means not applicable. * Six of the seven missing data cases did not have enough information to be classified

Category of contacts	*n*	%	Classification of contacts									
			ILT		NLT		PUR		MOP		INF	
			n	%	*n*	%	*n*	%	*n*	%	*n*	%
Emergency planning	656	20	–	–	–	–	–	–	–	–	656	39
Technical questions	512	16	–	–	–	–	–	–	–	–	512	31
Otorhinolaryngology	385	12	–	–	30	14	174	41	148	16	33	2
DCS	230	7	–	–	83	39	77	18	37	4	33	2
Medical exam	212	7	–	–	–	–	–	–	87	9	125	8
Medication	165	5	–	–	–	–	2	< 1	163	18	–	–
Musculoskeletal	120	4	–	–	10	5	39	9	66	7	5	< 1
Information about CMPQ	88	3	–	–	–	–	–	–	–	–	88	5
Pulmonary (excluding asthma)	72	2	–	–	12	6	12	3	40	4	7	< 1
Search for diving physician	67	2	–	–	–	–	–	–	–	–	67	4
Cardiovascular	60	2	1	25	1	< 1	1	< 1	52	6	5	< 1
Asthma	47	1	–	–	–	–	–	–	42	5	5	< 1
Vertigo	36	1	–	–	3	1	24	6	7	1	2	< 1
Thoracic pain	30	1	1	25	10	5	11	3	3	< 1	5	< 1
Headache	25	1	–	–	10	5	9	2	6	1	–	–
Contamination	24	1	1	25	6	3	7	2	1	< 1	9	1
Skin	24	1	–	–	6	3	15	4	2	< 1	1	< 1
Head trauma	21	1	–	–	–	–	–	–	21	2	–	–
Eye	20	1	–	–	7	3	3	1	9	1	1	< 1
Pregnancy	19	1	–	–	–	–	1	< 1	16	2	2	< 1
Teeth	16	< 1	–	–	1	< 1	6	1	7	1	2	< 1
Abdominal region	15	< 1	–	–	3	1	3	1	9	1	–	–
Panic	11	< 1	–	–	8	4	–	–	3	< 1	–	–
Marine life-induced injuries	10	< 1	–	–	–	–	8	2	1	< 1	1	< 1
Nausea	9	< 1	–	–	2	1	3	1	4	< 1	–	–
Cold	5	< 1	–	–	1	< 1	2	< 1	1	< 1	1	< 1
Pollution	4	< 1	–	–	1	< 1	–	–	–	–	3	< 1
Drowning	4	< 1	1	25	1	< 1	–	–	–	–	2	< 1
Other	338	10	–		17	8	28	7	193	21	100	6
Missing data*	7	< 1	–	–	–	–	–	–	–	–	1	< 1
Total	3,232	100	4	< 1	212	7	425	13	918	28	1,666	52

The four ILT contacts represented cases requiring immediate medical care. The first case involved loss of consciousness due to equipment failure during the dive (drysuit and mask leak then water aspiration through the regulator). The second case involved gas poisoning during the dive which was believed to lead to toxic pneumonitis. The third case concerned a professional diver developing a pneumomediastinum during a dive. The fourth case involved loss of consciousness developing during a dive, believed to be secondary to a cardiac problem. The coordination of intervention and treatment was quickly implemented for the first three cases and the patients were treated without any declared sequelae. The subject in the fourth case died nine hours later while under medical care.

Evaluating the INF calls (n = 986), only 27 (3%) required a physician response, with the majority being addressed by a technically knowledgeable non-physician.

Figure 2

Distribution of class over all years. Each bar represents the total number of contacts per year. The mean (standard deviation) (range) is presented in the legend for each class. ILT – immediate life-threatening issue; INF – information only; MOP – medical opinion required; NLT – current urgent but not immediate life threatening issue; PUR – medical issues arising after the critical period of urgency had passed

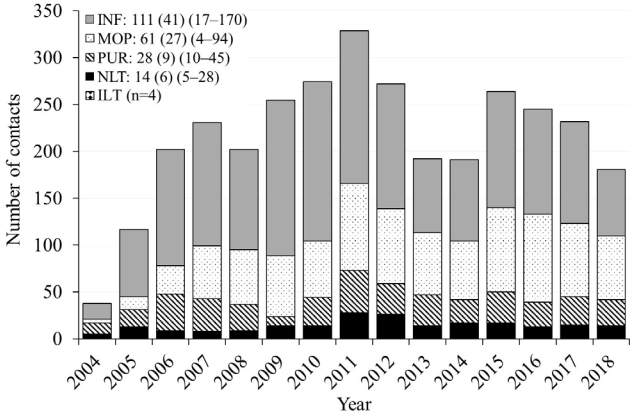

Figure 3

Seasonal distribution (n = 3,232; contacts distributed by month). The mean (standard deviation) (range) is presented in the legend for each class. ILT – immediate life-threatening issue; INF – information only; MOP – medical opinion required; NLT – current urgent but not immediate life threatening issue; PUR – medical issues arising after the critical period of urgency had passed

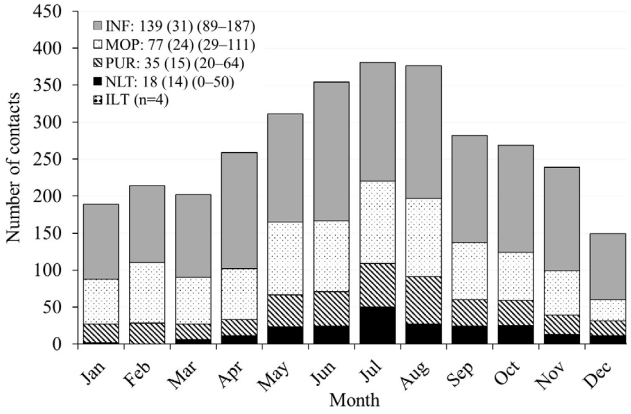

Table 4

Classification by type of diver. ILT – immediate life-threatening issue; INF – information only; MOP – medical opinion required; NLT – current urgent but not immediate life threatening issue; PUR – medical issues arising after the critical period of urgency had passed The dash (–) means non-applicable. * Five cases among recreational divers did not have enough information to be sorted into the five classes of contacts. [#]The unknown types are those which are declared divers but without specifying if they were recreational, professional or freedivers

Type of diver	*n*	%	Classification of contacts									
			ILT		NLT		PUR		MOP		INF	
			n	%	*n*	%	*n*	%	*n*	%	*n*	%
Recreational*	1,008	46	3	< 1	150	15	280	28	372	37	198	20
Professional	1,039	48	1	< 1	36	3	33	3	80	8	889	86
Free diver	11	1	–	–	3	27	4	36	1	9	3	27
Unknown[#]	117	5	–	–	11	9	48	41	32	27	26	22
Total[1]	2,175	100	4	< 1	200	9	365	17	485	22	1,116	51

The origin of contacts was established in 54% of cases (n = 1,733) (Table 5). Almost all of the contacts came from within Canada (98%; n = 1,702).

Discussion

The degree of urgency is an important metric in evaluating the activity of an emergency call centre. In the case of the CMPQ, 20% of the contacts were related to an urgent state (ILT, NLT, or PUR) from 2004 through 2018. This rate was similar to those reported for the Swiss DAN call centre for 2008 and 2009.[2] It was lower than the 31% reported for the DAN America call centre for 2010 through 2015;[1] and far lower than the > 90% reported for the DES Australia call centre for 1991 through 2007.[3] Variations are expected, with some services perceived as more appropriate for strict emergent events and others serving as a broader resource. Although the proportional share relating to emergencies and information remains comparable, the contact volume varies greatly depending on the centre. Determining call centre support needs must reflect regional, and possibly evolving, demands.

The marked paucity of contacts regarding events with the highest level of urgency (ILT) almost certainly indicates that such cases are generally entered into the medical system through traditional emergency medical services or possibly by direct arrival at the hyperbaric centre. The predominance of calls related to past urgent conditions and medical opinions likely reflects a desire for what is likely to be perceived as reliable specialist information.

The preponderance of emergency calls coming in on the weekend and non-emergency contacts made in the early part

Figure 4

Main health issues distributed by classification. CVD – cardiovascular; DCS – decompression sickness; ENT – ear nose and throat (otorhinolaryngology); MED – medications; MSK – musculoskeletal; PUL – pulmonary (excluding asthma). Only one immediate life-threatening case was captured in these six categories; it is not visible but it is included under CVD

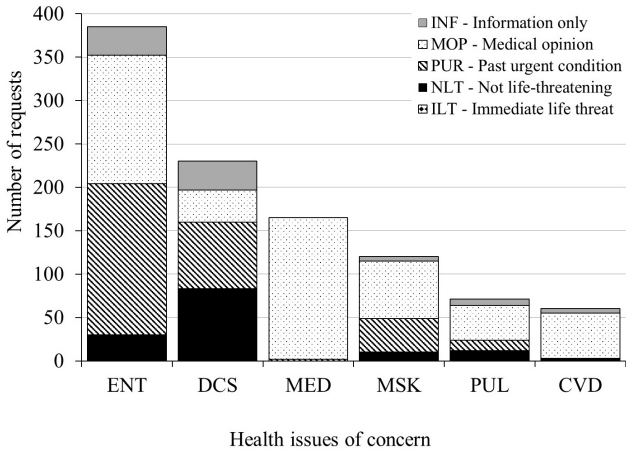

Figure 5

The figure represents the variation around its centred average, a weighted mean by year. The percent described in the legend represents the annual average variation for the six most common health issues. CVD – cardiovascular; DCS – decompression sickness; ENT – ear nose and throat; MED – medications; MSK – musculoskeletal; PUL – pulmonary (excluding asthma)

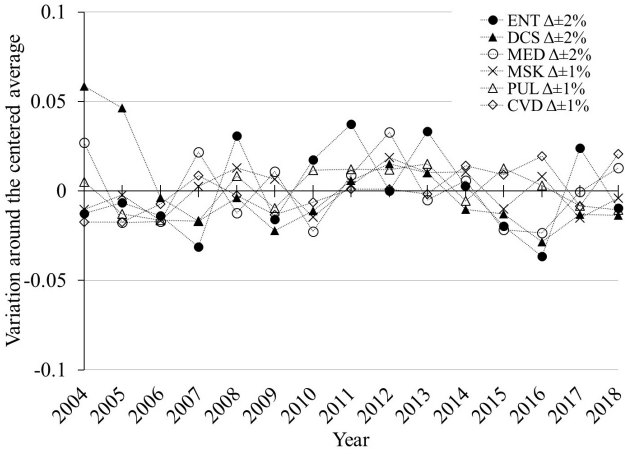

Table 5

Origin of contacts by location. The dash (–) means non-applicable

Form of contact	*n*	Distribution by location									
		Within Québec (km)						Canada-elsewhere		International	
		0 to 100		101 to 1,000		> 1,001					
		n	%	*n*	%	*n*	%	*n*	%	*n*	%
Calls	1,453	490	34	896	62	8	< 1	45	3	14	1
Emails	267	51	19	163	61	2	< 1	34	13	17	6
Mail	1	–	–	1		–	–	–	–	–	–
Unknown form	12	1	8	10	83	–	–	1	8	–	–
Total	1,733	542	31	1,070	62	10	1	80	5	31	2

of the week, particularly within the warmer months, reflects patterns observed by others.[3,5] Given that the majority of emergency calls were for recreational divers, it is expected that a higher volume would come in on weekends. It is noteworthy that the probability of receiving an emergency call in the warmer season was four times greater on weekends (data not shown).

Seasonal variations in contact volumes are expected given environmental conditions and accessibility issues in the colder months. Call times followed unsurprising trends according to both days of the week and season. The finding that almost one-third of emergency calls were made outside of normal business hours is similar to that reported by others,[3] and it speaks to the value of maintaining 24-hour services.

The contact volume and diversity indicated that both professional and recreational subgroups of the diving community utilise the CMPQ services in Québec. Recognition within the province appears to be substantial given the considerable portion of applicant diver contacts. Recreational divers appear to use it as more of a primary service, while professional diver may use it to augment other resources. The high frequency of contacts for emergency plans is consistent with a trusting relationship between divers and the CMPQ. Further expanding both awareness and trust could reduce the delay to solicit advice that is noteworthy in the recreational community. This could improve health and safety and reduce unaddressed concerns in an active population.

Call centre records can be helpful in identifying both issues in which community education could be improved

and emerging patterns of concern. The current data indicate substantial ongoing interest in questions or issues related to otorhinolaryngology and decompression sickness (Figure 5). Others have noted similar high frequency interest.[6–8] Moreover, the overall patterns only showed minimal variation over the reported years (Figure 5), suggesting that health issues of concern were not substantially changing in the community. It would be prudent for educators to expand general education to bolster understanding of topics frequently raised. The CMPQ, along with other bodies, could serve as a resource to develop relevant educational materials.

The most frequently addressed health issues of concern identified in this dataset, in rank order, involved otorhinolaryngology, decompression sickness, medications, musculoskeletal, pulmonary (excluding asthma, which was considered separately), and cardiovascular concerns (Figure 4). This could provide a reasonable priority list for developing educational initiatives. Otorhinolaryngological and decompression sickness issues might most effectively be addressed through expansion of existing training materials. High quality data regarding utility, impact, interactions, and hazards of medications in association with diving are lacking. This is an area in which additional research and ongoing consultation on a case-by-case basis will be needed. Call centre data could be useful to identify specific medications or interactions to be prioritised for study. Questions related to musculoskeletal issues are diverse, but patterns could also emerge to help focus research efforts. Pulmonary issues represent topics requiring ongoing consultation, research, and education. For example, the hazard of and risk factors for immersion pulmonary oedema require better education and case-by-case consultation. As a special case tabulated separately, there is both an idiosyncratic and evolving picture regarding the hazards of asthma and diving that warrants case-by-case consultation.

Questions regarding cardiovascular issues and diving are important due to frequent participation in diving by older individuals and growing complexities of care and/or treatment options. Patent foramen ovale (PFO) represents a common subtopic. Questions frequently arise regarding the importance of PFO and the merits, hazards, and need for surgical correction. It is likely that additional effort to educate the diving public across all levels of participation could benefit the community.

The observation that an important portion of information-related calls with the call centre did not require physician assistance is meaningful. While it is important to have clinicians on call, many inquiries can be addressed by persons with broad knowledge of the diving and hyperbaric field.

The scope of service is possibly one of the most interesting elements of the CMPQ to consider. The vast majority of contacts came from the province of Québec, but this is almost certainly a function of lack of awareness across the country. The fact that the service is bilingual may not be well known, but it is important. Practically, it is possible that the centre could be expanded into a national service with relatively modest effort. Many issues faced by divers are common to all environments, and cold water is a consideration in most Canadian diving. Future possibilities will be discussed separately.

The relatively small number of hyperbaric facilities and specialists across the country make it relatively easy to maintain effective lines of communication. A centralised service could provide an effective clearinghouse. On-call staffing could be increased with technical and medical resources drawn from across the nation. Expanding national collaboration could reduce the burden on local resources and provide opportunities to enhance training and preparedness for medical professionals who may normally see relatively few diving-related cases locally. An enhanced service could include additional efforts in data collection, educational content development, and timely dissemination of relevant information to both medical and diving communities. Expanding the resources available to the diving community could improve operational safety and readiness without legislative changes that have in some cases been promoted, but not established, outside of Québec.

LIMITATIONS

There were several limitations in this study. Most importantly, call centre interactions can rarely confirm diagnosis in the cases of health concerns, and follow up data were frequently not available. Insufficient information could produce errors in the classification of contacts. Consequently, this work is best interpreted as providing a broad description of patterns in call centre interactions.

Treating each contact as independent fails to capture situations in which multiple contacts address a single event or situation. The mitigation is that only the first contact in a medical emergency was defined as such, with follow up contacts counted as information only requests and the contact categories according to the primary subject.

The process of collecting data from all types of requests also evolved over time as prioritisation was given to the most efficient way to route each request to the appropriate destination. The methods used to record information changed over the years reviewed. Phone calls from May 2004 to December 2005 were first manually transcribed and then reported in a written monthly summary. The complete conversations sent by email were also deposited in this report. From August 2007, the monthly was accompanied by a call summary sheet, which included details for each call received and annual summaries. In August 2010 a monthly summary table was added. The monthly summary table was composed of seven columns which provided date, hours and time duration of call, identification, contact form and

a brief sentence on the topic. Gathering information based on the words used by callers or writers several years is easier with multiple sources. Details provided had evolved through the years. The monthly summary was suspended in January 2013 which caused the loss of the details of email conversations. The availability of the call summary sheet gradually decreased in 2015, leaving the monthly summary as the most robust source of contact data.

Many cases do not provide enough information to fit clearly into the designed configuration, and on several occasions it was difficult to be able to categorise the contacts. Some involved multiple topics, and the effort to determine the main reason was imperfect. Although the information available was not uniform, patterns were established confidently.

The origin of contacts by location must not to be confused with location of the cases for which the call (or email) was made. For example a call regarding a dive emergency planning might be done from the company location while the place of diving activity concerns a dam located 1,000 km away.

Conclusions

This review describes 15 years of activity in telemedicine and an emergency diving call centre based in Lévis, Québec, Canada. The service is utilised by professional and recreational divers and persons involved in the care of divers. Although the vast majority of contacts involve requests for information, there is a large proportion seeking medical opinions or remote medical consultation. Not surprisingly, greater activity is found during the warmer months. The call centre has provided a resource to the community, primarily providing information on health and safety for diving in addition to being available to assist with emergent needs. The insights gained here could help to organise, refine, and/or expand capabilities and enhance the training of divers and those responsible for the health and safety of divers. The service has the potential to expand across Canada as a national resource.

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