

Pediatric Orthopedic Clinic case report

Team 4

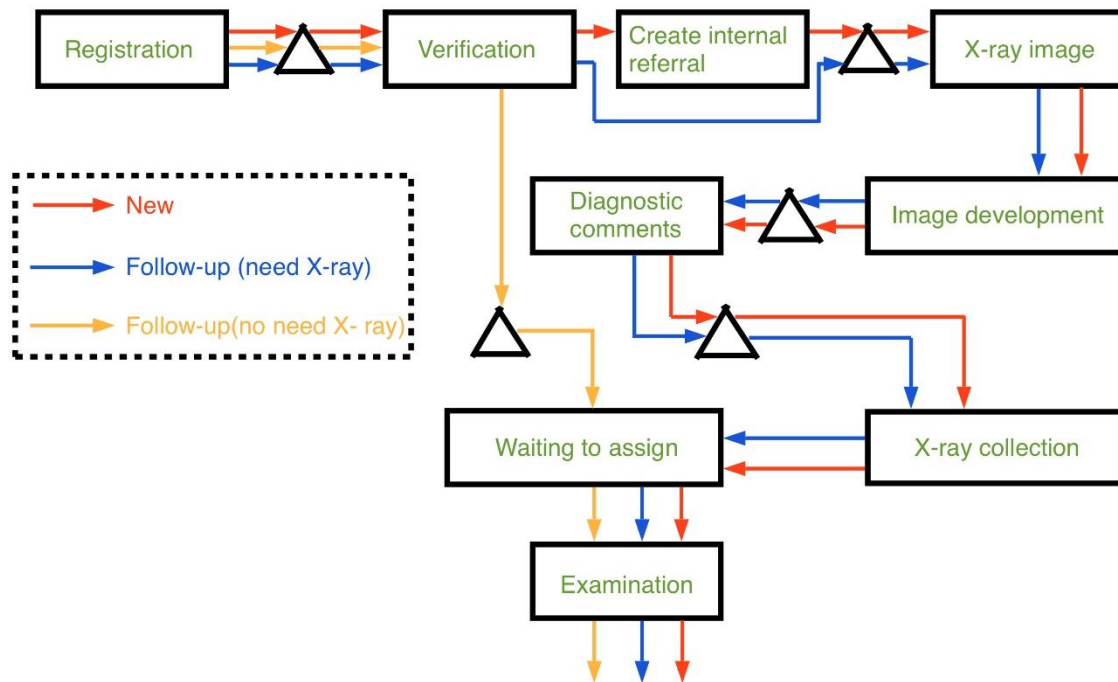
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1. Draw the process flow diagram for the Pediatric Orthopedic Clinic Case.



2. Compute the implied utilization of the following stations. Based on your analysis, which step is the bottleneck?

Activity		Resource	Cap. (patient/hr)	Dem. (patient/hr)	I.U. (Dem./Cap.)
Front desk	Registration	3	$60/5 \times 3$	$80/3$	0.74
	Verification and Collection	3	$60/[(9+2) \times 0.4 + 4 \times 0.6 \times 0.15 + (4+2) \times 0.6 \times 0.85] \times 3$	$80/4.25$	0.82
Radiology Department	X-ray imaging	6	$60/11 \times 6 \times (2/3)$	$(40\% \times 80 + 60\% \times 80 \times 85\%)/4$	0.83
	Development of X-ray	6(machine)	$60/7 \times 6 \times (2/3)$	$(40\% \times 80 + 60\% \times 80 \times 85\%)/4$	0.53
	Diagnostic reading and comments	3	$60/5 \times 3 \times (2/3)$	$(40\% \times 80 + 60\% \times 80 \times 85\%)/4$	0.76
	Hand-off of X-ray	1	$60/2$	$(40\% \times 80 + 60\% \times 80)/4.25$	0.63
Examination Room	Surgeon	1	$60/(7 \times 0.69 + 4 \times 0.31)$	$(40\% \times 80 + 60\% \times 80 \times 30\%)/4.25$	1.10
	Resident	1	$60/7$	$60\% \times 80 \times 70\%/4.25$	0.92
	Cast technician	1	$60/(0.53 \times 17 + 0.47 \times 13)$	$(40\% \times 80 \times 25\% + 60\% \times 80 \times 15\%)/4.25$	0.90

Surgeon in the examination room has the highest implied utilization, so it is the bottleneck.

3. What is the average flow time for new patients and follow-up patients, respectively?
What is the average flow time for all patients? Using this information, can you estimate the number of patients in the clinic?

	Avg. FT(min)
New patients	$30+58+3+38=129$
Follow-up patients	$25+58*85\%+3+33=110.3$
All patients	$(30+58+3+38)*40\%+(25+58*85\%+3+33)*60\%=117.78$

Estimate patients = Avg. FR * Avg. FT = Avg. Demand rate * Avg. FT
 $= 80(\text{patient})/3(\text{hr}) * [117.78(\text{min})/60(\text{min/hr})] = 26.67 \text{ patients/hr} * 1.963(\text{hr})$
 $= 52.35 \text{ patients}$

So the estimation of the patients' number in the clinic is about 53.

4. Estimate the average waiting time of new and follow-up patients at the Front Desk, Radiology Department, and Examination Room steps. Which step has the longest waiting time? Can you explain why?

Activity			Avg. rush-order FT(min)	Avg. FT(min)	Avg. waiting time(min)
Front desk	New patients		$5+9+2=16$	30	$30-16=14$
	Follow-up patient	Need X-ray(85%)	$5+4+2=11$	25	$25-11*0.85+9*0.15=14.3$
		No need X-ray (15%)	$5+4=9$		
Radiology Department	New patients		$11+7+5=23$	58	$58-23=35$
	Follow-up patient	Need X-ray(85%)	$11+7+5=23$	58	$(58-23)*0.85=29.75$
		No need X-ray (15%)	0	0	
Examination Room	New patients		$2+7+17*25\%=13.25$	38	$38-13.25=24.75$
	Follow-up patient	surgeon(30%)	$2+4+13*15\%=7.95$	33	$33-0.3*7.95-0.7*10.95=22.95$
		Senior resident (70%)	$2+7+13*15\%=10.95$		

The radiology department has the longest waiting time, for both new and follow-up patients.

The reasons are as follows:

- Only two-thirds of the capacity of this department can be used by patients from the clinic. Because for emergencies there is no such basis of “first-come, first-served”. If emergencies happen, the

regular patients must wait for them. And there is no limitation to this waiting time.

- Also, it takes the longest service time. Since the demand for this step is not much lower than others, the salient longer processing time will cause a longer waiting time.

5. The end of the case states three options to reduce the waiting time. The last option is to better schedule the patients' appointments and group certain types of patients together. Do you think this option will help reduce the waiting time? Why or why not? If you think this will help, how would you recommend the clinic to schedule and group the patients?

Yes, we think this option will help, the reasons and solutions are as follow:

- First, the adjustment will reduce a lot of waiting time in the radiology department. On the one hand, it will take the technician a lot of time for machine adjustment if consecutive patients require to take different types of X-ray images; if one certain imaging room only serves patients who need one of those two generic types of X-rays, it will save the technician from major adjustment, increase the implied utilization. This means patients can wait for the machine for a much shorter time. On the other hand, if the same type of images came simultaneously, the radiologists can even review and interpret similar parts at the same time.
- Second, it takes a lot of time for the cast technician's work, but this step has a low demand. So, if we can arrange patients who have this requirement alternatively on the surgeon and senior resident who deals with patients, there should be a lot of reduction for those who need adjustments of their cast. For example, alternate calling new and follow-up patients to lower the probability that the second patient waiting for the cast technician and occupying the examination room for waiting.
- Third, if the clinic allows patients to make appointments and handle required documents online, the staff can make arrangements for their visit dates to accomplish the solution above in a more efficient way.