

ED PIP: Solution Design Phase

Tools: Standard Operating Procedures

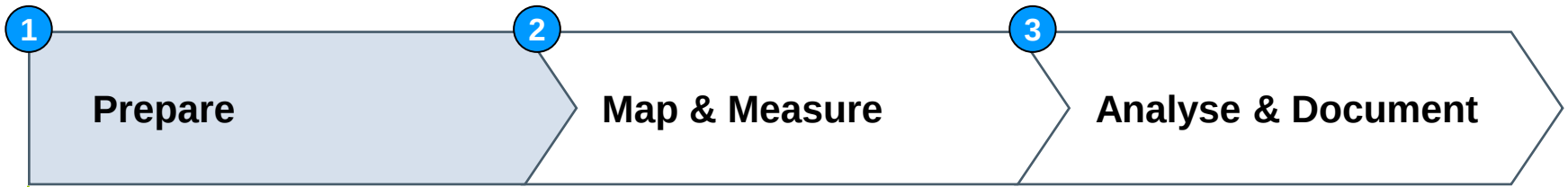
Ontario

Standard Operating Procedures (SOPs) – Overview

Outcome	▪ A stable “production” environment
Definition: **‘What is it?’**	▪ Standardize the method/process/procedure based on the accepted Best practice: Each individual that completes a “process” has different techniques – standardization ensures the application of the best method to optimize the process resulting in a consistent high efficiency process with high-quality results/minimal errors
Objectives: **‘What is it used for?’**	▪ Standard Operating Procedures: - Improve the knowledge of the individuals that are involved in the process - Help people understand alternate approaches to the same “process” - Help identify opportunities to reduce waste by finding the “best practice”
Benefits:	▪ Output, timing and quality of the process is more “predictable” ▪ Ensures that more people are adopting what is agreed as optimal (or “best”) practice ▪ Maintains consistent high quality level ▪ Enables consistent and effective training/orientation of staff ▪ Engages all individuals involved in the process
When to use	▪ SOPs should be used in conjunction with the Value Stream Map after the areas of opportunity have been identified - the opportunities that are highly variable need to be investigated and a SOP should be developed for the cases where the source of variation is the inconsistency of the process/method ▪ Whenever the “process” is not stable (e.g. output, quality or throughput time is inconsistent or unpredictable) ▪ Orientation of new staff

SOPs - Instructions For Use (1/3)

First identify where SOPs will have the greatest Impact...

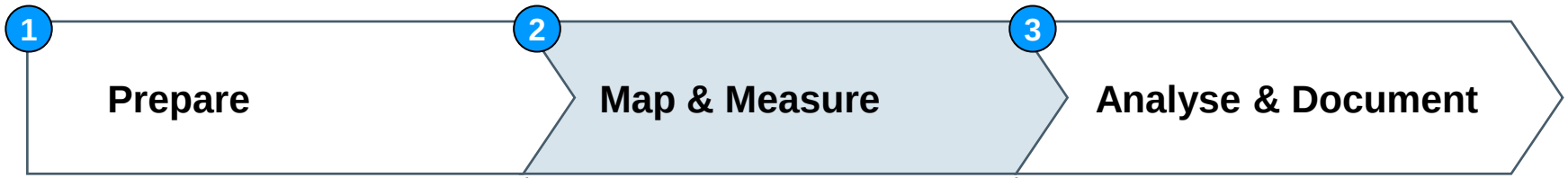


1. Identify areas of opportunity for the project (Process Mapping/Value Stream Mapping)
2. Identify the opportunities that are highly variable: throughput time, quality and/or output (Time and Motion/Go and See/Pareto Analysis)
3. Identify those opportunities where the root cause is the inconsistency in the process (5 Whys/ Fishbone Diagram)

- Complete the Value Stream Map to help you identify the areas of opportunity
- Investigate if the root cause of the inconsistencies are within the process
  - Is it the process itself or going through the process?
- Interview the different individuals within the process and understand what they believe is the source of the inconsistencies

SOPs - Instructions For Use (2/3)

It's critical that you learn about the process and its variability before you standardize it...



1. Physically walk through the process to determine the resource and information flows
   - Observe staff
   - Record all observed staff activities (even when told 'we don't normally do this')
   - Measure the touch time, cycle time, volumes and number of staff within the process
   - Ask how often they have to rework/redo work products
   - Note how activities are initiated and flow (e.g. batched, ad-hoc)
2. Collect / record cycle time and volume for the process
   - Utilize standard cycle time document to record information
3. Return to process area as necessary to acquire more or verify data details

- Use a stopwatch to verify all times (verify existing report and KPI metrics)
- Ensure all necessary data are collected at each step in the process to complete calculations
- Use standard measurements in all calculations (e.g. minutes vs. hours)
- Remember to include metrics and flows for exception processing and error correction
- Use pencil to map and record metrics
- Avoid using computers during reviews (time-consuming, distracting)

SOPs - Instructions For Use (3/3)

Develop and iterate the standard operating procedures with the team

1. **Prepare**
2. **Map & Measure**
3. **Analyse & Document**

1. Review the different approaches to the process with the team and discuss the strengths/weaknesses
2. Guide the team towards consensus on the final process, being sure to focus on the elimination of waste using the “customer’s eyes” to help determine value-add vs. non-value add steps in the process
   - Pilot the result on each shift, and review the feedback as a team and update the process as necessary
3. Use the standardized Work Instruction Sheet (see template at the end of this tool) to detail the instructions for each step of the process
   - Put in as much detail as necessary to maintain consistency between the different individuals across all of the shifts
   - Where practical, utilize pictures to make the SOP as user-friendly as possible
   - Be sure to include a reference number and an issue and reference date

- Analysis begins by listening to the staff who perform the process
  - Ask them what they would improve
  - Record notes when they mention things that “take too long”, they “have to wait” or are “complex or complicated”
- When discussing the strengths and weaknesses of the different options, be sure that the team understands that we are not judging their technique, but we are trying to find the best practice. Watch out for defensiveness within the team, if it seems to start, call for a break and remind the team what is the final goal of the discussion
- Review the different process options through the “customer’s eyes”
- Share ideas and have the team develop the “best practice”
- See the section on the 8 Wastes, for more detail on value add vs. non-value-add steps

Over time, there has been a clear paradigm shift in what Standard Operating Procedures are and how they are used

ED PIP has focused teaching and coaching around SOPs under the new paradigm

	Old Paradigm	*New Paradigm*
Process Improvements	SOPs are created and are never updated/improved	SOPs are created with an associated process to continuously review and update.
Accountability for Improvements	SOPs are used by management to "control" the efforts of the frontline workers	Safety and quality are the basic goal of the SOP with engagement of all individuals involved in the process to find the best possible solution
Overall objective	SOPs are used to get the most work out of the employees	SOPs are about improving the process by reducing or eliminating the non-value-added steps in the process – the focus is on the process, it is a chance for the individuals involved in the process to reduce or eliminate steps in the process that they know do not add value

Let's look at a couple examples to illustrate how SOPs can be used...

Example # 1	**Lab Test** •*Erythrocyte Sedimentation rate (ESR) Westergren Method*
Example # 2	**Establishing a peripheral IV line**

Each example in the following slides uses the template below to illustrate different types of instructions and details required to successfully implement Standard Operating Procedures

Process:	**Reference #:** **Page 1**
Authorised signature:	**Issuing Date:** **Next Revision Date:**
Staff:	
Principle of the Process:	
Importance of the Process:	
Special Prep Requirements:	
Equipment Requirements:	
Process Instructions:	
Reporting Requirements	
Internal Quality Control Procedures and Sources of Error:	
Reference:	

Example 1 (1 of 3)

ERYTHROCYTE SEDIMENTATION RATE (ESR) WESTERGREN METHOD	**A – 001** **Page 1**
Authorised signature:	**Issuing Date:** April 12, 2008 **Next Revision Date:** April 12, 2009

Staff able to perform test: Laboratory Assistant and higher

Principle of the Test Method

The ESR expresses in mm per hour the rate at which red blood cells settle when anti-coagulated blood is allowed to stand in a narrow tube (Westergren). It is shown by the height of the column of clear plasma at the end of one hour.

Clinical Significance of the Test:

ESR is used as a screening method for all diseases that are associated with a modification of the plasma proteins like globulin, albumin and fibrinogen. ESR is not a very reliable screening method as it can be raised when there is no disease and can be normal when disease is present. It also does not indicate the type of disease.

Specimen:

- 2 ml fresh Venous Blood or
- 2 ml fresh EDTA Blood (If kept at 4°C not older than 24 h)

Equipment Requirements:

- Westergren rack
- Westergren tubes, internal diameter 2.5mm
- Dilution bottles to hold 2 ml (4 volumes of blood/1 volume of anticoagulant dilutent solution)
- Timer (1hour)

Reagents & Stain Requirements:

- 3.8% Trisodium Citrate Solution

Preparation of 3.8% Tri-sodium Citrate Solution

- Tri-sodium Citrate, anhydrous ..... 3.8 g
- Distilled water ..... up to 100 ml

Important: Keep the solution in the refrigerator. If the solution is cloudy or contains particle discard and prepare a fresh solution!

Example 1 (2 of 3)

Test Procedure Instructions: Measure exactly 0.4 ml of the 3.8% Tri-sodium Citrate solution, with the help of a pipette or a syringe into a clean and dry small bottle.
Draw 2ml of venous blood and immediately place 1.6 ml into the Tri-sodium Citrate solution. Note: You can also use EDTA blood. If kept at 4°C, it can be used after up to 24 hours. In this case mix the EDTA blood well, and place 1.6 ml into the Tri-sodium citrate solution.
Mix the blood and Trisodium Citrate solution well.
▪ Fill a clean and dry Westergren ESR Tube with the mixture up to the 0 mark. ▪ Do not mouth pipette. Use a pipetting device.
▪ Wipe the outside of the Westergren tube with a tissue. ▪ Make sure no air bubbles enter the tube. ▪ Recheck that the tube is filled up to the 0 mark, exactly.
Close the top of the tube firmly while you place the tube into the tube holder, otherwise the mixture could escape the tube.
Immediately set your timer for **1 hour** or write down the time on a sheet of paper.
Exactly after 1 hour read how far the red cell layer has fallen. Give the result in mm per hour.

Example 1 (3 of 3)

Reporting and Interpretation of Results:

Normal Value: Male: 1 - 10 mm /hour Female: 3 - 14 mm /hour

Increased Values of ESR:

Are found with all diseases associated with a modification of the plasma proteins like globulin, albumin and fibrinogen. ESR shows especially high values in:

- Tuberculosis
- Leishmaniases
- Malignant condition
- Hepatic Amoebiasis
- Acute and Chronic Inflammation

Special Note: (While reading the result you should also pay attention to the following:)
The colour of the plasma:

- Dark yellow , indicates Hepatitis
- Clear as water, indicates lack of iron
- White and turbid, indicates Nephrosis, Diabetes, Lipaemia.
- The layer of white blood cells just above the red cells:
- If increased, indicates Leukaemia.

Internal Quality Control Procedures and Sources of Error:

- Correct dilution of blood and Tri-sodium Citrate Solution
- Store Tri-sodium Citrate Solution in the refrigerator
- Tri-sodium Citrate Solution should not be turbid
- Avoid air-bubbles in the Westergren tube
- Place the Westergren tube in a vertical position
- Temperatures above 23 °C increase the speed of the ESR, therefore keep the ESR rack at the coolest place of the lab and out of direct sun light.

Reference:

- Maurice King, 1973 A Medical Laboratory for Developing Countries, London, Oxford University Press
- WHO, 1980, Manual of Basic Techniques for a Health Laboratory. Geneva, WHO

Example 2 (1 of 6)

Peripheral Intravenous Access	**A – 002** **Page 1**
Authorised signature:	**Issuing Date:** April 12, 2008 **Next Revision Date:** April 12, 2009

Introduction:

The ability to obtain intravenous (IV) access is an essential skill in medicine and is performed in a variety of settings by paramedics, nurses and physicians. Although the procedure can appear deceptively simple when performed by an expert, it is in fact a difficult skill which requires considerable practice to perfect.

The rate of fluid flow is proportional to radius to the power of four, and inversely proportional to length; therefore fluids run fastest through a shorter and larger diameter tube. Also note that the smaller the gauge of a needle, the larger its diameter e.g. a 14 gauge needle has larger diameter than a 21 gauge needle.

Indications

By starting a peripheral IV, you gain access to the peripheral circulation of a patient, which will enable you to sample blood as well as infuse fluids and IV medications. IV access is essential to manage problems in all critically ill patients. High volume fluid resuscitation may be required for the trauma patient, in which case at least two large bore (14-16 G) IV catheters are usually inserted. All critically ill patients require IV access in anticipation of future potential problems, when fluid and/or medication resuscitation may be necessary.

Contraindications

Some patients have anatomy that poses a risk for fluid extravasation or inadequate flow and peripheral IVs should be avoided in these situations. Examples include extremities that have massive edema, burns or injury; in these cases other IV sites need to be accessed. For the patient with severe abdominal trauma, it is preferable to start the IV in an upper extremity because of the potential for injury to vessels between the lower extremities and the heart. For the patient with cellulitis of an extremity, the area of infection should be avoided when starting an IV because of the risk of inoculating the circulation with bacteria. As well, an extremity with an indwelling fistula or on the same side of a mastectomy (occasionally a problem) should be avoided because of concerns about adequate vascular flow.

Example 2 (2 of 6)

Complications

The main complications of an IV catheter are infection at the site and development of superficial thrombophlebitis in the vein that is catheterized. It is also common for the IV sites to leak interstitially.

Universal precautions

The potential for contact with a patient's blood while starting an IV is high and increases with the inexperience of the operator. Gloves must be worn while starting an IV and if the risk of blood splatter is high, such as an agitated patient, the operator should consider face and eye protection as well as a gown. Trauma protocol calls for all team members to wear gloves, face and eye protection and gowns. As well, once removed from the protective sheath, IV catheters should either go into the patient or into an appropriate sharps container.

Important: Recapping needles, putting catheters back into their sheath or dropping sharps to the floor (an unfortunately common practice in trauma) should be strictly avoided. **Recapping of needles is one of the commonest causes of preventable needle stick injuries in health care workers.**

Peripheral IV sites

Generally IV's are started at the most peripheral site that is available and appropriate for the situation. This allows cannulation of a more proximal site if your initial attempt fails. If you puncture a proximal vein first, and then try to start an IV distal to that site, the fluid may leak from the injured proximal vessel. The preferred site in the emergency department is the veins of the forearm, followed by the median cubital vein that crosses the antecubital fossa. In trauma patients, it is common to go directly to the median cubital vein as the first choice because it will accommodate a large bore IV and it is generally easy to catheterize. In circumstances where the veins of the upper extremities are inaccessible, the veins of the dorsum of the foot or the saphenous vein of the lower leg can be used. In circumstances in which no peripheral IV access is possible a central IV can be started.

Example 2 (3 of 6)

Equipment

All necessary equipment should be prepared, assembled and available at the bedside prior to starting the IV. Basic equipment includes:

- gloves and protective equipment
- appropriate size catheter 14-25 G IV catheter
- non-latex tourniquet
- alcohol swab/other cleaning instrument
- non-sterile 2x2 gauze
- sterile 2x2 gauze (this is not practiced in nursing)
- 6x7cm Tegaderm™ Transparent Dressing
- 3 pieces of 2.5 cm tape approximately 10 cm in length
- IV bag with solution set (tubing) (flushed and ready) or saline lock
- sharps container

To prepare the IV line, protective caps are removed from the fluid bag and the spiked end of the IV tubing. The regulating clamp for the IV line should be closed. The spiked end of the IV tubing is inserted into the receptacle on the IV bag while holding the IV bag inverted. The bag is then held upright with the IV line hanging from the bottom. The drip chamber should be filled half-way by pinching it and releasing. Following this the bag should be hung for the IV pole, at a point above the patient, and the regulating clamp should be opened to "flush" the line of air bubbles prior to connection to the patient.

Example 2 (4 of 6)

Establishing a peripheral intravenous line

1. Assemble your equipment.

2. Don a pair of appropriately sized non-latex examination gloves.

3. Apply tourniquet to the IV arm above the site.

4. Visualize and palpate the vein.

5. Cleanse the site with a chlorhexidine swab using an expanding circular motion.

6. Prepare and inspect the catheter.
   - ☐ Remove the catheter from the package.
   - ☐ Push down on the flashback chamber to ensure it is tight.
   - ☐ Remove the protective cover.
   - ☐ Inspect the catheter and needle for any damage or contaminants.
   - ☐ Spin the hub of the catheter to ensure that it moves freely on the needle.
   - ☐ Do not move the catheter tip over the bevel of the stylet.

7. Stabilize the vein and apply counter tension to the skin.

8. Insert the stylet through the skin and then reduce the angle as you advance through the vein.

9. Observe for "flash back" as blood slowly fills the flash back chamber.

10. Advance the needle approximately 1 cm further into the vein.

11. Holding the end of the catheter with your thumb and index finger, pull the needle (only) back 1 cm with your middle finger.

12. Slowly advance the catheter into the vein while keeping tension on the vein and skin.

13. Remove the tourniquet.

Example 2 (5 of 6)

Establishing a peripheral intravenous line (continued)

14. Secure the catheter by placing the Tegaderm™ over the lower half of the catheter hub taking care not to cover the IV tubing connection
15. Occlude the distal end of the catheter with the 3rd, 4th and 5th fingers of your non-dominant hand.
16. Secure the catheter hub with your thumb and index finger and carefully remove the needle.
17. Place the needle into the sharps container.
18. Remove the cover from the end of the IV tubing and insert the IV tubing into the hub of the catheter.
19. Secure the tubing to the catheter by screwing the Luer Lock tight.
20. Open up the IV roller clamp and observe for drips forming in the drip chamber.
21. Check that the IV is infusing into the vein by occluding the vein distal to the catheter and observing that the drips stop forming and then restart once the vein is released.
22. Adjust the IV drop to keep the vein open rate (TKVO) of approximately 30 - 60 mL/hr (one drop every 5 - 10 seconds for 10 gtts/mL solution set).
23. Place a piece of tape over the catheter hub.
24. Make a small (kink free) loop in the IV tubing and place a second piece of tape over the first (piece of tape) to secure the loop.
25. Place a third piece of tape over the IV tubing above the site.
26. Ensure that the IV is properly secured and infusing properly.
27. Ensure that all "sharps" are placed in the sharps container.

Example 2 (6 of 6)

To remove the IV

1. Shut off the IV by closing the roller camp.
2. Remove the tape and Tegaderm™ from the tubing and catheter.
3. Place a non-sterile 2x2 gauze over the IV site and remove the catheter from the arm and secure it in place with a piece of tape.

Template to document Standard Operating Procedures (SOPs)

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Reference:	

- The top 4 boxes (Process / Reference # / Authorized signature / Issuing & Next Revision Date) are mandatory.
- The boxes starting with “Staff” and below can be modified to meet the needs of the team.
- Keep the SOP as simple as possible, but with enough detail that the variations / inconsistencies that were highlighted by the team are significantly reduced or eliminated.