```
In[•]:=  (* C3.AI COVID CHALLENGE *)

In[•]:=  (* Sweden *)

In[1264]:=  Clear["Global`*"]

       type = "Deaths_per_Million";
       policy = "H6_Policy";

In[1267]:=  pD0 = 0.6650;
       pD1 = 0.1372;
       pD2 = 0.0598;
       pD3 = 0.1188;
       pD4 = 0.0192;
       pD0 + pD1 + pD2 + pD3 + pD4

Out[•]=  1.

In[•]:=  (* COnditional Prob *)

In[1274]:=  pD0C6l1 = 1;
       pD1C6l1 = 1;
       pD2C6l1 = 1;
       pD3C6l1 = 1;
       pD4C6l1 = 1;

In[1279]:=  pD0C6l0 = 1 - pD0C6l1;
       pD1C6l0 = 1 - pD1C6l1;
       pD2C6l0 = 1 - pD2C6l1;
       pD3C6l0 = 1 - pD3C6l1;
       pD4C6l0 = 1 - pD4C6l1;

In[•]:=  (* C6 - 1 *)

In[1285]:=  prC6l0 = pD0 pD0C6l0 + pD1 pD1C6l0 + pD2 pD2C6l0 + pD3 pD3C6l0 + pD4 pD3C6l0

Out[•]=  0.

In[1286]:=  prC6l1 = pD0 pD0C6l1 + pD1 pD1C6l1 + pD2 pD2C6l1 + pD3 pD3C6l1 + pD4 pD3C6l1

Out[•]=  1.

In[•]:=  (* Quantum Prob *)

In[1288]:=  interfC6l0 = Sqrt[pD0 pD0C6l0 pD1 pD1C6l0] Cos[θ00 - θ10] +
           Sqrt[pD0 pD0C6l0 pD2 pD2C6l0] Cos[θ00 - θ20] + Sqrt[pD0 pD0C6l0 pD3 pD3C6l0]
            Cos[θ00 - θ30] + Sqrt[ pD0 pD0C6l0 pD4 pD4C6l0] Cos[θ00 - θ40] +
           Sqrt[pD1 pD1C6l0 pD2 pD2C6l0 ] Cos[θ10 - θ20] +
           Sqrt[pD1 pD1C6l0 pD3 pD3C6l0] Cos[θ10 - θ30] +
           Sqrt[pD1 pD1C6l0 pD4 pD4C6l0 ] Cos[θ10 - θ40] +
           Sqrt[pD2 pD2C6l0 pD3 pD3C6l0] Cos[θ20 - θ30] + Sqrt[pD2 pD2C6l0 pD4 pD4C6l0 ]
            Cos[θ20 - θ40] + Sqrt[pD3 pD3C6l0 pD4 pD4C6l0 ] Cos[θ30 - θ40];
```

```
In[1289]:= interfC6l1 = Sqrt[pD0 pD0C6l1 pD1 pD1C6l1] Cos[θ01 - θ11] +
              Sqrt[pD0 pD0C6l1 pD2 pD2C6l1] Cos[θ01 - θ21] + Sqrt[pD0 pD0C6l1 pD3 pD3C6l1]
               Cos[θ01 - θ31] +  Sqrt[ pD0 pD0C6l1 pD4 pD4C6l1] Cos[θ01 - θ41] +
              Sqrt[pD1 pD1C6l1 pD2 pD2C6l1 ] Cos[θ11 - θ21] +
              Sqrt[pD1 pD1C6l1 pD3 pD3C6l1] Cos[θ11 - θ31] +
              Sqrt[pD1 pD1C6l1 pD4 pD4C6l1 ] Cos[θ11 - θ41] +
              Sqrt[pD2 pD2C6l1 pD3 pD3C6l1 ] Cos[θ21 - θ31] + Sqrt[pD2 pD2C6l1 pD4 pD4C6l1 ]
               Cos[θ21 - θ41] + Sqrt[pD3 pD3C6l1 pD4 pD4C6l1 ] Cos[θ31 - θ41];
```

```
In[1290]:= qprC6l0 = prC6l0 + 2 interfC6l0;
```

```
In[1291]:= qprC6l1 = prC6l1 + 2 interfC6l1;
```

```
In[1292]:=
```

```
In[1293]:= qprC6l0Norm = FullSimplify[ qprC6l0 / (qprC6l0 + qprC6l1) ];
```

```
In[1294]:= qprC6l1Norm = 1 - qprC6l0Norm;
          (*FullSimplify[ qprC6l1 / (qprC6l0+qprC6l1) ]; *)
```

```
In[1295]:= res = Minimize[{qprC6l0Norm, qprC6l0Norm + qprC6l1Norm == 1},
              {θ00, θ01, θ10, θ20, θ30, θ40, θ11, θ21, θ31, θ41}]
```

$$Out[\bullet]= \left\{0., \left\{\theta 00 \to -\frac{12}{5}, \theta 01 \to -\frac{1}{2}, \theta 10 \to -\frac{9}{5}, \theta 20 \to \frac{3}{5}, \right.\right.$$
$$\left.\left. \theta 30 \to -\frac{24}{5}, \theta 40 \to -\frac{21}{5}, \theta 11 \to \frac{11}{5}, \theta 21 \to -\frac{3}{5}, \theta 31 \to -\frac{6}{5}, \theta 41 \to -\frac{14}{5}\right\}\right\}$$

```
In[•]:= (* Params *)
```

```
In[1297]:= θ10 = res[[2]][[3]][[2]];
          θ20 = res[[2]][[4]][[2]];
          θ30 = res[[2]][[5]][[2]];
          θ40 = res[[2]][[6]][[2]];
          θ11 = res[[2]][[7]][[2]];
          θ21 = res[[2]][[8]][[2]];
          θ31 = res[[2]][[9]][[2]];
          θ41 = res[[2]][[10]][[2]];
```

```
In[•]:=
```

```
In[•]:= qprC6l0Norm = FullSimplify[ qprC6l0 / (qprC6l0 + qprC6l1) ];
```

```
In[•]:= qprC6l1Norm = 1 - qprC6l0Norm;
```

```
In[•]:= (* Updated probabilities *)
```

```
In[•]:= {qprC6l0Norm, qprC6l1Norm}
```

```
Out[•]= {0., 1.}
```

In[1310]:= `p0 = Plot3D[qprC6l0Norm, {θ00, 0, 2 π},`
`{θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),`
`AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},`
`BoundaryStyle → Thick, Boxed → False,`
`Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},`
`TicksStyle → Directive[Black, 12]];`

In[1311]:= `p1 = Plot3D[qprC6l1Norm, {θ00, 0, 2 π},`
`{θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),`
`AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},`
`BoundaryStyle → Thick, Boxed → False,`
`Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},`
`TicksStyle → Directive[Black, 12]];`

In[1312]:= `Show[p0, p1]`
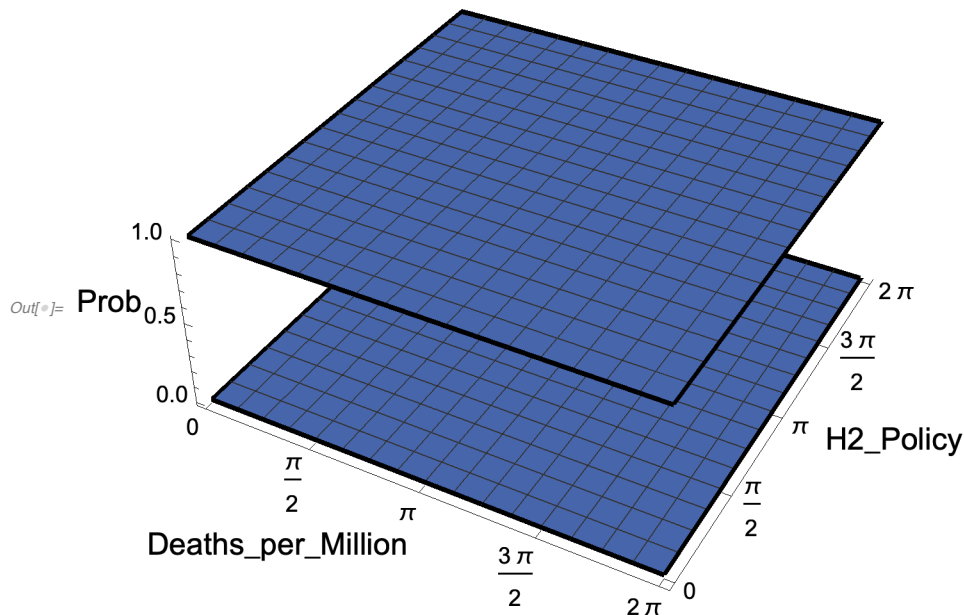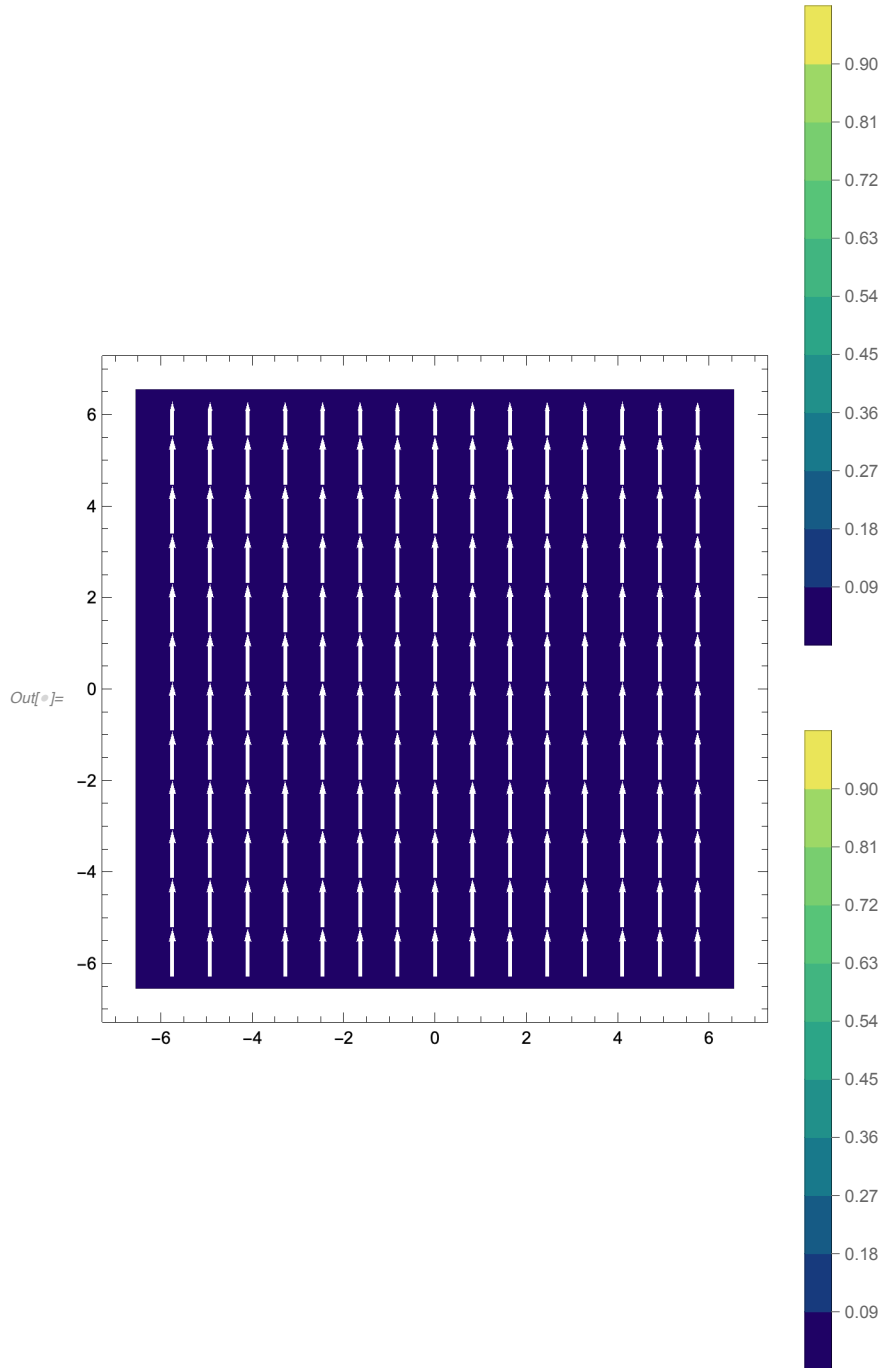
```
In[ ]:= fig = StreamDensityPlot[{qprC6l0Norm, qprC6l1Norm},
        {θ00, -2 π, 2 π}, {θ01, -2 π, 2 π}, ColorFunction → "BlueGreenYellow",
        PlotLegends → BarLegend[{"BlueGreenYellow", {0, 1}}, 10],
        AxesLabel → Automatic, StreamStyle → {White, Thick}]
```



```
In[ ]:= Clear[θ10, θ20, θ30, θ40, θ11, θ21, θ31, θ41]
```

In[ ]:= `res = Maximize[{qprC6l0Norm, qprC6l0Norm + qprC6l1Norm == 1},`
`{θ00, θ01, θ10, θ20, θ30, θ40, θ11, θ21, θ31, θ41}]`

Out[ ]= $\left\{0., \left\{\theta00 \to -\frac{12}{5}, \theta01 \to -\frac{1}{2}, \theta10 \to -\frac{9}{5}, \theta20 \to \frac{3}{5}, \right.\right.$
$\left.\left.\theta30 \to -\frac{24}{5}, \theta40 \to -\frac{21}{5}, \theta11 \to \frac{11}{5}, \theta21 \to -\frac{3}{5}, \theta31 \to -\frac{6}{5}, \theta41 \to -\frac{14}{5}\right\}\right\}$

In[ ]:= `θ10 = res[[2]][[3]][[2]];`
`θ20 = res[[2]][[4]][[2]];`
`θ30 = res[[2]][[5]][[2]];`
`θ40 = res[[2]][[6]][[2]];`
`θ11 = res[[2]][[7]][[2]];`
`θ21 = res[[2]][[8]][[2]];`
`θ31 = res[[2]][[9]][[2]];`
`θ41 = res[[2]][[10]][[2]];`

In[ ]:= `qprC6l0Norm = FullSimplify`$\left[\frac{qprC6l0}{qprC6l0 + qprC6l1}\right]$`;`

In[ ]:= `qprC6l1Norm = 1 - qprC6l0Norm;`

In[ ]:= `(* Updated probabilities *)`
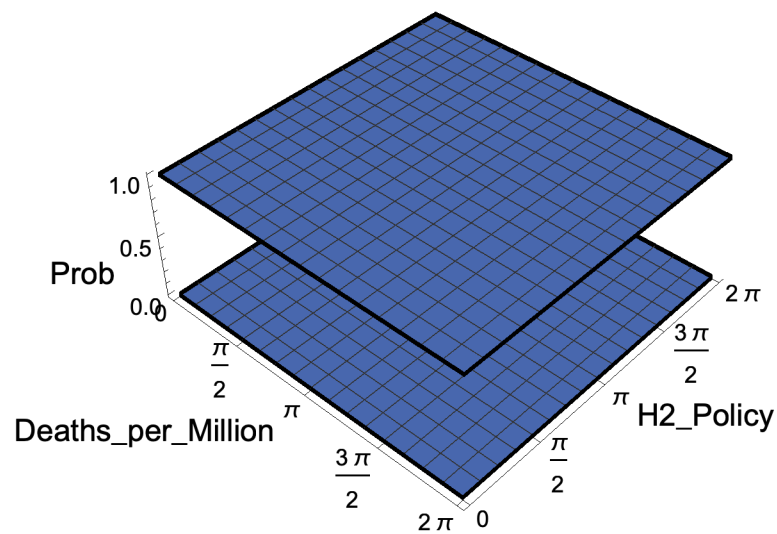
In[ ]:= `{qprC6l0Norm, qprC6l1Norm}`

Out[ ]= `{0., 1.}`

In[ ]:= `p0 = Plot3D`$\big[$`qprC6l0Norm, {θ00, 0, 2 π},`
`{θ01, 0, 2 π}, ColorFunction →` $\big($`ColorData["DarkRainbow"][#3] &`$\big)$`,`
`AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},`
`BoundaryStyle → Thick, Boxed → False,`
`Ticks →` $\big\{$`{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic`$\big\}$`,`
`TicksStyle → Directive[Black, 12]`$\big]$`;`

In[ ]:= `p1 = Plot3D`$\big[$`qprC6l1Norm, {θ00, 0, 2 π},`
`{θ01, 0, 2 π}, ColorFunction →` $\big($`ColorData["DarkRainbow"][#3] &`$\big)$`,`
`AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},`
`BoundaryStyle → Thick, Boxed → False,`
`Ticks →` $\big\{$`{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic`$\big\}$`,`
`TicksStyle → Directive[Black, 12]`$\big]$`;`

In[ ]:= **Show[p0, p1]**

Out[ ]=

In[ ]:= **fig = StreamDensityPlot[{qprC6l0Norm, qprC6l1Norm},**
{θ00, -2 π, 2 π}, {θ01, -2 π, 2 π}, ColorFunction → "BlueGreenYellow",
PlotLegends → BarLegend[{"BlueGreenYellow", {0, 1}}, 10],
AxesLabel → Automatic, StreamStyle → {White, Thick}]