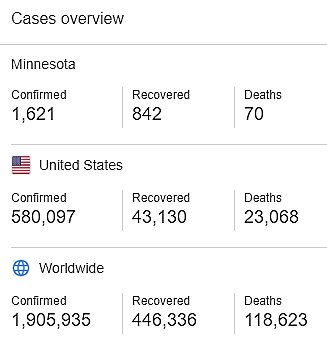
COVID – 19 **RISK MODEL & ASSESSMENT REPORT**

OUTBREAK in MARS STATE UNIVERSITY(MSU)

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**SUMMARY:**

About: A report is prepared on a case study of Mars State University (MSU). Primarily focused on realising how different scenarios about risks involved are considered and compared for a pandemic spread globally - Coronavirus disease 2019 (COVID-19) is a respiratory illness that can spread from person to person. The virus that causes COVID-19 is a novel coronavirus that was first identified during an investigation into an outbreak in Wuhan, China. And this report infers risks involved in resuming face to face classes after spring break. Mode: Online = 20% +more, Classroom = 80%.

Area of Focus: Midwest Regions (North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Kansas, Michigan, Indiana, and Ohio).

Tool Used: SIR model (David Smith, 2004); (model that computes the theoretical number of people infected with a contagious illness in a closed population over time. The name of this class of models derives from the fact that they involve coupled equations relating the number of susceptible people S(t), number of people infected I(t), and number of people who have recovered R(t)). One of the simplest SIR models is the Kermack-McKendrick model (wolfram alpha).

**SCOPE:**

Table 1: COVID'19 spread all over the world.

Considering, that COVID’19 is impacted and expanded suddenly during spring break when most of the students as well as faculty were on holiday trips = 65%, 20% stayed at home and 15% worked in campus jobs or activities. Measures/methods implementation started after the spring break was over and most of the students/faculties are back to their homes.

|  |  |
| --- | --- |
| People | Number of individuals associated with MSU |
| Students | 15,000 |
| Faculty | 600 |
| Staff | 400 |

**SCENARIOS:**

1. Moving classes to fully online, Low transmission/infection rates.
2. 5 Faculty/Staff & 10 Students coming back from Spring Break with Covid-19 as Contagious).
3. With social distancing b) Without social distancing.
4. Everything remained normal, no steps taken.
5. Only moving contagious student/faculty/staff to quarantine.

Table 2 Data taken for case study of MSU

**Assumptions on Transmission:**

1. It takes 1 whole week to show symptoms and the infection is infecting just one time to a single person.
2. Some may not survive according to the mortality rates = students (1%), staff/faculty (4%), older people are lesser immune and have higher chances to get Covid’19 (higher mortality rate than students).

**Model Explanation:**

Using SIR model (Shoder), firstly, obtain the value of how many people are we considering in university? = Total Number of People, how many of them are sick at first? = According to the scenarios, we took general classification as 15% of students or faculties were already infected during spring break, and for special scenarios, 10 students and 5 faculty contagious.

Secondly, we obtained various rates and number of days we want to calculate about the spread of disease. Where mortality rate is same as given above, infection or transfer rate for the SIR model is considered by every 10000 and accordingly how many of the people left are not sick yet but could be are considered in Susceptible category which is actually equal to Total – Infected, Assuming, only one time the person gets sick.

In some cases, the susceptible are left susceptible because they did not get interacted by the infected ones as according to the scenario of studying online 100% but still the chance of getting affected remains there. Thus, if the rate or difference is seen in recover rate is just because the susceptible people are still susceptible. Possible interactions would be multiplying Susceptible and Infected. Thus, small change in infected number would be susceptible \* Interaction rate\* infection rate.

* Infected = Infected + delta Infected \* delta Time
* Susceptible = Susceptible - delta Infected \* delta Time
* delta Recovered = Infected Before \* Recovery Rate
* Infected = Infected Before + (delta Infected - delta Recovered) \* delta Time
* Recovered = Recovered Before + delta Recovered \* delta Time (Shoder)

\*\* With some calculation like Death as a column, manually some values are entered according to the scenario and infection rate and differences in infection rate among the various age groups, also considering the real-world values. Also, for death column, values are put in very less number which can be changed.

**How this case study can help?**

Faculties, university staff, members or business, industrial, healthcare groups can be beneficial by using the model and report, as according the results,

* what steps should they take in their respective industries,
* how much commodities the company should produce beforehand for maximum supply and benefit,
* if social distancing is implemented how worse scenario tending to happen can be neglected and
* simultaneously, how common people especially students should take measures to curb such a pandemic.

**How countries where lockdown started very early happened to safeguard its vast population from COVID’19?**

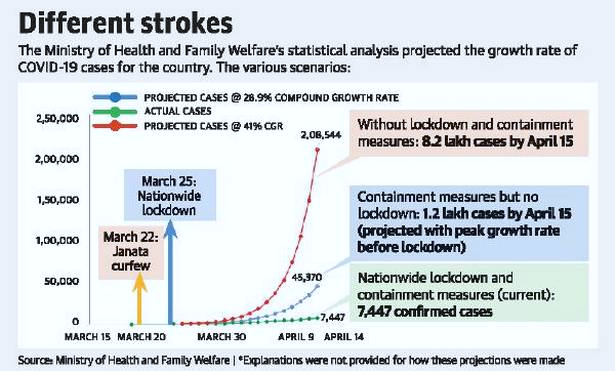


Figure 1This is an image taken from The Hindu (HIndu) new paper where India's respond with Social distancing paves its way to reduce the cases.

|  |  |  |
| --- | --- | --- |
| Factors (General) | Student | Faculty |
| Infection Rate | 0.02 | 0.04 |
| Interaction Rate | 0.05 | 0.08 |
| Mortality rate | 0.01% | 0.8% |

**Scenario 1**

****Moving classes to fully online i.e. Low transmission/infection rates. (students)

Table 3 For scenario where

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Day | Susceptible | Infected | Recovered | Death |
| Week 1 | 0 | 12750 | 2250 | 0 | 0 |
| 7 | 12413 | 2588 | 0 | 0 |
| Week 2 | 14 | 12490 | 2510 | 0 | 0 |
|  | 21 | 12271 | 2686 | 3 | 0 |
| Week 4 | 28 | 12040 | 2874 | 11 | 0 |
|  | 35 | 9155 | 1351 | 19 | 0 |
| Week 6 | 42 | 7785 | 1040 | 21 | 0 |
|  | 49 | 6725 | 801 | 27 | 0 |
| Week 8 | 56 | 5897 | 617 | 31 | 0 |
|  | 63 | 5249 | 475 | 43 | 0 |
| Week 10 | 70 | 4732 | 366 | 55 | 1 |
|  | 77 | 4311 | 281 | 56 | 0 |
| Week 12 | 84 | 3974 | 217 | 87 | 0 |
|  | 91 | 3670 | 167 | 150 | 0 |
| Week 14 | 98 | 3353 | 78 | 34 | 0 |
|  | 105 | 3241 | 37 | 22 | 0 |
| Week 16 | 112 | 1267 | 17 | 19 | 0 |
|  | 119 | 768 | 8 | 14 | 0 |
| Week 18 | 126 | 468 | 4 | 12 | 0 |
|  | 133 | 331 | 0 | 18 | 0 |
| Week 20 | 140 | 120 | 0 | 12 | 0 |
|  | 147 | 120 | 0 | 2 | 0 |
| Week 22 | 154 | 120 | 0 | 2 | 0 |
|  | 161 | 120 | 0 | 0 | 0 |
| Week 24 | 168 | 120 | 0 | 0 | 0 |
|  | 175 | 120 | 0 | 0 | 0 |
| Week 26 | 182 | 120 | 0 | 0 | 0 |
|  | 189 | 120 | 0 | 0 | 0 |
| Week 28 | 196 | 80 | 0 | 0 | 0 |
|  | 203 | 60 | 0 | 0 | 0 |
| Week 30 | 210 | 20 | 0 | 0 | 0 |

* Students and faculties staying at home: 15000, 1000 safe from getting infected until and unless they are already contagious without symptoms i.e. let’s consider Students and faculties/staffs (15% got infected while they were on holidays yet to show symptoms, rest stayed at home and are not infected).

Graph 1 Scenario1 where classes are moved online fully

Graph 2 Scenario 1

**For fully moved classes online (faculty):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Time | Susceptible | Infected | Recovered | Death |
| Week 1 | 0 | 850 | 150 | 0 | 0 |
| 7 | 828 | 173 | 0 | 0 |
| Week 2 | 14 | 828 | 173 | 0 | 0 |
|  | 21 | 827 | 185 | 0 | 0 |
| Week 4 | 28 | 825 | 197 | 1 | 0 |
|  | 35 | 627 | 93 | 5 | 0 |
| Week 6 | 42 | 529 | 71 | 7 | 0 |
|  | 49 | 451 | 55 | 10 | 0 |
| Week 8 | 56 | 386 | 42 | 12 | 0 |
|  | 63 | 332 | 33 | 11 | 0 |
| Week 10 | 70 | 289 | 25 | 11 | 1 |
|  | 77 | 252 | 19 | 11 | 0 |
| Week 12 | 84 | 222 | 15 | 12 | 0 |
|  | 91 | 195 | 11 | 12 | 0 |
| Week 14 | 98 | 171 | 5 | 12 | 0 |
|  | 105 | 154 | 3 | 19 | 0 |
| Week 16 | 112 | 133 | 1 | 40 | 1 |
|  | 119 | 91 | 1 | 45 | 0 |
| Week 18 | 126 | 45 | 0 | 36 | 0 |
|  | 133 | 9 | 0 | 6 | 0 |
| Week 20 | 140 | 3 | 0 | 2 | 0 |
|  | 147 | 0 | 0 | 1 | 0 |
| Week 22 | 154 | 0 | 0 | 0 | 0 |
|  | 161 | 0 | 0 | 0 | 0 |
| Week 24 | 168 | 0 | 0 | 0 | 0 |
|  | 175 | 0 | 0 | 0 | 0 |
| Week 26 | 182 | 0 | 0 | 0 | 0 |
|  | 189 | 0 | 0 | 0 | 0 |
| Week 28 | 196 | 0 | 0 | 0 | 0 |
|  | 203 | 0 | 0 | 0 | 0 |
| Week 30 | 210 | 0 | 0 | 0 | 0 |

|  |  |
| --- | --- |
| Total | 15000 |
| Infection Rate | 0.3 |
| Interaction Rate | 0.00005 |
| Initial Infected | 10 |
| Delta Time | 7 |
| Recovery Rate | 0.1 |

**Scenario 2**

5 Faculty/Staff & 10 Students coming back from Spring Break with Covid-19 (5F/S:10ST Contagious).

1. **With Social Distancing: (students)**

Interaction between students and teachers will completely reduced leading to low interaction rate

Initially as 10 were infected and 0.3% remains the infection rate as it will transmit at very low rate.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Time | Susceptible | Infected | Recovered | Death |
| Week 1 | 0 | 14990 | 10 | 0 | 0 |
| 7 | 14974 | 19 | 7 | 0 |
| Week 2 | 14 | 14945 | 35 | 20 | 0 |
|  | 21 | 14890 | 66 | 45 | 0 |
| Week 4 | 28 | 14787 | 122 | 91 | 0 |
|  | 35 | 14597 | 226 | 176 | 0 |
| Week 6 | 42 | 14250 | 415 | 335 | 0 |
|  | 49 | 13630 | 745 | 625 | 0 |
| Week 8 | 56 | 12563 | 1290 | 1147 | 0 |
|  | 63 | 10861 | 2089 | 2050 | 0 |
| Week 10 | 70 | 8478 | 3009 | 3512 | 1 |
|  | 77 | 5799 | 3582 | 5619 | 0 |
| Week 12 | 84 | 3618 | 3255 | 8126 | 0 |
|  | 91 | 2381 | 2213 | 10405 | 0 |
| Week 14 | 98 | 1828 | 1217 | 11954 | 0 |
|  | 105 | 1594 | 599 | 12806 | 0 |
| Week 16 | 112 | 1494 | 280 | 13225 | 0 |
|  | 119 | 1450 | 128 | 13421 | 0 |
| Week 18 | 126 | 1431 | 58 | 13510 | 0 |
|  | 133 | 1422 | 26 | 13551 | 0 |
| Week 20 | 140 | 1418 | 12 | 13569 | 0 |
|  | 147 | 1416 | 5 | 13577 | 0 |
| Week 22 | 154 | 1416 | 2 | 13581 | 0 |
|  | 161 | 1415 | 1 | 13583 | 0 |
| Week 24 | 168 | 1415 | 0 | 13583 | 0 |
|  | 175 | 1415 | 0 | 13584 | 0 |
| Week 26 | 182 | 1415 | 0 | 13584 | 0 |
|  | 189 | 1415 | 0 | 13584 | 0 |
| Week 28 | 196 | 1415 | 0 | 13584 | 0 |
|  | 203 | 1415 | 0 | 13584 | 0 |
| Week 30 | 210 | 1415 | 0 | 13584 | 0 |

Graph 3 The SIR model curve obtained for completely shifting of online classes (students)

**social distancing is the key to curb COVID’19**, as we can see in the curve, infection is reduced at a better rate compared to other scenarios, as well as susceptiblity towards getting infected deminishes at a greater rate, and almost negligible death rates with increase in recovering of people (basically the model merges down all the susceptible as well left ones into recovered).

|  |  |
| --- | --- |
| Total | 1000 |
| Infection Rate | 0.4 |
| Interaction Rate | 0.00024 |
| Initial Infected | 5 |
| Delta Time | 7 |
| Recovery Rate | 0.04 |

**With social distancing (faculties/staff):**

Interaction between teachers to all others will be completely reduced, leading to low interaction

rate and Initially as 5 faculties/staff were infected and 0.4% remains the infection rate as it will

transmit at very low rate compared to other scenarios

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Time | Susceptible | Infected | Recovered | Death |
| Week 1 | 0 | 995 | 5 | 0 | 0 |
| 7 | 992 | 7 | 1 | 0 |
| Week 2 | 14 | 987 | 10 | 3 | 0 |
|  | 21 | 981 | 13 | 6 | 0 |
| Week 4 | 28 | 972 | 18 | 10 | 0 |
|  | 35 | 960 | 25 | 15 | 0 |
| Week 6 | 42 | 944 | 34 | 22 | 0 |
|  | 49 | 922 | 47 | 32 | 0 |
| Week 8 | 56 | 893 | 62 | 45 | 0 |
|  | 63 | 855 | 82 | 62 | 0 |
| Week 10 | 70 | 808 | 107 | 85 | 1 |
|  | 77 | 749 | 135 | 115 | 0 |
| Week 12 | 84 | 681 | 165 | 153 | 0 |
|  | 91 | 606 | 194 | 199 | 0 |
| Week 14 | 98 | 527 | 219 | 253 | 0 |
|  | 105 | 449 | 235 | 315 | 0 |
| Week 16 | 112 | 378 | 240 | 380 | 0 |
|  | 119 | 317 | 234 | 448 | 0 |
| Week 18 | 126 | 267 | 218 | 513 | 0 |
|  | 133 | 228 | 196 | 574 | 0 |
| Week 20 | 140 | 198 | 172 | 629 | 0 |
|  | 147 | 175 | 146 | 677 | 0 |
| Week 22 | 154 | 158 | 123 | 718 | 0 |
|  | 161 | 145 | 101 | 753 | 0 |
| Week 24 | 168 | 135 | 83 | 781 | 0 |
|  | 175 | 128 | 67 | 804 | 0 |
| Week 26 | 182 | 122 | 54 | 823 | 0 |
|  | 189 | 117 | 43 | 838 | 0 |
| Week 28 | 196 | 114 | 35 | 850 | 0 |
|  | 203 | 111 | 28 | 860 | 0 |
| Week 30 | 210 | 109 | 22 | 868 | 0 |

Graph 4 The SIR model graph for scenario where 5 contagious staff/faculties with social distancing.

**With social distancing in the case of Faculties:** as we can see in the curve, infection is reduced at a better rate compared to other scenarios, as well as susceptiblity towards getting infected deminishes. however, due to more transfer and infection rate (transmission) the suceptibilty to COVID’19 compared to students is more for age groups (40-60), and with some casualities, but is lower.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Time | Susceptible | Infected | Recovered | Death |
| Week 1 | 0 | 14990 | 10 | 0 | 0 |
| 7 | 14978 | 22 | 0 | 0 |
| Week 2 | 14 | 14953 | 47 | 0 | 0 |
|  | 21 | 14897 | 102 | 0 | 0 |
| Week 4 | 28 | 14778 | 222 | 1 | 0 |
|  | 35 | 14521 | 478 | 1 | 0 |
| Week 6 | 42 | 13977 | 1020 | 2 | 0 |
|  | 49 | 12859 | 2135 | 5 | 0 |
| Week 8 | 56 | 10707 | 4282 | 11 | 0 |
|  | 63 | 7112 | 7865 | 23 | 0 |
| Week 10 | 70 | 2727 | 12228 | 45 | 1 |
|  | 77 | 112 | 14808 | 80 | 0 |
| Week 12 | 84 | 18 | 14896 | 121 | 0 |
|  | 91 | 3 | 14833 | 163 | 0 |
| Week 14 | 98 | 0 | 14795 | 204 | 0 |
|  | 105 | 0 | 14753 | 246 | 2 |
| Week 16 | 112 | 2 | 14712 | 287 | 0 |
|  | 119 | 0 | 14669 | 328 | 0 |
| Week 18 | 126 | 0 | 14628 | 369 | 0 |
|  | 133 | 0 | 14587 | 410 | 0 |
| Week 20 | 140 | 0 | 14546 | 451 | 0 |
|  | 147 | 0 | 14505 | 492 | 0 |
| Week 22 | 154 | 0 | 14465 | 532 | 3 |
|  | 161 | 3 | 14424 | 573 | 2 |
| Week 24 | 168 | 2 | 14380 | 613 | 0 |
|  | 175 | 0 | 14338 | 654 | 0 |
| Week 26 | 182 | 0 | 14298 | 694 | 0 |
|  | 189 | 0 | 14258 | 734 | 4 |
| Week 28 | 196 | 4 | 14218 | 774 | 0 |
|  | 203 | 0 | 14174 | 813 | 0 |
| Week 30 | 210 | 0 | 14135 | 853 | 0 |

|  |  |
| --- | --- |
| Total | 15000 |
| Infection Rate | 0.32 |
| Interaction Rate | 0.00035 |
| Initial Infected | 10 |
| Delta Time | 7 |
| Recovery Rate | 0.0004 |

1. **Without Social Distancing: cases: (Students to others)**

Students tend to roam, still even when it is restricted, and in such cases where no restriction

or social distancing is strict, it is conclusive to obtain huge amount of cases even when we

know 10 of the students are contagious.

Graph 5 The SIR model in case of 10 students contagious, without social distancing and infects to others

**Without social distancing in the case of students:** as we can see in the curve, infection is INcreasing at a higher rate and keeps on increasing untill it affects all of the students of the univeristy, Susceptiblity towards getting infected deminishes in curve because all the students got infected with 4 weeks. however, due to more transfer but lesser mortality rate lesser number of deaths are shown.

|  |  |
| --- | --- |
| Total | 1000 |
| Infection Rate | 0.46 |
| Interaction Rate | 0.00038 |
| Initial Infected | 5 |
| Delta Time | 7 |
| Recovery Rate | 0.0004 |

**Without social distancing (faculties):**

In case of staff/faculties, according to the data obtained by CDC and WHO,

higher ager groups or with other diseases carriers tend to get infected much faster,

More number of fatalities.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Time | Susceptible | Infected | Recovered | Death |
| Week 1 | 0 | 995 | 5 | 0 | 0 |
| 7 | 989 | 11 | 0 | 0 |
| Week 2 | 14 | 976 | 24 | 0 | 0 |
|  | 21 | 946 | 54 | 0 | 0 |
| Week 4 | 28 | 884 | 115 | 0 | 0 |
|  | 35 | 759 | 240 | 1 | 0 |
| Week 6 | 42 | 536 | 462 | 1 | 0 |
|  | 49 | 233 | 764 | 3 | 0 |
| Week 8 | 56 | 15 | 980 | 5 | 0 |
|  | 63 | 3 | 996 | 7 | 0 |
| Week 10 | 70 | 1 | 989 | 10 | 1 |
|  | 77 | 1 | 987 | 13 | 0 |
| Week 12 | 84 | 0 | 983 | 16 | 0 |
|  | 91 | 0 | 981 | 19 | 0 |
| Week 14 | 98 | 0 | 978 | 21 | 0 |
|  | 105 | 0 | 975 | 24 | 2 |
| Week 16 | 112 | 2 | 972 | 27 | 1 |
|  | 119 | 1 | 967 | 29 | 0 |
| Week 18 | 126 | 0 | 964 | 32 | 0 |
|  | 133 | 0 | 961 | 35 | 4 |
| Week 20 | 140 | 4 | 958 | 38 | 0 |
|  | 147 | 1 | 951 | 40 | 0 |
| Week 22 | 154 | 0 | 949 | 43 | 2 |
|  | 161 | 2 | 946 | 46 | 0 |
| Week 24 | 168 | 0 | 941 | 48 | 0 |
|  | 175 | 0 | 939 | 51 | 0 |
| Week 26 | 182 | 0 | 937 | 53 | 0 |
|  | 189 | 0 | 934 | 56 | 0 |
| Week 28 | 196 | 0 | 931 | 59 | 0 |
|  | 203 | 0 | 929 | 61 | 0 |
| Week 30 | 210 | 0 | 926 | 64 | 0 |

Graph 6 Graph for without social distancing 5 faculty already contagious scenario

**Without social distancing in the case of TEACHERS:** as we can see in the curve, infection is INcreasing at a higher rate and keeps on increasing untill it affects all of the fACULTIES OF the univeristy, Susceptiblity towards getting infected deminishes in curve because all the STAFF ALREADY got infected withIN 4 weeks.

Table 4 Scenario 2b: where without social distancing data is plotted for faculty to others

iNSIGHTS:

From the above cases, we obtained different results, for this case where all of the classes are usual as it was 85% offline and 15% online, the infection rate would be higher enough that it is considered same as taken initially for most of the cases 15% and it extends with the same number leading to more number of infected cases and fatalities.

From the first graph it is easier to observe that recovery rate is also very less because of the increase in infection rate.

For scope of business and healthcare, it is highly beneficial to know how much cases would have had affected if social distancing is not mandated and how much of supplies, ventilators, has to be obtained or simultaneously, transferring every task or documentation online and working from home facilities, software’s to keep up the work.

Scenario 3

If everything is kept normal for both students and staff.

Graph 7 For the scenario where no measure is implemented, and everything is kept normal in case of both students as well as staff

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Time | Susceptible | Infected | Recovered | Death |
| Week 1 | 0 | 13600 | 2400 | 0 | 0 |
| 7 | 13326 | 2641 | 34 | 0 |
| Week 2 | 14 | 13030 | 2899 | 71 | 0 |
|  | 21 | 12713 | 3176 | 111 | 0 |
| Week 4 | 28 | 12374 | 3471 | 156 | 0 |
|  | 35 | 12013 | 3783 | 204 | 0 |
| Week 6 | 42 | 11631 | 4112 | 257 | 0 |
|  | 49 | 11230 | 4456 | 315 | 1 |
| Week 8 | 56 | 10808 | 4814 | 377 | 0 |
|  | 63 | 10371 | 5183 | 444 | 0 |
| Week 10 | 70 | 9920 | 5562 | 517 | 1 |
|  | 77 | 9455 | 5948 | 595 | 0 |
| Week 12 | 84 | 8983 | 6337 | 678 | 0 |
|  | 91 | 8505 | 6726 | 767 | 2 |
| Week 14 | 98 | 8022 | 7113 | 861 | 0 |
|  | 105 | 7543 | 7492 | 961 | 0 |
| Week 16 | 112 | 7068 | 7862 | 1066 | 3 |
|  | 119 | 6598 | 8219 | 1176 | 0 |
| Week 18 | 126 | 6143 | 8560 | 1291 | 0 |
|  | 133 | 5701 | 8881 | 1411 | 0 |
| Week 20 | 140 | 5276 | 9182 | 1535 | 0 |
|  | 147 | 4869 | 9461 | 1663 | 0 |
| Week 22 | 154 | 4482 | 9715 | 1796 | 3 |
|  | 161 | 4113 | 9945 | 1932 | 0 |
| Week 24 | 168 | 3770 | 10149 | 2071 | 0 |
|  | 175 | 3448 | 10329 | 2213 | 0 |
| Week 26 | 182 | 3149 | 10483 | 2358 | 4 |
|  | 189 | 2868 | 10614 | 2505 | 0 |
| Week 28 | 196 | 2612 | 10721 | 2653 | 0 |
|  | 203 | 2377 | 10806 | 2803 | 0 |
| Week 30 | 210 | 2161 | 10870 | 2955 | 0 |

Graph 8 Another implementation to infer properly from the same data points

|  |  |
| --- | --- |
| Total | 16000 |
| Infection Rate | 0.15 |
| Interaction Rate | 0.000008 |
| Initial Infected | 2400 |
| Delta Time | 7 |
| Recovery Rate | 0.002 |

Scenario 4:

iNSIGHTS:

From the above cases, we obtained different results, for this case where only contagious student/faculty /staff are moved to quarantine all the classes are usual as it was 85% offline and 15% online, the infection rate would be similar but prologue in this case because the possibility of getting into contact will be less but somehow the infection still will prevail or spread either through parents or doctors if proper measures not taken. Thus, it extends with a greater number of infected cases and fatalities but less in comparison to the previous case.

From the first and second graph it is easier to observe that recovery rate is also very less because of the increase in infection rate.

Only moving contagious student/faculty/staff to quarantine.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Time | Susceptible | Infected | Recovered | Death |
| Week 1 | 0 | 13600 | 2400 | 0 | 0 |
| 7 | 13394 | 2572 | 34 | 0 |
| Week 2 | 14 | 13177 | 2753 | 70 | 0 |
|  | 21 | 12949 | 2943 | 108 | 0 |
| Week 4 | 28 | 12709 | 3142 | 149 | 0 |
|  | 35 | 12457 | 3350 | 193 | 0 |
| Week 6 | 42 | 12194 | 3566 | 240 | 0 |
|  | 49 | 11920 | 3790 | 290 | 1 |
| Week 8 | 56 | 11635 | 4021 | 343 | 0 |
|  | 63 | 11340 | 4259 | 399 | 0 |
| Week 10 | 70 | 11036 | 4504 | 459 | 1 |
|  | 77 | 10722 | 4754 | 522 | 0 |
| Week 12 | 84 | 10400 | 5009 | 589 | 0 |
|  | 91 | 10072 | 5267 | 659 | 2 |
| Week 14 | 98 | 9736 | 5527 | 733 | 0 |
|  | 105 | 9397 | 5789 | 810 | 0 |
| Week 16 | 112 | 9054 | 6051 | 891 | 0 |
|  | 119 | 8709 | 6311 | 976 | 0 |
| Week 18 | 126 | 8363 | 6569 | 1064 | 0 |
|  | 133 | 8017 | 6823 | 1156 | 0 |
| Week 20 | 140 | 7672 | 7072 | 1252 | 0 |
|  | 147 | 7330 | 7315 | 1351 | 0 |
| Week 22 | 154 | 6993 | 7550 | 1453 | 3 |
|  | 161 | 6657 | 7777 | 1559 | 0 |
| Week 24 | 168 | 6331 | 7995 | 1668 | 0 |
|  | 175 | 6012 | 8202 | 1780 | 0 |
| Week 26 | 182 | 5701 | 8397 | 1894 | 2 |
|  | 189 | 5398 | 8581 | 2012 | 0 |
| Week 28 | 196 | 5106 | 8753 | 2132 | 0 |
|  | 203 | 4824 | 8912 | 2255 | 0 |
| Week 30 | 210 | 4553 | 9058 | 2379 | 0 |

**COMPARISON:**

From the case studies and obtained results, it is conclusive that even though with social distancing, there would be some fatalities, but in comparison very less in amount and a very much less amount of spread of virus possibility will be there. These graphs are inferred from above graphs from different cases for students/staff/faculties, for infection and death spread.

**Effective ways to curb Covid’19 & how university can play role:**

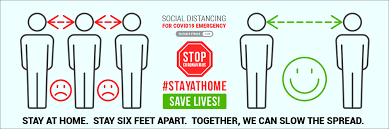
1. Social Distancing
2. Staying at home
3. Keep washing hands
4. Make less f2f contacts
5. Try to avoid sneezing in open, always use hanker chief or elbows

Figure 2: Steps to prevent COVID'19

1. Wear masks

**How business groups, industries, healthcare, education affected from the same:**

With increasing global impact and its spread, it is evident that even measures taken yet is not enough to completely constrict the spread of virus but lately business groups can help in providing supplies, commodities through different ways, healthcare groups can increase the sterilizing of areas and providing quarantine (Centre for disease control and prevention), masks, supplies to susceptible people, industries can increase their workload on machines but again with no human workload, any process is incomplete, common people can stay at home, follow measures and help the government lead the way and universities can help by:

1. shifting 100% classes online, deferring the labs/in classroom requirement classes to next semester
2. Working through interactive modules or dealing with software providers for efficient usage of material and guides online. Providing health services and quarantine ways to students who just came from different countries or cities already impacted by Covid’19.
3. Providing healthy solutions and access to various commodities to students living in dormitories and who in need.
4. Business advantage, University, industrial advantage, and pros and cons of recovery method as well as virus:

**Conclusion:** For a pandemic, early measures are very important for the economy, health or well-being for a society and according to the results we came through, the numbers lead us to follow social distancing as much as we can.

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