

**Four months of leave from work taken six months after an accident. Is this delayed time off work related to the earlier accident or not?**

**Can a mathematical model aid to solve this issue?**

Consider the following scenario:

A 50 year old male is involved in a road traffic accident in June 2014 and suffers a soft tissue injury to the neck. He attends his GP the following day. There had been some mild neck pain prior to the accident but nothing of significance and he has never had to take any time off work in the past due to neck pain. The GP prescribes pain killers, advises to remain mobile and organises the patient 6 sessions of physiotherapy. During this period the pain was bearable and he continued to work. With physiotherapy, the neck pain improved, but the patient did not reach pre-accident level of health.

The above situation continues, until 6 months after the accident, December 2014, where there is a sudden exacerbation of neck pain. There is no injury in December 2014 and the pain just flares up. The patient once again consults his GP and is referred for a further course of physiotherapy. The pain is severe and he takes time off work. An MRI scan of the neck is also organised and it shows degeneration and some disc bulges but there is no nerve or spinal cord compression.

With the second course of physiotherapy the patient's condition improves and he returns to work in April 2015, despite experiencing moderate levels of symptoms for the next 6 months. The neck pain becomes mild from November 2015 and feels that he has returned to his pre-accident state of health by June 2016.

The difficult question is "**Is the time off work from December 2014 till end of March 2015 causally related to the index accident?**"

**Now please consider the following mathematical model.**

The following three assumptions are made:

1. The exacerbation in December 2014 was due to degeneration and not due to the index accident.
2. The neck pain is evaluated on a scale to 0-100
3. A score of 50 or more in the above scale prevents the patient from working.

**Results**

The table below is an overview of the patient's pain score from June 2014 until June 2016, this timescale is established by the first column.

The 2<sup>nd</sup> column shows the pain score exclusively caused by the accident alone. It demonstrates the pain score gradually decreasing as the effects of the accident resolves.

The 3<sup>rd</sup> column shows the pain from degeneration alone, there is an exacerbation in score in December 2014, reflecting the period when he began taking time off work.

The 4<sup>th</sup> column is the combined pain score from the accident and the degeneration. As the highlighted section shows below, the combined score was above 50 between December 2014 and March 2015, i.e. when the patient had to take time off work.

	<b>Accident</b>	<b>Degeneration</b>	<b>Total = Accident + Degeneration</b>
<b>Jun-14</b>	25	10	35
<b>Jul-14</b>	24	11	35
<b>Aug-14</b>	23	13	36
<b>Sep-14</b>	22	16	38
<b>Oct-14</b>	21	20	41
<b>Nov-14</b>	20	25	45
<b>Dec-14</b>	19	45	64
<b>Jan-15</b>	18	44	62
<b>Feb-15</b>	17	42	59
<b>Mar-15</b>	16	38	54
<b>Apr-15</b>	15	34	49
<b>May-15</b>	14	30	44
<b>Jun-15</b>	13	25	38
<b>Jul-15</b>	12	20	32
<b>Aug-15</b>	11	15	26
<b>Sep-15</b>	10	10	20
<b>Oct-15</b>	9	10	19
<b>Nov-15</b>	8	10	18
<b>Dec-15</b>	7	10	17
<b>Jan-16</b>	6	10	16
<b>Feb-16</b>	5	10	15
<b>Mar-16</b>	4	10	14
<b>Apr-16</b>	3	10	13
<b>May-16</b>	2	10	12
<b>Jun-16</b>	1	10	11
<b>Jul-16</b>	0	10	10

**Table 1: Pain scores over a 2 year period due to effect of accident, degeneration and a total score.**

### **Interpretation**

In June 2014 the immediate effect of the accident gives a pain score of 25, the effect from degeneration is 10 at this point making a combined value of 35. Since this is below the threshold value of 50, the patient did not need to take time off work. However, In December 2014 there is a sudden exacerbation in the pain score from the degeneration, it increases from a value of 25 to 45. At this point the pain score due to effect of the accident alone is 19, giving a combined value of effects of accident and degeneration as 64 (19+45). Since this value is above 50, the claimant had to stop working. The total score stays above 50 until the end of March 2015.

In April 2015 the effects of the accident decreases to 15, the effect of degeneration is now 34 and hence the combined value becomes 49. The total value has decreased below 50, enabling the claimant to return to work. The overall symptoms become mild as time passes and the patient returns to his pre-accident state of health by the second anniversary of the accident (June 2016), where his total score is only 11.

From the above explanation it is clear that without the input of the effects of the accident to the overall pain score, the patient’s total score would not have gone above 50 at any point. Meaning if in December 2014 the effects of degeneration was the only contributing factor to the total pain score, it would not have gone beyond the threshold value of 50, therefore the patient would not have had to take any time off work. This shows that degeneration alone could not have prevented the claimant from working. Essentially “but for the accident” the claimant would not have had to take any time off work.

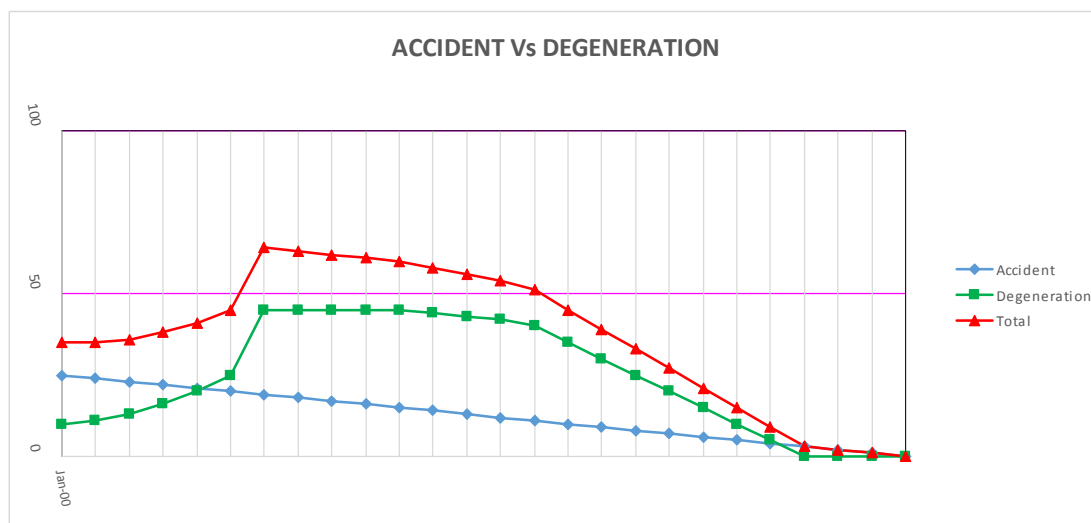


Table 2: Illustration of effects of accident, degeneration and total against the threshold value of 50.