The RescuWire

April 2011

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Also:

Fill out our online survey for your chance to win a $20 Tim Horton's gift card!

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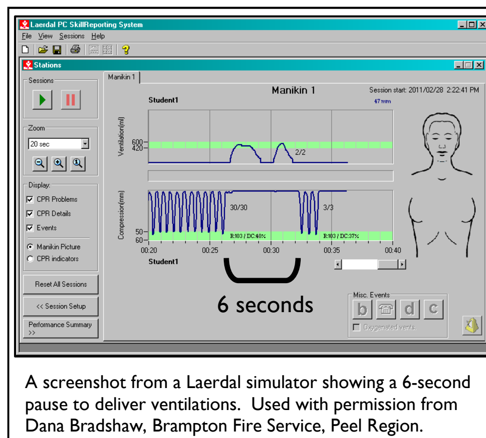
Minimizing hands-off time - Can we do it better?

The current AHA standard is to perform 30 chest compressions to 2 ventilations while reducing hands-off time throughout CPR. This is a huge challenge that has forced us to rethink how we approach CPR in order to optimize the patient's chance of survival.

Pausing to Ventilate

Traditional training has ingrained in us that it takes about 2-3 seconds to complete compression and refill the hand-held ventilation bag. Following that, we must pause for 4-6 seconds to deliver two ventilations after performing the compressions. That means that we can complete two and a half sequences of 30:2 in a minute, and that we have paused every minute for 10-15 seconds to deliver ventilations. Every minute our hands are doing compressions only 75% of the time, giving us our compression fraction.



A screenshot from a Laerdal simulator showing a 6-second pause to deliver ventilations. Used with permission from Dana Bradshaw, Brampton Fire Service, Peel Region.

Why is this important?

Survival is directly associated with compression fraction. The higher your compression fraction - the more you can reduce hands-off time - your patient is more likely to survive.

Pausing to Defibrillate

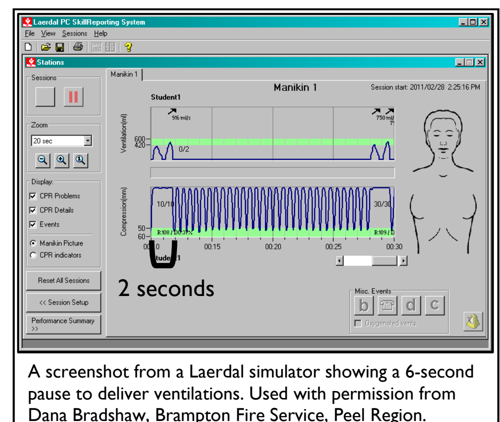
Dana Edelson is small in stature but a mighty resuscitation researcher from the University of Chicago. She first demonstrated to the world the relationship between pausing for shock and death at the American Heart Association's annual meeting in November 2010. In combination with our own Sheldon Cheskes, who led the project, Dana and a group of investigators from the Resuscitation Outcomes Consortium (ROC) looked at all the cases of cardiac arrest that presented in a shockable rhythm and measured the pause to analyze and charge, as well as the pause after shock to get the hands back on the chest to resume compressions.

Dr. Dana Edelson

They clearly showed that stopping compressions to analyze and charge the defibrillator is detrimental - the longer you pause the lower the chance of survival.

Minimizing the Pauses – Opening the Gateway to Survival

Ventilating in 1-2 seconds: All the ventilation that is required during a cardiac arrest is 500ccs, which can be achieved with only a small squeeze of the bag. Also, there is no need to wait for the bag to completely re-inflate prior to starting compressions after the second and final ventilation. By reducing the tidal volume and compressing quickly after the second ventilation you can reduce the pause for ventilations to 1-2 seconds. This is presented visually in the image below. This is from a Laerdal simulator showing the ventilation volumes between 420 and 600 and the 2 second pause in compressions.



A screenshot from a Laerdal simulator showing a 6-second pause to deliver ventilations. Used with permission from Dana Bradshaw, Brampton Fire Service, Peel Region.

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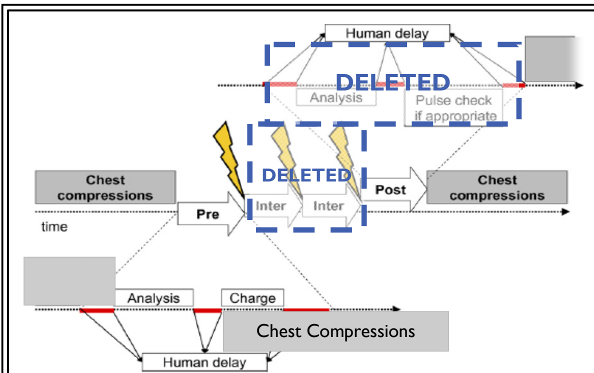
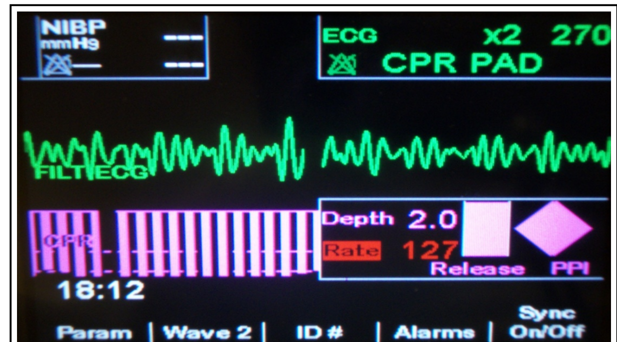
The peri-shock pause is comprised of the pauses before, during, and after defibrillation. Each component of this has been addressed by subsequent versions of the AHA guidelines. For example, in 2005, the human delay for analysis post-shock and during the pulse check was removed, eliminating the post-shock pause. The 2005 guidelines also reduced it to one shock. In 2010 however, the guidelines recommend minimizing the pre-shock pause by doing compressions while charging.



Interventions to minimize pre- and post-shock pause. Adapted from Kramer-Johansen et al. Pauses in chest compression and inappropriate shocks: A comparison of manual and semi-automatic defibrillation attempts. Resuscitation 2007 73, 212-220.

What remains in the peri-shock interval is to reduce the pre-shock pause. This is a challenge, as it takes between 18-28 seconds to interpret the rhythm in automatic mode. In manual mode we can reduce this to 5 seconds or less with training on how to identify VF or VT. The downside however is that we over-read and defibrillate a non-shockable rhythm four times more frequently when in manual mode (at least 26% of the time). Thus, we must balance faster timing with accuracy of interpretation.

What will help us to address these problems are new and improved CPR software for defibrillators. When it becomes available this new software will allow the provider to see the ECG waveform throughout compressions. Also, the defibrillator algorithm has heightened sensitivity to identify VF or VT and prompt the provider to pause, check and confirm at a set time in the 2 minute interval between shocks. If VF or VT is identified early this may enable earlier use of antiarrhythmics such as amiodarone and lidocaine. The software also keeps the capacitor charged throughout CPR, permitting the shock to be given without pausing to charge at each 2 minute interval. This feature, with manual mode defibrillation, has the potential of decreasing the pre-shock pause to less than 5 seconds.



The new and improved CPR software with ECG and compression waveforms visible. Used with permission from San Diego ROC Investigator Dan Davis's unpublished study on in-hospital cardiac arrest.

This new software is in various stages of development across the defibrillator manufacturers and we anticipate it will be in play soon.

Over the next year Rescu and the ROC investigators will continue to work with the EMS services and basehospitals in the Toronto Regional RescuNet to ensure that all paramedics and fire fighters are trained to reduce these deadly pauses in CPR and optimize survival from cardiac arrest.

- Dr. Laurie Morrison and Dr. Sheldon Cheskes

PACT launches at St. Michael's and Sunnybrook!

The Post Arrest Consult Team (PACT) officially launched at 7:30am on February 1st, 2011 at St. Michael's Hospital. Incredibly the St. Michael's PACT team on call was activated just hours after the launch celebration.

On call for PACT were Dr. Chris Hayes, Tessa Diston, and RN Stan McIntyre. When the patient first arrived, the team sprung into action. Working together with the ED staff and RT's, they targeted the hemodynamics, goal-directed gas exchange and initiated cooling of the patient. There was strong communication between all team members, and within 90 minutes of arrival in the ED the patient was transferred to the ICU and cooling was sustained. Three hours after arrival the patient's temperature was recorded at 33.9°C – right on target!

Just a few weeks after our exciting start at St. Michael's, PACT was launched at Sunnybrook Health Sciences Centre and both sites are going strong; to date we have seen eight post-arrest patients at St. Michael's, and four at Sunnybrook.

I would like to send a special thank you to the research team, Jevin So, Elizabeth Racz and Lejla Halilovic for all the efforts in helping with the PACT launch.

Stay tuned to hear other great success stories as the PACT project continues!

- Michelle Gaudio

CPRS ready to recruit students

Graduate training program in resuscitation science at the University of Toronto first of its kind in North America

The Collaborative Program in Resuscitation Sciences (CPRS) has been officially approved by the School of Graduate Studies. Thirteen different U of T graduate programs, ranging from technical/engineering sciences to medical sciences to health services, have hopped on board. The courses, which take an inter-disciplinary approach to the field of Resuscitation Sciences, are ready to be launched for the first intake of students in September 2011.

The goal of the CPRS program is to train scientists pursuing research in the optimal care of the acutely ill and injured patient and, ultimately, to create leaders in the discipline who will supervise others providing this level of scientific inquiry. It will be a "bench to bedside to curbside" training program and will focus on the development and delivery of time-sensitive interventions directly affecting patients in the pre-hospital and in-hospital settings.

We are happy to report that we have successfully attracted funding from CIHR (Canadian Institutes of Health Research) to hold our first Scientific Meeting. We are currently in the planning stages for this meeting and hope to announce the date soon. The meeting will bring together local, regional, national and international participants from a variety of disciplines related to the field of resuscitation science, fostering the building of active and meaningful collaborations. The meeting will also provide students with the opportunity to participate in a scientific poster session.

Seminars

In January 2011 we held the first of our monthly "Science and Sushi" seminar series, designed to provide students and faculty in the CPRS program an opportunity to interact, network, and hear from expert researchers in the field of Resuscitation Sciences. These interactive seminars, normally held on the 3rd Monday of each month, give students the opportunity to meet with colleagues from other departments, thus enhancing opportunities for interdisciplinary collaboration to occur.

Both the January and February seminars were a great success. Attendees represented the broad spectrum of Masters Students, PhD Students, Postdoctoral Fellows, Practicing Investigators, and other hospital and university staff members. The January seminar, "*The Path to Independent Collaboration: Innovative Science in Medicine and Engineering*", led by Drs. Laurie Morrison, Steven Brooks and Timothy Chan, provided a highly interactive discussion of the utilization of the Epistry database and the importance and advantages of building collaborations. The February seminar, "*Understanding and Succeeding in Clinical Research*", led by Dr. Muhammad Mamdani, took on a similarly interactive approach to the evaluation and discussion of critical success factors for young clinical researchers. Evaluation forms administered at the end of each seminar provide us with good feedback, allowing us to continue improving the quality of the seminars. So far the seminars have gotten great reviews.

- Sandy Iverson and Kemi Akano

Coming Up!

CPRS Science and Sushi - April 18, 2011

Dr. Paul Dorian and Katie Allan discuss research tactics, antiarrhythmic drugs in an experimental model of VF, and "cardiotoxic" neighborhoods.

Need more information? Email us at cprsinfo@smh.ca

A time of change

ROC Epistry Cardiac update

Since its humble beginnings back in December of 2005, a total of 24,602 out-of-hospital cardiac arrest patients have been enrolled into the ROC Epistry study. Although this includes patients that are obviously dead, it's still quite a staggering number of patients. The data is used to answer important questions in treating and improving the care for patients that suffer from this sudden and life-threatening medical condition. In addition to the 24,602 cardiac arrest patients enrolled in ROC Epistry, there were another 5,543 patients enrolled into the ROC PRIMED trial, which looked at the amount of up-front CPR given and the use of an impedance threshold device (ITD) when treating these patients. While there have been a lot of changes to our research over the last 6 years or 30,000 cardiac patients, spring signals a major time for change and the next few months will undoubtedly be one of the busiest and most dynamic times of change in Rescu's history.

The first major change that we will see this spring will be implementing a new dataset for the ROC Epistry study that includes an expanded in-hospital dataset. This includes all 43 of the destination hospitals and 7 EMS agencies in the Toronto RescuNet, which includes the Regional Municipalities of Hamilton, Halton, Peel, Toronto, Durham, York, Simcoe, and the District of Muskoka. Although the Toronto ROC Site has collected in-hospital data since March 2010 and throughout ROC PRIMED, the new dataset will be quite expansive and

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include a larger dataset that expands on many pre-existing variables such as hypothermia and cardiac catheterization and includes many new variables such as the different types of hemodynamic support and regular procedures such as chest x-ray, EEG and ECG testing, similar to what we have been collecting in the Strategies for Post Arrest Care (SPARC) network. There are also a number of changes to the prehospital dataset including collecting time stamps for procedures and collecting information on a variety of new drugs and interventions.

As the ROC Epistry dataset is expanded there will also be some major changes to the local Epistry website and data-entry interface. While the website interface will not change for the prehospital data case report forms, we will be integrating the use of "check boxes" and "radio buttons" on the Epistry website in lieu of drop-down boxes for each question. Radio buttons will be used to indicate a single discrete response to a particular question (*e.g.*, choose answer A, B, C, or D) and the check boxes will be used to indicate where multiple responses can be accepted (*e.g.*, check all that apply). In addition, we will be removing visibility rules that will make questions appear or disappear based on previous responses. Through these changes we hope achieve two things; First, to increase the speed at which our data abstractors can select responses to questions, and second, make the case report forms easier to complete accurately.

These changes to the local Epistry website and the advent of the new Epistry dataset will provide a smooth and user-friendly interface which will form the basic dataset for every cardiac arrest patient enrolled in Epistry. In addition to the new dataset, patients who have an out-of-hospital cardiac arrest in the Toronto RescuNet may also be enrolled in two new studies that we will be launching in the next several months: ROC CCC and ROC ALPS.

ROC Trial of Continuous Compressions versus Standard CPR in Patients with Out-of Hospital Cardiac Arrest - ROC CCC

This exciting new study will look at how successful standard CPR consisting of interrupted chest compressions (ICC, 30:2), compares to CPR consisting of continual chest compressions (CCC, 10:1) when treating a cardiac arrest. The goal of this study is to evaluate the importance of not stopping CPR during resuscitation and also delaying intubation until three 2 minute cycles of chest compressions have been given. The majority of patients that are enrolled in ROC Epistry will also be enrolled in the ROC CCC study as the only major exclusions for this study include local age of consent, protected populations, EMS witnessed arrest, and if initial compressions are performed by an EMS agency not participating in the ROC CCC study. Interestingly, the EMS agencies in both Vancouver and Seattle already use a continuous chest compression strategy for treating out-of-hospital cardiac arrest - major urban centers which boast survival rates approximately of 48% compared to 20% (RescuNet) in the bystander witnessed VF cohort.

Pre-loaded syringes of Amiodarone, Lidocaine, and placebo

ROC Amiodarone (PM101), Lidocaine, or Placebo for Out-of-Hospital Cardiac Arrest Due to Ventricular Fibrillation or Tachycardia - ROC ALPs

The second study, ROC ALPs (Amiodarone, Lidocaine, Placebo), is designed to find out whether survival to hospital discharge is improved through the use of a new Captisol-Enabled formula of Amiodarone compared to placebo for patients suffering from re-current ventricular fibrillation or ventricular tachycardia (VF/VT), and also Amiodarone compared to Lidocaine. The reason why the ROC is doing this study is that previous Amiodarone studies may have been negatively affected by it's late administration, limited dosing, and the formulation used and were unable to demonstrate any improved survival to discharge benefit over placebo or lidocaine. Approximately 25 to 30 percent of all patients who suffer an out-of-hospital cardiac arrest will fall into this group of patients with recurrent VF/VT. Thus, a single patient may be enrolled in ROC Epistry, ROC CCC, and ROC ALPs, as appropriate. This will maximize the amount of data collected in order to efficiently and effectively answer the important questions posed by these studies.

"Never underestimate what a small group of committed individuals can accomplish!"

There is no doubt that the Toronto RescuNet will be experiencing one of it's busiest times this spring. As the largest single enrolling site of patients into ROC studies in North America, every single person who makes up the Toronto RescuNet makes a difference in improving the science behind resuscitation. This research is made possible through the invaluable contributions of paramedics and firefighters who implement these studies in the field as well as research personnel at Rescu and base-hospitals, investigators, data abstractors, and countless others. Never underestimate what a small group of committed individuals can accomplish!

Thank you for your continued support and dedication.

- Patrick Van Rooyen

Does gender matter if you are in need of post-arrest care?

A summary of the Gender Differences in Access to Post -Arrest Care project

Cardiovascular disease (CVD) is responsible for the death of more Canadian women (and men) than any other disease category. In Ontario, over 13,990 women died of a major CVD in 2005.

Over the last two decades many studies have reported that certain medical conditions/diseases have innate gender-based predominance due to specific hormonal regulation. Studies have suggested that women have unfavourable outcomes in cardiac arrest, with significantly lower unadjusted survival rates than men. Preliminary analysis of local data we have collected demonstrates significantly lower survival to discharge rates for women, 3.9%, vs. 6.4% for men. Why this difference in mortality exists, is unknown.

It has been suggested by previous work that the gender related difference in survival to discharge rates might be partially attributed to receiving different in-hospital medications and procedures, or inequity in access, similar to what has already been demonstrated in myocardial infarction.

A very recent study indicated that women are likely to be treated less aggressively compared to men even when their medical condition warrants more aggressive treatment. In the absence of sociological models that could account for observed gender differences in outcome, perhaps there are gender related barriers to post resuscitation care which contribute to unfavorable outcomes in women presenting with cardiac arrest. These barriers may include differential application of guidelines, unique gender specific knowledge gaps, attitudes and behaviors in all care givers that affect women more than men.

Studies that further clarify why knowledge transfer seems to have a gender bias for application in post-arrest care are needed to help us address this inequality. By building on our existing knowledge translation network (SPARC Network) of 37 participating hospitals in Southern Ontario, we will collect data on access to post-arrest care across both genders. We will also conduct a qualitative study to identify the perceived and real barriers to knowledge translation for both genders . We will use this information to develop a knowledge transfer strategy in concert with our network of experts and local champions to address this inequity in post arrest care and potentially contribute to improved survival for women in the future.

This work will contribute to capacity building in resuscitation research by supporting the work of a postdoctoral fellow with interest in gender issues (Dr. Valeria Rac) and a postdoctoral fellow in knowledge translation (Dr. Katie Dainty).

- Dr. Valeria Rac

PREDICT prepares for economic analysis as it nears final patient enrolment

PREDICT continues to enroll as we surpass the 8,000 mark for chest pain episodes. We have fulfilled all but one of our cohorts and will continue to enroll chest pain patients from episodes occurring prior to December 31, 2010. The focus will be on completing enrolment and data collection at our 3-lead ECG sites, Thunder Bay and Sudbury.

We are working hard to prepare the massive amount of data for the economic analysis – a job made significantly easier with the help of our tireless in-hospital data abstractors working across the province. Besides tolerating constant requests regarding data cleaning, our data abstractors continue to enter the data that helps us to capture treatments chest pain patients receive throughout the continuum of care – from ambulance to hospital discharge.

The newly formed PREDICT Mobile Team deserves special mention for their incredible work to date. Nasser and Eugene were thrown into PREDICT In-hospital abstraction and have risen to the challenge. They have been absolutely critical to our success in obtaining in-hospital data from a great number of our admitting sites. We are very thankful for their continued efforts.

- Andy Brooks

PROPHET ahead of schedule and surpassing projected enrolment

Once again the Toronto site is the third top enroller for the PROPHET study and we have already surpassed our projected enrollment numbers.

We expect that enrolment will be completed by the end of June 2011.
Our prehospital and in-hospital data abstractors did spectacularly in completing the data well before their benchmarks. Thank you for all your hard work!

- Precilla D'Souza

Combined enrollment as of March 14, 2011:

Receiving Hospital	Cases
St. Michael's Hospital	138
Hamilton General	96
McMaster Children	13
Sick Kids	16
Sunnybrook Hospital	157
Pronounced on Scene/Died	71
Total	491

Enrolling Agency	Cases Enrolled
TEMS	323
HEMS	112
PRPS	21
YORK	12
Ornge	23
Total	491

Will a defibrillator be close by when you need it most?

The PADLOC study group is working towards smarter placement of AEDs in Toronto.

A collaborative group of investigators from the University of Toronto Department of Mechanical and Industrial Engineering, Clinician-Scientists in Emergency Medicine at Rescu, Toronto Emergency Medical Services and the City of Toronto Planning Department the PADLOC (Public Access Defibrillator Location) are working together to optimize AED placement to improve survival rates in Toronto.

To date, collaborators Dr. Timothy Chan, an Assistant Professor from U of T Engineering and Dr. Steven Brooks, a Clinician-Scientist from Rescu have focused on the geographic optimization of public access defibrillator locations within the City of Toronto. Dr. Chan lead the group in developing mathematical optimization models using data on public location cardiac arrests from the Epistry database. The two are currently drafting a manuscript describing the results of their work on this project for submission to a peer-reviewed journal. These initial results from the project were presented in Chicago at the AHA Scientific Sessions meeting in the fall of 2010.

Jonathan Hsu, a summer student from McMaster University, will be returning in May to continue his work with Dr Steve Brooks. They are working together to determine which type of public buildings and outdoor locations are associated with the highest risk for cardiac arrest. The team hopes this will add to Dr. Chan's optimization work to guide the rational placement of future public access defibrillators. The risk profile of public buildings will be compared with current locations of public access defibrillators registered with Toronto EMS dispatch. Jonathan and Dr. Brooks will be working to publish this data by the end of the summer.

More recently, an exciting collaboration has been developed between the City of Toronto Planning Department and PADLOC. The PADLOC team is hoping to work with the Planning Department to add some data collection on public access defibrillator locations within the city to the Toronto Employment Survey. This survey is conducted annually by the City and involves review and data collection from all public buildings in Toronto with respect to things like business type and the number and type of employees within each public building. Employees of the city visit each and every building and therefore have an opportunity to determine whether an AED is on site. The PADLOC team is hoping to develop a section of this survey which will form the basis of an AED registry within the City of Toronto. As a result, more public location AEDs can be registered with Toronto EMS dispatch so that they can be easily located in the event of a cardiac emergency.

- With files from Dr. Steven Brooks

We want to know what you think

The first 100 readers who complete our online survey will be entered for a chance to win a Tim Card loaded with $20.

That's 12 double-doubles!

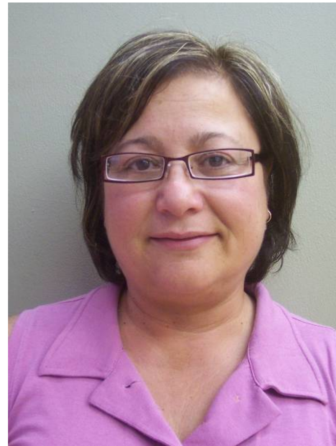
Fill out our survey online at :
www.surveymonkey.com/s/XMVVKPX

Contest closes April 30th, 2011

One entry per person, please!
Rescu staff not eligible

Data Guardian Spotlight: Grace Burgess

Rescu's success has always been dependent on a large, multi-disciplinary team of determined, hard-working individuals. In this edition of the newsletter we have the pleasure of highlighting the contributions of someone who has filled multiple roles throughout Rescu's research efforts – Grace Burgess.



After getting a start in EMS with Ornge as an education training officer, Grace joined the Sunnybrook-Osler Centre for Prehospital Care (SOCPC) as a research associate. There, since February 2006, Grace has worked with Rescu in multiple capacities.

Early on, Grace provided assistance as a Prehospital Data Guardian, collecting and abstracting data for out-of-hospital cardiac arrests and traumas for Toronto and Peel Regions. Grace continues to oversee Peel Epistry, but in the past year, Grace has also become increasingly involved as an In-hospital Coordinator as well. Grace collects trauma outcomes for 23 destination hospitals stretching across Toronto, Peel, Halton, and Simcoe Regions, and more recently, cardiac arrest data.

If the résumé listed above doesn't highlight her contributions enough, at the time of writing this article Grace has worked on a staggering 17 819 cases, counting prehospital and in-hospital data across both trauma and cardiac cohorts, That's 17 819 calls to 911, and 17 819 patients - nearly half of all patients in Epistry. And counting.

" I really feel good about what I do when I hear that our survival rates are improving. "

When asked about her contributions, Grace has said "I realize that the work I do and have done over the years on Epistry has helped our leaders better understand the impact of cardiac arrest and trauma cases. I really feel good about what I do when I hear that our survival rates are improving."

Aside from the value of the work itself, Grace has also described why she enjoys the process itself.

"I really enjoy working with the crew at Rescu, all of the staff in the hospitals, my colleagues in the fire services, EMS services, and most of all, my friend Dina at SOCPC. It is the people that I work with that make the job rewarding and fun. I also have to say that it is a pleasure to work with Dr. Cheskes. He is a great leader who keeps things fun but still gets the job done. And of course none of this is possible without Dr. Morrison who has worked through so many challenges to put this whole Epistry project together."

That feeling, of course, is more than mutual.

"Grace possesses the fundamental characteristics that make this kind of research possible," said Patrick Van Rooyen, who has worked with Grace over the last three years. "She is the kind of person that cares about what she does and goes that extra mile. Grace makes every effort possible to do her job to the best of her ability, takes pride in what she does, and really makes a difference."

Trading Epistry and computers, Grace enjoys traveling, poolside sun and the occasional round of golf. She also counts Fine dining, good wine, and trips to the museum as favourite pastimes.

And, "If you ask my son," Grace adds, "he is most impressed that I play killer bass on Rock Band."

- Adam Byers

New Faces of Rescu

Marta Zielinski recently joined Rescu as a research assistant and is focusing her efforts on the ROC studies. Marta is a perfect fit for the position as she has experience as a study coordinator in cardiovascular clinical trials and having formerly worked in a busy emergency department. Marta graduated from the University of Toronto and holds an H.BSc from the University of Toronto, majoring in both human biology and psychology. During her time off, Marta enjoys working out, reading, and spending time with friends and family.

Meena Lobo started with Rescu in October and has since contributed immensely with any- and everything related to PREDICT. She continues to assist with a wide variety of tasks as her role has expanded into contributing to in-hospital abstraction and data management. Meena holds a degree in Health Sciences and is furthering her career in medical research.
Meena loves to take long drives through the countryside, experimenting in the kitchen, and watching TV.

Liz Racz comes to Rescu from UHN, where she was a research coordinator in multi-organ transplant clinical trials for the past three years. She has also worked in HIV clinical trials and basic science research. She holds Bachelor's degrees in biological and life sciences, is a certified lab technologist, and plans to pursue her Masters and PhD in Immunology. Liz is a whiz with a whisk and has already spoiled everyone at Rescu with delicious home-made cookies and cakes.

A. M. Waheedul Hoque joined the Rescu team in December 2010. He is currently working on PREDICT, the CPR Anytime: Lunch & Learn project, and the ROC studies. Prior to joining us at Rescu, Waheed was involved with maternal and child health research, environmental health research, health program evaluation and health administration in Bangladesh, Thailand & East Africa. He has training and experience in both quantitative and qualitative research.

Lejla Halilovic will be working alongside Liz, Jevin, and Michelle as she contributes to the SPARC and PACT projects. She comes to us by way of Health Canada, where she worked as a Regulatory Affairs Analyst. Lejla has also been a contributor to the Women and Health Protection (WHP) working group of the National Network on Environments and Women's Health, a national think tank with a focus on health policy development. Not one to rest on her laurels, Lejla established a pro-bono patient navigation service called April Health two years ago.
Lejla holds a BSc from York University and a post-graduate certificate in Pharmaceutical Regulatory Affairs from Seneca College.

The RescuWire is a newsletter published quarterly by Rescu, a clinical research group at St. Michael's Hospital in Toronto, Ontario, Canada.

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