STEHealth

Application Manual

version 1.1

This manual is a part of the project : **spatiotemporal analysis with application development for epidemiological study of suicide mortality**.

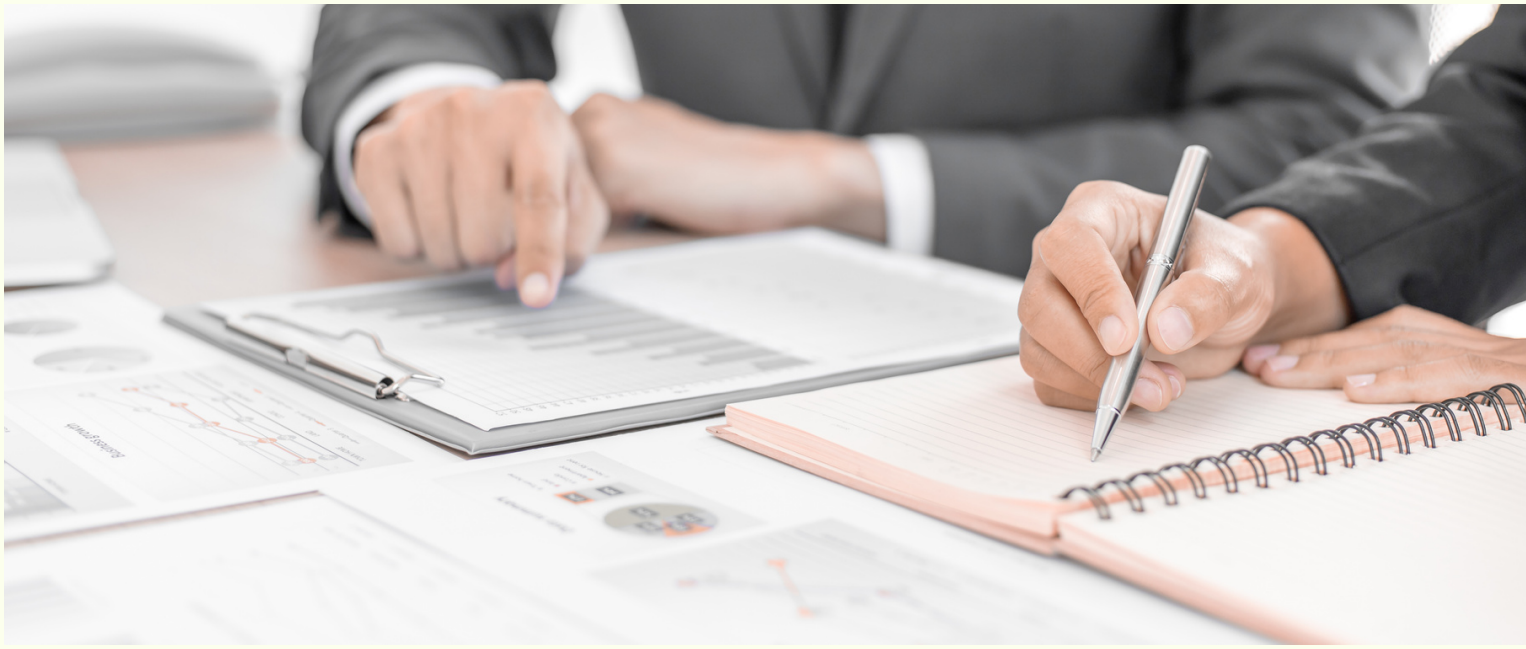


Table of Contents

01 What is STEHealth ?

STEHealth (It stands for **S**patio**t**emporal **E**pidemiological **Health**) is a application for analyzing space-time pattern and association with risk factors of suicide and other health outcomes, which allows users to import their own data, analyze, and visualize.

Objectives

To develop a user-friendly interface to facilitate visualization and analysis for spatial and spatiotemporal epidemiological studies

02 System Requirements

Minimum:
Requires a 64-bit processor and operating system
OS: Windows OS only (Windows 10 or above)
Processor: AMD Athlon Gold 3150U with Radeon Graphics 2.40 GHz
Memory: 4 GB RAM
Storage: 1.5 GB available space

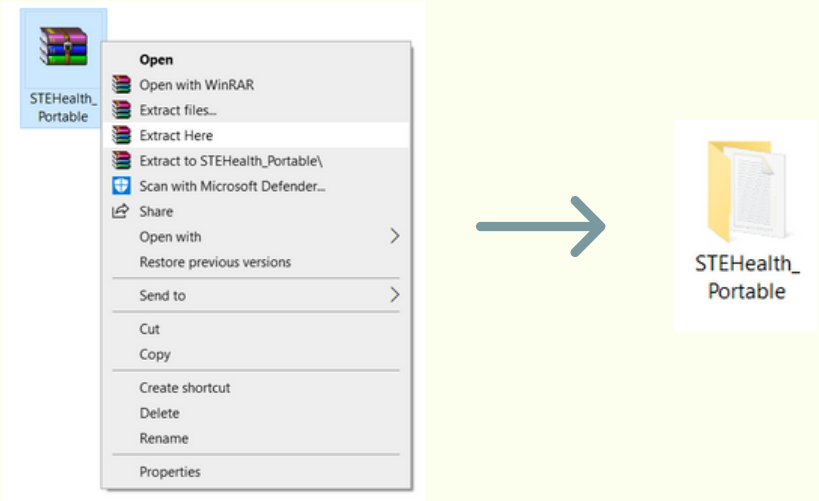
Recommened:
Requires a 64-bit processor and operating system
OS: Windows OS only (Windows 10 or above)
Processor: AMD Ryzen 5 2600 Six-Core Processor
Memory: 8 GB RAM
Storage: 1.5 GB available space

*__Note that:__ If you got “out of memory” when using our app, it might be because your computer doesn't have enough resources. Try closing any other programs you're not using at the moment.

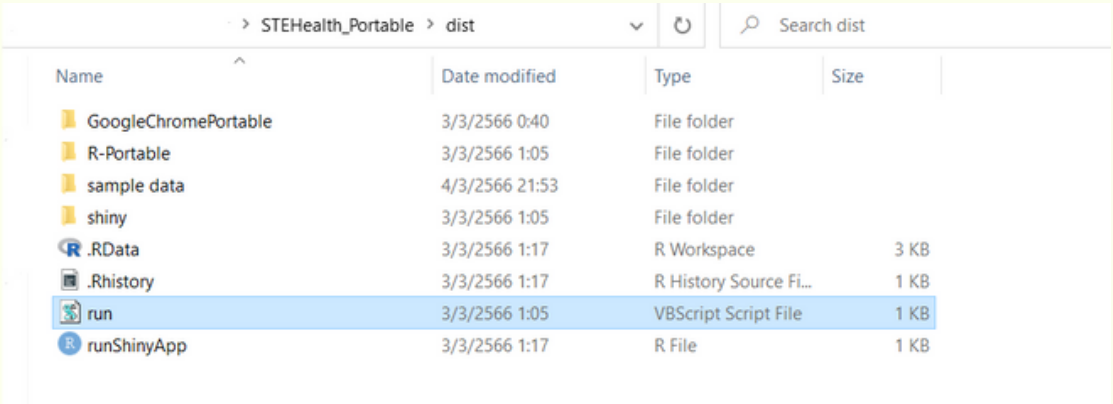
03 How to Download Application Portable

Step 1 Go to this link to download the STEHealth portable
https://drive.google.com/drive/folders/1gKW8w891qTPaKvu2-IGe38mEXaXtG39W?usp=share_link

Step 2 Extract the downloaded file



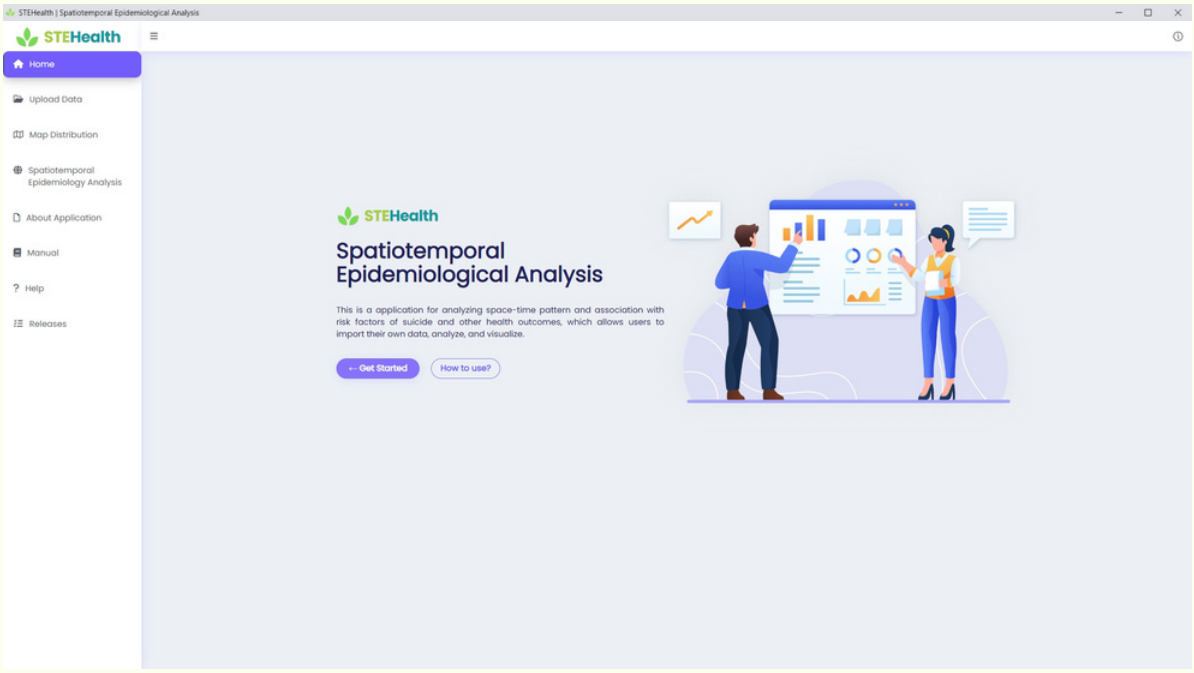
Step 3 Go to \STEHealth_Portable\dist\ and open **"run.vbs"***



***Note that:** If you open "run.vbs" and the web application doesn't open or the web application is blank, **please press "run.vbs" several times**.

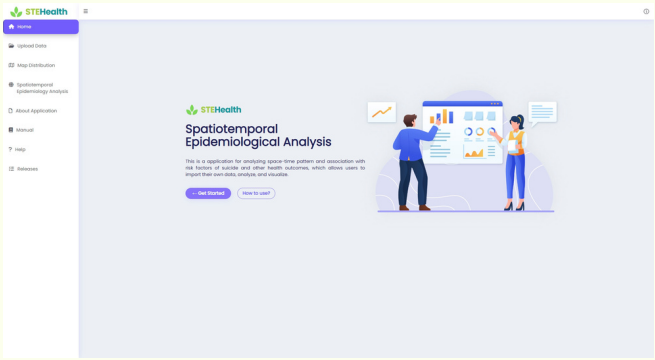
Step 4

Now you can use the application.

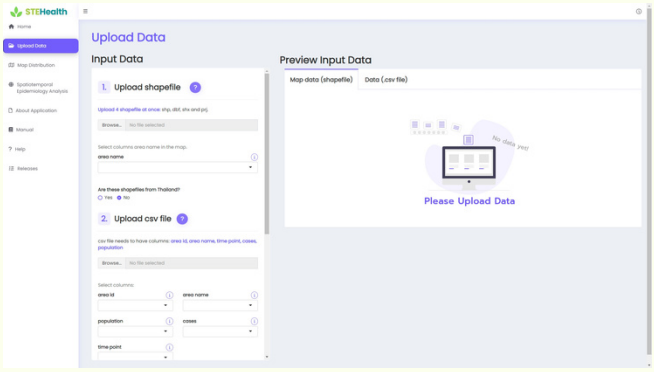


04 Application Pages

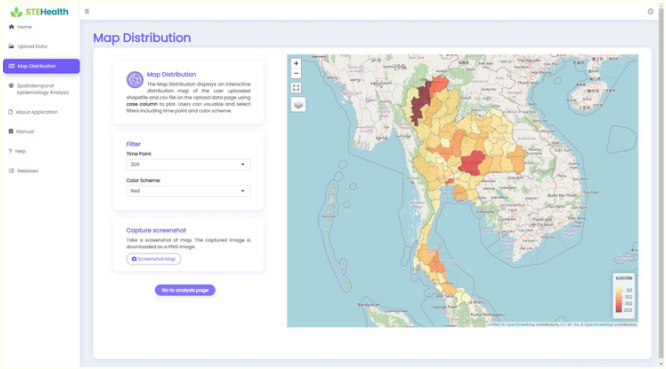
The application consists of eight pages:



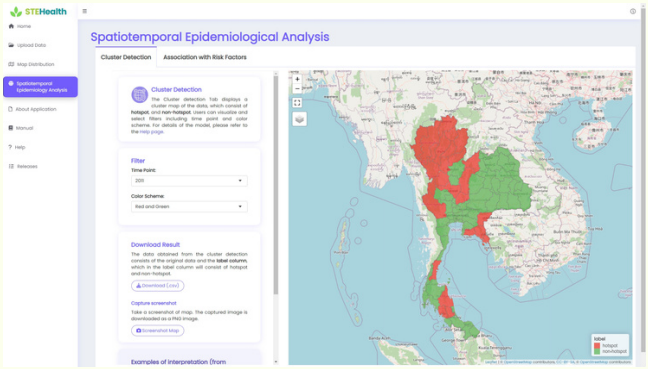
1 Home Page



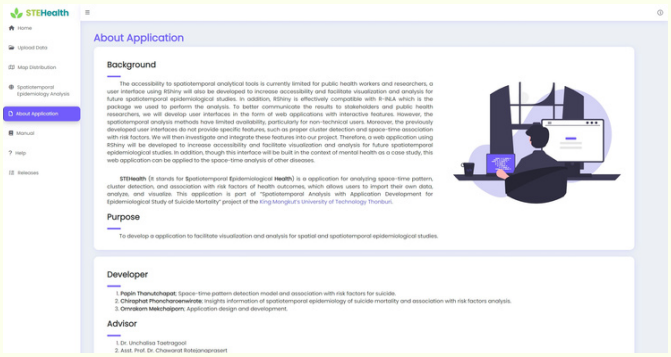
2 Upload Data Page



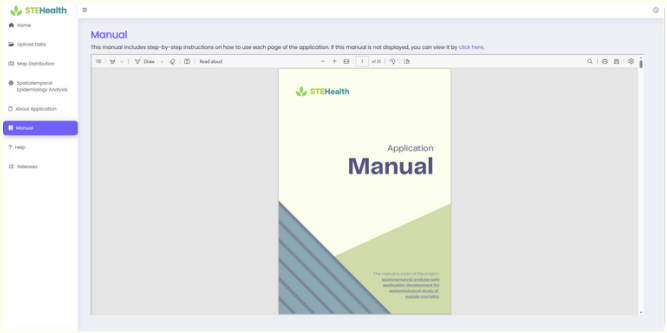
3 Map Distribution Page



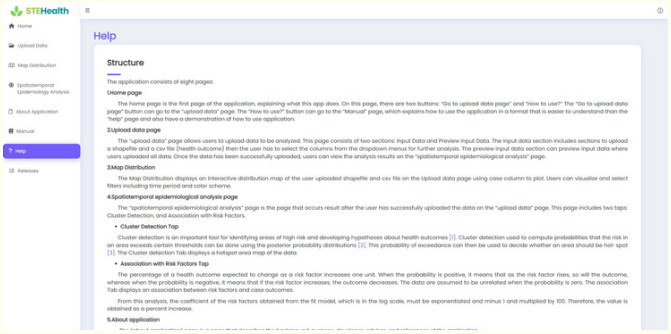
4 Spatiotemporal Epidemiological Analysis Page



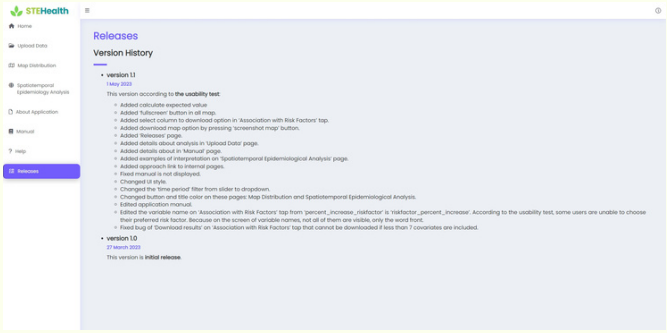
5 About Application Page



6 Manual Page



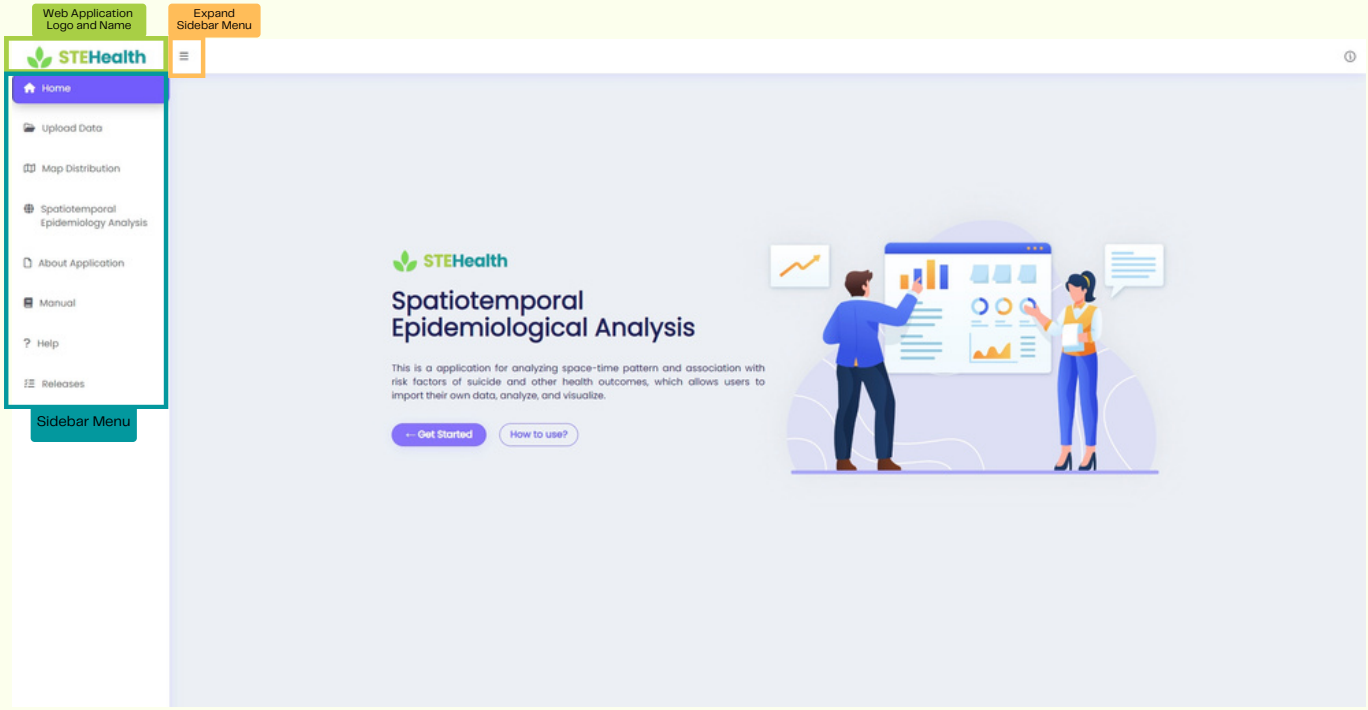
7 Help Page



8 Releases Page

Application Pages

1 Home Page



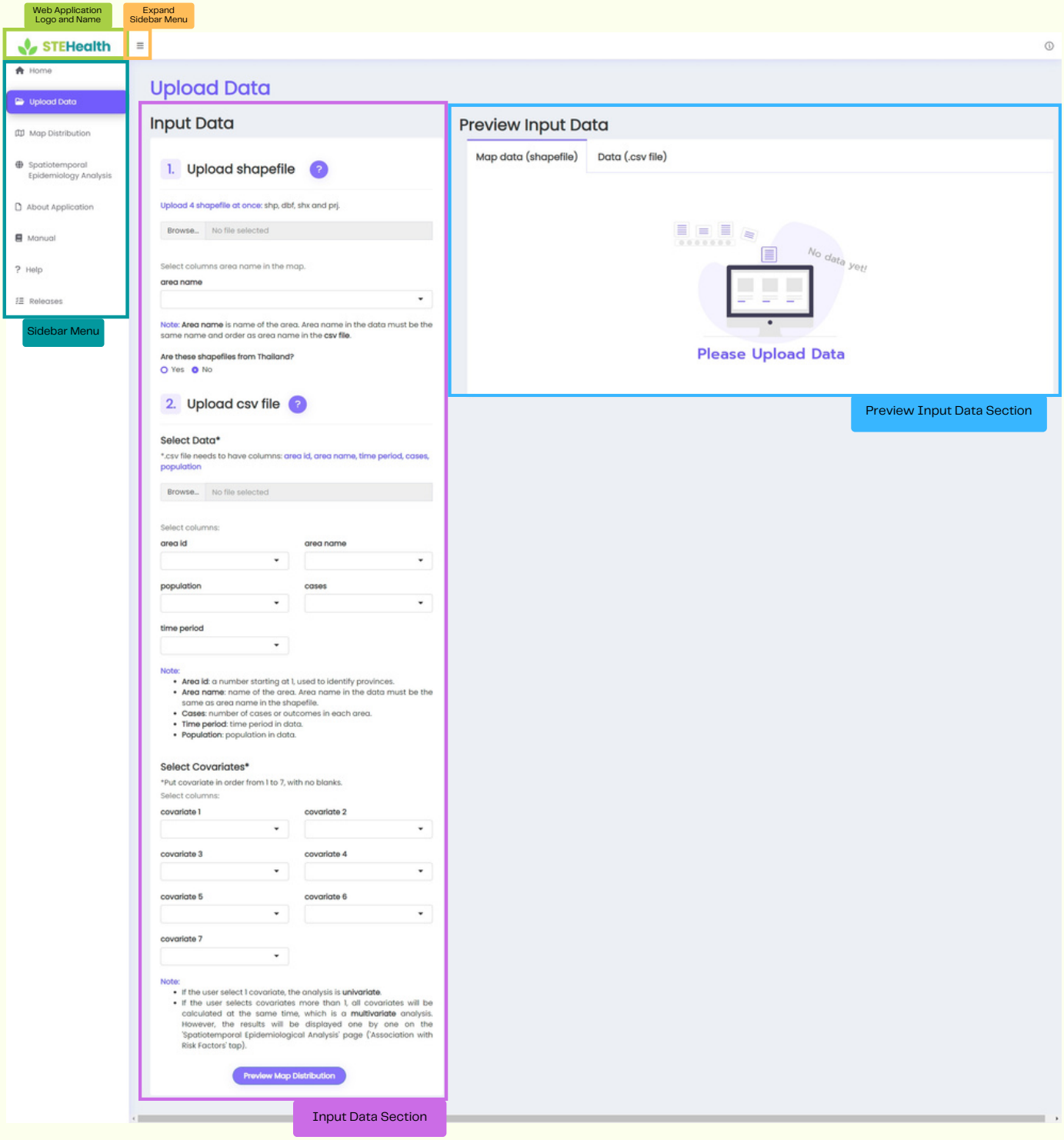
The home page is the first page of the application, explaining what this app does. On this page, there are two buttons:

1. ← Get Started — This buttons can go to the **"upload data" page**.

2. How to use? — This button can go to the **"Manual" page**, which explains how to use the web application in a format that is easier to understand than the "help" page and also have a demonstration of how to use application.

Application Pages

2 Upload Data Page



The "upload data" page allows users to upload data to be analyzed. This page consists of two sections:

1. The input data section
2. The preview input data section

1. The input data section includes sections to upload shapefile and a csv file (health outcome) then the user has to select the columns from the dropdown menus for further analysis.

- **shapefile**

Thai geographic coordinates, Thai provincial boundaries data (shapefile) will be obtained from the GEO package file in the Global Administrative Region Database (GADM). Shapefile upload allows users to upload all 4 files at the same time only: 1. shp 2. dbf 3. shx and 4. prj. Then, the user has to select the area id in the dropdown which must match the area name in the csv file.

In addition, users can view additional details, including the description of the shapefile and loading preview data, by pressing a button ?.

Screenshot of sample shapefile (Thailand Shapefile)

	ID_0	COUNTRY	ID_1	NAME_1	VARNAME_1	NL_NAME_1	TYPE_1	ENGTYPE_1	CC_1	HASC_1	ISO_1	geometry
0	THA	Thailand	THA.1_1	Amnat Charoen	None	จังหวัดอำนาจเจริญ	Changwat	Province	37	TH.AC	None	POLYGON ((104.58696 15.60588, 104.58676 15.605...
1	THA	Thailand	THA.2_1	Ang Thong	None	จังหวัดอ่างทอง	Changwat	Province	15	TH.AT	None	POLYGON ((100.38371 14.74216, 100.38600 14.742...
2	THA	Thailand	THA.3_1	Bangkok Metropolis	Bangkok|Krung Thep|Krung Thep Maha Nakhon|Phra...	จังหวัดเชียงใหม่	Changwat	Province	10	TH.BM	None	POLYGON ((100.51929 13.66410, 100.51927 13.663...
3	THA	Thailand	THA.4_1	Bueng Kan	None	บึงกาฬ	Changwat	Province	None	TH.BK	None	POLYGON ((103.99140 17.87424, 103.99107 17.874...
4	THA	Thailand	THA.5_1	Buri Ram	Buri Rum	จังหวัดบุรีรัมย์	Changwat	Province	31	TH.BR	None	POLYGON ((102.73676 14.13985, 102.73386 14.139...
...	...	...	...	...	...	...	...	...	...	...	...	...
72	THA	Thailand	THA.73_1	Udon Thani	None	จังหวัดอุดรธานี	Changwat	Province	41	TH.UN	None	POLYGON ((102.90189 16.85360, 102.90183 16.853...
73	THA	Thailand	THA.74_1	Uthai Thani	None	จังหวัดอุทัยธานี	Changwat	Province	61	TH.UT	None	POLYGON ((99.52662 14.97926, 99.52472 14.98022...
74	THA	Thailand	THA.75_1	Uttaradit	None	จังหวัดอุตรดิตถ์	Changwat	Province	53	TH.UD	None	POLYGON ((100.05381 17.18046, 100.05165 17.179...
75	THA	Thailand	THA.76_1	Yala	None	จังหวัดยะลา	Changwat	Province	95	TH.YL	None	POLYGON ((101.09618 5.70161, 101.09572 5.70217...
76	THA	Thailand	THA.77_1	Yasothon	None	จังหวัดยโสธร	Changwat	Province	35	TH.YS	None	POLYGON ((104.35171 15.34208, 104.35113 15.342...

77 rows × 12 columns

click here to downloads sample shapefiles

- **csv file**

The user can only upload one csv file, which must contain:

> **1. area id** (a number starting at 1, used to identify provinces).
> **2. area name** (name of province)
> **3. cases** (outcomes)
> **4. time point**
> **5. population**
> and 7 **covariates**. The user can then specify each column by selecting it from a dropdown menu.

In select covariates section, user must putting covariates in the dropdown is to put them in order from 1 to 7, with no blanks. If the user select 1 covariate, the analysis is **univariate**. If the user selects covariates more than 1, all covariates will be calculated at the same time, which is a **multivariate** analysis.

Furthermore, the user can press the button ? for more information and download sample data.

Screenshot of sample csv file (Thai suicide mortality and risk factors 2011-2021)

	province	province_id	year	suicide	population	debt	income	poverty	expenditure	homicide crime	property crime	shocking crime
0	Amnat Charoen	1	2011	15	372241	15816.29521	15619.29521	19.465428	14093.59122	93.803267	103.259996	11.132917
1	Ang Thong	2	2011	15	284061	23426.86803	23229.86803	11.370984	19134.75280	132.802670	249.675410	21.027569
2	Bangkok Metropolis	3	2011	136	5674843	49759.27425	49562.27425	3.971482	31896.10984	3478.753667	9877.476599	493.980976
3	Bueng Kan	4	2011	16	407634	17420.63623	17223.63623	4.419098	15850.78284	97.173624	103.904513	18.819348
4	Buri Ram	5	2011	82	1559085	16775.13139	16578.13139	34.641094	13042.21393	370.039319	279.426377	28.979629
...	...	...	...	...	...	...	...	...	...	...	...	...
842	Udon Thani	73	2021	164	1559860	25454.97746	25257.97746	6.712360	30506.27100	171.799921	371.360346	34.148120
843	Uthai Thani	74	2021	19	325025	23302.91004	23105.91004	3.962674	23866.78137	77.163457	71.663962	6.758570
844	Uttaradit	75	2021	36	446349	23139.96822	22942.96822	7.977242	21975.76472	84.386137	134.992120	13.473962
845	Yala	76	2021	11	538960	10747.17634	10550.17634	18.491871	10899.73612	248.055302	1115.498036	116.100956
846	Yasothon	77	2021	27	533604	23520.83817	23323.83817	9.359222	20389.94348	98.303706	193.468316	13.071078

847 rows × 12 columns

click here to downloads sample csv files

The sample csv file contains the following 12 columns:

1. **province** is the name of province which has a total of 77 provinces.
2. **province_id** is the number of province starting at from 1 to 77.
3. **year** is the number of year starting at from 1 to 11.
4. **suicide** is the number of suicides.
5. **population** is the population in each area.

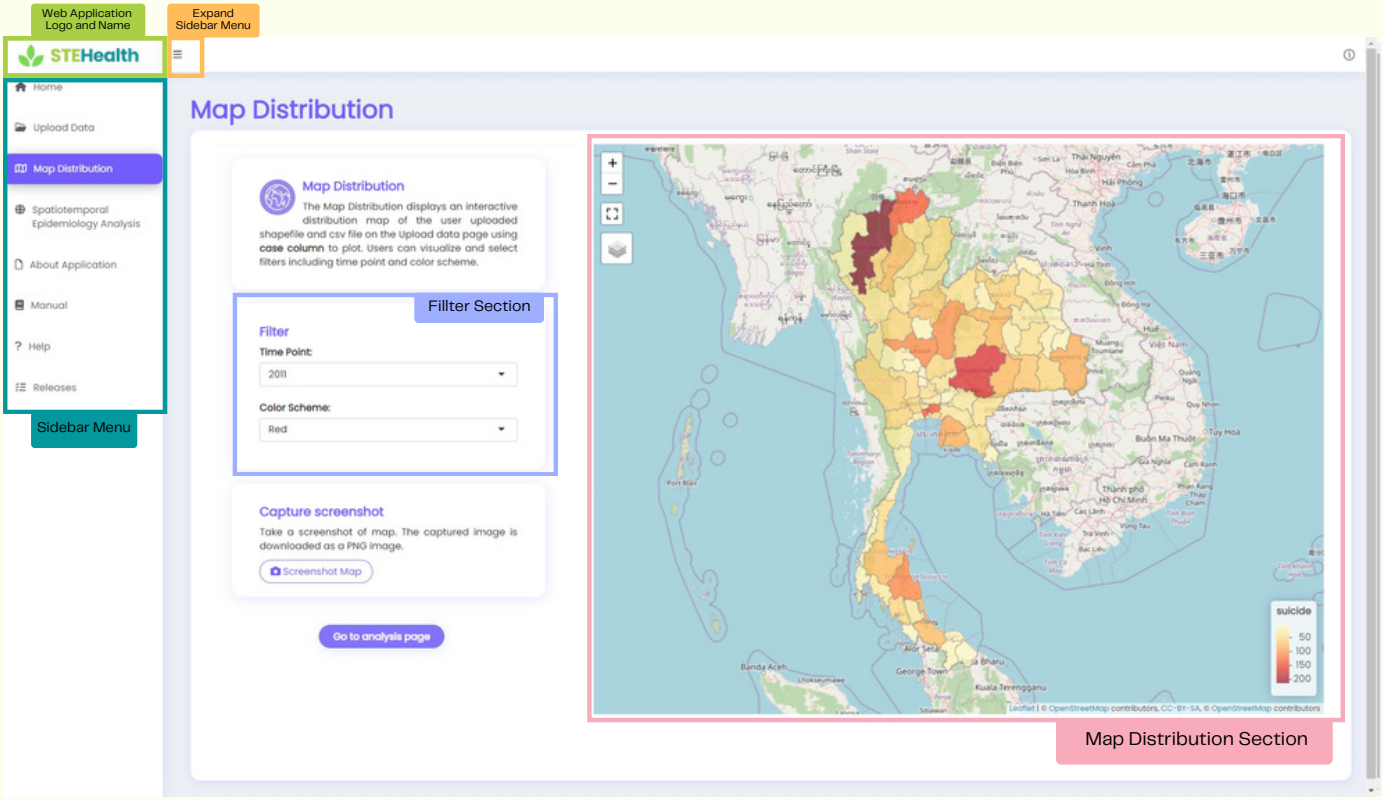
6-12. 7 covariates: debt, income, poverty, expenditure, homicide crime, property crime and shocking crime.

2. The preview input data section can preview input data (shapefile and a csv file (health outcome)) where users uploaded data.

Once the data has been successfully uploaded, users must press Preview Map Distribution button then user will go to "Map Distribution" page.

Application Pages

3 Map Distribution Page



The Map Distribution page displays an interactive distribution map of the user uploaded shapefile and csv file on the Upload data page using **case column** to plot.

- **Filter Section** Users can select time point (from time point column in Upload data page) and color scheme to visualize.

- **Map Distribution Section:**
  - User can hover over the area to display the value of that area.
  - Users can zoom in or zoom out by press 
  - Users can view fullscreen map by press 
  - Users can change theme map by press 

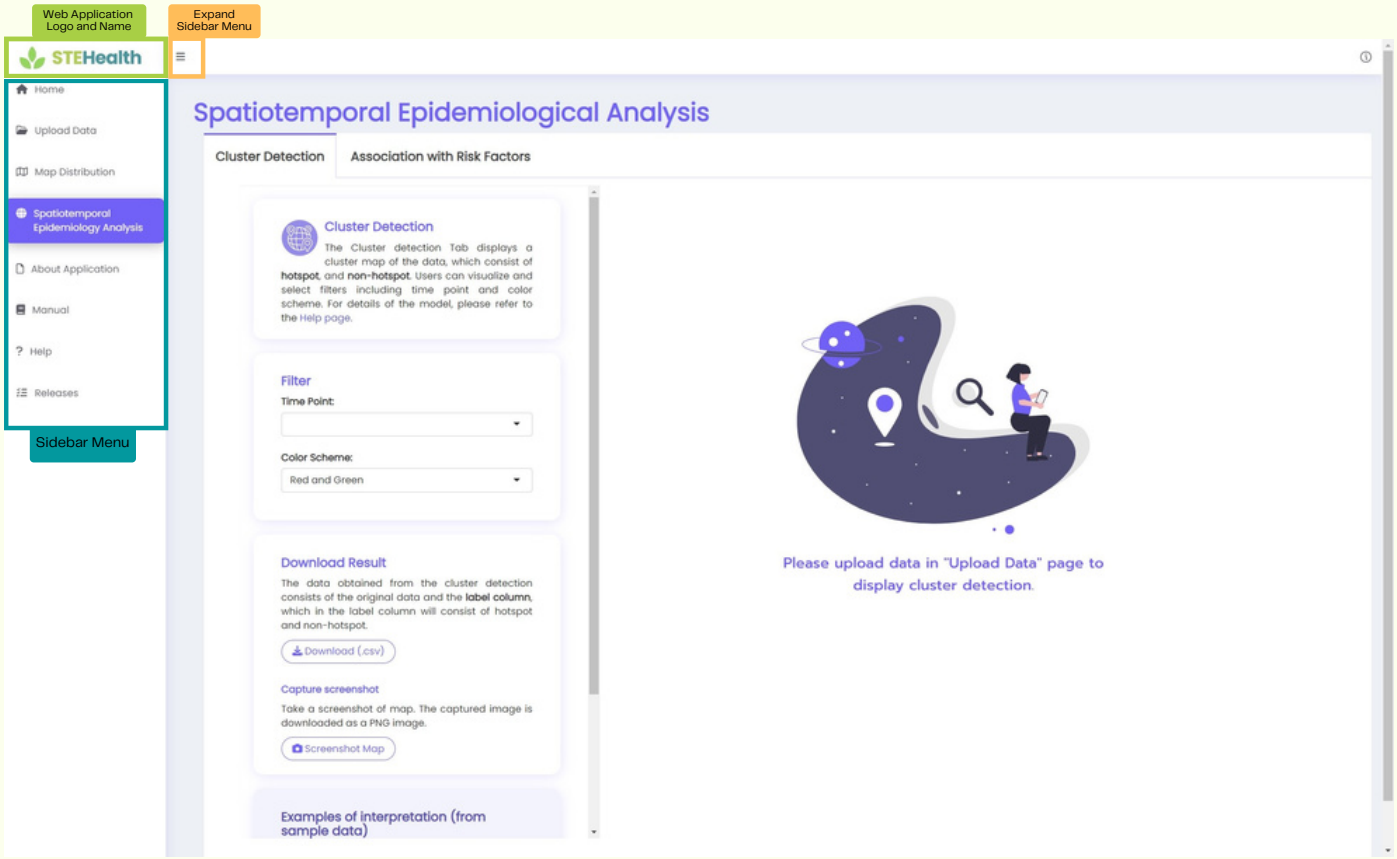
- Users can **take screenshot of map** by press button 

. The captured image is downloaded as a PNG image.

when user views the map distribution finished, press the 

button. then user will go to "spatiotemporal epidemiological analysis" page.

4 Spatiotemporal Epidemiological Analysis Page



The "spatiotemporal epidemiological analysis" page is the page that occurs result after the user has successfully uploaded the data and press Go to analysis page button on the "Map Distribution" page.

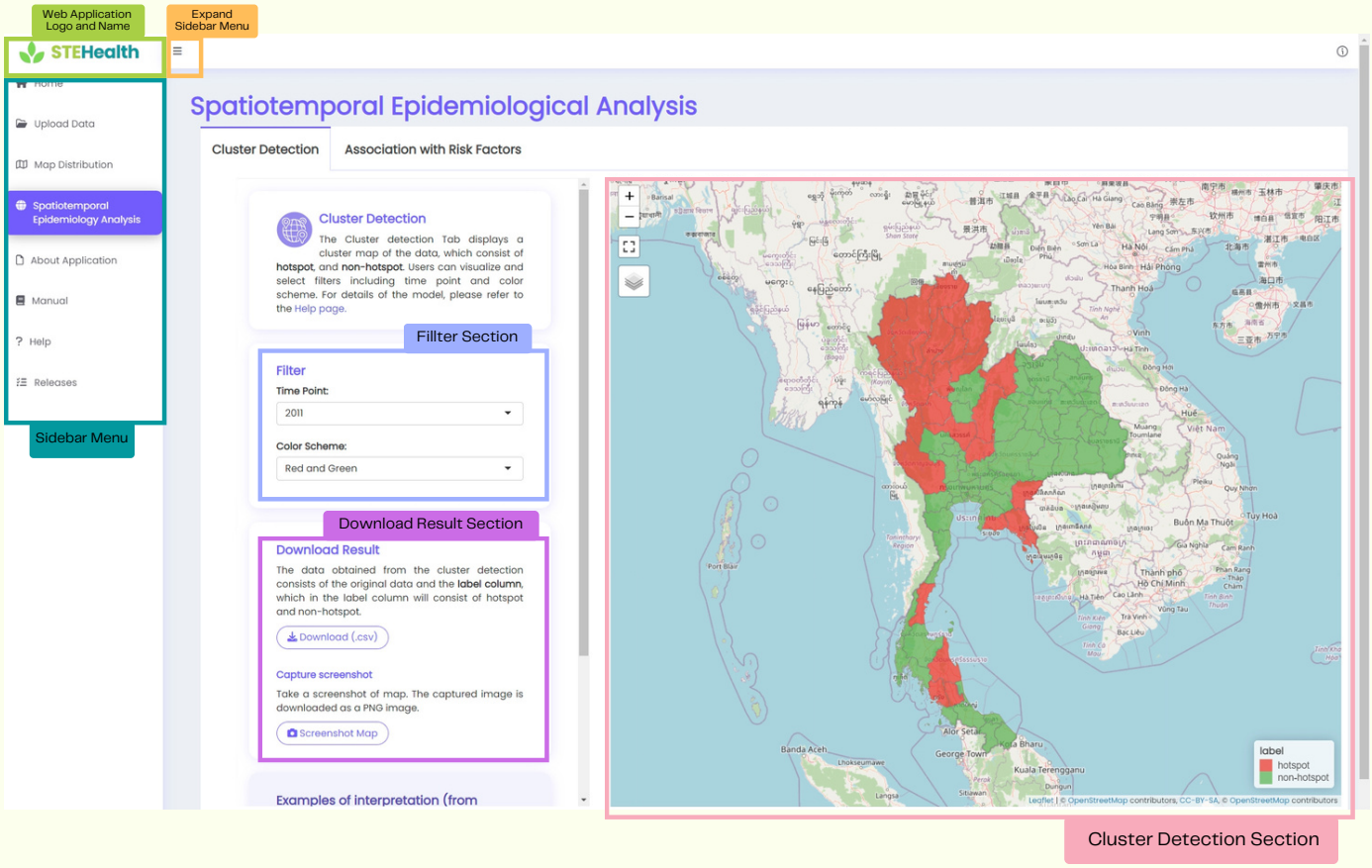
This page includes two tabs:

01 – Cluster Detection

02 – Association with Risk Factors

Application Pages

4.1 Spatiotemporal Epidemiological Analysis Result Page: Cluster Detection



Cluster detection is an important tool for identifying areas of high risk and developing hypotheses about health outcomes [1]. Cluster detection used to compute probabilities that the risk in an area exceeds certain thresholds can be done using the posterior probability distributions [2]. This probability of exceedance can then be used to decide whether an area should be hot-spot [3].

The cluster detection tab displays a **hotspot area map** of the data.

- **Details of the model**

This application perform cluster detection in spatiotemporal epidemiological analysis section using Bayesian spatiotemporal model. Let y(it) be raw death counts for location i and time t which are a more common outcome of Bayesian disease mapping is modeled as an combination of intercept, and random effects.

$$y_{it} \sim Poisson(E_{it}\rho_{it}),$$
$$\log(\rho_{it}) = \alpha + \eta_{it}$$

The space-time random effects in the model describe variation due to location and time. The spatial effect is spatially structured effect called BYM. It is spatial effects combined unstructured spatial effect and spatially structured effect which can be expressed as;

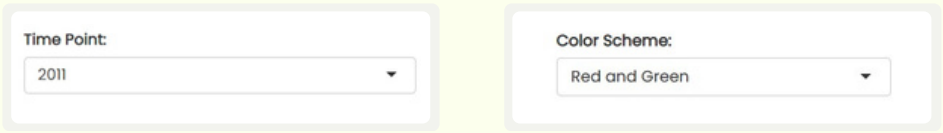
$$u_i | u_{-i} \sim Normal\left(\mu_i + \frac{1}{N_i}\Sigma_{j=1}^{n} a_{ij}(u_j - \mu_j), s_j^2\right) + u_i \sim iid\ Normal(0, \sigma^2)$$

The temporal effect is structured effect called random walk prior of order 1 which can be written as;

$$\gamma_t | \gamma_{t-1} \sim Normal(\gamma_{t-1}, \sigma^2)$$

The prior distribution of space-time interaction depends on the spatial and temporal main effects which are assumed to interact. The model is interaction type I which unstructured spatial and temporal effects interact to each other.

- **Filter Section** Users can select time point (from time point column in Upload data page) and color scheme to visualize.



- **Cluster Detection Section:**
  - User can hover over the area to display the label of that area.
  - Users can zoom in or zoom out by press 
  - Users can view fullscreen map by press 
  - Users can change theme map by press 

- **Download Result Section**
  - Users can **download csv result** by press button 

. The result data from cluster detection consists of the original data and the **label column**, which in the label column will consist of hotspot and non-hotspot.
  - Users can **take screenshot of map** by press button 

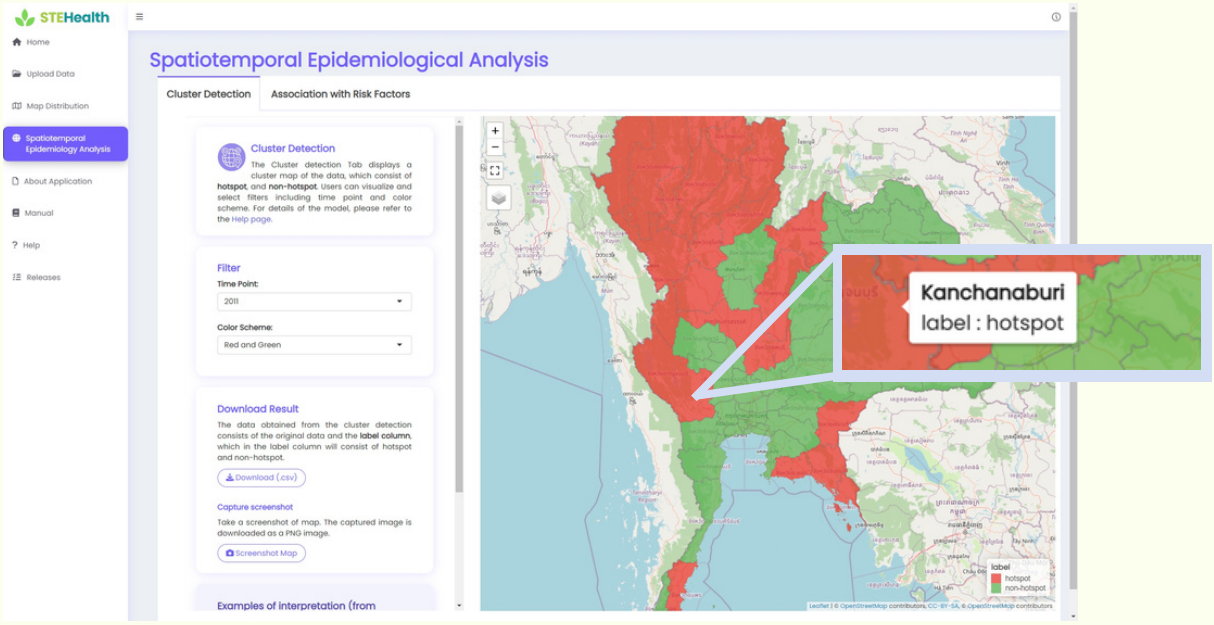
. The captured image is downloaded as a PNG image.

Screenshot of sample result data from cluster detection

	province	province_id	year	y	E	debt	income	poverty	expenditure	homicide.crime	property.crime	shocking.crime	label
0	Amnat Charoen	1	1	15	22.499667	15816.29521	15619.29521	19.465428	14093.59122	93.803267	103.259996	11.132917	non-hotspot
1	Ang Thong	2	1	15	17.169731	23426.86803	23229.86803	11.370984	19134.75280	132.802670	249.675410	21.027569	non-hotspot
2	Bangkok Metropolis	3	1	136	343.009171	49759.27425	49562.27425	3.971482	31896.10984	3478.753667	9877.476599	493.980976	non-hotspot
3	Bueng Kan	4	1	16	24.638955	17420.63623	17223.63623	4.419098	15850.78284	97.173624	103.904513	18.819348	non-hotspot
4	Buri Ram	5	1	82	94.237048	16775.13139	16578.13139	34.641094	13042.21393	370.039319	279.426377	28.979629	non-hotspot
...	...	...	...	...	...	...	...	...	...	...	...	...	...
842	Udon Thani	73	11	164	93.573496	25454.97746	25257.97746	6.712360	30506.27100	171.799921	371.360346	34.148120	hotspot
843	Uthai Thani	74	11	19	19.827627	23302.91004	23105.91004	3.962674	23866.78137	77.163457	71.663962	6.758570	non-hotspot
844	Uttaradit	75	11	36	27.867017	23139.96822	22942.96822	7.977242	21975.76472	84.386137	134.992120	13.473962	hotspot
845	Yala	76	11	11	29.845162	10747.17634	10550.17634	18.491871	10899.73612	248.055302	1115.498036	116.100956	non-hotspot
846	Yasothon	77	11	27	32.570332	23520.83817	23323.83817	9.359222	20389.94348	98.303706	193.468316	13.071078	non-hotspot

847 rows × 13 columns

Example interprets of sample data from cluster detection

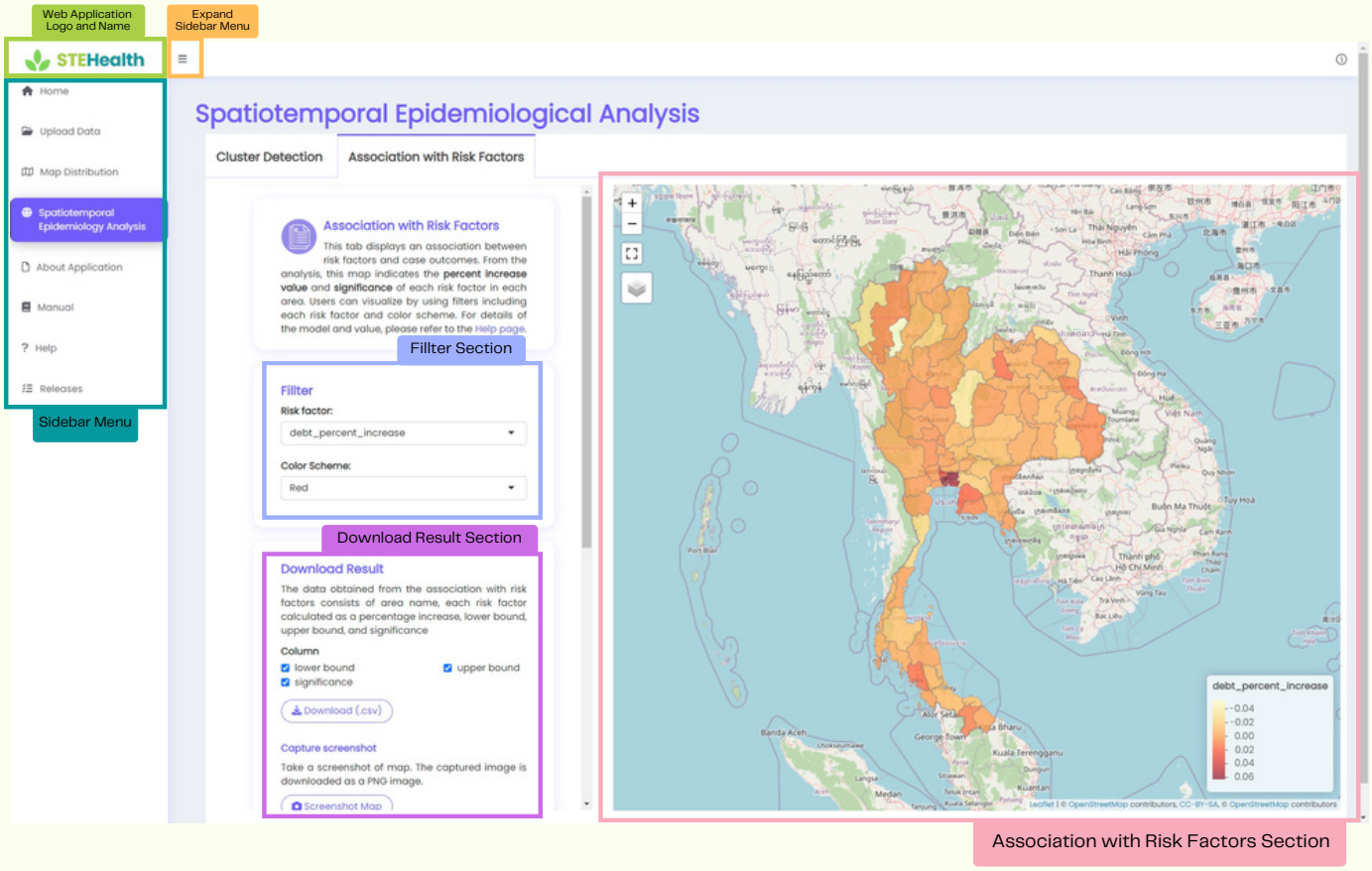


In Kanchanaburi, has a hotspot, meaning that Kanchanaburi has a higher number of suicides than the specified threshold (the base line of our work is defined as the average number of suicides).

Application Pages

Spatiotemporal Epidemiological Analysis Result Page:

4.2 Association with Risk Factors



The percentage of a health outcome expected to change as a risk factor increases one unit. When the probability is positive, it means that as the risk factor rises, so will the outcome, whereas when the probability is negative, it means that if the risk factor increases, the outcome decreases. The data are assumed to be unrelated when the probability is zero.

This tab displays an **association between risk factors** and case outcomes. From the analysis, the coefficient of the risk factors obtained from the fit model, which is in the log scale, must be exponentiated and minus 1 and multiplied by 100. Therefore, the value is obtained as a **percent increase**. In addition, the map also indicates the **significance** of each risk factor in each area.

- **Details of the model**

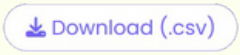
Association with risk factors is performed in spatiotemporal epidemiological analysis section using Bayesian spatiotemporal model. Let y(it) be raw death counts for location i and time t which are a more common outcome of Bayesian disease mapping is modeled as an combination of intercept, fixed effects (risk factors), and random effects.

$$y_{it} \sim Poisson(E_{it}\rho_{it}),$$
$$\log(\rho_{it}) = \alpha + \Sigma_m^M \beta_m x_{mit} + \eta_{it}$$

The risk factor association is modeled on the multiplicative scale. Conditioned on the random effect terms and other fixed effects constant.
The space-time random effects in the model describe variation due to location and time. The details of spatial effect, temporal effect and space-time interaction in this model can be found on **page 18**

- **Filter Section** Users can select risk factor (from 7 covariates) and color scheme to visualize.

- **Association with Risk Factors Section:**
  - User can hover over the area to display the mean of that area.
  - Users can zoom in or zoom out by press 
  - Users can view fullscreen map by press 
  - Users can change theme map by press 

- **Download Result Section**
  - Users can **download csv result** by press button 

. The result data from association with risk factors consists of the area name and each risk factor calculated as a **percentage increase**, lower bound, upper bound, and significance. Users can select the desired column by clicking on the checkbox.
  - Users can **take screenshot of map** by press button 

. The captured image is downloaded as a PNG image.

Screenshot of sample result data from association with risk factors

	NAME_1	percent_increase_debt	debt_lowerbound	debt_upperbound	debt_significance	...	percent_increase_shocking.crime	shocking.crime_lowerbound	shocking.crime_upperbound	shocking.crime_significance
0	Amnat Charoen	0.003541	-0.002228	0.002299	not significant	...	-0.010432	-0.014509	0.014193	not significant
1	Ang Thong	0.000837	-0.002241	0.002258	not significant	...	-0.003207	-0.014455	0.014358	not significant
2	Bangkok Metropolis	0.061935	-0.001694	0.002934	not significant	...	0.059457	-0.013251	0.015030	not significant
3	Bueng Kan	-0.018724	-0.002391	0.002003	not significant	...	-0.127153	-0.016257	0.012428	not significant
4	Buri Ram	-0.003422	-0.002266	0.002199	not significant	...	0.002679	-0.014371	0.014453	not significant
...	...	...	...	...	...	...	...	...	...	...
72	Udon Thani	-0.005361	-0.002292	0.002185	not significant	...	0.020211	-0.013871	0.014474	not significant
73	Uthai Thani	0.003036	-0.002202	0.002262	not significant	...	-0.025650	-0.014624	0.013852	not significant
74	Uttaradit	0.002325	-0.002207	0.002258	not significant	...	0.081126	-0.013178	0.015638	not significant
75	Yala	0.012414	-0.002128	0.002377	not significant	...	-0.012394	-0.014568	0.014190	not significant
76	Yasothon	-0.006113	-0.002262	0.002140	not significant	...	-0.011269	-0.014583	0.014239	not significant

77 rows × 29 columns

1. debt

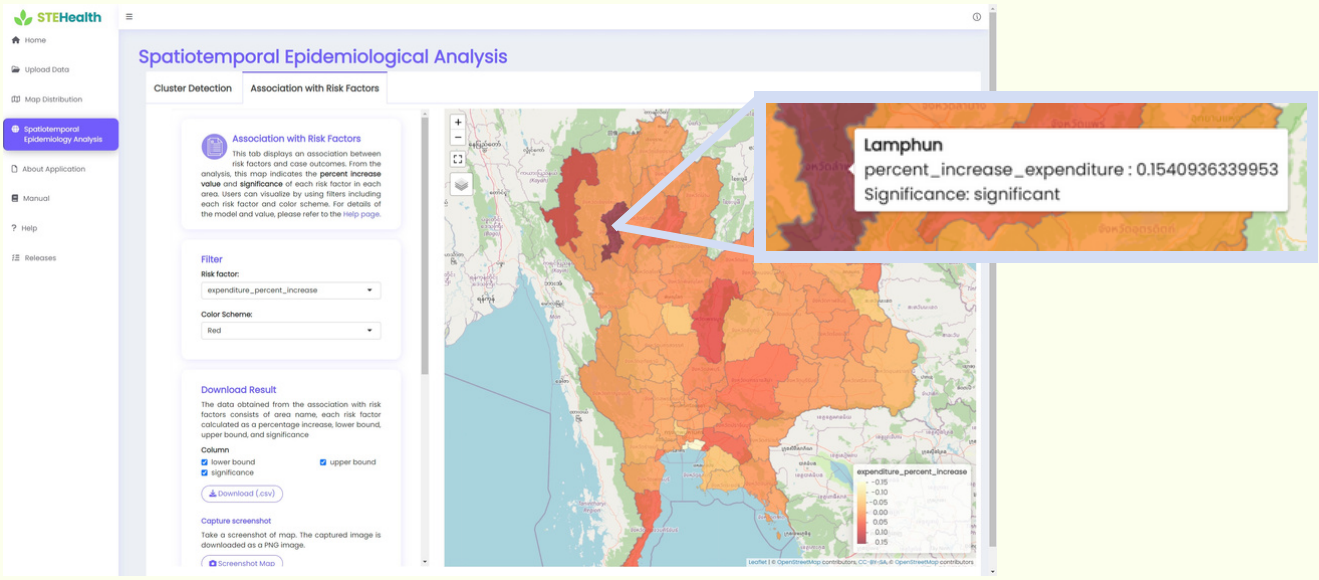
...

7. shocking crime

Example interprets of sample data from association with 7 risk factors (Multivariate Analysis)

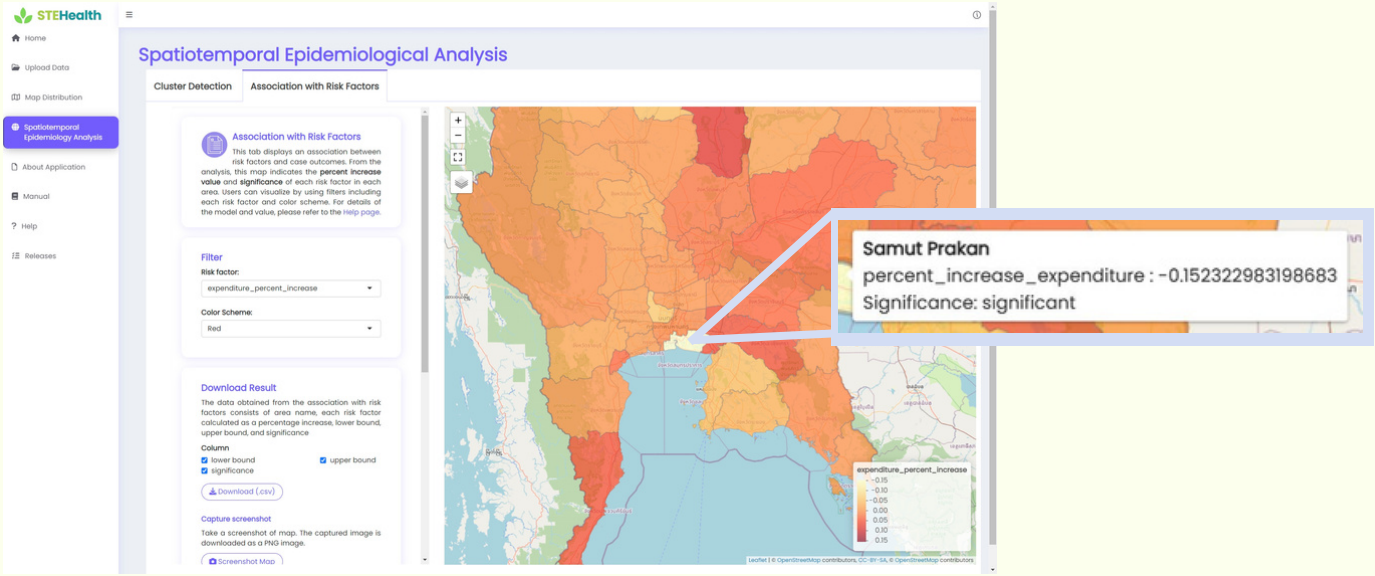
This example is an interpretation of a multivariable analysis of Thai suicide and risk factors. The model used 7 risk factors for multivariable analysis. However, the results are displayed one by one.

- If the significance is **significant**
  - If the value is **positive (+)**



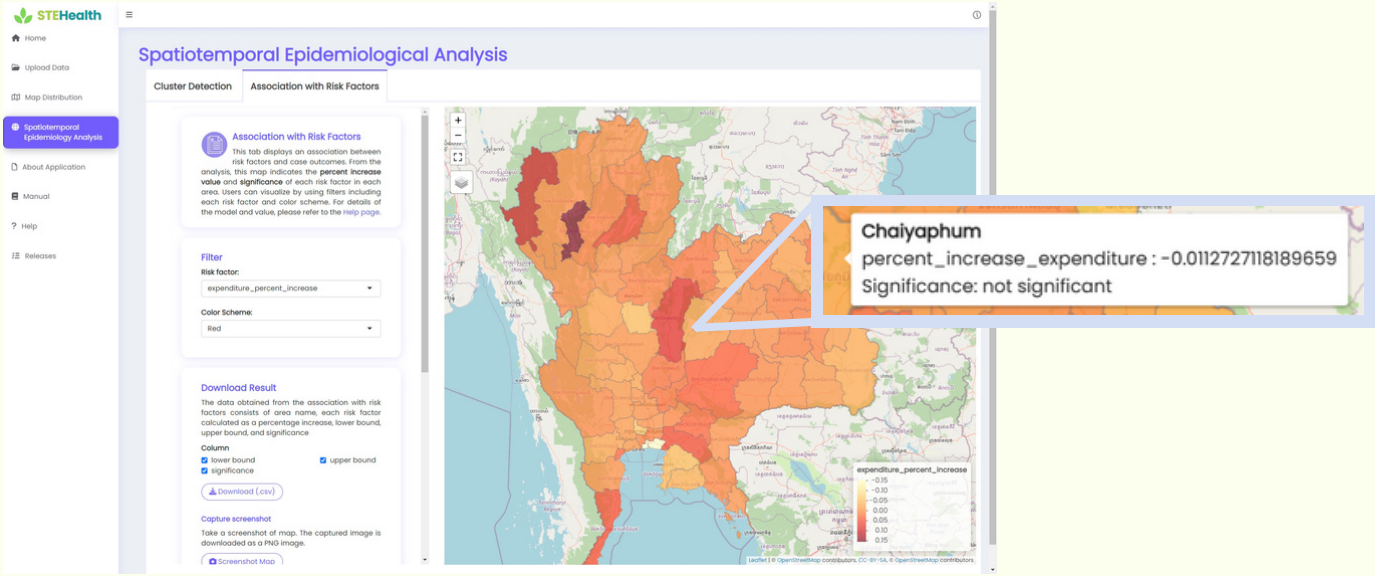
In Lamphun, the percent increase in expenditure is 0.15, which means if expenditure increases by 1 baht (THB), the suicide risk will increase by 0.15%, or every 100 baht (THB) increase in expenditure increases the suicide risk by 15%.

- If the value is **negative (-)**



In Samuut Prakan, the percent increase in expenditure is -0.15, which means if expenditure increases by 1 baht (THB), the suicide risk will decrease by 0.15%; in other words, if the expenditure increases by 100 baht (THB), it will decrease the suicide rate by 15%.

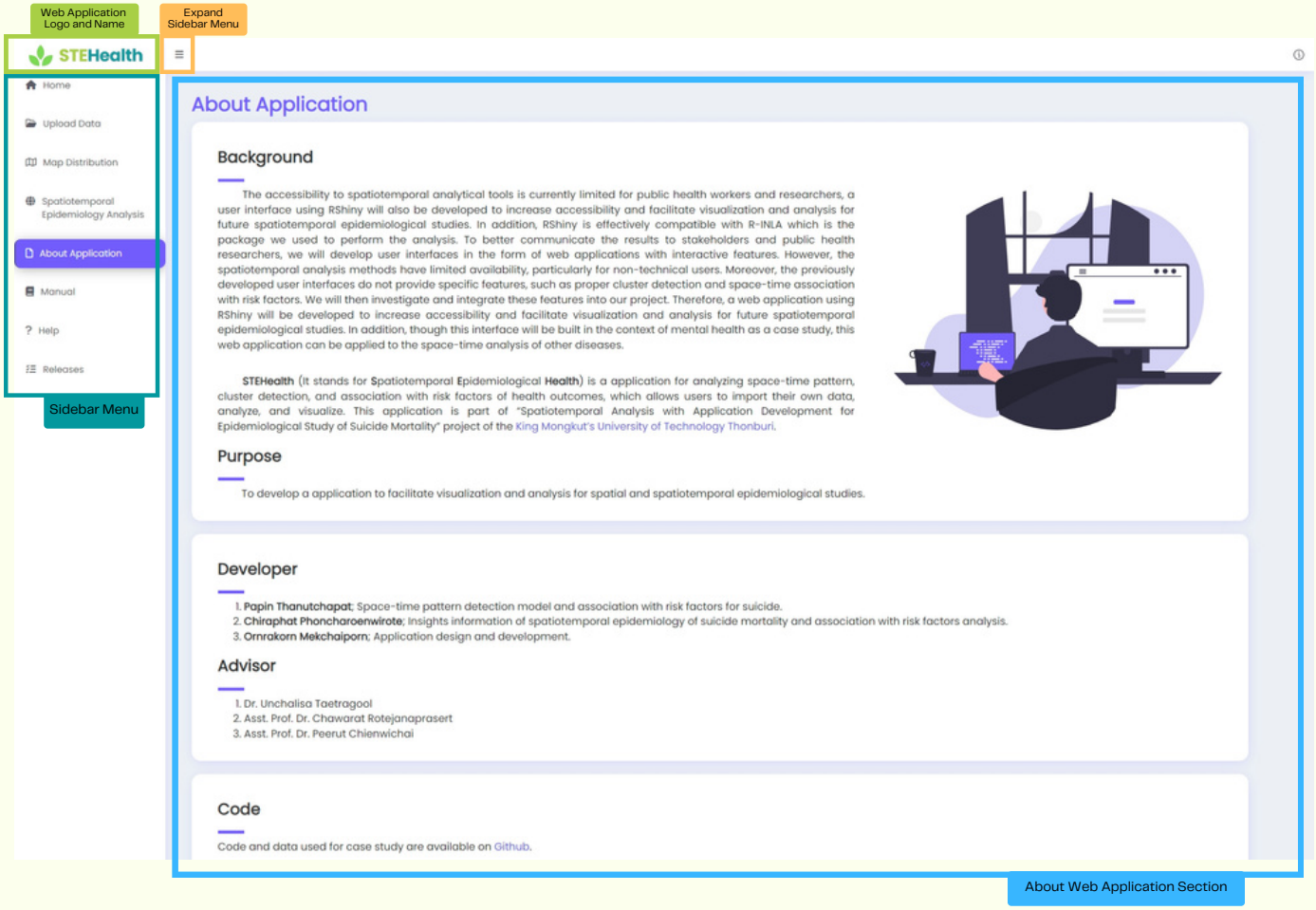
- If the significance is **not significant**



When the value of significance is not significant, it means that the expenditure variable and the suicide rate do not have significant relationships in Chaiyaphum.

Application Pages

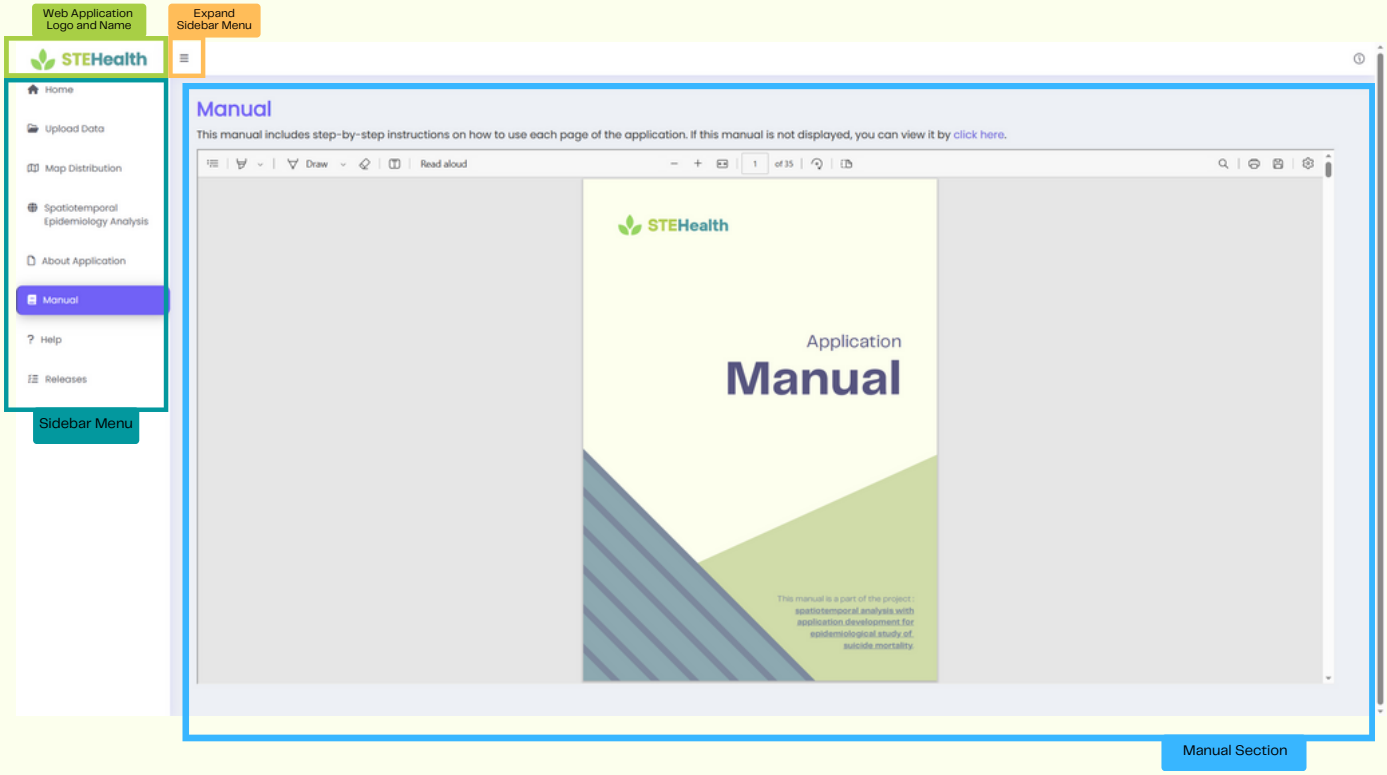
5 About Application Page



The "about application" page is a page that describes the background, purpose, developer, advisor, references, and credit of the application.

Application Pages

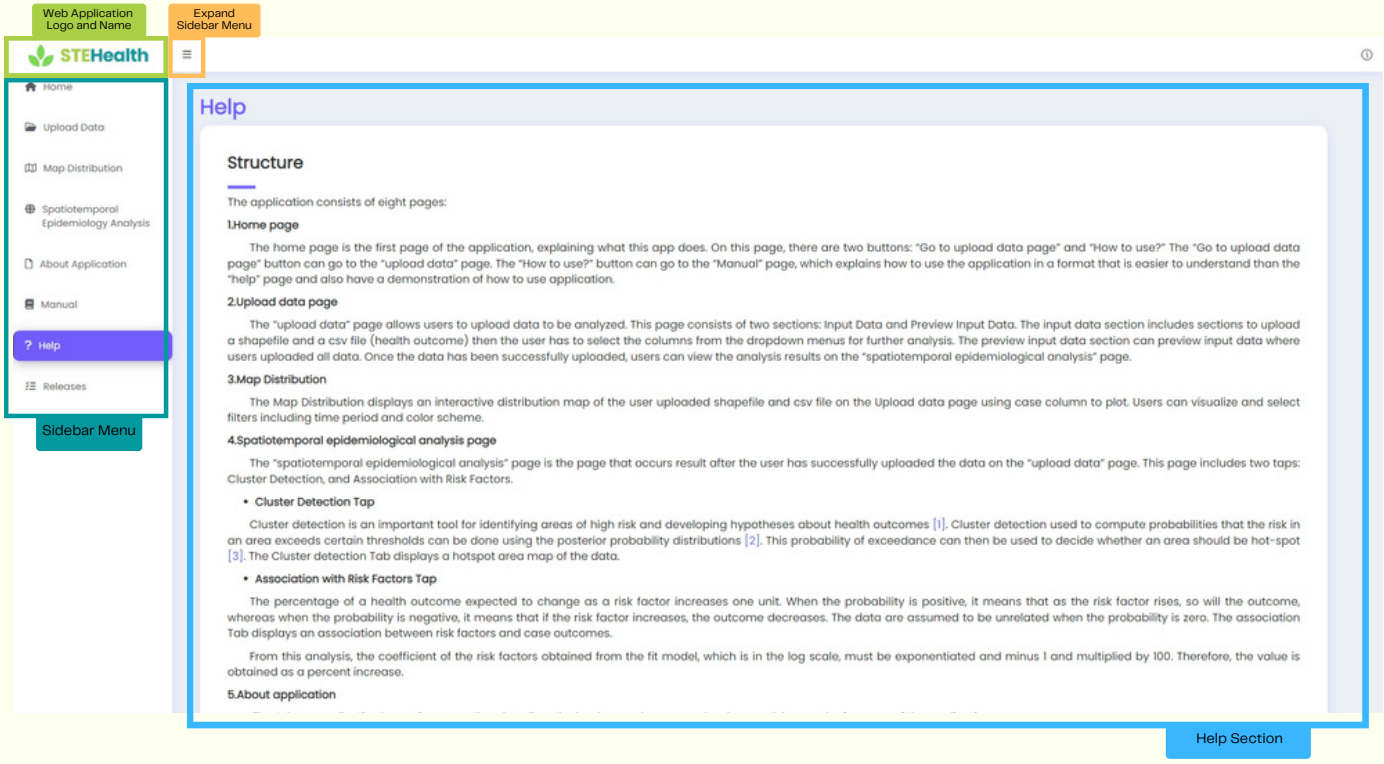
6 Manual Page



The "Manual" page explains how to use the application as a pdf book. This manual includes step-by-step instructions on how to use each page of the application

Application Pages

7 Help Page



The "help" page is a page that describes structure of each page, contact, data used for case study of the application and **example error** (next page).

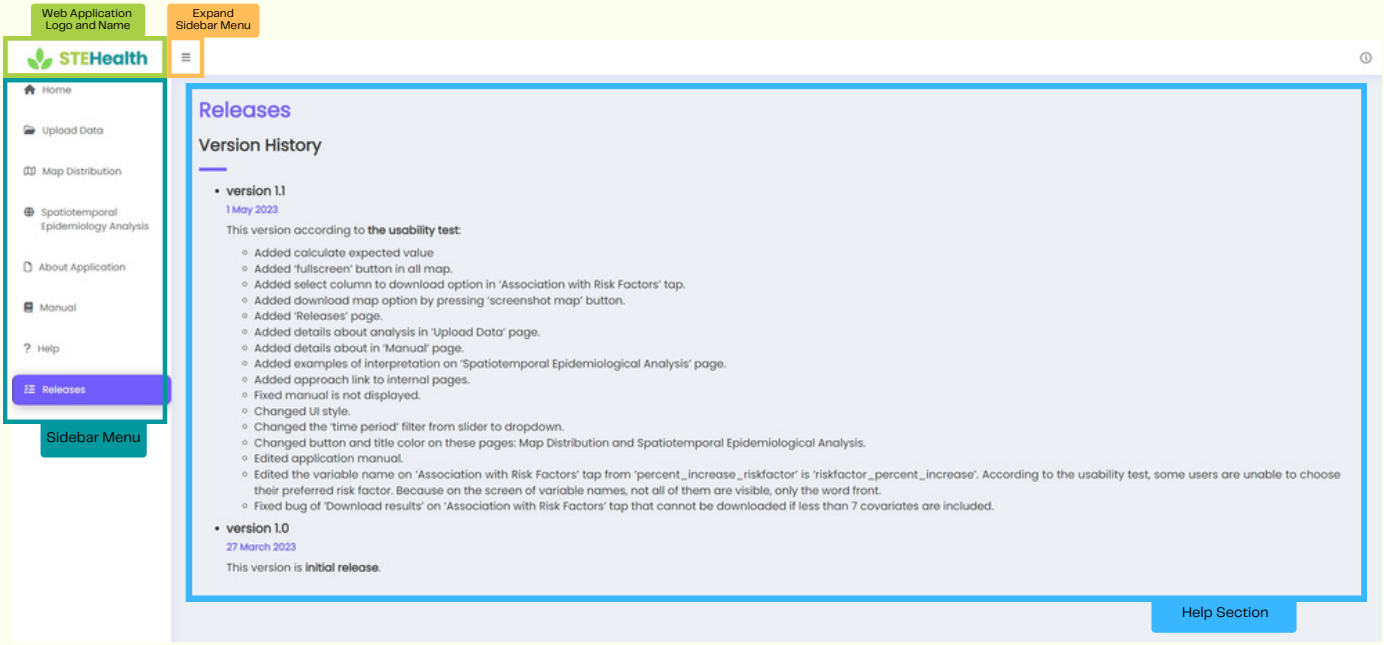
Help Page:

7.1 When Error Occurred ?

If an error occurs in usage, for example:

Error Message	Description
Map display gray color	It is caused by the user changing pages or changing taps while the application is plotting the map. The solution is to try displaying the map by filters adjusting.
Application crashes or analysis not working	It may be because the user uploaded data that is not as specified making it unable to analyze the data.
Application crashes display “ERROR: out of memory”	Depending on the performance of the device used, it may be because the user is using the application too quickly, for example, plotting a map too often without completing the previous plot.

8 Releases Page

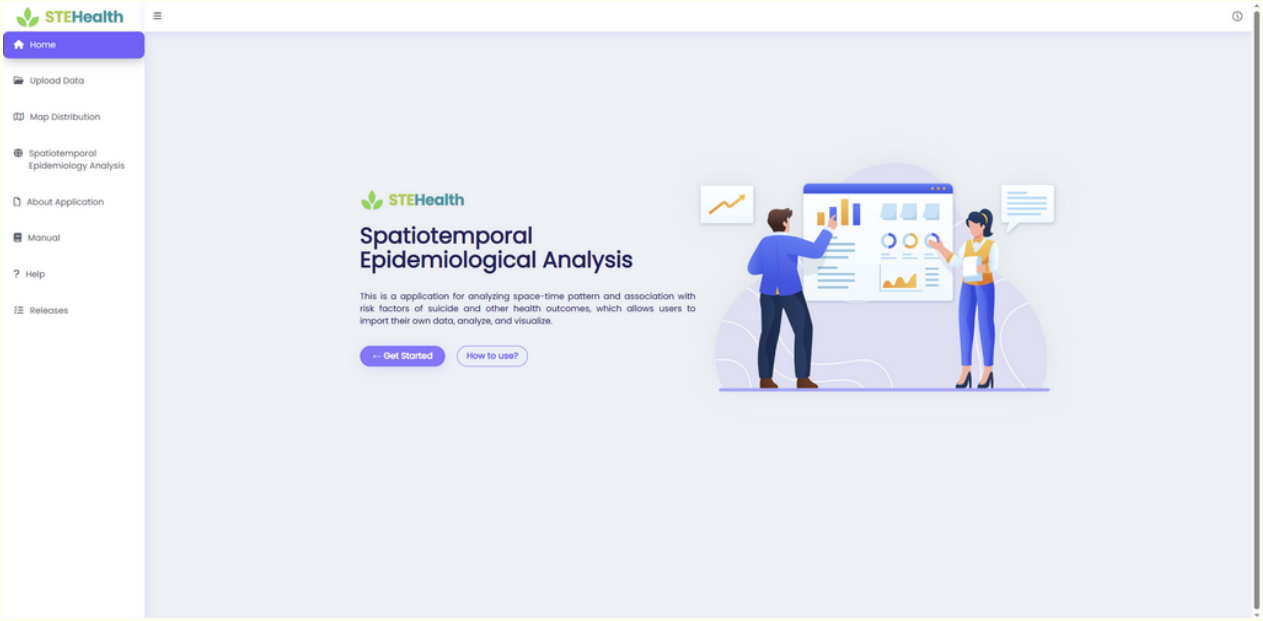


The “Releases” page is a page that describes version history of application.

05 Demonstration of How to use application

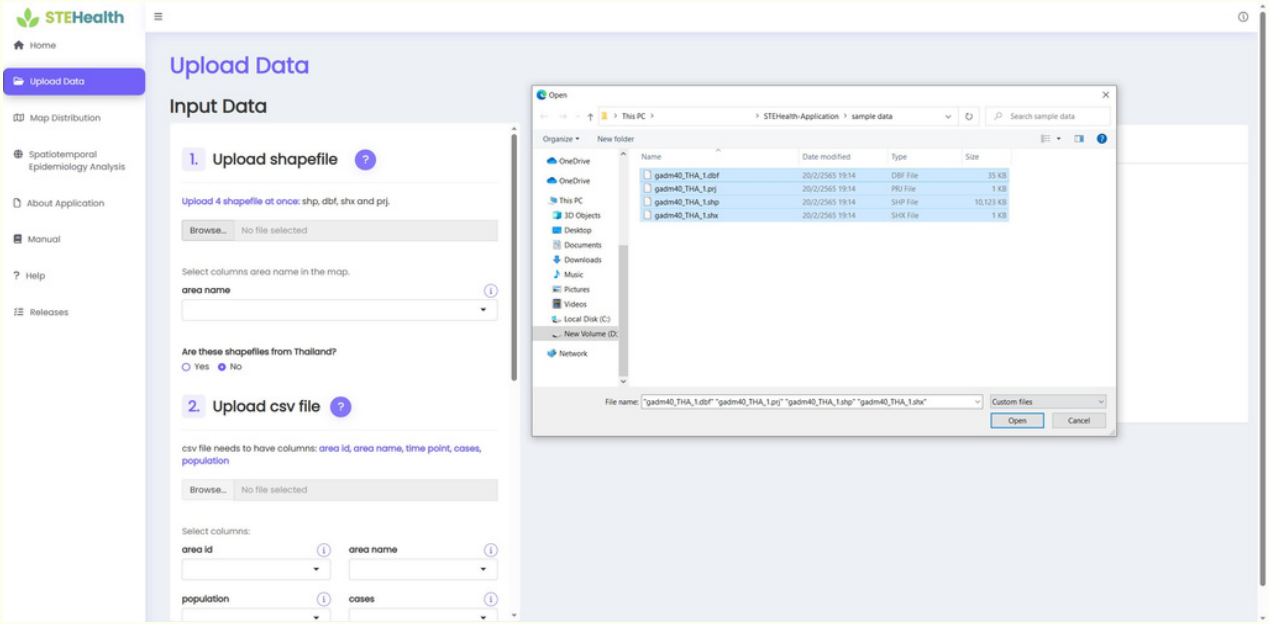
Step 1

Open application and go to **Upload Data Page**.



Step 2

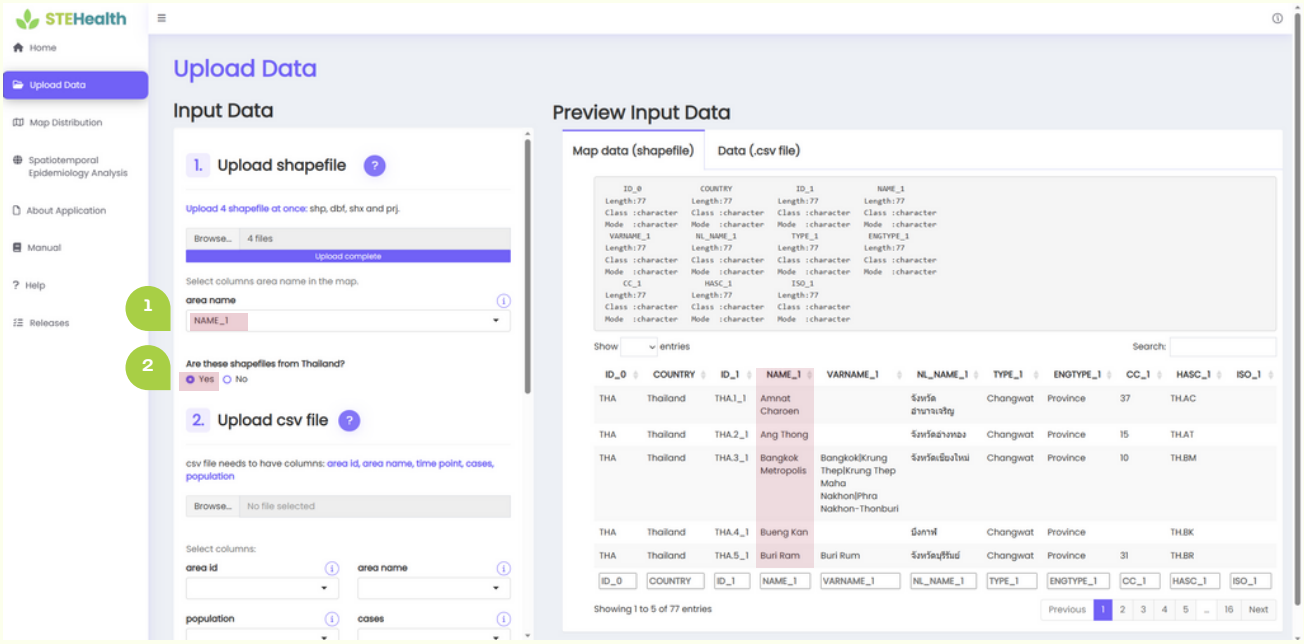
Upload 4 shapefile at once: shp, dbf, shx and prj.



Step 3

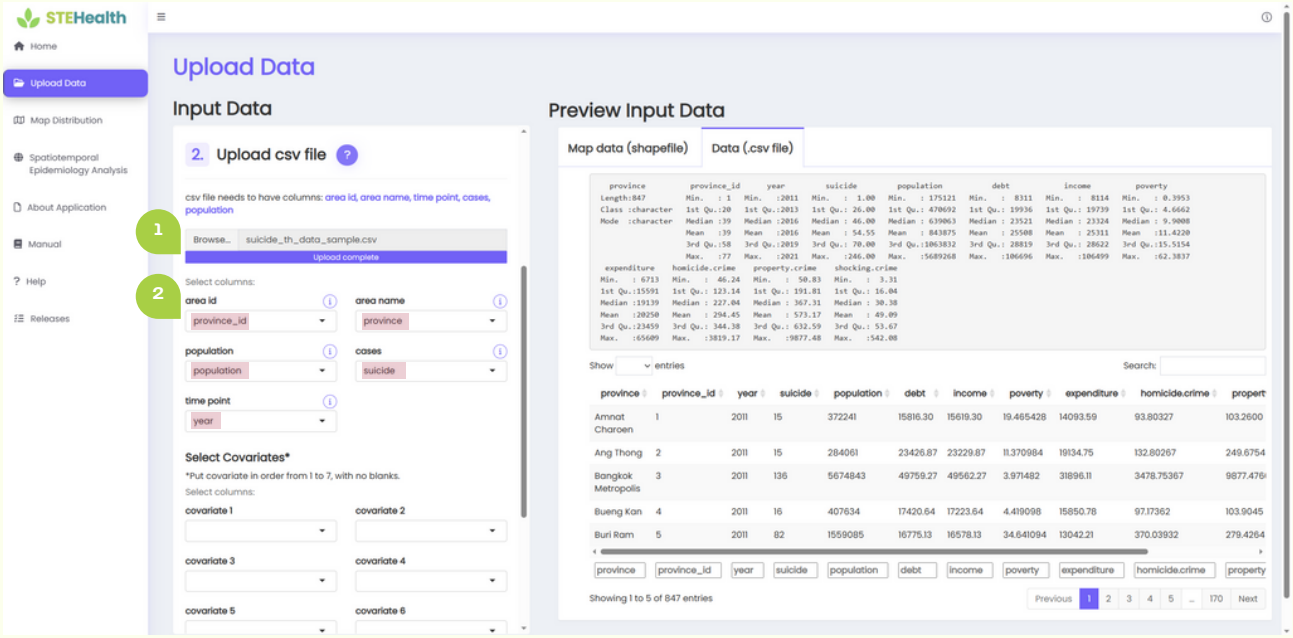
-Select columns **area name**.

Note that: "**area name**" in the shapefile must be matched to "area name" in the csv file



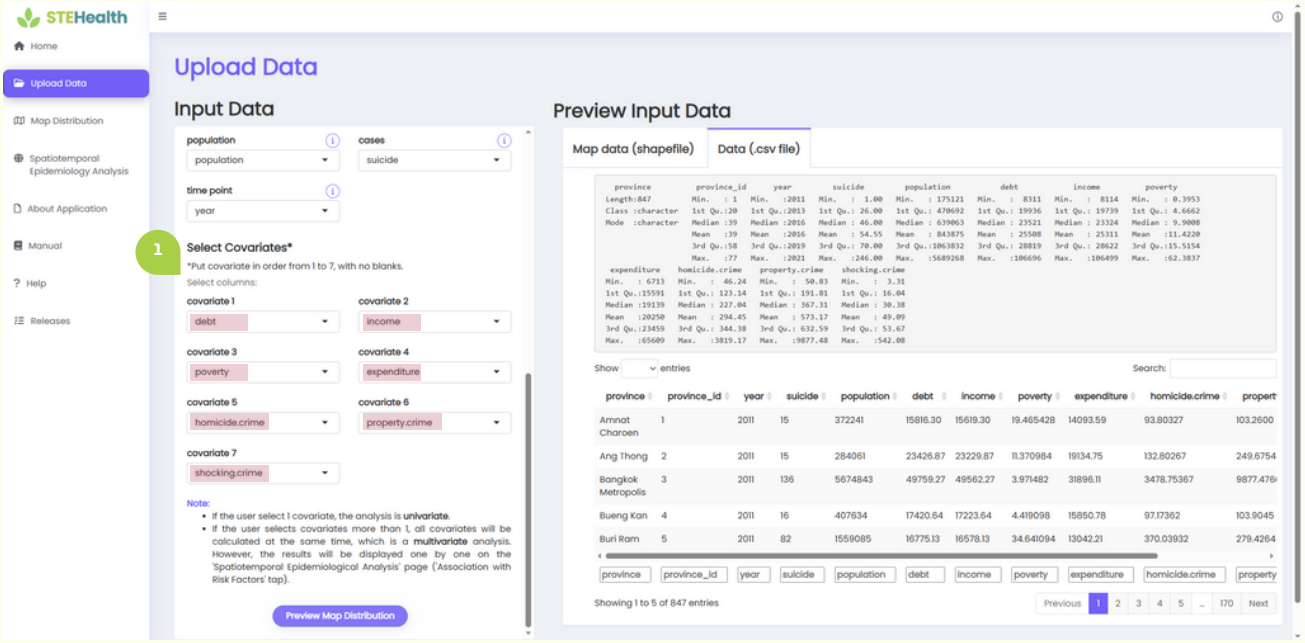
Step 4

-**Upload csv file**
-Select columns: area id, area name, time point, population, cases



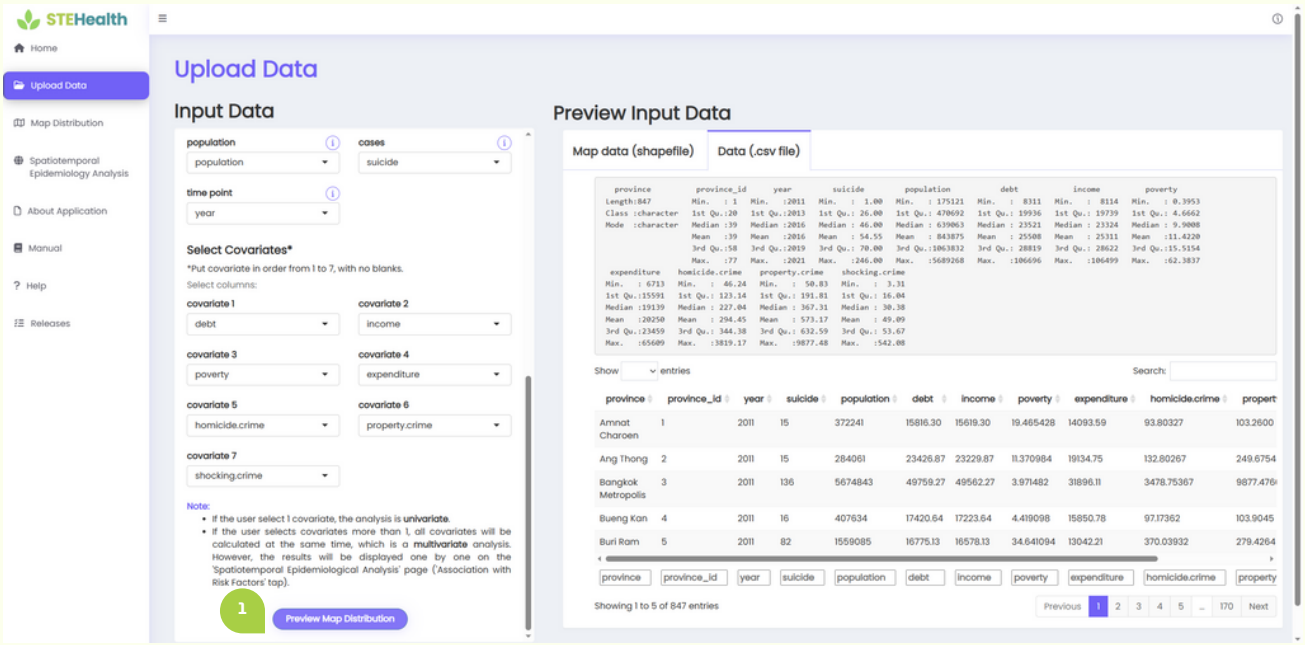
Step 5 –Select Covariates:

Note that: putting covariates with no blanks.



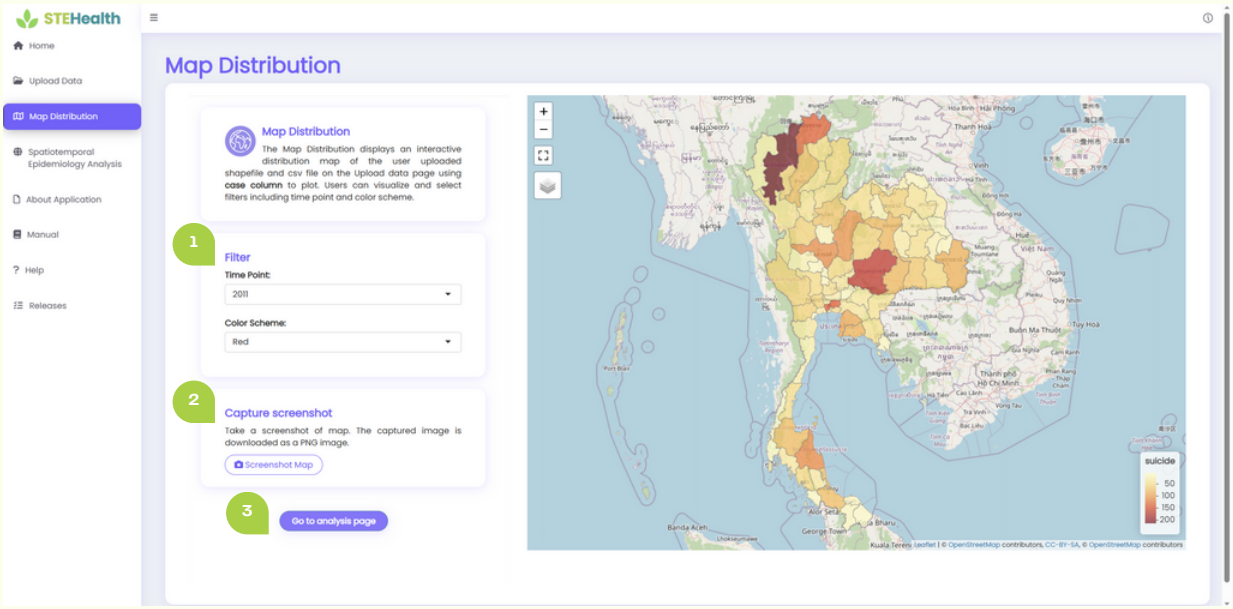
Step 6

Press **Preview Map Distribution** button.



Step 7

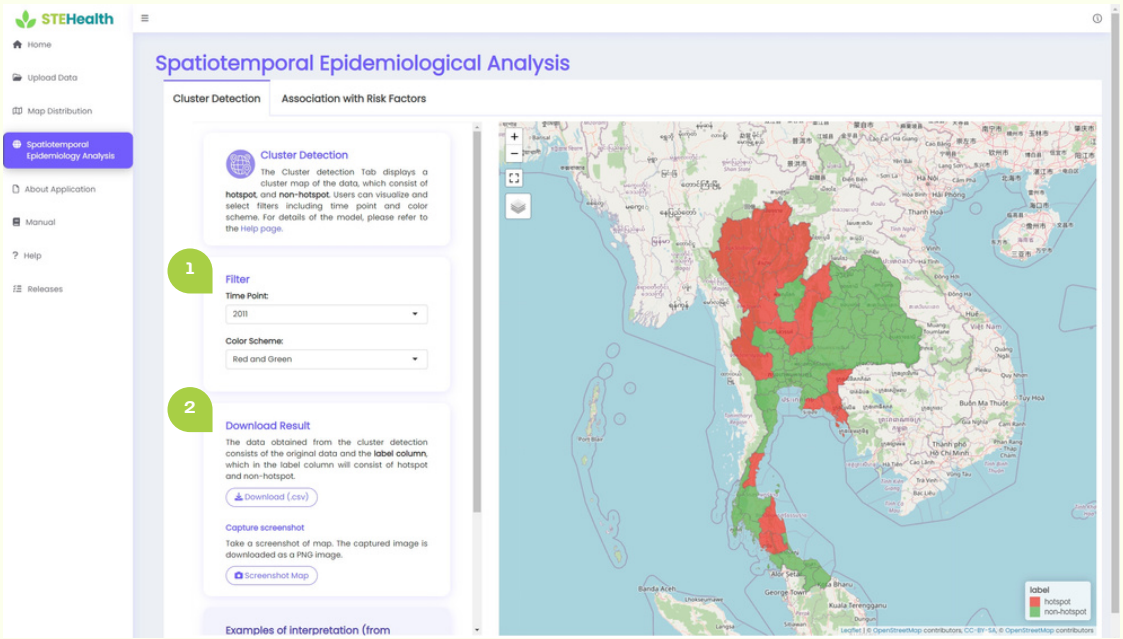
-Users can visualize **Map Distribution** by using filters including time point and color scheme.
-Users can also take a screenshot of map.
-Press Go to analysis page button.



Step 8

In **Cluster Detection Tab**:

-Users can visualize results of **Cluster Detection** by using filters including time point and color scheme.
-Users can also download data obtained from cluster detection and take a screenshot of map.



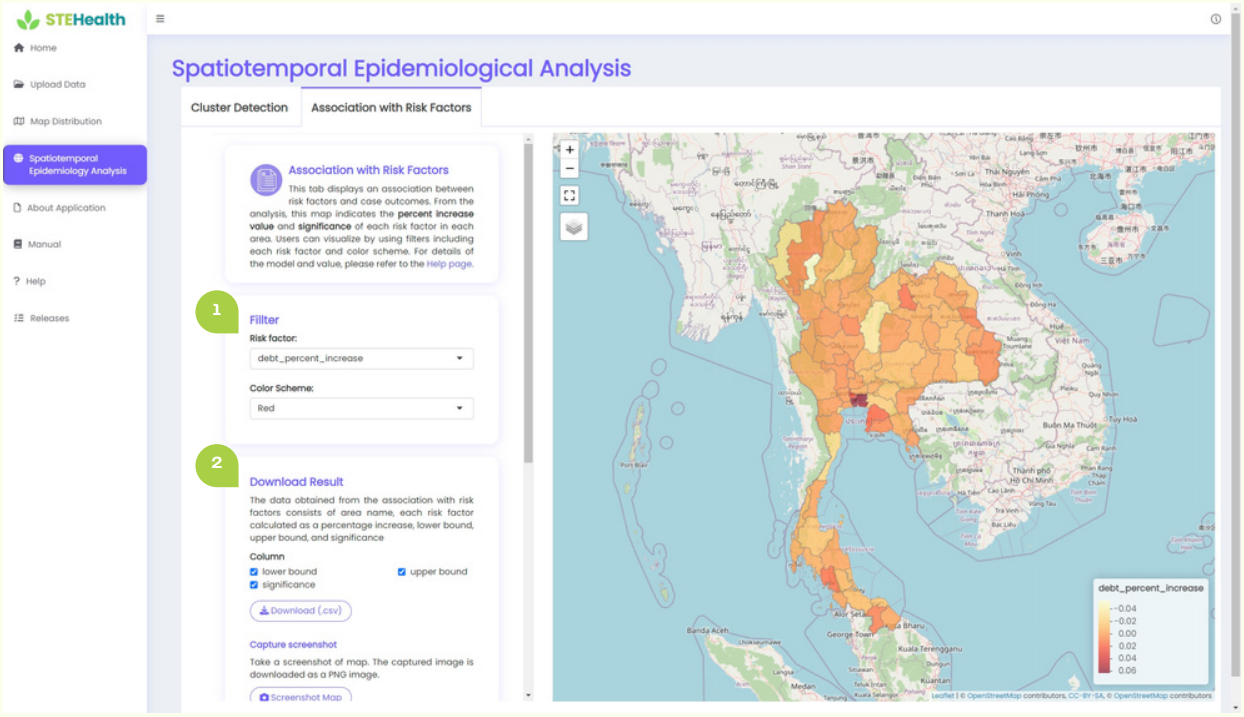
Note that: The Spatiotemporal Epidemiological Analysis page may take 1-3 minutes to calculate depending on computer performance.

Step 9

In **Association with Risk Factors Tab**:

–Users can visualize **Association with Risk Factors** by using filters including each risk factor and color scheme.

–Users can also download data obtained from cluster detection and take a screenshot of map.



06 Dependencies, References, Credits, and Contact us

Dependencies

- **Softwares**

Software	Description
R	Language and environment for statistical computing and graphics
R-Portable	R portable configures R to work with the PortableApps framework, so that R can be ran from a thumb drive or portable hard drive without leaving artifacts on the computer.
Google Chrome Portable	Google Chrome Portable can run from a cloud folder, external drive, or local folder without installing into Windows.

- **R packages**

R packages	Description
shiny	Makes to build interactive web apps from R
shinydashboard	Use with shiny to create dashboards
shinyjs	Perform common useful JavaScript operations in Shiny apps that will greatly improve the apps without having to know any JavaScript
shinyBS	Adds additional Twitter Bootstrap components to Shiny
shinyWidgets	Collection of custom input controls and user interface components for 'Shiny' applications. Give your applications a unique and colorful style!
shinydashboardPlus	Extend 'shinydashboard' with 'AdminLTE2' components. 'AdminLTE2' is a free 'Bootstrap 3' dashboard template
dplyr	A fast, consistent tool for working with data frame like objects, both in memory and out of memory
ggplot2	Creates elegant data visualisations using the grammar of graphics
leaflet	Create Interactive Web Maps with the JavaScript 'Leaflet' Library
leaflet.extras	This package serves as an add-on to the 'leaflet' package by providing extra functionality via 'leaflet' plugins.
RColorBrewer	Provides color schemes for maps and other graphics
rgdal	Provides bindings to Frank Warmerdam's Geospatial Data Abstraction Library (GDAL)
R-INLA	Performs full Bayesian analysis on generalised additive mixed models using Integrated Nested Laplace Approximations
spdep	Spatial Dependence: Weighting Schemes, Statistics
capture	Add a button in Shiny application or R Markdown document to take a screenshot (PNG or PDF) of a specified element.
bsplus	The Bootstrap framework lets you add some JavaScript functionality to your web site by adding attributes to your HTML tags.

References

1. Wheeler, D. C. (2007). A comparison of spatial clustering and cluster detection techniques for childhood leukemia incidence in Ohio, 1996 – 2003. International Journal of Health Geographics, 6(1), 13. doi:10.1186/1476-072x-6-13

2. Green, P. J., & Richardson, S. (2002). Hidden Markov Models and Disease Mapping. Journal of the American Statistical Association, 97(460), 1055–1070. http://www.jstor.org/stable/3085830

3. Richardson, S., Thomson, A., Best, N., & Elliott, P. (2004). Interpreting posterior relative risk estimates in disease-mapping studies. Environmental Health Perspectives, 112(9), 1016-1025. doi:10.1289/ehp.6740

4. Paula Moraga (2017), SpatialEpiApp: A Shiny web application for the analysis of spatial and spatio-temporal disease data. Spatial and Spatio-temporal Epidemiology, 23:47-57 DOI: https://doi.org/10.1016/j.sste.2017.08.001

5. ArcMap. (n.d.). Retrieved March 8, 2023, from https://desktop.arcgis.com/en/arcmap/latest/manage-data/shapefiles/what-is-a-shapefile.htm

Credits

- logo of STEHealth application was modified from logo by Ally Hamid on Canva
- Image in Home page created by pikisuperstar on Freepik
- Images in Upload Data page, Spatiotemporal Epidemiological Analysis Result page, and About Application created by Katerina Limpitsouni on undraw
- World icons in Spatiotemporal Epidemiological Analysis Result page created by Freepik on Flaticon
- World map icons in Spatiotemporal Epidemiological Analysis Result page created by Freepik on Flaticon
- Document icons in Spatiotemporal Epidemiological Analysis Result page created by smalllikeart on Flaticon
- Manual cover in STEHealth web application was modified from report cover by Temptackle on Canva

Contact us

If you have any trouble with this application or have any further questions or feedback, then please contact us at: ornrakorn.mek@outlook.com and we will be happy to help.