Development of an Excel-Based Software Solution to Collegiate EMS Shift Scheduling & Placement

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POSTER PRESENTATION ABSTRACT | PROGRAM DEVELOPMENT & EVALUATION CATEGORY

Introduction: For variably-scheduled volunteer EMS organizations, scheduling becomes a priority to sustain services to the community. EMS leadership must fill each shift by placing EMTs on shifts that best match their availability. With approximately 50 EMTs, 20 of whom lead calls, the University of Pennsylvania's Medical Emergency Response Team (MERT) covers 18 shifts per week, with 2-4 EMTs on each shift. Each week, MERT volunteers submit availability digitally. Prior to implementation of the current system, the scheduling coordinator would aggregate the schedule options submitted and assemble the schedule by hand. This system was inefficient and imperfect.

Program Development & Implementation: While there are commercial solutions available, over Fall 2018, MERT developed an Excel-based solution customized to the agency's needs. The result is an Excel-spreadsheet-based algorithm that interprets the availability and optimizes the number of covered shifts based off availability responses. A binary variable was generated for each person and each potential shift. Constraints limited total shifts an EMT could take, defined a filled shift, and ensured that EMTs were only slated when they were available. This generated a linear model that the Excel OpenSolver add-on optimizes to preferentially fill shifts and match providers to empty shifts. The solved model is then interpreted by an array function with conditional formatting to output a formatted schedule. Additional options are available on the front-end to force the solver to provide for shifts with two crews, athletics events, and/or call reviews.

Program Evaluation: With implementation over 8 scheduling cycles, the model increased the proportion of fully covered shifts from 56% to 76% ($P < 0.03$) and partial coverage from 85% to 97% when the schedule was released ($P < 0.05$). This model now allows maximal coverage when the schedule is first released and has dramatically reduced the time needed to manually schedule providers.

Discussion/Conclusions: A similar model could potentially be utilized by other collegiate EMS organizations, without cost, to optimize availability and maximize coverage.

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