DCSOps Update – Functional Specification

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1. Executive Summary

DCSOps is the incident management and volunteer scheduling system utilized by Red Cross volunteer responders and dispatchers. It is a Ruby on Rails application that was launched in January 2014 to both improve the volunteer experience for responders and dispatchers and to increase the amount of recorded data regarding incident response. Since its launch, various analysis has been done around predicting the number of incidents that will occur during a given shift in a given region, likelihood of a volunteer responding when called, etc. This analysis led to the identification of several new DCSOps features that could further improve the volunteer shift sign-up process and the way dispatchers quickly staff incidents with reliable responders. The goal of implementing these features is to **increase volunteer engagement** by making it easier for volunteers to sign up for shifts when they are available and needed. This in turn will likely expand the Red Cross' ability to quickly and effectively respond to disasters. Additionally, this DCSOps update will further increase the volume and variety of data recorded by DCSOps to allow new types of analysis going forward.

2. Document Overview

This document is intended as a guide for the implementation of new features in DCSOps. To provide context, the first part of the document contains a description of the system's current functionality and the motivation for the new features. It then moves to provide detailed descriptions of the desired features, including UI mock ups and formulas when necessary.

1. Goals
2. Background Information
3. Prioritized Functional Requirements
4. Detailed Feature Descriptions
Appendix A: Definitions and Acronyms

3. Goals

Increase volunteer engagement by…	**Priority**
Improving the way volunteers sign up for shifts so they can be called when they want to respond and so there is better, more balanced schedule coverage overall	p0
Increasing the amount of volunteer information available to dispatchers when staffing an incident so dispatchers can quickly identify volunteers willing and likely to respond	p1
Enable measurement of improvements in volunteer engagement by…	**Priority**
Creating mechanisms for storing the data generated from these new DCSOps features	p0

4. Background Information

4.1 DCSOps – Main Components

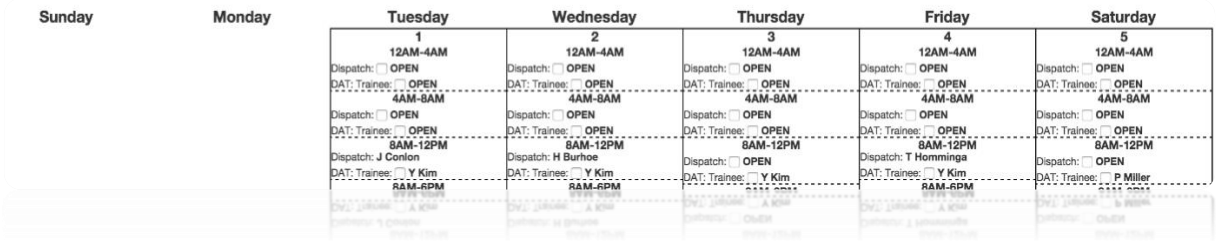
The three main components of DCSOps are the volunteer contact/notification settings manager, the DAT Scheduling tool, and the incidents reporting portal, which includes the incident staffing interface used by dispatchers. DCSOps stands for Disaster Cycle Services Operations. The DCSOps application handles the logistics of Red Cross disaster response through all stages from initially reporting an incident to choosing volunteer responders from the schedule to documenting the needs and interactions with the client both during and after the incident.

Settings Manager

The only volunteer settings that are actually stored, managed, and editable directly from DCSOps all relate to the way a volunteer is contacted by dispatch during an incident (e.g. what number dispatch should call and whether or not that number can receive SMS messages). Other volunteer information such as email and address are managed through a separate site called Volunteer Connection. This portion will not be involved in any of the new features outlined in this document.

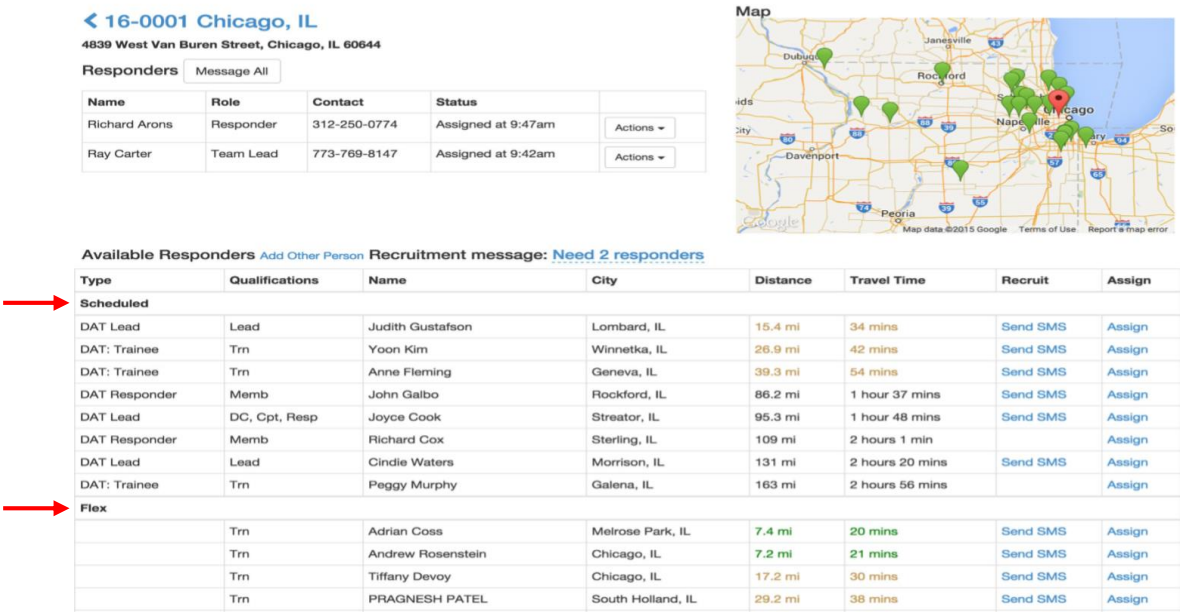
DAT Scheduling Tool

The DAT Scheduling tool is what volunteers use to put themselves on the schedule (i.e. sign up for shifts). Currently, the volunteer can view the calendar in several different formats and "filter" it in different ways (by position, region, open shifts, etc.). Volunteers in all different positions (dispatch, DAT captain, DAT lead, DAT responder, DAT trainee, etc.) utilize this calendar to sign up for shifts. DAT stands for Disaster Action Team, and is the prefix used for volunteers in positions related to incident response. Most of the DAT shifts have no limit and are therefore always "open" until after the date has passed. Dispatcher shifts close after one person has signed up. Shifts are constant, 4-hour blocks covering 24 hours a day, 7 days a week (12am-4am, 4am-8am, 8am-12pm, etc.). A volunteer can be registered to respond to incidents in several regions. The regions covered by the American Red Cross of Greater Chicago include Chicago, Greater Cook, Southwest Suburbs, and Northwest Indiana.



Incident Portal

The portion of the incident portal that is important for this project is the interface used when the dispatcher is trying to staff an incident (i.e. calling volunteers from the schedule to see if they are available to respond to a given incident). The current view is shown below. Once an incident is reported and entered into DCSOps, the dispatcher sees this screen and calls responders based on the information presented. Currently, the only volunteer information the dispatcher has to consider is positions, city of home address, and distance/travel time to the incident. Both the official schedule and the flex schedule are shown to the dispatcher on this screen. The flex schedule is a less-committal way for volunteers to list themselves as "likely to be available" and therefore willing to receive response calls. While some of the analysis and underlying algorithms described in this document relate to the flex schedule, the features to be added do not directly relate to the flex schedule as much as they do to the official schedule. Note: any reference to "the schedule" throughout this document means the official schedule (not the flex schedule).



16-0001 Chicago, IL

4839 West Van Buren Street, Chicago, IL 60644

Responders | Message All

Name	Role	Contact	Status	
Richard Arons	Responder	312-250-0774	Assigned at 9:47am	Actions
Ray Carter	Team Lead	773-769-8147	Assigned at 9:42am	Actions

Map

Available Responders Add Other Person Recruitment message: Need 2 responders

Type	Qualifications	Name	City	Distance	Travel Time	Recruit	Assign
Scheduled							
DAT Lead	Lead	Judith Gustafson	Lombard, IL	15.4 mi	34 mins	Send SMS	Assign
DAT: Trainee	Trn	Yoon Kim	Winnetka, IL	26.9 mi	42 mins	Send SMS	Assign
DAT: Trainee	Trn	Anne Fleming	Geneva, IL	39.3 mi	54 mins	Send SMS	Assign
DAT Responder	Memb	John Galbo	Rockford, IL	86.2 mi	1 hour 37 mins	Send SMS	Assign
DAT Lead	DC, Cpt, Resp	Joyce Cook	Streator, IL	95.3 mi	1 hour 48 mins	Send SMS	Assign
DAT Responder	Memb	Richard Cox	Sterling, IL	109 mi	2 hours 1 min		Assign
DAT Lead	Lead	Cindie Waters	Morrison, IL	131 mi	2 hours 20 mins	Send SMS	Assign
DAT: Trainee	Trn	Peggy Murphy	Galena, IL	163 mi	2 hours 56 mins		Assign
Flex							
	Trn	Adrian Coss	Melrose Park, IL	7.4 mi	20 mins	Send SMS	Assign
	Trn	Andrew Rosenstein	Chicago, IL	7.2 mi	21 mins	Send SMS	Assign
	Trn	Tiffany Devoy	Chicago, IL	17.2 mi	30 mins	Send SMS	Assign
	Trn	PRAGNESH PATEL	South Holland, IL	29.2 mi	38 mins	Send SMS	Assign

4.2 Motivation for update

For every incident the Red Cross responds to, approximately 70,000 each year in the United States, the goal is to have a team of responders on scene within 90 minutes. A team is made up of two people: one DAT Lead and one other DAT volunteer (either Responder or Trainee). To reach this goal, it is very important that there are enough volunteers in each position on the schedule for every single shift and that these volunteers are engaged by being given the opportunity to respond when they want to. However, analysis revealed that 12% of volunteers are given 70% of the opportunities to respond. This is a problem because it leads to a small group of highly engaged/utilized volunteers and a large group of new or unengaged volunteers that are never called by dispatch during an incident. Because the work of the Red Cross is made possible by its large volunteer base, improving volunteer engagement is a top priority.

5. Prioritized Functional Requirements

Scheduling

#	Requirement	Priority
1	When a volunteer lands on the initial "DAT Scheduling" page, they see a monthly calendar view with shifts specific to their position and *one* default region. They can navigate to calendars for other regions through a set of menu tabs.	p1
2	When viewing a schedule, volunteers can filter visible shifts by day/time preferences. These preferences will be automatically saved and will repopulate each time the volunteer logs in and views a schedule.	p0
3	When signing up for shifts, volunteers in a DAT position can click a button to see recommendations for shifts for which they are likely to be available and needed.	p0

Dispatching

#	Requirement	Priority
4	When staffing an incident, the dispatcher sees a "Pick Me!" icon next to potential responders who have specifically indicated that they want to respond.	p0
5	When staffing an incident, dispatchers sees a "Not Likely" icon next to potential responders who have extremely low response rate.	p0
6	When staffing an incident, the dispatcher sees a "Super Reliable" icon next to potential responders with exceptional response histories.	p2

Settings

#	Requirement	Priority
7	A volunteer can mark themselves as "Pick Me!" for a given scheduled shift.	p0

Analysis Metrics

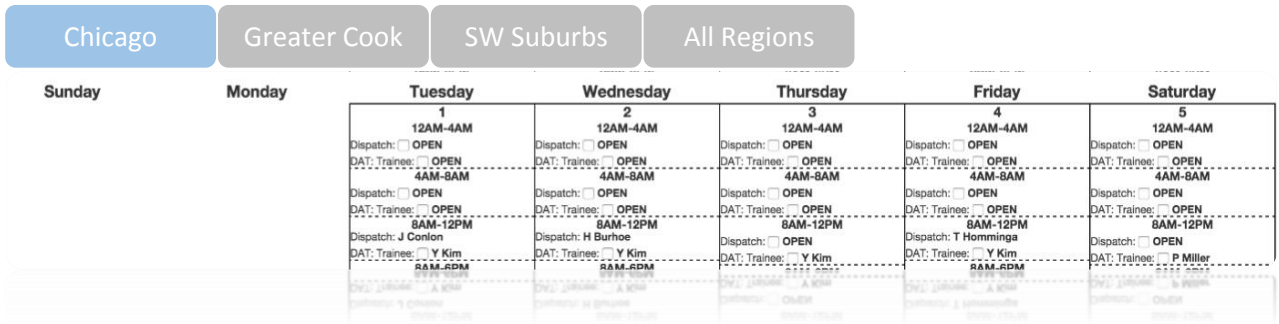
#	Requirement	Priority
8	There exists a dataset with shift scheduling information (e.g. date/timestamp a volunteer signed up for a shift, whether the shift was recommended, etc.).	p0
9	There exists a dataset that documents the volunteer information available to the dispatcher when a volunteer is called (icons, distance, etc.).	p0

6. Detailed Feature Descriptions

Requirement #1

When a volunteer lands on the initial "DAT Scheduling" page, they should see a monthly calendar view with shifts specific to their position and only *one* default region. Currently, the calendar that appears includes shifts for the volunteer's positions in all regions. By focusing in on one region, the goal is both to immediately point the volunteer to the region with the most need and to display a less cluttered, confusing calendar view.

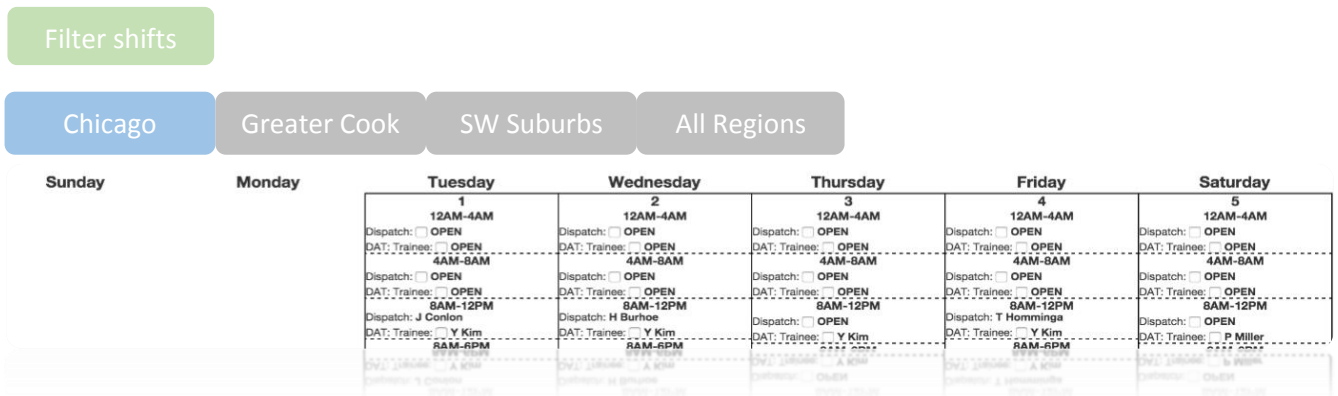
The volunteer can navigate to calendars for other regions for which they are registered through a set of menu tabs (i.e. the calendar below belongs to a volunteer registered in Chicago, Greater Cook, and Southwest Suburbs only). Additionally, there should be a tab for All Regions that shows shifts for all of the regions in which the volunteer is registered (similar to DCSOps' current My Positions view).

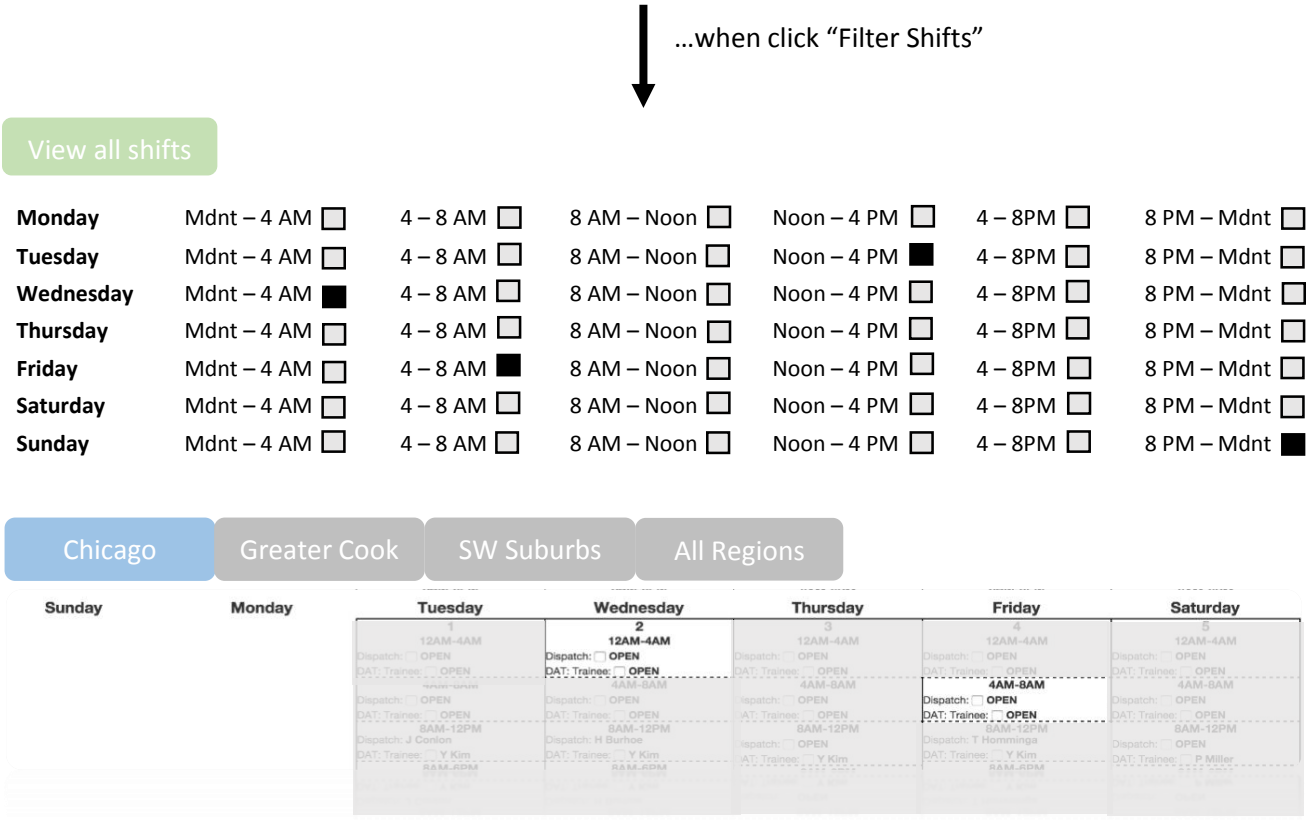


The "default" calendar for a given volunteer is determined by the incident frequency of the regions for which the volunteer is registered. The general order of incident frequency in regions handled by the American Red Cross of Greater Chicago is as follows: Chicago > Greater Cook > Southwest Suburbs > Northwest Indiana. Therefore, if a volunteer is only registered for incidents in Greater Cook and Southwest Suburbs, their default region is Greater Cook. For now, this order is static and does not depend on predicted number of incidents or lack of schedule coverage at that specific time.

Requirement #2

When viewing a schedule, volunteers can filter visible shifts by day/time preferences.





These scheduling preferences should automatically save when changed by the volunteer. Each time the volunteer logs in to DCSOps and views the filtered calendar, the saved preferences from their last session should repopulate the check boxes and filter the schedule.

These schedule preferences are linked to a specific region’s calendar.

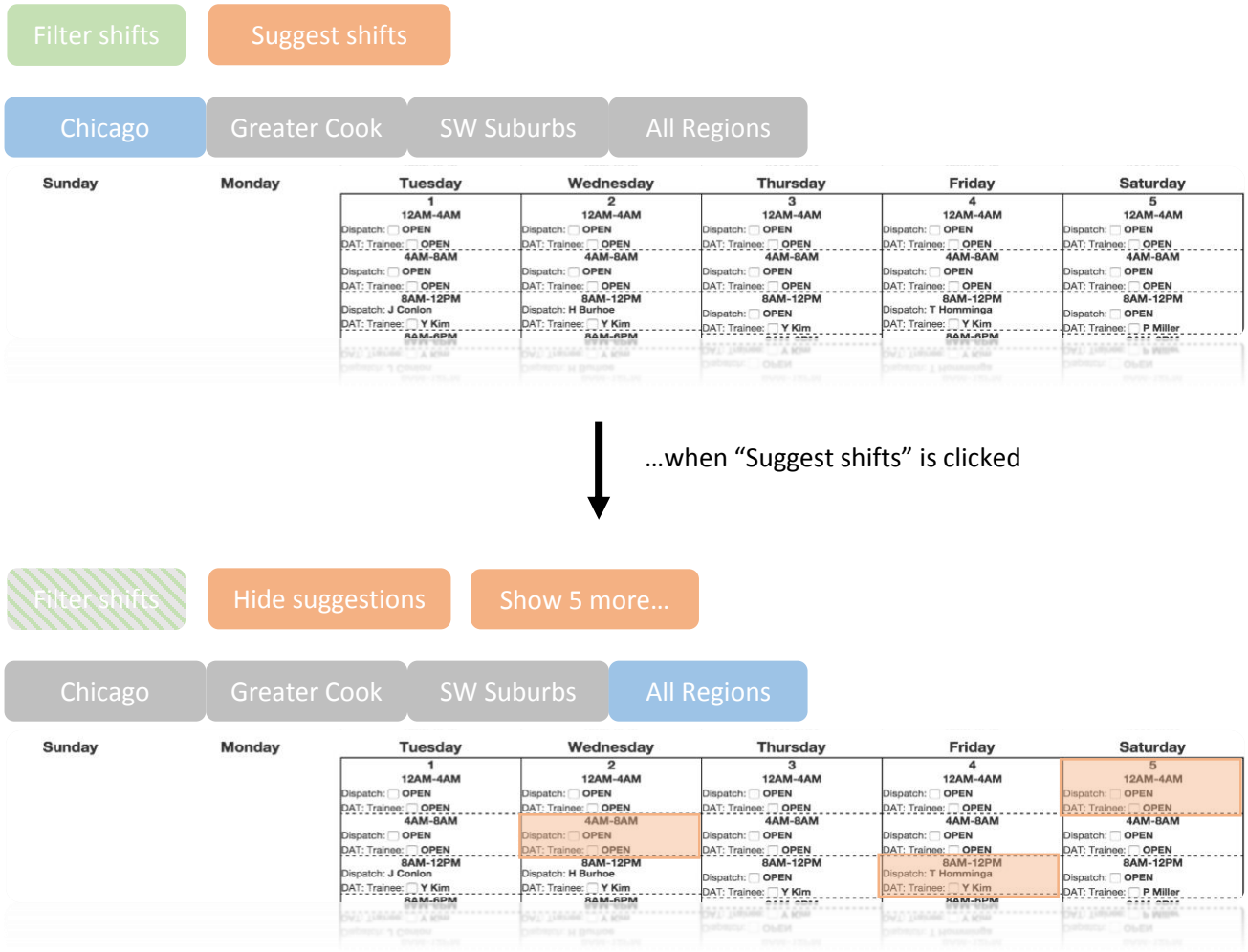
On the back end, the only additional requirement for implementing this features is the creation of a `volunteer_schedule_preferences` table that stores scheduling preferences on a “one volunteer/region pair per row” basis (example below).

Person.ID	**Region**	Mon.Shift1	Mon.Shift2	Mon.Shift3	…	Tues.Shift1	Tues.Shift2	…
8423	CHI	1	0	0		0	1	
8423	COOK	1	1	0		0	0	
6442	CHI	0	0	0		1	0	
6442	ALL	0	0	0		1	0	
2345	SUB	0	0	1		0	0	
2345	IND	1	0	1		1	0	
2345	COOK	0	0	1		0	0	

Each time a volunteer changes their scheduling preferences via the check box screen show above, the corresponding volunteer/region row in this table is updated or added. Note: the “All Regions” tab is treated as its own separate region in this context.

Requirement #3

Volunteers in DAT positions (Lead, Responder, or Trainee) should have the option of clicking a “Suggest shifts” button that highlights 5 recommended shifts over the next 30 days. Recommended shifts are a combination of those most in need of volunteers and those in which the volunteer has had successful responses in the past (formula below). The classification of shifts as “in need” is a function of expected number of incidents in that shift and number of volunteers already signed up for that shift.



When utilizing the shift recommendation tool, the volunteer should be automatically jumped to the “All Regions” tab of the calendar. Note that because shift recommendations can be for any shift over the next 30 days and it is best for all recommendations to appear on the same screen, it is likely necessary for 2 calendar months to be displayed on the same page when this feature is in use (normally only one month is displayed at a time).

When the “Suggest shifts” button is clicked, a recommendation score will be calculated for each unique shift of the next 30 days. The shifts with the top 5 recommendation scores should then be highlighted on the calendar. The volunteer should then have the option of clicking a “Show 5 more” button, a “Hide suggestions” button, or signing up for a shift directly from this screen like they normally would.

A “unique shift” here is really a region/day/time block combination, so the total number of unique shifts for the next 30 days is equal to 30 days * 6 time blocks per day * # of regions for which the volunteer is registered. Note that all of the metrics defined below correspond to unique shifts (defined at the region/day/time block level).

$$Recommendation\ Score = (Newness)(Need) + (10)(1 - Newness)(Past\ Accepts - \ Past\ Declines)$$

The various components of this formula are further defined below.

Appropriate values for the “Newness” parameter can be found in the table below. An opportunity to respond is defined as a call from dispatch while on the schedule (regardless of whether the volunteer accepted or declined the incident). This opportunity has nothing to do with the unique shift being evaluated, but is a broad measure of how new the volunteer is to DAT response.

Newness	# Opportunities to Respond, X
1.0	$X < 5$
0.7	$5 <= X < 20$
0.5	$X >= 20$

$$Need\ = \ Target\ Volunteers - \ Volunteers\ Signed\ Up$$

$$Target\ Volunteers\ = \frac{Expected\ \#\ of\ Incidents}{Shift\ Response\ Rate}$$

$$Expected\ \#\ of\ Incidents = Average\ \#\ of\ incidents\ in\ that\ unique\ shift\ over\ last\ 12\ months$$

$$Shift\ Response\ Rate = \frac{Calls\ with\ Positive\ Response}{Total\ Calls}$$

Here, Total Calls is the number of calls that the dispatcher made to volunteers during a shift in an effort to staff an incident. Note that this Shift Response Rate metric is not related to a specific volunteer, but all volunteers who were called during that shift.

$$Past\ Accepts = 0.2(Accept.Prop_R) + 0.3(Accept.Prop_{DT}) + 0.5(Accept.Prop_{RDT})$$

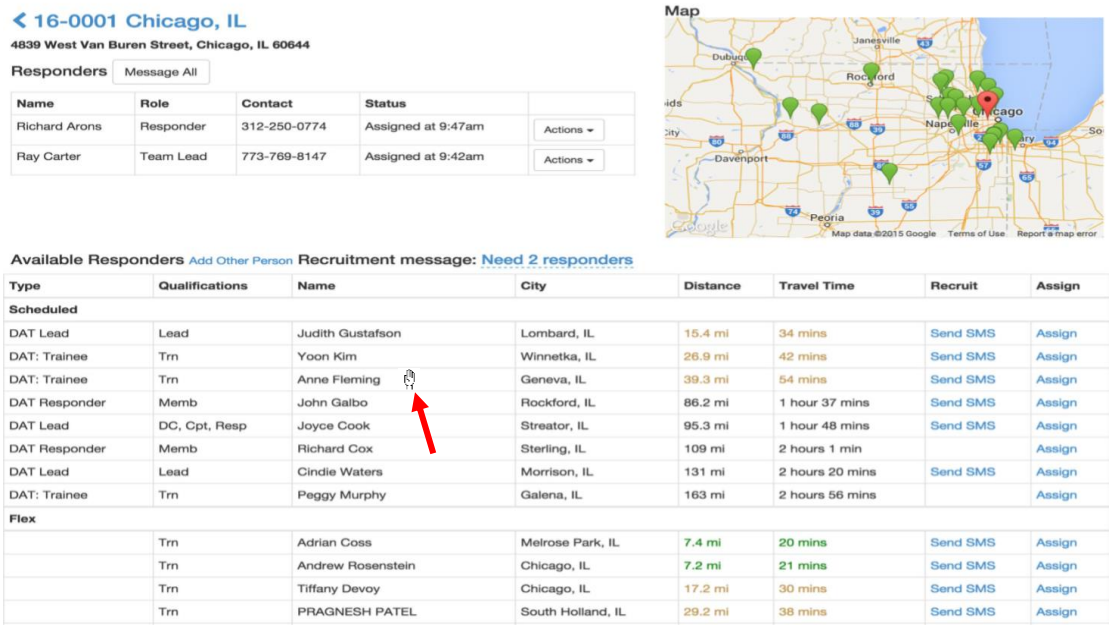
$$Past\ Declines = 0.2(Decline.Prop_R) + 0.3(Decline.Prop_{DT}) + 0.5(Decline.Prop_{RDT})$$

Accept.Prop and Decline.Prop refer to the proportion of a volunteer’s accepted opportunities and declined opportunities, respectively, that occur under the conditions of the subscript. Subscript R means region, subscript DT means day/time block, and subscript RDT means region/day/time block. For example, $Accept.Prop_{RDT}$ is the proportion of the volunteer’s accepted opportunities that occur in the same region/day/time block as the shift being scored. Similarly, $Decline.Prop_R$ is the proportion of the volunteer’s declined opportunities that occur in the same Region as the shift being scored. Note, not answering the phone when on the schedule counts as declining.

Requirement #4

When choosing from the list of possible responders on the incident dispatching portal, the dispatcher sees a special icon next to the names of volunteers who really want to get called to respond. This "Pick Me!" feature will hopefully help to balance out the number of opportunities given to the small group of "engaged" volunteers and the large group who never get called. Whether or not a volunteer has an icon next to their name is based on a setting the volunteer chooses when signing up for shifts (see Requirement #10 below). This feature only applies to the official schedule (not the flex schedule).

Sample "Pick Me!" Icon: 



Requirement #5

When choosing from the list of possible responders on the incident dispatching portal, the dispatcher sees a special icon next to the names of volunteers who have an extremely low response rate (based on the last 10 calls). This "Not Likely" feature will hopefully help dispatchers avoid wasting time when they are really in a hurry to staff an incident. Additionally, this will inform the Red Cross of volunteers who are likely better suited for different non-DAT roles. Whether or not a volunteer has an icon next to their name is based on the formula below.

A volunteer should have the "Not Likely" icon next to their name if they have been given at least 10 opportunities to respond and have declined (or not answered the phone) the last 7 in a row.

Sample "Not Likely" Icon: 

This feature applies to both the official schedule and the flex schedule, but the decision to mark someone as "Not Likely" is only based on their response history for the schedule they are currently on.

For example, if a volunteer has a perfect response rate on the official schedule but has declined 50 opportunities in a row on the flex schedule, the volunteer only gets a “Not Likely” icon by their name when they are on the flex schedule.

The UI for the incident dispatch portal as a result of this feature is the same as in Requirement #4 above.

Requirement #6

When choosing from the list of possible responders on the incident dispatching portal, the dispatcher sees a special icon next to the names of volunteers whose past response record classifies them as “Super Reliable.”

A volunteer should have the “Super Reliable” icon next to their name if they have been given at least 20 opportunities to respond and have declined (or not answered the phone) less than 10% of the time.

Sample “Super Reliable” Icon: 

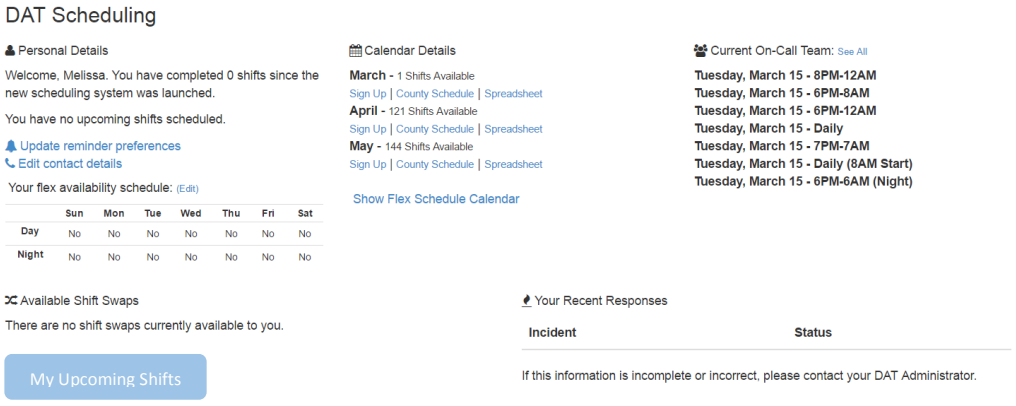
Again, this feature applies to both the official schedule and the flex schedule, but the decision to mark someone as “Super Reliable” is only based on their response history for the schedule they are currently on.

The UI for the incident dispatch portal as a result of this feature is the same as in Requirement #4 above.

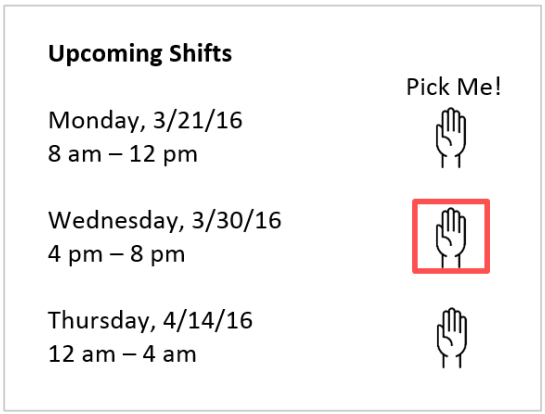
Requirement #7

When a volunteer signs up for a given shift, they should have the option of marking themselves with the “Pick Me!” icon for that shift so they are more likely to be called during an incident. This hopefully will be a good way for newer, more under-engaged volunteers to get an opportunity to get involved.

To make this possible, there needs to be a basic button or link on the DAT Scheduling main screen (the view with Personal Details, Calendar Details, Current On-Call Team, etc.) that, when clicked, leads to a page that list the shifts for which the volunteer is currently signed up. On this page, they can select the “Pick Me!” icon next to a shift. When a reminder is sent out to a volunteer about an upcoming shift, there should be a link to this page to remind volunteers of the “Pick Me!” option.



…when “My Upcoming Shifts” is clicked



Requirement #8

Once volunteers have the option of receiving shift recommendations, it is very important for the Red Cross to have the ability to measure the effect this feature has on volunteer engagement and schedule coverage overall. Therefore, there needs to exist a `shift_signup` table in the following format:

Person.ID	**Shift.ID**	Signed.Up	Suggested	Newness	Need	Past.Accept	Past.Declines
8638	CHI-2015-05-08-S1	2015-04-17 04:12:09	1	0.7	.45	.72	0.03
8638	SUB-2015-06-28-S3	2015-06-23 18:37:26	0	0.7	.32	.13	0.21
4220	IND-2015-09-30-S2	2015-09-01 10:42:03	0	1.0	.06	.03	0.13
9728	CHI-2016-04-01-S4	2016-02-14 16:52:58	1	0.5	.91	.29	0.09

Every time a volunteer signs up for a shift, a record in this `shift_signup` table needs to be generated. Note that Volunteer ID and Shift ID together make the primary key and that Shift ID is just a unique identifier for a given shift (region, date, time block). See Requirement #3 for definitions of Need and Past Success.

Requirement #9

It is very important for the Red Cross to know which features of the Incident Portal are valuable to dispatchers when they are staffing incidents. To store data this data, the following columns needs to be added to the `incidents_responder_assignments` table.

Incident.ID	**…**	**Person.ID**	PickMe	NotLikely	SuperReliable	Distance
37029		8638	1	0	0	4.3
37029		2381	0	0	1	15.9
37029		4220	0	1	0	11.3
46138		9728	1	0	1	7.8

Appendix: Definitions and Acronyms

ARC – American Red Cross

ARCGC – American Red Cross Greater Chicago

DAT – Disaster Action Team

DCSOps – Disaster Cycle Services Operations

Dispatcher – Red Cross volunteer who is responsible for calling potential responders to staff an incident as quickly as possible

Potential responder – Red Cross volunteer who is either on the schedule or the flex schedule. The dispatcher can call them and ask them to respond to an incident, and the potential responder can accept or decline.