Title
Project Management for the Health Professional

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Project Management for Health Professionals

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Abstract

Public health and health services planning, training, implementation, evaluations, and corrective actions are all implemented as a series of projects. In this review we cover practical project management concepts and techniques applicable to public health and health services projects. Traditional project management provides practical concepts and tools that can be applied in many settings. Readers will learn how to supercharge their productivity by learning the essentials of project management relevant to health-related projects.

Keywords: Project management, Public health, Health services

1. Introduction

A *project* is a temporary endeavor to produce a unique product or service [1]. A *program* is collection of projects that share a purpose. *Operations* is an ongoing, repetitive set of activities that sustain an organization ("business as usual"). Modern public health practice consists mainly of project activities (e.g., public health anti-smoking media campaign). *Project management* consists of methods and techniques based on accepted management principles for planning, estimating, and controlling work activities to reach a desired result on time, within budget, and according to specification [2]. Yet, public health professionals receive little to no formal training in project management. This is not surprising when we realize that the *Core Competencies for Public Health Professionals* do not even include basic project management as a core competency [3]. If project success means completing projects on schedule, within budget, and with high quality deliverables, then the majority of public health projects actually fail!

With honest reflection, most of us will admit to having worked on or led projects that were late, incomplete, over budget, or that produced deliverables that did not meet stakeholder[1] expectations. Some of us currently work on projects that are in trouble. Most of us have horror stories of hired consultants who failed to produce project deliverables to our satisfaction. Finally, most of us work on multiple projects with a diversity of stakeholders, and some of us feel overextended, overwhelmed, and stressed! We believe that if we were just better at "time management" everything would get back on track. Wrong! What we actually need are core competencies in project management.

[1] Anyone who contributes to or is impacted by the project.

Public health and health services planning, training, implementation, evaluations, and corrective actions are almost all implemented as a series of projects. Likewise, a health program may be a series of interconnected, interdependent projects.

Here are predictable and avoidable pitfalls every project faces [4]:

1. Not being sufficiently client and/or customer-focused
2. Unclear goals and/or solutions
3. Poor communication with stakeholders
4. Unclear roles and responsibilities
5. Poor plans and schedules
6. Poor risk planning and mitigation
7. Uncontrolled scope and not prioritizing
8. Not anticipating and accomodating change
9. Not challenging assumptions and beliefs
10. Not managing expectations of stakeholders
11. Not enough support from upper management
12. Not learning from experiences and mistakes

Most of these pitfalls are self-evident, yet they continue to occur project after project. In theory, we could converge to better practices through trial and error, lessons learned, and continuous improvement—and some do. However, it is much more efficient to learn from decades of project management experience and research. We can and will avoid such predictable pitfalls through basic project management.

More precisely, a project is "a sequence of unique, complex, and connected activities that have one goal or purpose and that must be completed by a specific time, within budget, and according to specification" [5]. All project

Figure 1: The Scope Triangle [5]

management approaches must answer the following six questions [5]:

1. What problem or opportunity is being addressed? (goal)
2. What solution is needed? (vs. what is wanted)
3. What will we produce? (requirements)
4. How will we do it? (project plan)
5. How will we know we did it? (success criteria)
6. How well did we do? (product & process quality)

We cannot emphasize enough the importance of distinguishing between what is *needed* versus what is *wanted*. Our tendency is to express what we want rather than what we actually need to solve a problem or to exploit an opportunity. To embark on a project based on wants is risky because eventually we discover that the project deliverables are not what is needed.[2]

Requirements comprise the detailed, accurate specifications of a solution. If the requirements are not completely known, then the project management approach must accomodate learning and discovery in order to converge to the best solution given existing constraints (see Scope Triangle). In public health, learning and discovery are integral parts of research, evaluations, and field investigations.

1.1. The Scope Triangle

All projects are constrained by time, costs, available resources, scope, and quality goals. Historically, this was called the "triple constraints" which consisted of time, costs, and scope, each on a side of a triangle. Sometimes costs included resources, and scope include quality. We prefer the Scope Triangle (Figure 1) that graphically depicts that scope and quality are shaped and constrained by time, costs, and available resources.

All projects have primary drivers, which comprise the highest priority component(s) of the Scope Triangle. For example, after the emergence of the novel influenza A (H1N1) in spring 2009, nations set out to produce a new influenza vaccine for the fall/winter season. Therefore, time was a primary driver, as were scope (enough vaccine), and quality (safe vaccine). In order to produce enough safe vaccine for the fall (primary drivers), governments needed to ensure sufficient funding (cost driver) to manufacturers (resource driver). In public health emergency response activities, time is often the primary driver. In general, efforts to address one constraint affects the others. In other words, there is "no free lunch."

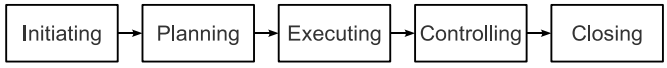

Figure 2: The Project Management Process Groups

1.2. Project Management Process Groups

The good management of projects share common processes. The Project Management Institute (PMI) has defined a core set of processes called *Process Groups* (Table 1). Most project management approaches can be studied and understood using these Process Groups. For our purposes, we will review these processes as sequential (Figure 2). In actual practice; however, project management methodologies have diverse implementations referred to as "project management life cycles".

From a management perspective, the initiating, planning, and controlling processes are the most important. In the initiating process the project manager determines what will be done (solution) and why (goal), and selects the best project management approach. In the planning process the project manager determines how (work breakdown structure) and when (schedule) it will get done, and who will do it (resource leveling). And in the the controlling process the project manager will measure and evaluate progress, and will implement corrective actions to stay or get back on track. From a technical perspective, the execution process launches project activities that are discipline focused (e.g., setting up and running a mass vaccination clinic). The closing process formally ends the project.

Table 1: The Project Management Process Groups Descriptions

Process Group	Description
Initiating	Develop statement of work that summarizes the public health value, goal, and solution of the project. Determine best project management approach.
Planning	Identify work and estimate time, cost, and resource requirements and gain approval.
Executing	Launch and coordinate the people and resources to implement the plan.
Controlling	Ensure project objectives are met by monitoring and measuring progress regularly to identify variances from the plan so that corrective actions can be taken.
Closing	Formalize acceptance of the project deliverables and ending the project.

[2]Tip: A good consultant will ask many questions to uncover actual needs.

1.3. Project Management Knowledge Areas

Next, the Project Management Institute has specified nine core *Knowledge Areas* that are applied within each Process Group:

1. Integration Management
2. Scope Management
3. Time Management
4. Cost Management
5. Quality Management
6. Human Resources Management
7. Communications Management
8. Risk Management
9. Procurement Management

The Process Groups and the Knowledge Areas are interdependent (see Table 3). Integration Management integrates all the deliverables (e.g., Project Charter, Statement of Work, and Project Plan) from the Process Groups into a unified whole; monitors and controls project work; integrates change control, and closes the project. Scope Management involves identifying, gathering, and documenting requirements; selecting the appropriate project management approach; developing the work breakdown structure; and implementing a change control process.

1.4. Project Management Life Cycle

The project management life cycle (PMLC) is a sequence of processes that include the five Process Groups. A valid PMLC always starts with a single initiating process and ends with a single closing process. The intervening processes must each be done at least once and may be repeated any number of times in some logical order [5]. In this review we borrow heavily from Eric Verzuh's PMLC displayed in Figure 3 [1].

When the goal and solution of the project are known and specified, we use traditional project management (TPM) (Table 2). When the goal of the project is known, but the solution is incomplete or unknown, we need a project management approach that accommodates learning and discovery in order to converge to the best solution given existing constraints. Agile Project Management (APM) [5] is an approach that explicitly integrates learning and discovery. For all approaches, we use the Initiating Process to gather the information to decide which PMLC approach

Table 2: Project Management Life Cycle Appoach Matrix

	Solution	
Goal	Clear	Not clear
Not clear	Extreme PM*	Extreme PM
Clear	Traditional PM	Agile PM

* Variant of Extreme PM

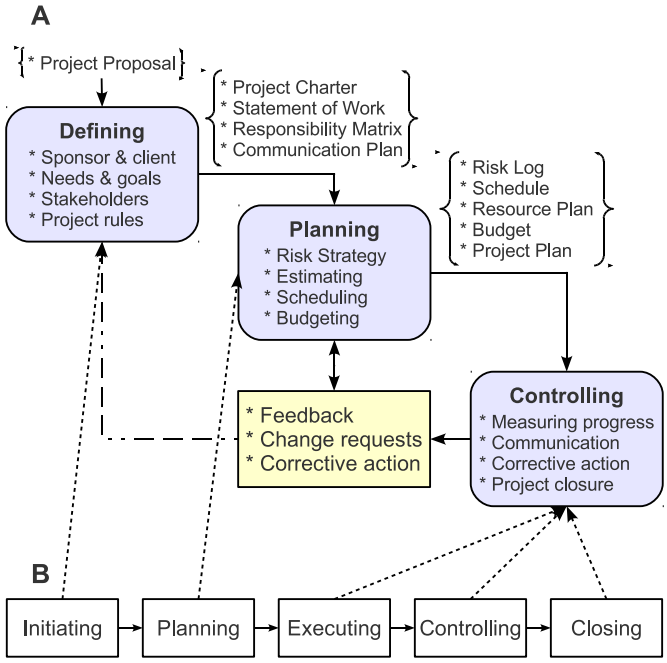

Figure 3: (A) Project Management Functions (a Traditional Project Management Life Cycle), adapted from Verzuh, 2008 [1], is mapped to (B) the project management Process Groups. The brackets contain key documents used to define, plan, and contol the project.

is suited for a specific project. In this review we cover traditional project management.

In summary, when the goal is known and the solution is completely known, we use a TPM approach (described in this review). When the goal is known and the solution is incomplete or unknown, we would use an APM approach. Although it is beyond the scope of this review, for other goal-solution scenarios we would use extreme project management or a variant. See Table 2 for summary.

2. Defining the Project (Initiating Process Group)

Traditional project management is used when, after the initiating process, the project goals are clear and the solution (requirements) is completely known and specified. That is, the *why* (goal) and *what* (solution) are known.

Table 3: Mapping of the Nine Knowledge Areas to the Five Process Groups (Adapted from Wysocki [5])

Knowledge Area Management	Initiating	Planning	Executing	Controlling	Closing
Integration	●	●	●	●	●
Scope	●	●		●	
Time	○	●		●	
Cost	○	●		●	
Quality	○	●	●	●	
Human Resources		●	●	●	
Communications		●	●	●	
Risk		●		●	
Procurement		●	●	●	●

Next, in planning, the *how* is broken down into tasks (work breakdown structure) and sequenced (network diagram); the *when* is scheduled (Gantt chart); and the *who* (resources) are assigned (resource leveling). Only with this level of detail can we develop a realistic budget (costs) and timeline. We combine this with management plans for change requests, quality, communications, risk, and procurement into a Project Plan. With an approved plan we launch our project (executing), monitor and implement corrective actions (controlling), and eventually deliver the solution and complete the project (closing).

Traditional project management is designed to move sequentially through the Process Groups. Once the project plan is developed, change is minimized (even discouraged) by instituting a change management plan. In this section we review traditional project management based on a project management life cycle adapted from Verzuh [1]. Verzuh defines project management functions as *defining*, *planning*, and *controlling* the project (Figure 3). These functions are repeated as necessary to manage a project. We mapped his approach back into the Process Groups for learning purposes.

Defining a project requires the following steps:

1. Identify and engage stakeholders;
2. Elicit true needs and project goal;
3. Gather requirements (requirements breakdown structure); and
4. Write the "project rules";
   (a) Project charter
   (b) Statement of work
   (c) Responsibility matrix
   (d) Communication plan

To collect, synthesize, and summarize this information will require several meetings. It is very important that we invest adequate time into this phase because we need to not only define the scope of the project, but also determine the project management methodology (TPM vs APM).

2.1. Identify and Engage Stakeholders

A stakeholder is anyone who will contribute to or be impacted by the project. To identify stakeholders we ask the following questions: (a) Who is the client or customer? (b) Who is on the project team? (c) Who will make a contribution?, and (d) Who will be affected by this project? The best approach is to conduct a systematic, comprehensive *stakeholder analysis* (see Appendix A). The information collected will be incorporated into the responsibility matrix and the communication plan.

Project stakeholders play different roles: (a) project manager; (b) project team; (c) management; (d) client or customer; (e) representatives of external constraints; and (f) advocates, opponents, and bystanders. From management, every project needs three types of support:

- Sponsorship: an executive accountable for project success;
- Resources: functional managers that will assign staff and resources to our project; and
- Decision authority: managers that influence project success because they represent organizational authority, policy, or assets.

A sponsor is the person with formal authority who is ultimately responsible for the project. A sponsor's primary role is to help the project team succeed, and their primary contribution is through their authority. Sponsors will exercise their authority in the following ways: (a) authorize a project charter; (b) assist in developing the responsibility matrix; (c) review and approve the statement of work; (d) review and approve the project plan; (e) meet with and advise the project manager regularly; and (f) assist the project manager in overcoming organizational obstacles.

Every project has a client or customer. A client could be funding the project and/or be the primary user of the product or service delivered by the project. In any case, their needs, inputs, perceptions, and expectations will be key to a successful project.

2.2. Elicit True Needs and Project Goal

Once key stakeholders have been identified, especially clients and sponsors, we must meet with them to clarify (a) What problem or opportunity is being addressed? (b) What are their true needs (vs. wants) in relation to the problem or opportunity? and (c) What is the goal of the project? We reiterate the importance of distinguishing between what is *wanted* versus what is *needed* to achieve a goal. A want tends to be solution-focused; that is, our tendency is to express what solution we want rather than first identifying what is needed to solve a problem or to exploit an opportunity. To embark on a project based on wants is very risky because eventually we will discover that the project deliverables are not what we actually need.

2.3. Gather Requirements

Requirements are the detailed and comprehensive description of the solution; they define the product(s) and/or service(s) that the project will deliver.

We have two methods for gathering requirements. The first method is to build a requirements breakdown structure (RBS). An RBS approach is more common when building a specific, usually single, deliverable. The second method is to start with a project logic model. A logic model approach is more appropriate for a complex set of health-related activities, outputs, and expected outcomes and impacts. In public health projects there are often several major deliverables (outputs) with expected outcomes and impacts in the target communities.

For our purposes, the terms requirements and RBS will apply to the results from both these methods.

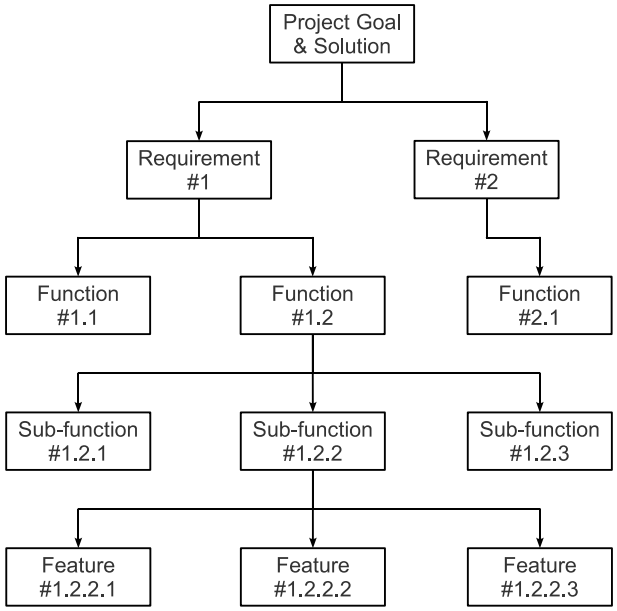

Figure 4: The Requirements Breakdown Structure

2.3.1. Method 1 is to build a requirements breakdown structure

For a requirements breakdown structure we ask the following:

- What are the components of the solution? (requirements)
- For each component, what must it be able to do? (functions)
- For each function, are there any sub-functions?
- For each sub-function, are there any features?

Methods for gathering requirements include the following: (a) facilitated group discussions; (b) interviews; (c) observation; (d) requirements reuse; (e) business process diagramming; (f) prototypes; and (g) use case scenarios.

We can gather the requirements into a requirements breakdown structure (RBS)—a hierarchical description of the requirements. While the RBS is documentation of *what* we will produce, the work breakdown structure (WBS) (covered in Planning) is documentation of *how* we will produce it. The RBS can be presented in a graphical form (Figure 4) or in outline form:

1 Requirement
  1.1 Function
  1.2 Function
    1.2.1 Sub-function
    1.2.2 Sub-function
      1.2.2.1 Feature
      1.2.2.2 Feature
      1.2.2.3 Feature
    1.2.3 Sub-function
2 Requirement
  2.1 Function

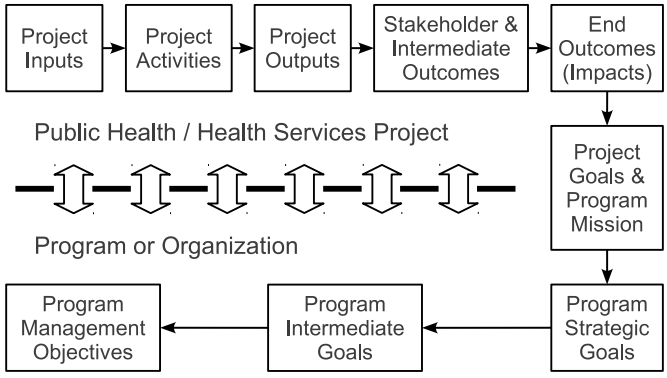

Figure 5: The Project Logic Model (Adapted from RAND [6])

Large or complex requirements can be gathered into a *Requirements Document*.

Gathering requirements is critical to project success! Without a detailed description of the project solution, there is no destination. How can we hope to address the problem or opportunity, or to reach our goal, if we do not have a clear idea of where we are going? Without requirements, risk of project failure is very high.

2.3.2. Method 2 is to start with a project logic model

For many public health projects we produce several outputs (products and services) to impact the health of a target population. The "solution" is the design and implementation of a health intervention or a research study. A project logic model offers a visual representation of a project's flow from inputs to project activities, to outputs, to stakeholders and intended outcomes. We have adapted the RAND logic model template [6] for projects and it is depicted in Figure 5:

Project inputs includes time, budget, and resources. Project activities result in project outputs. The major activities will be documented in the statement of work (next section). Project outputs are the products, services, or change in processes; that is, the deliverables. Intermediate outcomes are *expected* outcomes, and end outcomes are the *intended* outcomes or impact (e.g., changes in population health status). The "solution", then, is the project outputs and the intermediate outcomes. Success criteria would include quality output coupled with positive intermediate outcomes, and hopefully with positive end outcomes. The project logic model also can depict how the project goals align with the program or organization mission and strategic goals (bottom half of Figure 5).

The project logic model is a powerful, high level view of the project goals, solutions, relevance, and longer term impact. Then, the RBSs will be constructed for each project output as described in Method 1.

2.4. Write the "Project Rules"

The primary output from the Defining (initiating) phase consists of four documents (Table 4). First, the *Project*

Table 4: Defining the project results in four key documents

Document	Description
1. Project Charter	Formally announces and authorizes the project, the managers, and team.
2. Statement of Work	Defines project purpose, objectives, success criteria, and scope statement.
3. Responsiblity Matrix	Assigns major activities to accountable key stakeholder groups.
4. Communication Plan	Defines information flow to stakeholders: who, what, when, and how.

Charter[3] formally announces and authorizes the project. It can be a one-page announcement; for example:

> Project name: [Project name]
> Project Manager: [Project manager name]
> Sponsor: UC Berkeley School of Public Health
> Date: [date]
>
> This charter serves to announce the initiation of the Cal PREPARE Exercise Laboratory Project. We are undertaking this project [describe project background and purpose].
>
> [Project manager name] has been selected to lead this project.
>
> Please provide your complete cooperation to the project and to [project manager name].
>
> Thank you.
>
> [Sponsor name]
> [Sponsor signature]

The project charter should be written in non-technical language and sent to anyone associated with the project. It should be signed by the sponsors, including collaborating authorities that will pave the way for project acceptance and cooperation. A project charter is most important when dealing with other departments or agencies where we need the legitimate authority and their cooperation to conduct a project. More details can be added if they will reinforce authority or enhance cooperation.[4]

Second, the *statement of work*[5] (SOW) is a high-level document containing the project purpose, goals, objectives, success criteria, scope, etc. that was negotiated, agreed upon, and formally approved by key stakeholders. The SOW contains the following sections:

1. Purpose;
2. Goals and objectives;
3. Success criteria;
4. Scope specifications;
   (a) High-level requirements;
   (b) Major deliverables;
   (c) Major activities;
   (d) Out-of-scope;
5. Budget, schedule, and resource estimates;
6. Stakeholders;
   (a) Stakeholder table (name, role, contribution)
   (b) Project Organzational Chart
7. Project context and dependenices;
8. Assumptions, Constraints, and Risks;

The SOW is a formal agreement and cannot be changed unless key stakeholders approve. If the agreement is between different legal entities (e.g., a university and a health department), then the SOW forms the basis of a legal contract between the parties.

The project purpose summarizes the public health problem and/or opportunity that the project addresses. The project goals are what we propose to accomplish that addresses the problem or opportunity; they provide direction to the project. For each goal, the objectives are subgoals that, taken together, are *necessary* and *sufficient* to achieve that goal. That is, each and every objective must be accomplished to achieve that goal. The success criteria specifies, in a measurable way, how we will know we have achieved our project goal (intermediate outcome) and/or successfully addressed the public health problem or opportunity (ultimate outcome or impact).

The scope specifications lists the high level requirements (from the Requirements Breakdown Structure), major deliverables, major activities, and any key requirement, deliverable, or activity that is out-of-scope. Delineating what is out-of-scope helps to manage expectations. Listing the major activities is the first step of building a work breakdown structure that will be completed in the Planning phases. Remember, the RBS describes *what* solution will be created, and the WBS describes *how* it will be created. The major activities will also be assigned to key stakeholder groups in the responsibility matrix.

The SOW will have an estimated budget. The schedule should specify dates (or range of dates) for (a) the project completion; (b) major project milestones; and (c) external milestones affecting the project. The schedule should also describe the impact of late delivery.

The stakeholder table will summarize findings from the stakeholder analysis. Key stakeholder groups will be assigned major activities in the responsibility matrix. A project organizational chart is included to describe the "chain of command."

Project context is how the project aligns (or does not align) with existing program and organizational goals and activities. Project dependencies are non-project activities that, if not completed, can affect project results or success. For example, this project may depend on a deliverable from another project.

In the SOW we also identify important assumptions, constraints, and risks which can come from these areas:

[3] Other books use the term "project charter" for the document we call the "statement of work".

[4] For more detailed project charter template see http://www.projectmanagementdocs.com/templates/project-charter.html

[5] Called "Project Definition Document" by the Project Management Institute, and called "Project Charter" in some books.

Table 5: Using SMART Criteria in Statement of Work

SMART Criteria	Statement of Work: Purpose	Goal	Objectives	Success Criteria	Scope, etc.[b]	Proj. Plan
Specific	•	•	•	•	•	•
Measurable			•	•	•	•
Agreed to	•	•	•	•	•	•[a]
Realistic					○	•
Time-based					○	•

[a] Assignable
[b] Includes budget and schedule estimates

technological, business environment, interpersonal relationships, organizational culture, and causal relationships. Along with assumptions, include what are the project impacts if key assumptions are incorrect. *Constraints* are project threats that are *certain* to occur, and *risks* are project threats that *might* occur. Threats are anything that can adversely affect any component of the Scope Triangle (Figure 1).

In the SOW we apply high-level SMART criteria (Table 5). At this point we are focusing on understanding and agreement on purpose, goals, objectives, success criteria, and scope. In the Planning phase we will develop a detailed, comprehensive project plan with tasks and schedule using more precise SMART criteria. Time constraint dates can be incorporated into the SOW if time is a primary driver.

Third, the *responsibility matrix* assigns major activities to the key stakeholder groups. When appropriate, individuaul functional roles or names can be used. To create the matrix we do the following:

1. List the major activities of the project (column 1);
2. List the stakeholder groups (column headings); and
3. Code the responsibility matrix

   R = Responsible for execution;
   A = Approval authority;
   S = Support role;
   I = Must be informed; and
   C = Must be consulted.

The responsibility matrix must leave no doubt about who must be consulted and who has final authority. Key stakeholders must approve the original responsibility matrix, and they must approve any changes. See Table 6 for an example.

Fourth, the *communication plan* is essential for communication, coordination, notification, status updates, and managing expectations. A communication plan answers the following questions:

1. Who needs information? (sponsor, functional management, client, customers, project team, project manager)
2. What information do they need? (authorizations, status changes, coordination, regular meeting notices)
3. How often do they need it?
4. How will they get it? (email, newsletter, etc.)

We organize this information into the communication planning matrix with the following column headings:

1. Stakeholder;
2. Information needs (status reports, etc.);
3. Frequency (daily, weekly, monthly, etc.);
4. Medium (email, newsletter, Web site, etc.);
5. Response (Is a response required from stakeholder and when?)

Consider incorporating social media technology to communicate with Stakeholders (Facebook, Twitter, etc.). Finally, we use the communication plan to schedule regular meetings.

In summary, the defining (initiating) phase is used to (a) identify and engage stakeholders; (b) elicit true needs and project goals; (c) gather requirements and construct logic model; and (d) write the "project rules" (project charter, statement of work, responsibility matrix, and communication plan). The project charter, statement of work, and responsibility matrix require key approvals. The latter two cannot be changed without approval. The completion of this phase sets the foundation for comprehensive and detailed project planning in the next phase.

3. Planning the Project (Planning Process Group)

By now the project has been defined and approved; we have the "go ahead" to plan and execute the project. The statement for work provides the high-level road map. Now, good project planning involves the following steps:

1. Develop a risk management strategy;
2. Build a work breakdown structure (WBS);
3. Identify task relationships (network eiagram);
4. Estimate work packages (duration vs. effort);
5. Calculate initial schedule (Gantt chart, float, critical path);
6. Assign and level resources;
7. Develop budget;
8. Develop change management plan;
9. Develop quality management plan;

Table 6: RASIC responsibility matrix for a research study

Major Activities	IRB[a]	PI[b]	Epidemiologist	Statistician	Study Nurse
Design study	A	A	R	C	I
Recruit subjects	A	A	R	I	S
Collect data	A	I	S	I	R
Analyze data	I	C	R	C	I
Prepare report	I	A	R	I	I

[a] Institutional Review Board
[b] Principal Investigator

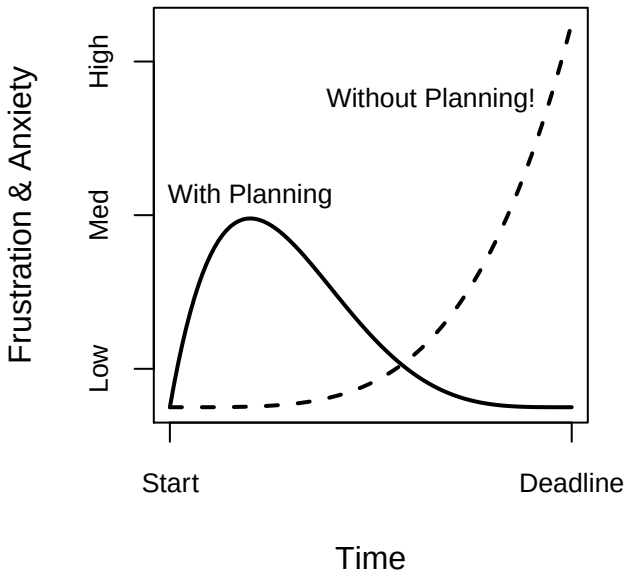

Figure 6: The Planning Frustration & Anxiety Curve

10. Develop procurement management plan;
11. Update responsibility matrix and communication plan; and
12. Compile into project plan and get approval.

For large, complex, high-stakes, or risky projects, we must carry out all steps. For small, simple projects with little or no risks, we might use these steps as a "checklist" to organize our planning. However, in general, public health projects undergo inadequate planning; we are usually enthusiastic to get moving on project activities. Planning feels like unproductive time; afterall nothing is being produced. Nothing can be farther from the truth.

Consider the planning frustration and anxiety curve in Figure 6. Planning is a lot of work! It is easier and tempting to move quickly to executing project activities based on the statement of work. While this might work for personal projects or small projects with little risk, it is a *big* mistake not to invest time and resources to the planning phase of a project. Without adequate planning up front we guarantee increasing frustration and anxiety as our project runs into trouble due to pitfalls (see p. 1) we should have avoided. The first step of the planning phase is to develop a risk management strategy.

3.1. Develop a risk management strategy

The planning process starts with developing a risk management strategy so that we can incorporate effective activities into the project plan. In public health, a hazard is a condition or event that has the potential to threaten human health directly or indirectly. In project management, a *hazard* is a condition or event that has the potential to threaten the Scope Triangle. *Risks* are probabilities and they apply to hazards, exposures (to hazards), and events (given exposures). When an adverse event occurs, the *impacts* are measured in terms of effects to one or more components of the Scope Triangle. Key risk management terms are summarized in Table 7.

Table 7: Risk management definitions

Term	Definition
Hazard (Haz)	Any condition or event that threatens one or more components of the Scope Triangle[a]
Exposure (Exp)	Cumulative exposure to a hazard
Event (Ev)	Occurrence of an event that impacts one or more components of the Scope Triangle
Risk	Cumulative probability of an event and is a function of hazards, exposures, and time
Impact	Impact of an event occurrence measured in one or more components of the Scope Triangle

[a] time, cost, resource availability, scope, or quality

The expected impact of a project adverse event is equal to the impact of the event times the risk of the event (Equation 1).

$$\begin{aligned} E\left[\text{Impact}\right] &= (\text{Risk of Event}) \times (\text{Impact of Event}) \\ &= P(\text{Haz})P(\text{Exp} \mid \text{Haz})P(\text{Ev} \mid \text{Exp}) \times \text{Impact} \end{aligned} \quad (1)$$

In "risk" management, we manage probabilities (risks) and consequences (impacts).[6] Therefore, when faced with a hazard, exposure, or event we have the following possible responses:
1. Do nothing (*Accept risk and impacts*); vs.
2. Do something:

- Risk management
  - *Avoid risk*;
  - *Mitigate risk* (eliminate/minimize risks);
  - *Transfer risk* (buy insurance, outsource);
- Consequence management
  - *Detect early and control* (monitor and control)
  - *Mitigate impacts* (eliminate/minimize impacts: protection, resiliency);
  - *Plan contingencies* (activate alternate plans);

By accepting a risk (and its potential impacts) we have concluded that the expected costs of "doing nothing" is less than the costs of "doing something." The converse is also true: by deciding to "do something" we have concluded that the expected costs of "doing nothing" is more than the costs of "doing something."

To mitigate means to take action(s) that will eliminate or minimize the risks of an event occurring or the consequences of an event once it has occurred. When we decide to act, first, we can focus on avoiding, transferring, or mitigating the risks of a hazard, a hazard exposure, or an event given a hazard exposure. This risk management is similar to "primary prevention" in public health (prevent events by eliminating hazards or exposures). Second, we

[6] Impacts on the Scope Triangle can be converted into dollar costs.

can also focus on detecting events and responding, mitigating impacts, and activating contingency plans. This consequence management is similar to "secondary prevention" (early event detection and control) and "teriary prevention" (mitigate impacts) in clinical medicine

Given this background, we see that what is commonly called "risk management" is actually risk *and* consequence management. Developing a risk management strategy consists of the following steps:

1. Risk identification (identify hazards, exposures, and events);
2. Risk assessment (estimate probabilities and impact, and prioritize);
3. Risk mitigation (mitigation and response plan)
    - Risks: accept, avoid, mitigate, or transfer
    - Impacts: detect events early, mitigate, respond, and plan contingencies
4. Risk monitoring and control (risk log)

3.1.1. Risk identification

In risk identification we gather the project team at the planning phase to brainstorm on risks. We find it useful to review the following risk categories:

- Technical risks
- Project management risks (see "pitfalls" on first page)
- Organizational (internal) risks
    - Management support;
    - Prioritization of projects;
    - Conflicts with competing projects; and
    - Politics and personal agendas;
- External risk
    - Shifting legal and regulatory requirements;
    - Supplier and contractor risks;
    - Economic collapse or work stoppages;
    - Lack of support from external parties; and
    - Deliverables from teams that are external to own;

Next we develop a tabular risk assessment template with the rows named by risk category and the columns named by the components of the Scope Triangle (Table 8). Then, for each risk we specify how it might impact components of the Scope Triangle.

Table 8: Risk Assessment Template: Row and Column names

Risk Category (rows)	Scope Triangle (columns)
Technical	Scope
Project Management	Time
Organizational	Cost
External	Quality
	Resources

3.1.2. Risk assessment

Once we have identified the risks, we prioritize them based on probability of occurrence and potential impact. Impact can be defined in terms of Scope Triangle components; for example, costs. Expected impact is the product of risk and impact (Equation 1). Rigorous quantitative risk assessments are necessary for high risk projects. However, for many projects this is impractical or not feasible. Nevertheless, we must conduct a risk assessment.

3.1.3. Risk response plan

The risk response plan can be divided into two categories: risk management and consequence management. Selected risk strategies can be incorporated into the project plan (changes to RBS, WBS, schedule, communication plan, etc.) and some of these risks can be completely prevented, avoided, or transferred. Risks that remain must be monitored, detected early, and controlled. Strategies for monitoring, detecting, and responding should be incorporated into the project plan. A risk response matrix can summarize risks, who is monitoring, expected impact, and who should respond.

3.1.4. Risk monitoring and control

Continuing risks (potential hazards, exposures, or events) must be monitored and controlled. This is accomplished using a risk log. The risk log should include the following fields:

- Identification number: Never changes;
- Risk description;
- Risk owner: Person responsible for monitoring risk;
- Action to be taken: Proposed, ongoing, or completed action to a hazard, exposures, or event;
- Outcome: Description of what happened after actions taken.

The risk log is provided to project team and is reviewed during status updates. This keeps everyone in tune with mitigating, monitoring, and controlling risks and consequences.

3.2. Build work breakdown structure

The work breakdown structure (WBS) is a hierarchical listing of all the activities required to complete the project as defined in the SOW. The RBS is the input into the WBS. Whereas the RBS specifies the solution, the WBS specifies how the solution will be built. The WBS is critical to project management because it provides the following:

- Detailed description of the project scope;
- Measurable tasks to monitor progress;
- Valid data to estimate costs and schedule; and
- Valid information to build project teams.

Table 9: Summary of Activity vs. Task vs. Work Package

Activity	= Chunk of work
Task	= Activity + Criteria
Work package	= Description + Task = Description + Activity + Criteria

3.2.1. Clarify some terminology

The WBS consists of activities, tasks, and work packages. An *activity* is a chunk of work. A *task* is an activity that possesses the following characteristics (criteria):

1. *Measurable* status and completion;
2. *Bounded* activity;[7]
3. *Deliverable* output;
4. *Estimable* time and cost;
5. *Duration* is acceptable;
6. *Independent* work assignment.

A measurable task facilitates status and completion reporting. A bounded task has an obvious beginning and ending event. The beginning of the task is usually scheduled as the completion of the preceding task. A task should have a tangible deliverable (e.g., inspection and approval report). *Effort* is the estimated person-time required to complete a task. *Duration* is the estimated calendar time to complete a task. For example, a task may require 8 hours of person-time effort, but for a variety of reasons, it may actually take 20 days duration to complete it. The calendar time used for duration will depend on which work calendar is used. A typical work calendar is Monday through Friday, 8 hours per day.

For better management, a task should not be longer that 2 weeks duration (10 business days). A independent task, once started, continues uninterrupted without the need for additional input or information.

A *work package* is a detailed description of how a task will actually be completed (what, who, when, and how). A summary is provide in Table 9.

In summary, terminology can vary widely; therefore, it is more important to understand the concepts and the relationships. For example, Verzuh only uses the terms "summary task" (which we call activity) and work packages. We make the distinction between tasks and work packages. For us tasks will become work packages at a later step when we add operational details to each task.

[7] Clearly defined start and end event

3.2.2. Decomposition of activities to tasks is a powerful method

Breaking down work into a hierarchy of activities and tasks is called *decomposition*. Building a WBS is simply the decomposition of activities starting from the top. Consider the activity of preparing a manuscript for publication:

1 Prepare a manuscript; (activity)
- 1.1 Update literature review; (activity)
  - 1.1.1 Repeat MEDLINE search; (task)
  - 1.1.2 Retrieve articles; (task)
  - 1.1.3 Read articles; (task)
  - 1.1.4 Summarize articles; (task)
- 1.2 Write draft; (activity)
  - 1.2.1 Write introduction; (task)
  - 1.2.2 Write methods; (task)
  - 1.2.3 Write results; (task)
  - 1.2.4 Write discussion; (task)
- 1.3 Send to co-authors for review; (task)
- 1.4 Revise draft; (task)
- 1.5 Submit manuscript to publisher; (task)
- 1.6 Revise manscript; (task)
- 1.7 Resubmit manuscript to publisher; (task)

The activity (of preparing a manuscript) is decomposed until every chunk of work is a task. What constitutes a task, even when applying six criteria, requires subjective judgement. In practice, this will occur by consensus with the project planning team and technical experts. In fact, another team would decompose activities differently into a different WBS. That's okay: same destination — different journey!

The WBS can be presented in outline form (as above) or in graphical form like Figure 4. A graphical WBS is primarily for communication purposes and should only display Level 1 (major activities) and Level 2 activities. In practice, an outline WBS is created using project management software.

In our approach, each activity contains a *verb* and a *deliverable* (tangible output). An alternative approach is to use nouns in the WBS. This is more common when building a physical product. The verb-based WBSs are more appealing and intuitive for public health projects.

3.2.3. Caveats

Here are a few caveats we keep in mind when creating a WBS:

- Start from the top with major activities.
- Describe activities using verb-based syntax.
- Level 1 and Level 2 activities should be meaningful to non-project team stakeholders because they are used to communicate project scope and status.
- Focus only on decomposing to tasks; not sequencing tasks (this comes later).
- The duration of a task should not be longer than the reporting period (time between status meetings). If

status reports occur weekly, then tasks should not be longer than one week. By the end of week 1, the task should be either completed or near completion, and by the end of week 2 it should definitely be completed. If it is not completed by the end of week 2 then it requires corrective action. This approach is easy to implement and identifies problems early.

- Be flexible in decomposing to tasks: make adjustments if it improves time and cost estimation, if it is easier to assign, or if it is easier to track.
- Decompose to tasks using the project team; even better is to include the actual staff that will do the work. This will ensure their input and buy in.
- When all tasks in an activity are complete, the activity is complete; that is, the tasks are *necessary* and *sufficient* for activity completion.
- Do not forget to include project management, risk management, and quality management activities in the WBS.
- When decomposing activities with the project team, use sticky notes, markers, and white board until the WBS is complete. Keep the process simple, flexible, visual, and interactive.
- Finally, enter data into project management software for the WBS outline.

3.3. Identify task relationships (Network Diagram)

The WBS is a comprehensive hierarchical list of all project tasks. Now we must sequence the tasks to reflect techical dependencies. Sequencing tasks is necessary to construct a realistic schedule. Here is our approach:

1. Define task relationships only between tasks, not activities;
2. Task relationships should reflect only technical constraints, not resource constraints
3. Start with independent, current tasks; and then
4. Introduce task dependencies.

Consider the WBS for preparing a manuscript. For the activity "Update literature review", there are four tasks: conduct search, retrieve articles, read articles, and summarize articles. We only need to sequence the tasks since they entirely represent the activity.

Next, we sequence tasks based on logical order and technical constraints. We do not say "but we only have one staff so every task must be sequential", but rather we imagine we have adequate staff so that resource constraints do not influence the task order. It is better to get a realistic picture of what it takes to do the job right, especially if we are in a position to advocate for more resources.

We start with all the independent, concurrent tasks that can be started early (see Figure 7). Concurrent tasks will shorten project duration compared to sequential tasks. Then we begin to add dependent tasks. Notice our focus is on tasks, not activities. Tasks will have relationships

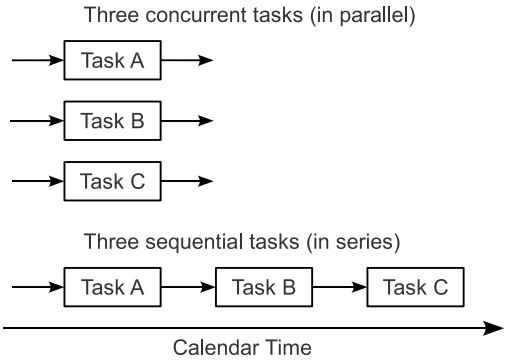

Figure 7: Network Diagram: Sequential vs. Current Tasks. If tasks that are usually done sequentially can, in fact, be done concurrently, then this will decrease the duration. This is called "fast-tracking."

and dependencies across differenct activities. We want to consider these cross-cutting dependencies without being influenced or biased by activity groupings.

We have two methods for organizing task relationships: network diagram and predecessor table. Consider the tasks for preparing a manuscript (we are not listing activities):

- (1.1.1) Repeat MEDLINE search; (task)
- (1.1.2) Retrieve articles; (task)
- (1.1.3) Read articles; (task)
- (1.1.4) Summarize articles; (task)
- (1.2.1) Write introduction; (task)
- (1.2.2) Write methods; (task)
- (1.2.3) Write results; (task)
- (1.2.4) Write discussion; (task)
- (1.3) Send to co-author for review; (task)
- (1.4) Revise draft; (task)
- (1.5) Submit manuscript to publisher; (task)
- (1.6) Revise manuscript; (task)
- (1.7) Resubmit manuscript to publisher; (task)

3.3.1. Set task relationships using a network diagram

A network diagram for preparing a manuscript is displayed in Figure 8. The project starts with a milestone ("Start") and three concurrent tasks: repeat a MEDLINE search, write the methods section, and write the results section. Retrieve, read and summarize the articles, and write the introduction are sequentially dependent tasks. Writing the discussion depends on having a literature review summary, and completed introduction, methods, and results sections. The remaining sequential tasks are dependent, and the project ends when the article is "accepted" (milestone).

Figure 8 has two milestones. A *milestone* is a special event of zero duration. Milestones have several important uses:

- Set project start date;
- Indicate project end date;

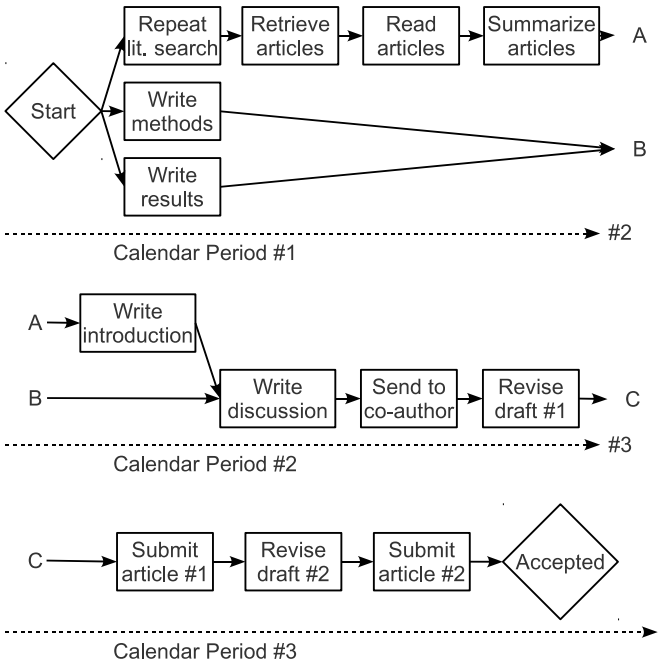

Figure 8: Network Diagram Example: Preparing a manuscript. Tasks are in rectangles and milestones in diamonds. Duration times not shown.

- Mark input from another party (e.g., external dependencies such as "Notice of Award" letter from a funding agency); and
- Represent significant events that are not represented by a task (useful for major progress points).

In practice, network diagrams are created using the same sticky notes used in generating the WBS. It is much easier (for the vast majority of projects) to move sticky notes and display the results to the project team. Eventually, these can be entered into project management software using a predecessor table which is part of the same WBS outlining function.

3.3.2. Set task relationships using a predecessor table

When we create WBSs in project management software, we enter the necessary data for a predecessor table. We have added some durations to the tasks for preparing a manuscript (see Table 10). In addition, we added two lag periods. Task 13 depends on Task 12 finishing plus 4 months. The 4 month "lag" is our estimate of how long it will take to hear back from the publisher. Likewise, the milestone "Accepted" depends on Task 13 finishing plus a 2 month lag. The durations and lags are not displayed in Figure 8.

3.3.3. Task dependencies are not all the same

In Table 10 all the task dependencies we chose were of the "Finish-to-Start" type. This means that the preceding task must finish before the dependent task starts. In software packages, this is the default setting. This approach will produce a more conservative schedule; i.e., overestimate the actual project duration. However, we may want to incorporate more realistic task dependencies. The types of task dependencies are displayed in Figure 9. Good project management software will enable these options.

Table 10: Predecessor table for preparing a manuscript

No.	Task	Duration	Predecessors
1	Start	0d	n/a
2	Repeat MEDLINE search	5d	1
3	Retrieve articles	5d	2
4	Read articles	10d	3
5	Summarize articles	5d	4
6	Write introduction	5d	5
7	Write methods	10d	1
8	Write results	10d	1
9	Write discussion	10d	6, 7, 8
10	Send to co-author for review	2d	9
11	Revise draft #1	10d	10
12	Submit article #1	5d	11
13	Revise draft #2	10d	12+80d*
14	Submit article #2	5d	13
15	Accepted	0d	13+40d*

*d = delay in business days

The data from Table 10 is sufficient to generate a Gantt chart (Figure 10). A Gantt chart is a visual display of the project schedule that integrates task dependencies and schedule durations. A Gantt chart only requires: (a) task duration; (b) task dependency [Finish-Start (FS) [default], Finish-Finish (FF), Start-Start (SS), or Start-Finish (SF)]; and (c) milestones as needed. Shortly, we will explore other properties of Gantt charts.

3.3.4. Estimate work packages (bottom-up estimating)

Up to now we have developed a WBS and network diagram. We estimated task durations and generated an initial project schedule using a Gantt chart (Figure 10). For simple, low-risk projects, this may be all that is required. However, for complex, high-risk projects we need to convert our tasks into work packages. Work packages are necessary in order to (a) develop an accurate project schedule, (b) develop a realistic budget, (c) assign staff resources, and (d) monitor progress.

In order to estimate the cost and schedule of an entire project, we must estimate the cost and duration of each task. We call this bottom-up estimating. Labor *effort* is the person-time labor required to complete a task. Task *duration* is the actual calendar time in business days required to complete the task. The task *cost* is determined by (a) equipment and materials, (b) labor effort, and (c) task duration (Figure 11). Project scheduling is determined by task durations.

We have two approaches to determining task duration:

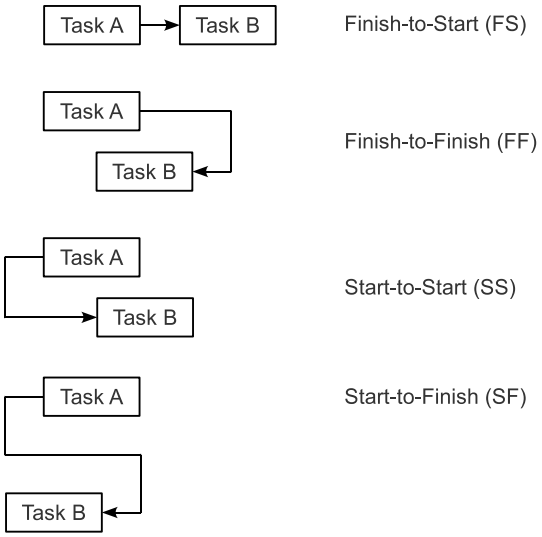

Figure 9: Types of Task Dependencies: FS (when A finishes, B may start); FF (when A finishes, B may finish); SS (when A starts, B may start); SF (when A starts, B may finish). Only FS task dependencies were used for Table 10.

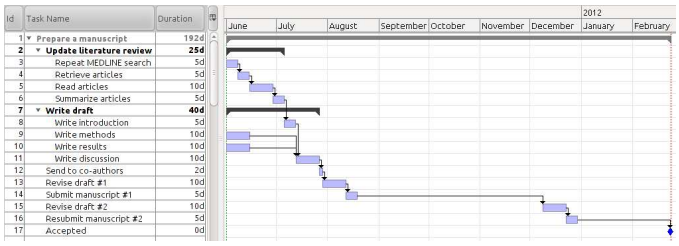

Figure 10: Gantt Chart for Preparing a Manuscript (from Table 10).

- Fixed duration (duration-driven): task duration is fixed independent of the any staff resources available. This approach is easier and we used it for Table 10 and Figure 10. We use this approach when the effort is unknown or too cumbersome to estimate. When staff are assigned, the duration remains fixed, but costs increase accordingly.
- Fixed effort (effort-driven): task duration is calculated from effort and staff resources available. For a given effort, more staff resources results in a shorter duration. This approach requires estimating the effort required to complete a task and to assign staff resources. If no staff are assigned, then the duration is fixed.

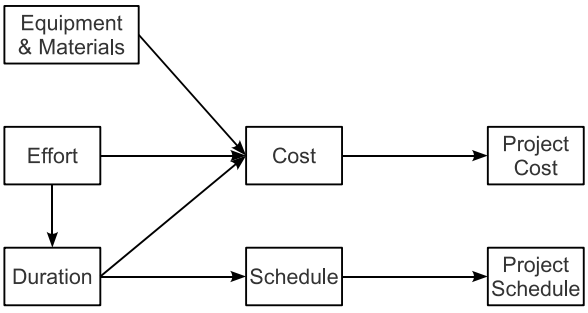

Figure 11: Bottom-up work package estimation

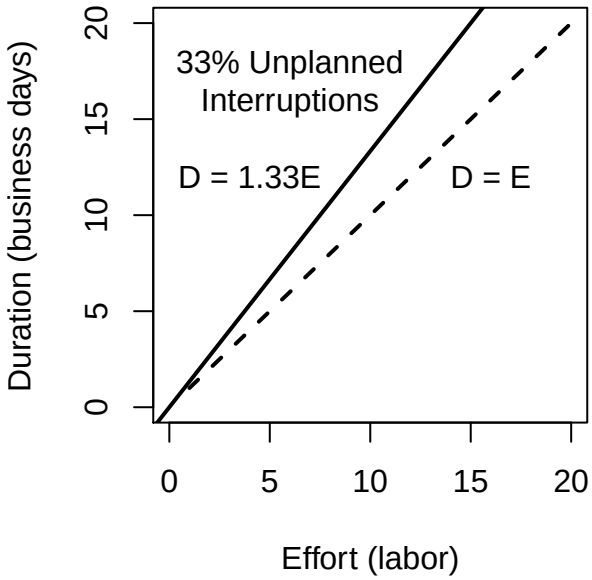

Figure 12: The relationship between effort and duration time.

What is the actual duration for an estimated effort? Ideally, duration and effort time would be the same ($D = E$ in Figure 12); however, in reality, because of interruptions the duration is always longer than the effort. Even if we are confident in the effort required to complete a task, we might still inflate the effort used for planning in order to accommodate unplanned interruptions.

A more general relationship between duration (D) and effort (E) is represented by

$$D = \frac{E(1+f)}{R}, \tag{2}$$

where R is number of staff resources assigned, and f is the fraction of unplanned interruptions. When $R = 1$ and $f = 0$, then $D = E$.

Unfortunately, for some tasks, effort is difficult to estimate or poorly correlated with task duration. In public health, estimating task effort is difficult because staff often work on multiple projects. Their effort on any one project is divided over several weeks so that a task duration is always much longer than its actual effort. A task duration can also be longer than its effort for external reasons. For example, the task of scheduling a mission critical meeting with a key stakeholder should not take more than 1 hour of staff effort; however, for a variety of reasons (politics, passive aggressive behavior, etc.), it may take much longer duration to schedule this meeting[8]. Therefore, we should use a fixed task duration for this task instead of effort.

[8]This is based on a true story; it took 6 weeks to schedule a meeting. And it only succeeded after we tried to schedule a meeting with the supervisor instead.

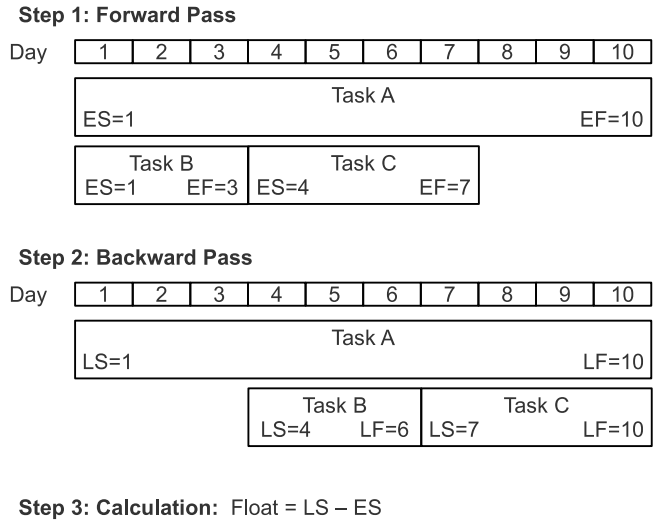

Figure 13: Steps for calculating float: (1) do forward pass to determine early start (ES) and early finish (EF); (2) do backward pass to determine late start (LS) and late finish (LF); and (3) calculate float by substracting ES from LS. Therefore, in days, $F_A = 0$, $F_B = 3$, $F_A = 3$.

3.3.5. Project management software handle effort and duration differently

If a task is assigned 40 hours of effort (not duration), and no staff resources are assigned, then the scheduling software will treat the 40 hours of effort taking 40 hours duration (i.e., $E = D$) (5 business days). However, if four staff can be assigned to this task and they have 5 hours per day they can devote to this task, then the task duration will only be 2 days ($4 \times 5h/d \times 2d = 40h$)!

In contrast, if a task is assigned 40 hours duration (not effort), then the task will always take 40 hours no matter how many staff are assigned to it. The task duration is fixed, although the task costs will go up with the assignment of more staff. Software solutions give us flexibility for schedule planning, but we need to know how it handles the data we enter.

3.4. Calculate initial schedule with float and critical path

To calculate the initial schedule we only need (a) a network diagram (task dependencies), (b) effort or fixed duration for each task, and (c) assigned staff resources. From this we calculate float and the critical path. *Float* (also called *slack*) is the amount of time a task completion can be late without affecting the project duration. The *critical path* is defined as all the tasks with zero or negative float. On a network diagram, the critical path is the longest path through the network. Float and critical path analysis is very informative:

- The critical path is the *minimum time the project will take.*
- Any task on the critical path that finishes late will delay the project completion date.

Figure 14: Gantt chart for Figure 13. Each Task has a single, dedicated staff. The critical path (light red) is Task A. We can ignore Saturday and Sunday (28th and 29th).

- If project completion time is the primary driver (as in most public health emergencies), then tasks on the critical path will require more risk management and planning to ensure no delays.
- Float identifies *the latest date a task can begin* without delaying the project (assumes the estimated task duration is unchanged or shorter).
- Float identifies *the latest date a task can finish* without delaying the project (no assumptions about task duration).

In practice, float is calculated by a computer; however we review a simple example to understand the calculation. Figure 13 illustrates the method using three tasks. Task A is of 10 days effort. Task B and Task C are finish-to-start dependent and are 3 days and 4 days effort, respectively. Each task will have a single, dedicated staff resource. In effect, the actual task durations will equal the task efforts (Figure 14).

Now, we use the forward pass to determine early start (ES) and early finish (EF) days, and the backward pass to determine late start (LS) and late finish (LF) days. We then calculate the float (F) for task i using:

$$F_i = LS_i - ES_i \tag{3}$$

Here are the calculations:

$$F_A = 1 - 1 = 0$$
$$F_B = 4 - 1 = 3$$
$$F_C = 7 - 4 = 3$$

Now, if we assign two dedicated staff (Wayne and Mike) to Task A we can cut the duration in half (Figure 15). This has the effect of changing the critical path to Tasks B and C which now both have zero float. Now Task A has 2 days of float: it can start up to 2 days late without delaying project completion (assumes duration remains ≤ 5 days), or it can finish up to 2 days late without delaying project completion (no assumption on duration).

This level of detailed planning is necessary to develop a realistic budget. Many projects run over budget precisely because planners did not conduct the detailed planning necessary for budget development.

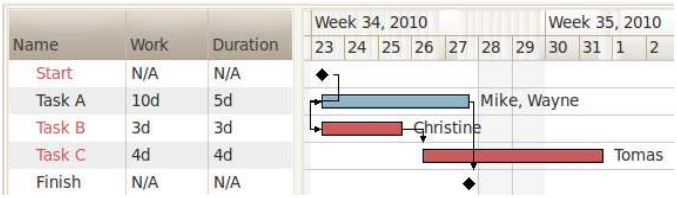

Figure 15: Gantt chart for Figure 13 after adding staff. Task A has two dedicated staff (Mike & Wayne), cutting the duration in half. The critical path (light red) is consist of Tasks B and C. We can ignore Saturday and Sunday (28th and 29th).

4. Controlling the Project

4.1. Executing Process Group

Instead of the "executing process group," Wysocki calls this *launching* [5]. His rationale is that the moment we launch the project, monitoring and control begins. Likewise, Verzuh moves directly to the controlling function of project management. In any case, the executing (or launching) process group consists of the following:

- Complete project team;
- Establish team operating rules;
- Finalize schedule;
- Establish change management process; and
- Launch project.

4.2. Controlling Process Group

Controlling the project involves the following.

1. Integration Management;
2. Scope Management:
   - Process Change Requests
   - Monitor and address issues (Issues Log)
3. Time Management: Measure schedule performance
4. Cost Management: Measure cost performance
5. Quality Management: Monitor and assure quality
6. Communications Management:
7. Risk Management: Monitor and mitigate risks (Risk Log)

In scope managment we set up processes to minimize "scope creep." If it is not in the statement of work, it does not get added. To add it requires vetting and approval. In time management we monitor the project schedule to ensure we are not falling behind. If so, corrective actions are taken. Likewise, in cost management, we monitor budget expenditures to ensure we are not running over budget. In quality management we set up processes to ensure quality. Communications and risk management continue.

Because controlling scope creep and managing stakeholders' expectations are so important, we expand upon them further.

4.2.1. Scope management

Project scope has a component in every process group in the PMLC. When a project reaches the controlling phase, project scope should be well defined, documented, verified, formally approved, decomposed into a WBS, and scheduled. One focus in the controlling phase of the PMLC is verifying the delivery of scope items and managing changes to it which is the purpose of scope management. The need to manage changes to scope can be a result of new opportunities, unforeseen requirements, changing regulations, a risk response, or other environmental changes which warrant scope modification. Scope management is implemented by defining a *change control process* which is a mechanism by which changes to scope can be assessed, decided upon, and if approved, implemented.

Stakeholders use the change control process to propose changes to the project's deliverables. To recommend a change, the requestor follows a series of pre-defined steps. The requestor must provide a description of the change and a rationale to support the change. Some examples of include cost avoidance, revenue benefit, risk mitigation, or regulatory compliance. The change request then goes to a Change Control Board (CCB). CCBs are the decision authority for project changes and include the project manager, project sponsor, and a small number of key stakeholders for the project. The CCB's responsibility is to evaluate the change request and the impact on the cost, schedule, risk plan, and other components of the project. The change control process must be clear with change proposals well-defined, quantified, and actionable. Once approved, the change control process must ensure the change is integrated into the project plan with an updated WBS, schedule, and budget.

During the controlling phase, small unplanned needs, or issues, will surface. Issues can be small work efforts that block a scheduled task from completing. Issues are commonly captured on an issues log. An issues log has a several elements including a description of the issue, its impact, when it was recorded, who discovered the issue, resolution date, priority, and a responsible person for resolving it. Issues logs are commonly reviewed and managed during project team meetings where the team validates priority, ownership, and progress.

4.2.2. Communications management

In communications management it is essential that we continue to manage stakeholder expectations. We do so by addressing concerns before they become issues and in order to anticipate risks. In doing so we increase the probability of project success by ensuring that stakeholders remain involved with project challenges and solutions. By controlling stakeholder communications we also decrease the chance of the project derailing due to unresolved stakeholder concerns that could impact the scope, quality, or timeline if not proactively handled.

During communications management, we have the opportunity to review the completion status of our commu-

nication plan and audit whether key communications have reached their targets. We also have the chance to update the communication plan to address any gaps or needs that have surfaced. Revisiting the communication plan is a key risk management strategy for successful projects, as we all could communicate more frequently.

4.3. Closing Process Group

Closing the project involves the following:

1. Gain client approval of having met project requirements;
2. Write report on lessons learned;
3. Write the final project report; and
4. Conduct the post-implementation audit.

5. Summary

In this review we covered practical project management concepts and techniques applied to public health and health services projects. We emphasized the initiating and planning process groups because they are the foundation for scheduling, budgeting, executing, and controlling the project.

Appendix A. Stakeholder Analysis

Stakeholder Role Profile

To identify key stakeholders, start by asking who ...

1. approves funding for this project?
2. approves functional requirements?
3. approves technical requirements?
4. approves design decisions?
5. approves changes to requirements?
6. approves changes affecting schedule?
7. approves changes affecting cost?
8. will use the product or service produced by the project?
9. set the organizational goals that drive the necessity of this project?
10. will assign people to the project team and determine the hours per day they work on the project?
11. approves contracts for suppliers?
12. is the manager or executive sponsoring this project (will use their authority on behalf of the project team to overcome organizational obstacles)?
13. will manage the project (provide leadership to assure tasks are assigned and completed on time, cost and schedule are monitored, issues are identified and resolved)?
14. represents organization policies governing this project?
15. represents regulations or laws affecting this project?
16. will have their work disrupted by this project?
17. will have to change their systems or processes because of this project?
18. will benefit from this project? (If this is a large group, who will represent this group?)
19. will perform the work on this project? (This includes all vendors and subcontractors as well as employees)
20. will participate in phase gate decisions to approve moving the project to the next phase?

Stakeholder Alignment Questions

For each stakeholder, answer the following questions:

1. What is their contribution to the project?
2. To whom do they report?
3. What authority do they have over the project?
4. What is their goal for the project (what is their stake in the project) and how does it relate to their organization's goal or other personal goals? (What makes this a 'win' for them?)
5. Do they present a specific threat or opportunity?
6. What perception do we want them to have about the project?

Plan Stakeholder Communications

Use the responsibility matrix and communication plan to document roles and responsibilities and how stakeholders will be kept informed and engaged.

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