

Measuring the Efficiency of Schedules

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This is the ninth article of a series on jail staffing analysis, exploring the methodology developed by the National Institute of Corrections and presenting enhancements developed since NIC's latest workbook¹ was published. In this article, we focus on staff schedules again, introducing a new tool that measures scheduling efficiency.

Staffing costs represent more than half of jail operating costs, often more than 70% of the annual costs. Most jails cannot afford to waste any of their staffing resources, and a review of scheduling efficiency measures the extent to which hours are scheduled when they are not needed.

Believe it or not, there are times when more employees report for duty than are needed to meet coverage needs in some jails. Of course supervisors rarely complain about this windfall, and often find creative and effective ways to use the extra hours. But when employees work their regular hours but do not address coverage needs, it usually creates a shortfall later in the fiscal year.

Before we describe efficiency methodology, let's put the budgeting process in the context of the overall staffing analysis process.

A Schematic Diagram of the Staffing Analysis and Budgeting Process

Figure 1 describes the process through which needs are identified, coverage is determined, and the "math" of calculating Net Annual Work Hours (relief factors) and determining budget needs.

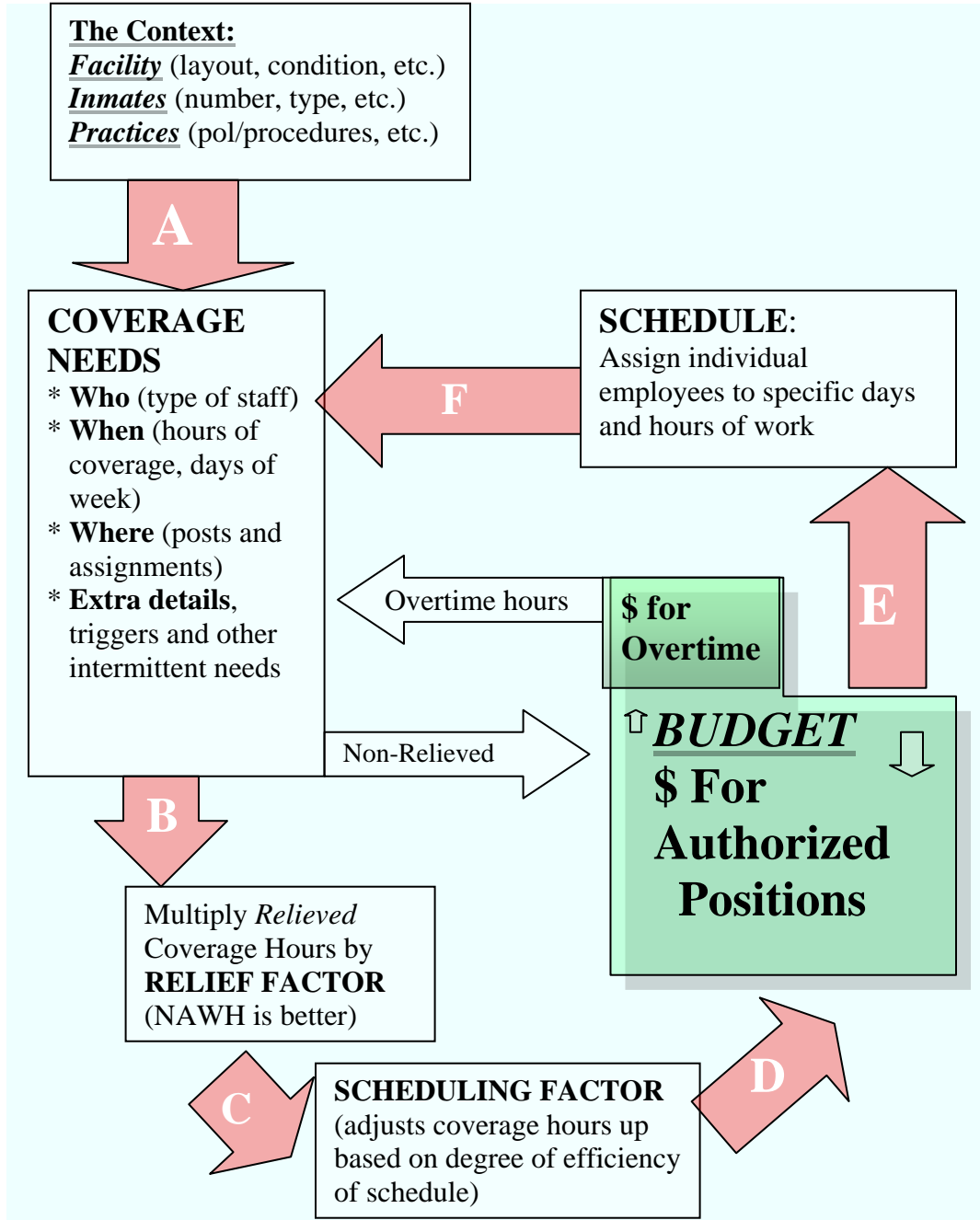
The road to providing sufficient staffing is fraught with error. The following list describes *some* of the difficulties encountered in this process, using the letters on each arrow of the flowchart to indicate the point at which the difficulties are encountered:

- A. Incomplete or inaccurate characterization of the context. Not using data fully, not identifying changes and trends. The context needs to be updated yearly in order to avoid this error.

- B. Underestimating coverage needs by not evaluating sufficiency. Failing to find ways to "work smarter" with what we have (such as using staffing overages to cover needed details such as training or searches). Not using data to refine coverage needs.

¹ **Staffing Analysis Workbook for Jails**, First Edition. Rod Miller and Dennis Liebert. National Institute of Corrections, Washington D.C. 1987. Second Edition published 2003. The NIC methodology has been embraced by jails throughout the United States and has also been adopted by police, fire, transportation, health care and nursing home operations.

Figure 1: Staffing Analysis Flowchart



- C. Inaccurate calculation of Net Annual Work Hours (NAWH) or “relief factor.” For example, if you have overestimated NAWH by ten percent and you have 100 FTE correctional officers, you will be 10 FTE short in your budget.
- D. Inefficient schedule(s) and/or failure to account for the inefficiency of schedules.
- E. Unable to fill authorized positions, or to keep them filled.

- F. Employees who are actually deployed are not fully effective due to fatigue, lack of training, lack of experience, and other factors.

These are just a few of the difficulties and deficiencies that may occur at *any* of these stages to reduce the adequacy of the staffing practices that are finally employed. Many jails wrestle with *most* of these issues and more.

Why Measure Scheduling Efficiency?

Our focus in this article is to demonstrate how schedules vary in their efficiency and to introduce a new methodology to calculate the efficiency of schedules to inform the budget-setting process. If your schedules are not 100% efficient, you must determine the extent to which employees' regular work hours are lost, and ask for sufficient budget resources to compensate.

Just as we calculate Net Annual Work Hours (NAWH) to identify the hours that employees are away from their posts with pay, measuring scheduling efficiency identifies the hours that employees' efforts are misplaced.

Back to Coverage as the Benchmark

Start by revisiting your coverage needs (Step 4 of the NIC process) to determine if they represent the "minimums" that are acceptable, or if they sometimes describe optimal staffing levels. Ask yourself whether any lower level of staffing would result in unsafe or insecure operations. If the answer is yes, then your coverage levels are minimums.

Identify Minimum Staffing Levels

If your coverage needs do not represent "minimums", you will need to establish minimum levels of staffing for each shift and each day of the week. These minimums provide the bottom line below which staffing levels must not drop. Minimum staffing levels will vary from shift to shift, and sometimes from day to day.

Describe Staffing Levels and Contingencies

Written policies and procedures must anticipate various contingencies that will be encountered, providing clear instructions for each situation. These contingencies will include times when:

- Staffing levels are temporarily below minimums
- Staffing levels are temporarily higher than coverage needs prescribe

When staffing levels fall short of minimums, supervisors must know what steps are to be taken, such as:

- Instituting mandatory overtime to fill vacancies

- Calling part-time personnel to fill vacancies
- Operating below minimum levels and altering operations to compensate for staffing shortfalls (e.g. which post[s] may be unfilled, what services or activities are to be suspended)

Some jails encounter chronic problems filling their shifts. Although budgets authorize sufficient positions, they are not able to hire and retain enough employees to fill the roster. Overtime is used to fill shift vacancies, but employees have limits to the number of hours and days they may safely work. These jails often set up a hierarchy of operational decisions that respond to the actual level of staffing that occurs on each shift, such as:

1. One employee short on Shift A, Tuesdays: Suspend inmate outdoor recreation.
2. Two employees short on Shift A, Tuesdays: Suspend inmate programs.
3. Three employees short on Shift A, Tuesdays: Suspend inmate visitation.
4. Four employees short on Shift A, Tuesdays: Close program center.

This approach reduces the levels of activities, and even closes certain areas of the facilities, in response to staff shortages. Another facility has a procedure for implementing “rolling lockdowns” when insufficient numbers of employees are available, confining inmates to their cells and reducing staffing levels in response.

Practices Must be Consistent

Policies, procedures and post orders provide the foundation for jail operations. Failing to consistently comply with these directives erodes the safety and security of the jail, and exposes all parties to liability. Daily practices must comply at all times and under all circumstances.

Two Approaches to Scheduling Staff

Scheduling is the process of assigning individual employees to specific hours and days of work:

1. Assigning the exact number of employees to match the minimum staffing levels for each shift.
2. Assigning extra employees in anticipation of absences (in effect “overbooking” a shift anticipating that some employees will not appear for work every time they are scheduled).

The first approach relies on employees who are working overtime, or part-time employees, to fill intermittent vacancies on shifts and ensure sufficiency.² This approach rarely results in scheduling inefficiencies because the number of employees who report for duty does not exceed the minimum levels.

² In some larger facilities, some employees are scheduled to be part of a “pool” that is available to backfill vacancies as needed, using regular hours instead of overtime or part-time employees.

The second approach acknowledges that employees have many reasons for failing to report for a given shift. As a rule of thumb, an employee will not be available for 15 to 20 percent of the days for which he/she is scheduled. The Net Annual Work Hours (NAWH) calculations reflect this phenomenon.

In practice, the second approach will produce more shifts above minimum but *either* approach may result in inefficiencies depending on the shift configuration that is used. Scheduling poses a difficult balancing act between sufficiency and efficiency.

Shift Configurations

In the last issue we examined “shift configurations” which consists of:

- Number of hours that comprise a shift
- Start and end times for each shift
- Employee Regular Days Off (RDO)

We noted that many jails use more than one shift configuration as a creative solution to meet staffing needs. Now we provide a tool to evaluate the efficiency of various shift configurations. Each shift configuration will bring its own challenges in terms of efficiencies. Also, the number of employees who are to be scheduled often creates inefficiencies when combined with the shift configuration. Consider Figure 2, which schedules 9 employees for 8-hour shifts. The total number of employees who appear each day varies from 5 to 7.

Figure 2: Illustration of 8-Hour Shift Schedule with 9 Employees

Staff Name	Mon	Tues	Wed	Thur	Fri	Sat	Sun	Weekend Days Off
1. Carole	X	X	X	X	X	O	O	2
2. Larry	X	X	X	X	O	O	X	1
3. Jean	X	X	X	O	O	X	X	0
4. Moe	X	X	O	O	X	X	X	0
5. Rudolph	X	O	O	X	X	X	X	0
6. Susan	O	O	X	X	X	X	X	0
7. James	O	X	X	X	X	X	O	1
8. Barbara	X	X	X	X	X	O	O	2
9. Nancy	X	X	X	X	O	O	X	1
TOTAL On Schedule by Day	7	7	7	7	6	5	6	(7)

But if only 7 employees were being scheduled (Figure 3), the number who appear each day would be the same (5). This demonstrates the impact that the number of employees may have on the consistency of a schedule, and ultimately on the efficiency of a schedule. When using a 5 on- 2 off shift configuration, multiples of 7 employees will produce level results.

Figure 3: Illustration of 8-Hour Shift Schedule with 7 Employees

Staff Name	Mon	Tues	Wed	Thur	Fri	Sat	Sun	Weekend Days Off
1. Carole	X	X	X	X	X	O	O	2
2. Larry	X	X	X	X	O	O	X	1
3. Jean	X	X	X	O	O	X	X	0
4. Moe	X	X	O	O	X	X	X	0
5. Rudolph	X	O	O	X	X	X	X	0
6. Susan	O	O	X	X	X	X	X	0
7. James	O	X	X	X	X	X	O	1
TOTAL On Schedule by Day	5	5	5	5	5	5	5	(4)

Similarly, many 12-hour shift configurations operate with teams that work opposite schedules.³ When the total number of employees on the two teams is an even number, the resulting schedule will provide level staffing levels, while an odd number of staff assigned to the two teams will produce different levels of staffing half of the time.

Measuring Schedule Efficiency

As with measuring sufficiency, the coverage plan is the foundation for measuring efficiency. If your coverage plan does not represent your minimum staffing levels, your minimums will be used instead.

When you developed your coverage plan (Step 4 of the NIC process) you identified the number and types of staff needed using a spreadsheet. This provided the basis for the mathematical calculations that are needed to determine the number of full-time-equivalent (FTE) staff needed in the budget. In our seventh article, we introduced a new tool, "Form E."⁴

To evaluate the sufficiency of a schedule according to shift assignment levels, Use Form E to identify the work days and off days for each staff member assigned to a shift. Use a "1" to record a work day, and a "0" (the number zero, not the letter o) to record a scheduled off day. Figure 4 provides a sample of Form E, using a shift that has 20 staff assigned to it.

When you are finished recording the work and off days for each employee, add the numbers in each column to determine how many persons are scheduled for each day (A). Enter the totals from the coverage plan below the scheduled coverage figures (B), and

³ An example is the 4/3, 3/4 schedule that repeats every two weeks. Team 1 would have the first four days off, while Team 2 would be working those four days. Team 1 would work the next three days while Team 2 is off. Another balanced shift configuration would be a 4/4, 3,3.

⁴ The NIC workbook provides forms A through D, therefore E is the logical label for this new tool.

then calculate⁵ the difference (C) between scheduled staff and coverage needs with this simple formula:

$$\text{Scheduled Hours } \textit{minus} \text{ Coverage Hours} = \text{Difference (plus or minus)}$$

Figure 4: Sample Form E - Excerpt (Top of Form)

Staff Member Code	Sun	Mon	Tues	Wed	Thur	Fri	Sat	Total Days Worked
1	0	1	1	1	1	1	0	5
2	0	0	1	1	1	1	1	5
3	0	1	1	1	1	1	0	5
4	0	1	1	1	1	1	0	5
5	0	1	1	1	1	1	0	5
6	0	0	1	1	1	1	1	5
7	1	0	0	1	1	1	1	5
8	1	0	0	1	1	1	1	5
9	1	1	0	0	1	1	1	5
10	1	1	0	0	1	1	1	5
11	1	1	1	0	0	1	1	5
12	1	1	1	1	0	0	1	5
(continue until all staff are shown) ▼								

1 = work day 0 = day off

Figure 5 provides a sample of the bottom of Form E. This technique produces *quantifiable* results. A template for Form E is provided, along with this sample, at our national clearinghouse (www.staffinganalysis.com).

When the schedule falls below minimum coverage needs, the difference (C) will be a negative number. When the two numbers match, your schedule has efficiently provided the right number of staff to meet coverage needs. When there is a positive number, your schedule provides more staff than you have determined are needed. In others words, when the difference between scheduled hours and coverage hours is:

- a negative number, your schedule is *insufficient* to meet coverage needs
- a positive number, your schedule *exceeds* coverage needs
- zero, your schedule *matches* coverage needs

⁵ Form E has this, and other formulas, embedded in the template.

Figure 5: Sample Form E - Excerpt (Bottom of Form)

Staff Member Code	Sun	Mon	Tues	Wed	Thur	Fri	Sat	Total Days Worked
1	0	1	1	1	1	1	0	5
▼								
19	1	1	1	1	0	0	1	5
20	1	1	1	1	1	0	0	5
A. Total Scheduled	13	15	15	14	14	15	14	100 shifts scheduled
B. Total Coverage Needed	12	16	14	13	14	14	15	98 shifts needed
C. DIFFERENCE (B minus A)	1	-1	1	1	0	1	-1	2
D. Shortfalls (Schedule is <u>less</u> than coverage needs)		-1					-1	-2
E. Excess (Schedule is <u>over</u> coverage needs)	1		1	1		1		+4

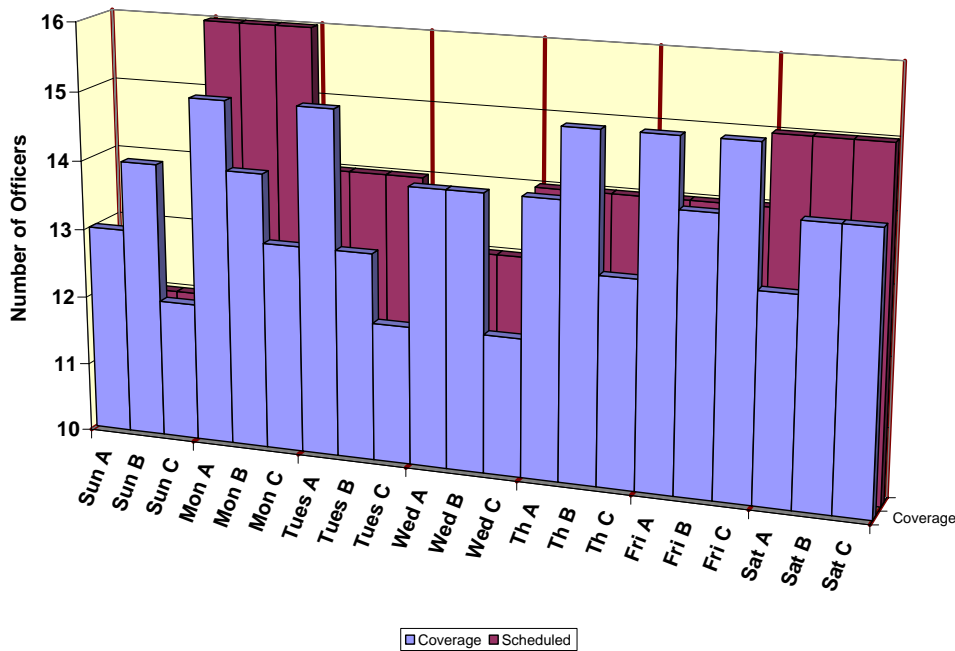
Note that Form E posts negative numbers in one row, and positive numbers in another. This is necessary to ensure that you generate a separate count of positive and negative number, and not to combine them. The grand totals on the form indicate the number of hours under, and over, for the cycle.

The spreadsheet also provides the ability to *graphically* identify the hourly relationship between the schedule and coverage needs.

Is the Schedule Efficient?

Fortunately, the same techniques used to determine sufficiency also indicate efficiency. A negative number in our previous calculations told us that the schedule was insufficient. A positive number (see Figure 5) suggests that the schedule is *inefficient*. The positive figures and totals in Figure 5 numerically suggest the efficiency-- or lack of efficiency. Figure 7 graphically identifies the times that the schedule *exceeds* coverage needs by showing where columns in the rear (scheduled hours) are higher than the coverage needs in the front. The extent to which the scheduled hours in the back appear suggests the degree to which the schedule exceeds coverage needs.

Figure 6: Coverage Needs Compared to Scheduled Hours



Few jails have enough money to assign staff when they are not really needed. Sure, we can always use more staff at just about any time, but remember there are costs associated with these windfalls. For every hour that a staff member works above coverage needs, that hour is no longer available to be used to meet coverage needs at regular pay. When an employee’s regular hours are used up, you must pay a 50% premium as overtime or compensatory time, and the costs will mount even faster.

Next time, we’ll add the “math” to these calculations by looking at some actual practices of jails around the country, and there-by showing you, how to create, a *Scheduling Factor*

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The materials identified in this article, along with many other resources, are available at no cost at our on-line staffing analysis clearinghouse: www.staffinganalysis.com. The clearinghouse is a service provided by CRS, Incorporated, a non-profit organization (www.correction.org).

Rod Miller has headed CRS Inc. since he founded the non-profit organization in 1972. He is the author and co-author of numerous texts and articles on various aspects of jail planning, design, and operations. For more information, contact him at rod@correction.org, 925 Johnson Drive, Gettysburg, PA 17325, and (717) 338-9100.

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