



Application Manual

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



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01 What is STEHealth ?

 **STEHealth** (It stands for Spatiotemporal Epidemiological 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

Recommended:

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

03 How to Download Application Portable

Step

1

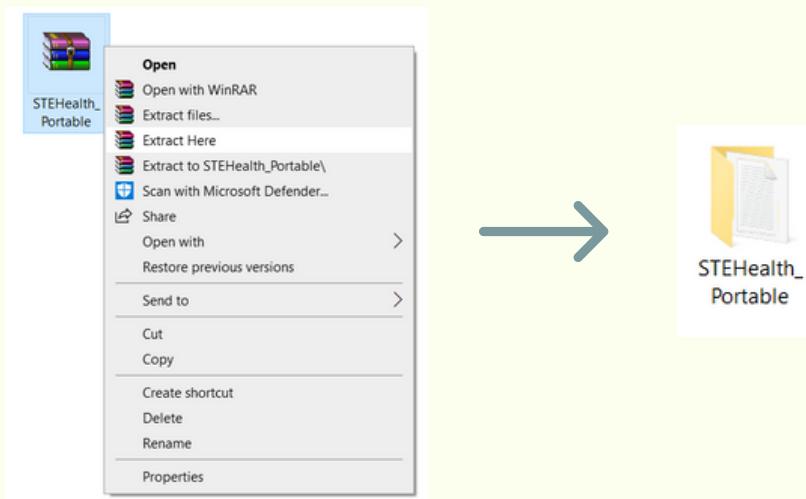
Go to this link to download the  STEHealth portable
https://drive.google.com/drive/folders/1YA23UjLrYrfifcDIYwM-ZzqYedHF9pqp?usp=share_link



Step

2

Extract the downloaded file



Step

3

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

Name	Date modified	Type	Size
GoogleChromePortable	3/3/2566 0:40	File folder	
R-Portable	3/3/2566 1:05	File folder	
sample data	4/3/2566 21:53	File folder	
shiny	3/3/2566 1:05	File folder	
.RData	3/3/2566 1:17	R Workspace	3 KB
.Rhistory	3/3/2566 1:17	R History Source Fi...	1 KB
run	3/3/2566 1:05	VBScript Script File	1 KB
runShinyApp	3/3/2566 1:17	R File	1 KB

*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

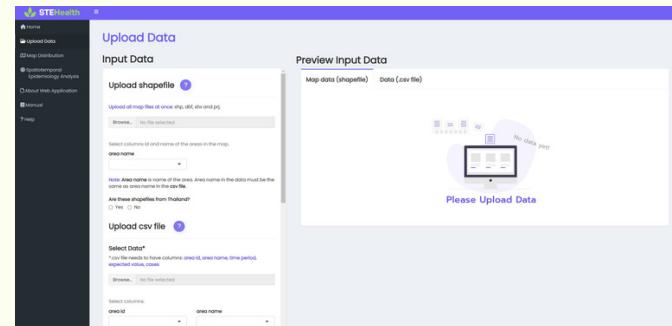
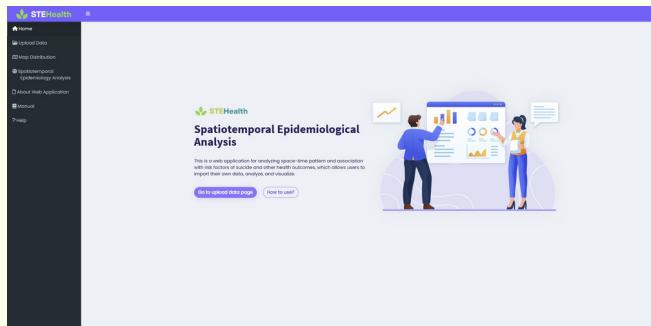
4

Now you can use the application.

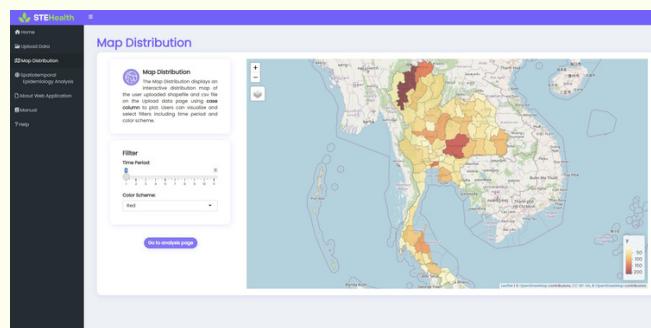


04 Application Pages

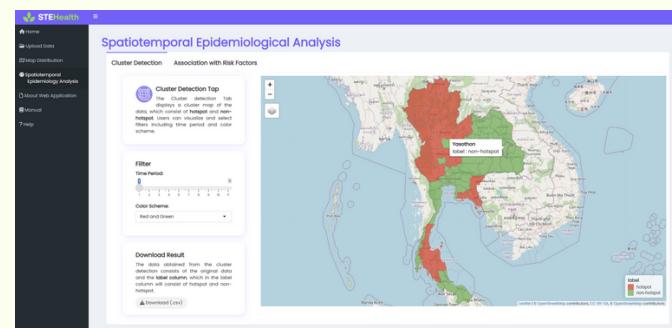
The application consists of seven pages:



1 Home Page



3 Map Distribution Page



4 Spatiotemporal Epidemiological Analysis Page

About Web Application

Background

The accessibility to spatiotemporal analytical tools is currently limited for public health workers and researchers, a user interface using R shiny will also be developed to increase accessibility and facilitate visualization and analysis for future studies. This web application will be developed to facilitate visualization and analysis for future studies and used to perform the analysis. To better communicate the results to stakeholders and public health researchers, we will develop user interfaces in the form of web applications with interactive features; however, the spatiotemporal analytical study or cluster detection and space-time association with risk factors, we will then investigate the results to stakeholders and public health researchers. The web application will be developed to increase accessibility and facilitate visualization and analysis for future spatiotemporal epidemiological studies in addition, though this interface will be built in the context of mental health as a case study, this web application can be applied to the specific needs of other health studies.

Purpose

To develop a web application to facilitate visualization and analysis for spatial and spatiotemporal epidemiological studies.

Developer

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Advisor

- Dr. Uğurhan Taşiroglu

A Case Study for Mental Health

Manual

Web Application Manual

This manual is a part of the project and provides detailed information about the application for spatiotemporal epidemiological studies.

5 About Application Page

6 Manual Page

Help

Structure

The application consists of seven pages:

- 1. Home page
- 2. Upload data page
- 3. Spatiotemporal Epidemiological analysis page
- 4. Cluster detection page
- 5. Association with Risk Factors page
- 6. About web application
- 7. Help page

Input Data

The "upload data" page allows users to upload data to be analyzed. This page consists of two sections: "Input Data" and "Preview Input Data". The "Input Data" section includes sections to upload a shapefile and a CSV file. The "Preview Input Data" section shows the data that has been successfully uploaded. Users can view the analysis results on the "spatiotemporal epidemiological analysis" page.

Cluster Detection

The "Cluster detection" page displays an interactive distribution map of the user uploaded shapefile and CSV file on the "upload data" page using case column to plot. Users can visualize and select filters including time period and color scheme.

Association with Risk Factors

The "Association with Risk Factors" page is the page that occurs result after the user has successfully uploaded the data on the "upload data" page. This page includes two topics: Cluster Detection and Association with Risk Factors.

Cluster Detection

Cluster detection is important 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-spotted [3]. The Cluster detection tab displays the results of the cluster detection process.

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. The Association tab displays an association between risk factors and disease outcomes.

About web application

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

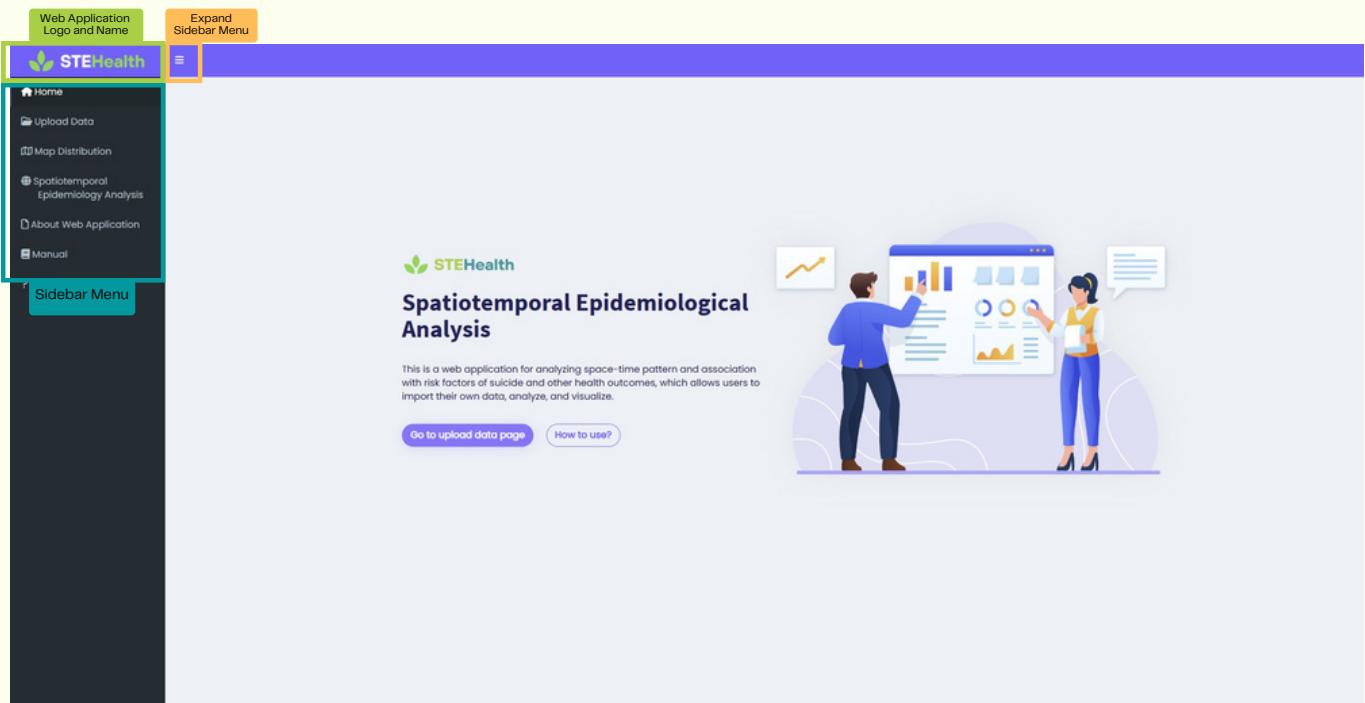
Help page

The "Help" page explains how to use the web application in a format that is easier to understand than the "help" page.

7 Help 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. [Go to upload data page](#) This button 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 screenshot shows the 'Upload Data' page of the STEHealth application. The page is divided into two main sections:

- Input Data Section (Purple Border):** This section contains fields for uploading shapefiles and csv files, selecting columns, and choosing covariates.
- Preview Input Data Section (Blue Border):** This section shows a message "Please Upload Data" with a "Preview Input Data Section" button.

Input Data Section Fields:

- Upload shapefile:** Includes a "Browse..." button and a note: "Upload all shapefile at once: shp, dbf, shx and prj." Below it is a dropdown for "area name".
- Note:** "Area name is name of the area. Area name in the data must be the same name and order as area name in the csv file."
- Are these shapefiles from Thailand?** Radio buttons for "Yes" and "No".
- Upload csv file:** Includes a "Browse..." button and a note: ".csv file needs to have columns: area id, area name, time period, expected value, cases, population". Below it is a dropdown for "area id" and "area name".
- Select Data***: A note: ".csv file needs to have columns: area id, area name, time period, expected value, cases, population". Below it is a dropdown for "expected value" and "cases".
- Select Covariates***: A note: "Put covariate in order from 1 to 7, with no blanks." Below it is a dropdown for "covariate 1" and "covariate 2".
- Select columns:** A note: "Select columns: covariate 1, covariate 2, covariate 3, covariate 4, covariate 5, covariate 6, covariate 7". Below it is a dropdown for "covariate 3" and "covariate 4".
- Select columns:** A note: "Select columns: covariate 5, covariate 6, covariate 7". Below it is a dropdown for "covariate 5" and "covariate 6".
- Select columns:** A note: "Select columns: covariate 7". Below it is a dropdown for "covariate 7".
- Preview Map Distribution** button.

Preview Input Data Section:

No data yet!

Please Upload Data

Preview Input Data Section

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	จังหวัดอัมnat ชารอน	Changwat	Province	37	TH.AC	None	POLYGON ((104.58696 15.60588, 104.58676 15.605...)	
1	THA	Thailand	THA.2_1	Ang Thong	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		ปีงกาฟ	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		จังหวัดอุดรธานี	Changwat	Province	41	TH.UN	None	POLYGON ((102.90189 16.85360, 102.90183 16.853...)
73	THA	Thailand	THA.74_1	Uthai Thani		จังหวัดอุทัยธานี	Changwat	Province	61	TH.UT	None	POLYGON ((99.52662 14.97926, 99.52472 14.98022...)
74	THA	Thailand	THA.75_1	Uttaradit		จังหวัดอุตรดิตถ์	Changwat	Province	53	TH.UD	None	POLYGON ((100.05381 17.18046, 100.05165 17.179...)
75	THA	Thailand	THA.76_1	Yala		จังหวัดยะลา	Changwat	Province	95	TH.YL	None	POLYGON ((101.09618 5.70161, 101.09572 5.70217...)
76	THA	Thailand	THA.77_1	Yasothon		จังหวัดยะโสธร	Changwat	Province	35	TH.YS	None	POLYGON ((104.35171 15.34208, 104.35113 15.342...)

77 rows × 12 columns

[click here to download 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. expected value

4. cases (outcomes)

5. time periods

6. 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

	province	province_id	year	suicide	population	E	debt	income	poverty	expenditure	homicide crime	property crime	shocking crime
0	Amnat Charoen	1	1	15	372241	25.045791	15816.29521	15619.29521	19.465428	14093.59122	93.803267	103.259996	11.132917
1	Ang Thong	2	1	15	284061	19.112705	23426.86803	23229.86803	11.370984	19134.75280	132.802670	249.675410	21.027569
2	Bangkok Metropolis	3	1	136	5674843	381.825033	49759.27425	49562.27425	3.971482	31896.10984	3478.753667	9877.476599	493.980976
3	Bueng Kan	4	1	16	407634	27.427167	17420.63623	17223.63623	4.419098	15850.78284	97.173624	103.904513	18.819348
4	Buri Ram	5	1	82	1559085	104.901172	16775.13139	16578.13139	34.641094	13042.21393	370.039319	279.426377	28.979629
...
842	Udon Thani	73	11	164	1559860	104.953317	25454.97746	25257.97746	6.712360	30506.27100	171.799921	371.360346	34.148120
843	Uthai Thani	74	11	19	325025	21.868919	23302.91004	23105.91004	3.962674	23866.78137	77.163457	71.663962	6.758570
844	Uttaradit	75	11	36	446349	30.032059	23139.96822	22942.96822	7.977242	21975.76472	84.386137	134.992120	13.473962
845	Yala	76	11	11	538960	36.263280	10747.17634	10550.17634	18.491871	10899.73612	248.055302	1115.498036	116.100956
846	Yasothon	77	11	27	533604	35.902908	23520.83817	23323.83817	9.359222	20389.94348	98.303706	193.468316	13.071078

847 rows × 13 columns

[click here to download sample csv files](#)

The sample csv file contains the following 13 columns:

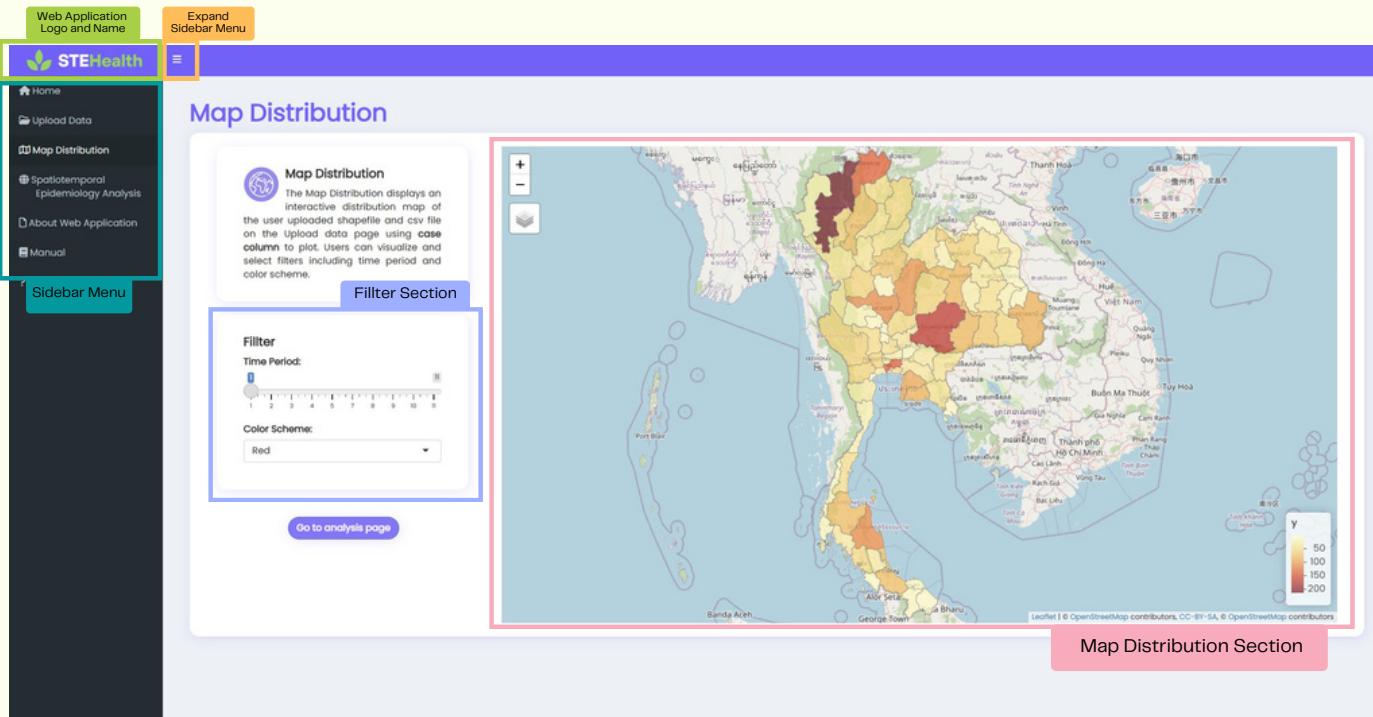
1. **province** is the name of province which has a total of 77 provinces.
2. **province_id** is the number of province starting at from 1 to 77.
3. **year** is the number of year starting at from 1 to 11.
4. **suicide** is the number of suicides.
5. **population** is the population in each area.
6. **E** is the number of expected value.
- 7-13. **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

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 period (from time period 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 change theme map by press

when user views the map distribution finished, press the [Go to analysis page](#) button. then user will go to "spatiotemporal epidemiological analysis" page.

Application Pages

4 Spatiotemporal Epidemiological Analysis Page

Web Application Logo and Name

Expand Sidebar Menu

STEHealth

Home

Upload Data

Map Distribution

Spatiotemporal Epidemiology Analysis

About Web Application

Manual

Sidebar Menu

Cluster Detection

Association with Risk Factors

Cluster Detection Tab

The Cluster detection Tab displays a cluster map of the data, which consist of hotspot and non-hotspot. Users can visualize and select filters including time period and color scheme.

Filter

Time Period:

Color Scheme:

Red and Green

Download Result

The data obtained from the cluster detection consists of the original data and the label column, which in the label column will consist of hotspot and non-hotspot.

Download (.csv)

Please upload data in "Upload Data" page to display cluster detection.

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

The screenshot shows the STEHealth application interface. At the top, there are two buttons: 'Web Application Logo and Name' (green) and 'Expand Sidebar Menu' (orange). The main title is 'Spatiotemporal Epidemiological Analysis' with tabs for 'Cluster Detection' and 'Association with Risk Factors'. On the left, a sidebar menu includes 'Home', 'Upload Data', 'Map Distribution', 'Spatiotemporal Epidemiology Analysis' (which is selected), and 'About Web Application'. A 'Sidebar Menu' button is at the bottom of the sidebar. The central area is titled 'Cluster Detection Section'. It contains a 'Cluster Detection Tab' with a description, a 'Filter Section' with a slider for 'Time Period' (set to 1) and a dropdown for 'Color Scheme' (set to 'Red and Green'), and a 'Download Result Section' with a 'Download (.csv)' button. To the right is a map of Southeast Asia with regions colored red or green based on the cluster detection results. A legend at the bottom right of the map indicates 'label' with 'hotspot' in red and 'non-hotspot' in green.

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].

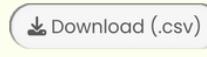
The cluster detection tab displays a **hotspot area map** of the data.

- **Filter Section** Users can select time period (from time period 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 change theme map by press 

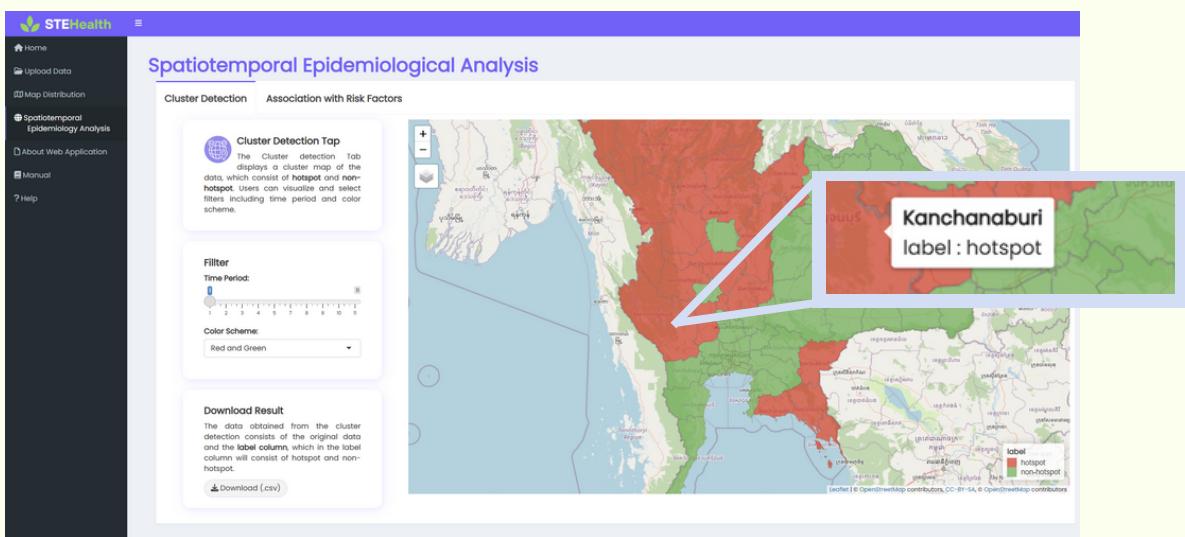
- **Download Result Section** Users can download result by press button . The result data from cluster detection consists of the original data and the **label column**, which in the label column will consist of hotspot and non-hotspot.

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	Arnat 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

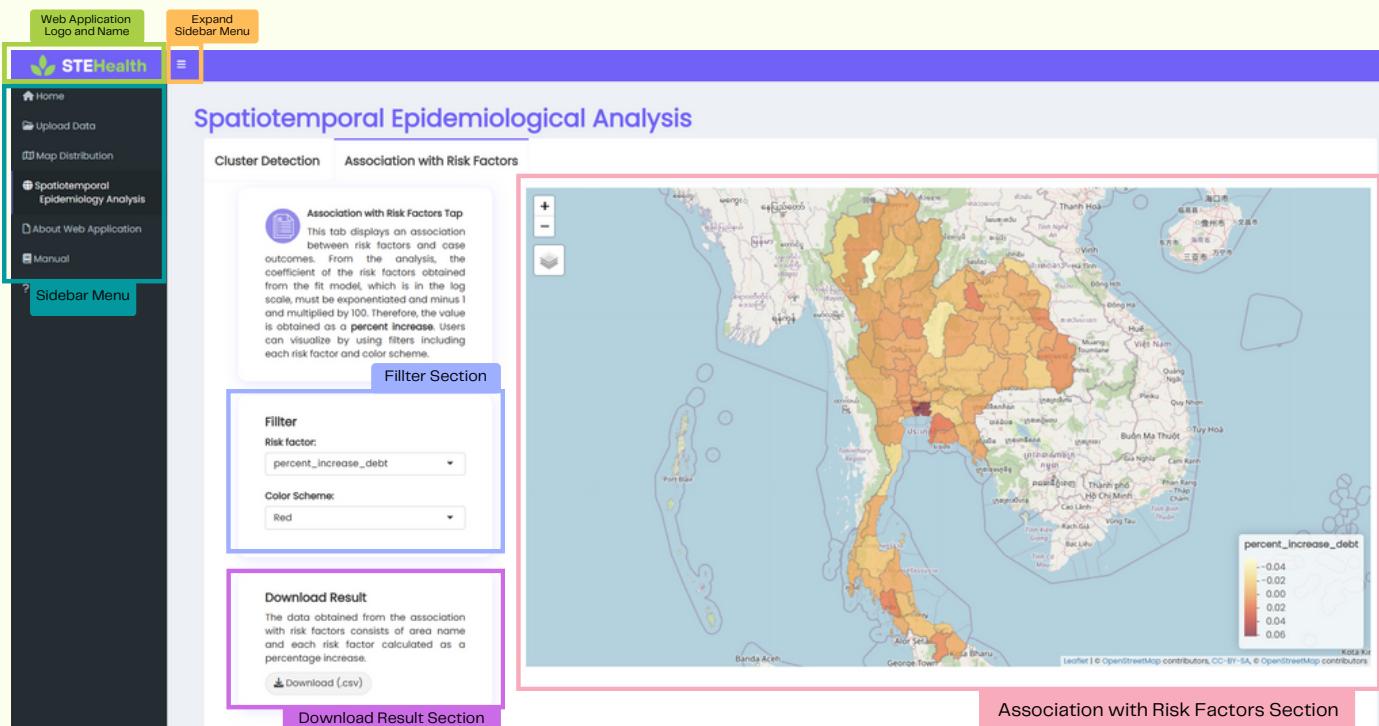
Example interprets of sample data from cluster detection



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

4.2 Spatiotemporal Epidemiological Analysis Result Page: 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.

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

Risk factor:

percent_increase_debt

Color Scheme:

Red

- **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 change theme map by press

- **Download Result Section** Users can download 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

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

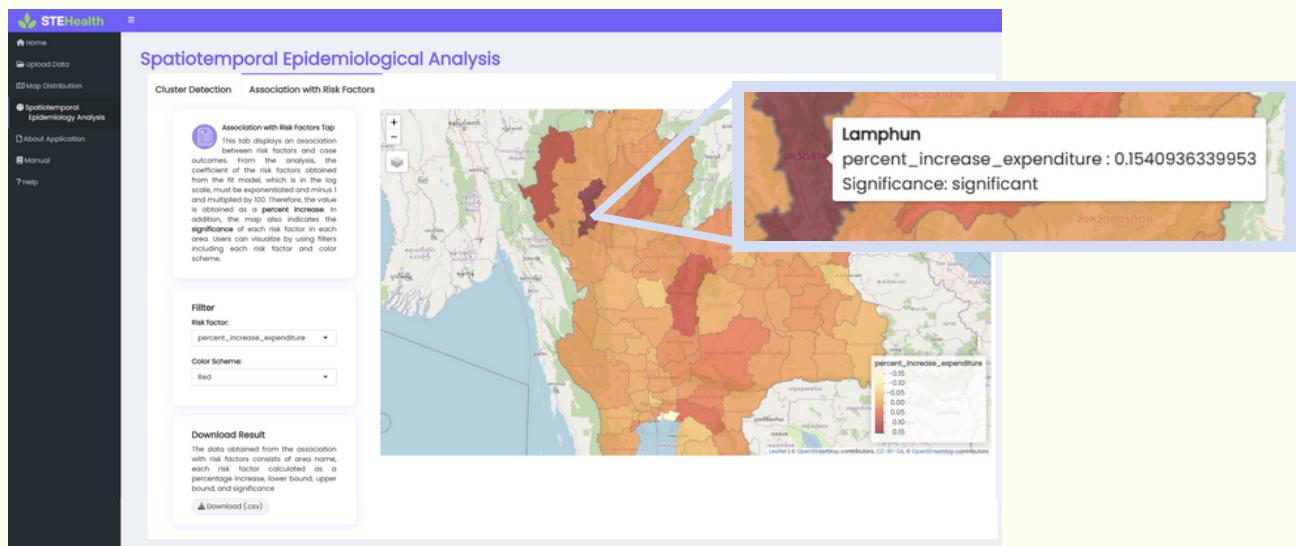
1. debt

7. shocking crime

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

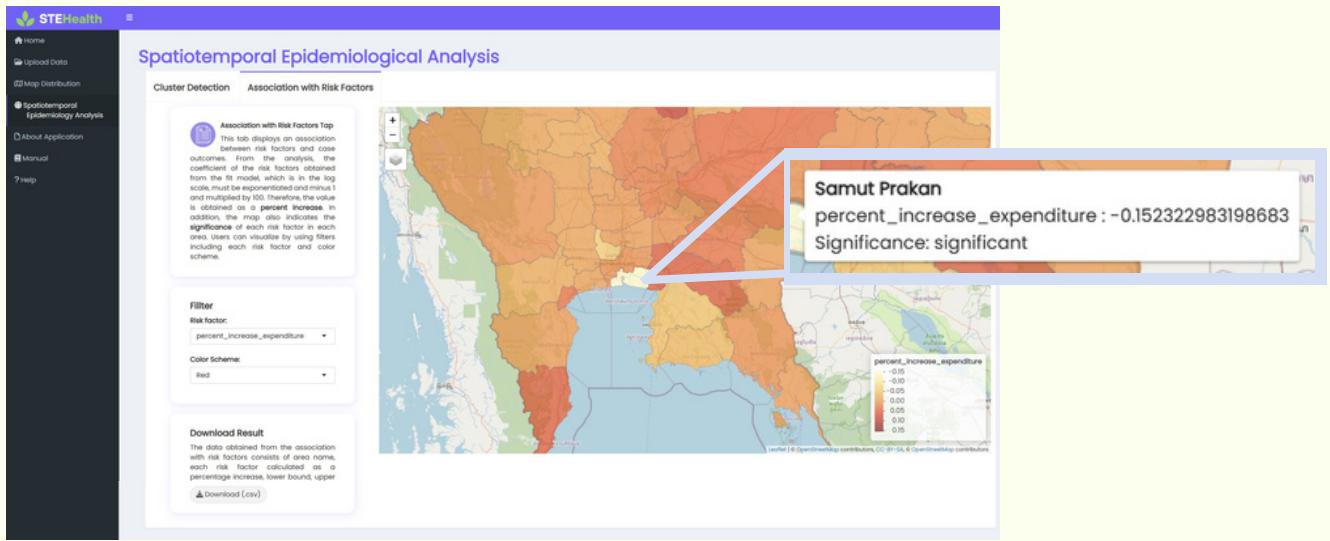
This example is an interpretation of a multivariable analysis of Thai suicide and risk factors. The model used 7 risk factors for multivariable analysis. However, the results are displayed one by one.

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



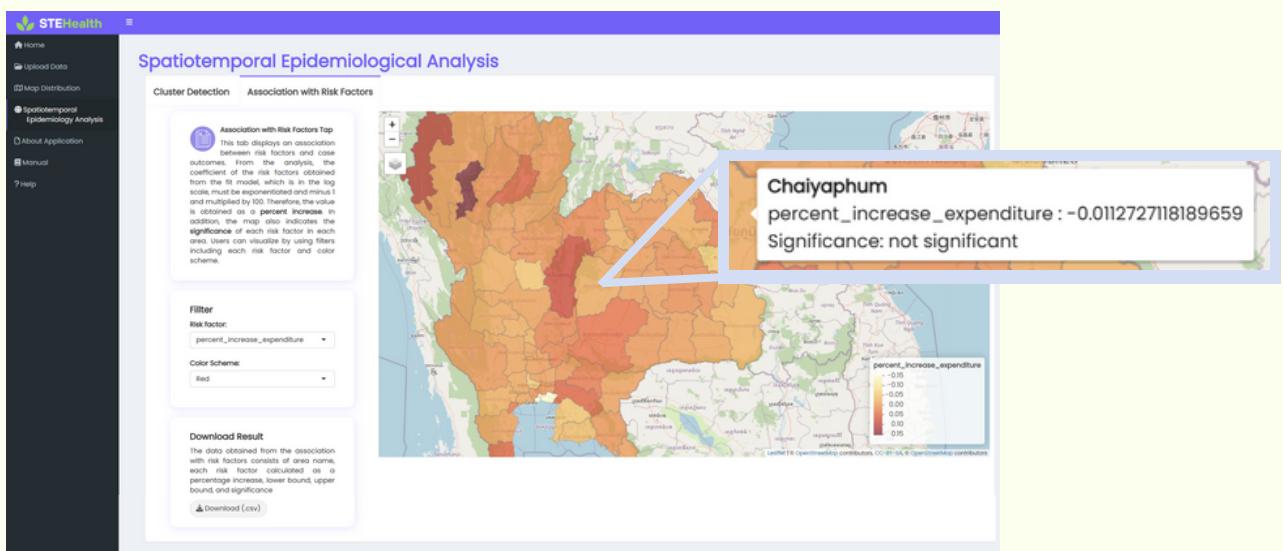
In Lamphun, the percent increase in expenditure is 0.15, which means if expenditure increases by 1 baht (THB), the suicide risk will increase by 0.15%, or every 100 baht (THB) increase in expenditure increases the suicide risk by 15%.

- 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

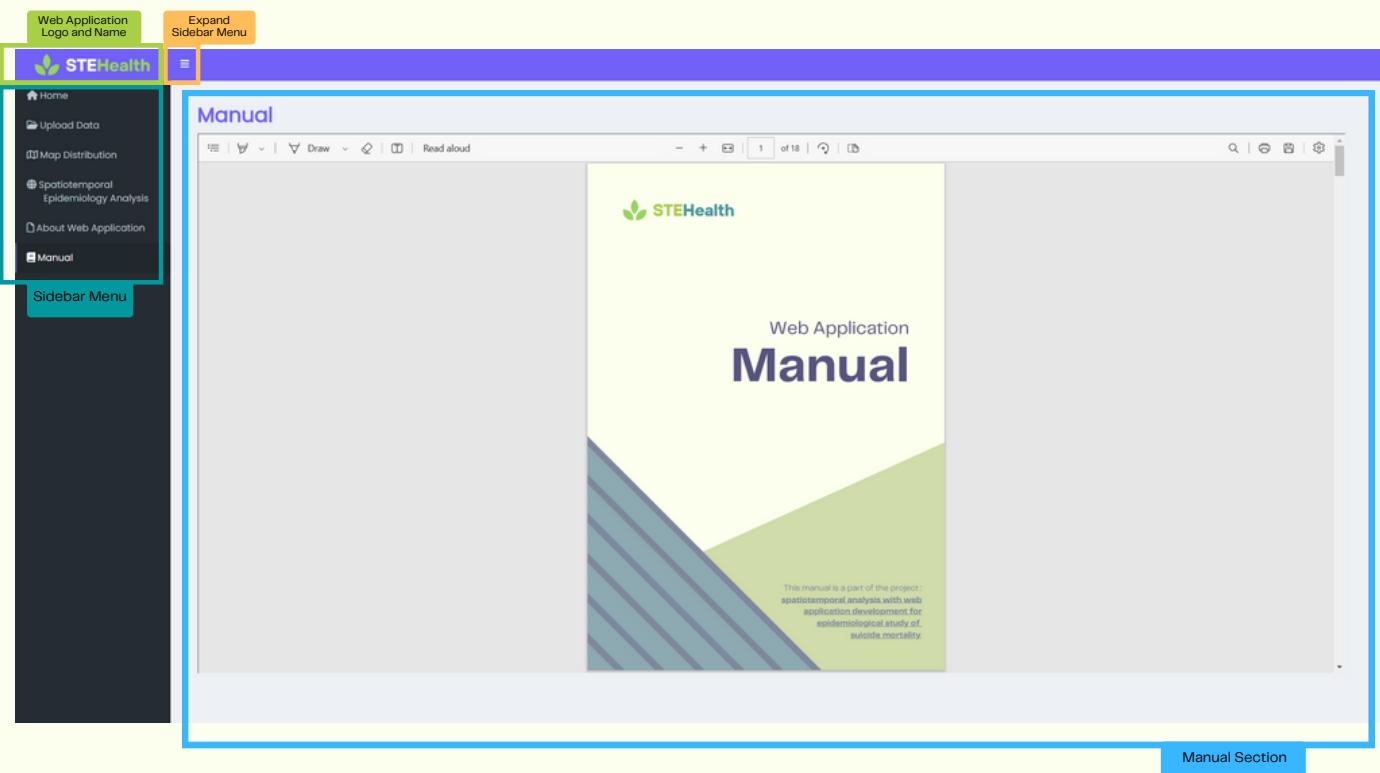
The screenshot shows the STEHealth web application interface. At the top, there's a navigation bar with a logo, a search bar, and several menu items: Home, Upload Data, Map Distribution, Spatiotemporal Epidemiology Analysis, About Web Application, and Manual. A 'Sidebar Menu' button is also present. On the left, a sidebar contains links for Home, Upload Data, Map Distribution, Spatiotemporal Epidemiology Analysis, About Web Application, and Manual. The main content area is titled 'About Web Application' and has a sub-section 'Background'. It includes a paragraph of text about the accessibility of spatiotemporal analytical tools and a related image of a person working at a computer. Below this is a 'Purpose' section with a list of goals, a 'Developer' section listing three names, and an 'Advisor' section listing one name. At the bottom right of the content area is a blue button labeled 'About Web Application Section'.

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.

Application Pages

7

Help Page

Web Application Logo and Name

Expand Sidebar Menu

STE Health

Home

Upload Data

Map Distribution

Spatiotemporal Epidemiology Analysis

About Web Application

Manual

Sidebar Menu

Help

Structure

The application consists of seven pages:

1.Home page

The home page is the first page of the web application, explaining what this web app does. On this page, there are two buttons: "Go to upload data page" and "How to use?". The "Go to upload data page" button can go to the "upload data" page. The "How to use?" 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 web application.

2.Upload data page

The "upload data" page allows users to upload data to be analyzed. This page consists of two sections: Input Data and Preview Input Data. The input data section includes sections to upload a shapefile and a csv file (health outcome) then the user has to select the columns from the dropdown menus for further analysis. The preview input data section can preview input data where users uploaded all data. Once the data has been successfully uploaded, users can view the analysis results on the "spatiotemporal epidemiological analysis" page.

3.Map Distribution

The Map Distribution displays an interactive distribution map of the user uploaded shapefile and csv file on the Upload data page using case column to plot. Users can visualize and select filters including time period and color scheme.

4.Spatiotemporal epidemiological analysis page

The "spatiotemporal epidemiological analysis" page is the page that occurs result after the user has successfully uploaded the data on the "upload data" page. This page includes two tabs: Cluster Detection, and Association with Risk Factors.

• Cluster Detection Tab

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.

• Association with Risk Factors Tab

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. The Association Tab displays an association between risk factors and case outcomes.

5.About web application

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

6.Manual page

The "Manual" page explains how to use the web application in a format that is easier to understand than the "help" page.

7.Help page

Help Section

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

Application Pages

Help Page:

7.1

When Error Occurred ?

If an error occurs in usage, for example:

Error Message	Description
ERROR: Wasn't able to determine range of domain	If the message displayed in "Map Distribution" page on the map, it means area name of shapefile and csv file do not match.
ERROR: no applicable method for 'filter' applied to an object of class "NULL"	If the message displayed in "Cluster Detection" tab on the map, it means the user forgot to import the data before beginning the analysis or did not press the "go to analysis page" button on the Map Distribution page.
ERROR: trying to get slot "data" from an object of a basic class ("NULL") with no slots	If the message displayed in "Association with Risk Factors" tab on the map, it means the user forgot to import the data before beginning the analysis or did not press the "go to analysis page" button on the Map Distribution page.
Application crashes	It may be because the user uploaded data that is not as specified making it unable to analyze the data.

Demonstration of 05 How to use application

Step 1

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

The screenshot shows the STEHealth web application homepage. The left sidebar contains links for Home, Upload Data, Map Distribution, Spatiotemporal Epidemiology Analysis, About Web Application, Manual, and Help. The main content area features the STEHealth logo and the title "Spatiotemporal Epidemiological Analysis". It includes a brief description of the application's purpose: "This is a web 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." Below the description are two buttons: "Go to upload data page" and "How to use?". To the right of the text is an illustration of two people interacting with a large screen displaying various charts and graphs.

Step 2

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

The screenshot shows the "Upload Data" page of the STEHealth application. The left sidebar is identical to the homepage. The main area has two sections: "Input Data" and "Preview Input Data". In the "Input Data" section, there is a "Upload shapefile" section with a "Browse..." button and a note: "Upload all map files at once: shp, dbf, shx and prj." Below it is a "Select columns id and name of the areas in the map." section with a dropdown menu set to "area name". A note below says: "Note: Area name is name of the area. Area name in the data must be the same as area name in the csv file." There is also a "Upload csv file" section with a "Select Data*" note: ".csv file needs to have columns: area id, area name, time period, expected value, cases". Below this are dropdown menus for "area id" and "area name", and input fields for "expected value" and "cases". On the right side, a "Preview Input Data" section shows a file selection dialog titled "Open". The dialog lists four files: "gadm41_THA_1.dbf", "gadm41_THA_1.prj", "gadm41_THA_1.shp", and "gadm41_THA_1.shx". The "File name" field at the bottom contains the path: "gadm41_THA_1.dbf;gadm41_THA_1.prj;gadm41_THA_1.shp;gadm41_THA_1.shx".

Step 3 -Select columns area name.

3

Note that: area name is name of the area. Area name in the data must be the same name and order as area name in the csv file.

Step 4

-Upload csv file

-Select columns: area id, area name, time period, expected value, cases

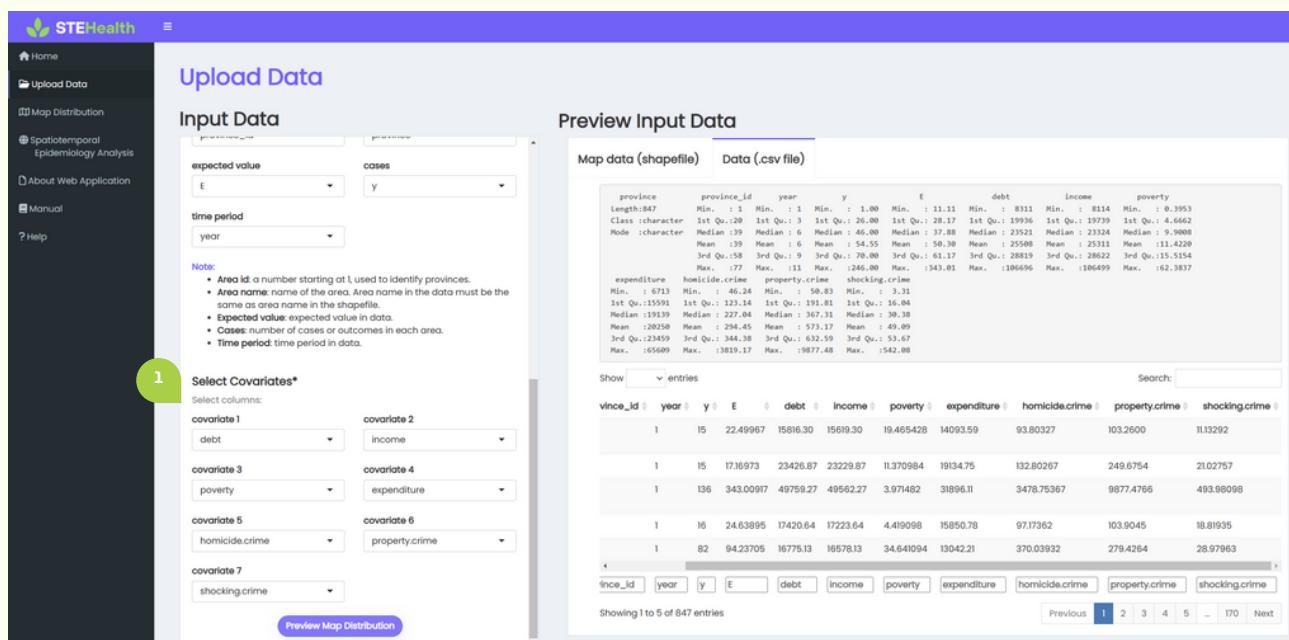
Note that:

- **Area id:** a number starting at 1 used to identify provinces.
- **Area name:** name of the area. Area name in the data must be the same as area name in the shapefile.
- **Expected value:** expected value in data.
- **Cases:** number of cases or outcomes in each area.
- **Time period:** time period in data.

Step -Select Covariates:

5

Note that: putting covariates with no blanks.

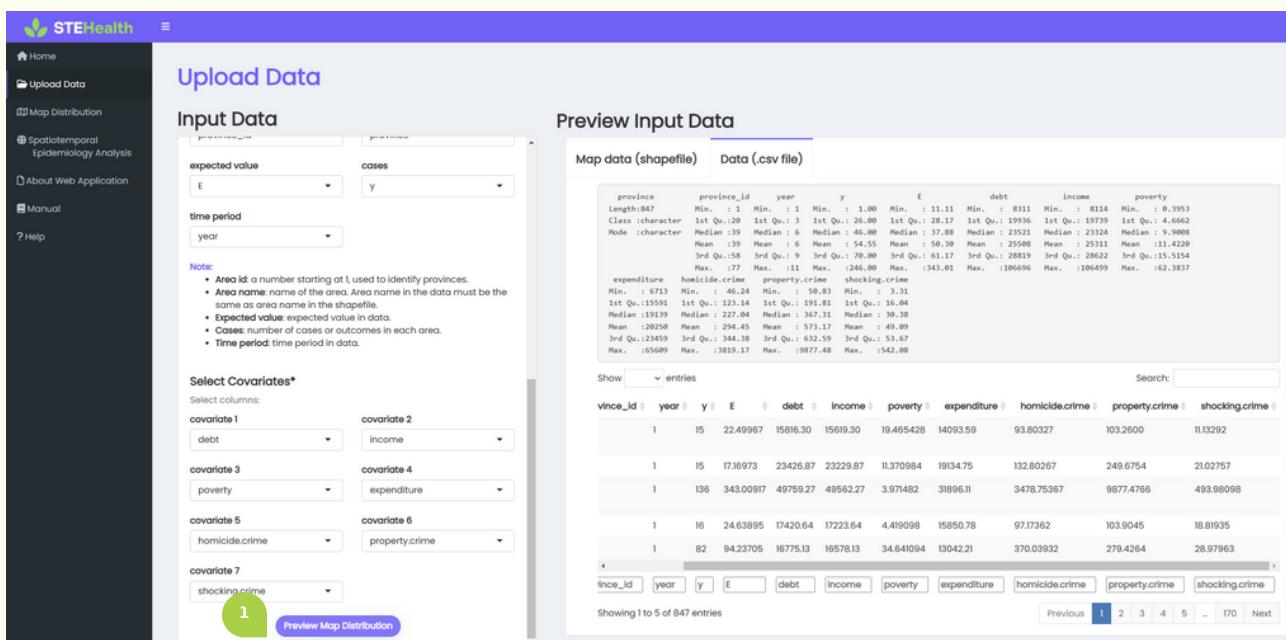


The screenshot shows the STEHealth application's 'Upload Data' and 'Preview Input Data' sections. In the 'Input Data' section, 'expected value' is set to 'E' and 'cases' is set to 'Y'. In the 'Select Covariates*' section, seven covariates are listed in pairs: covariate 1 (debt) and covariate 2 (income), covariate 3 (poverty) and covariate 4 (expenditure), covariate 5 (homicide.crime) and covariate 6 (property.crime), and covariate 7 (shocking.crime). A green circle highlights the '1' button next to the 'Preview Map Distribution' button. The 'Preview Input Data' section shows a table of data with columns: province, province_id, year, y, E, debt, income, poverty, homicide_crime, property_crime, and shocking_crime. The table includes statistical summaries for each column.

Step

6

Press **Preview Map Distribution** button.

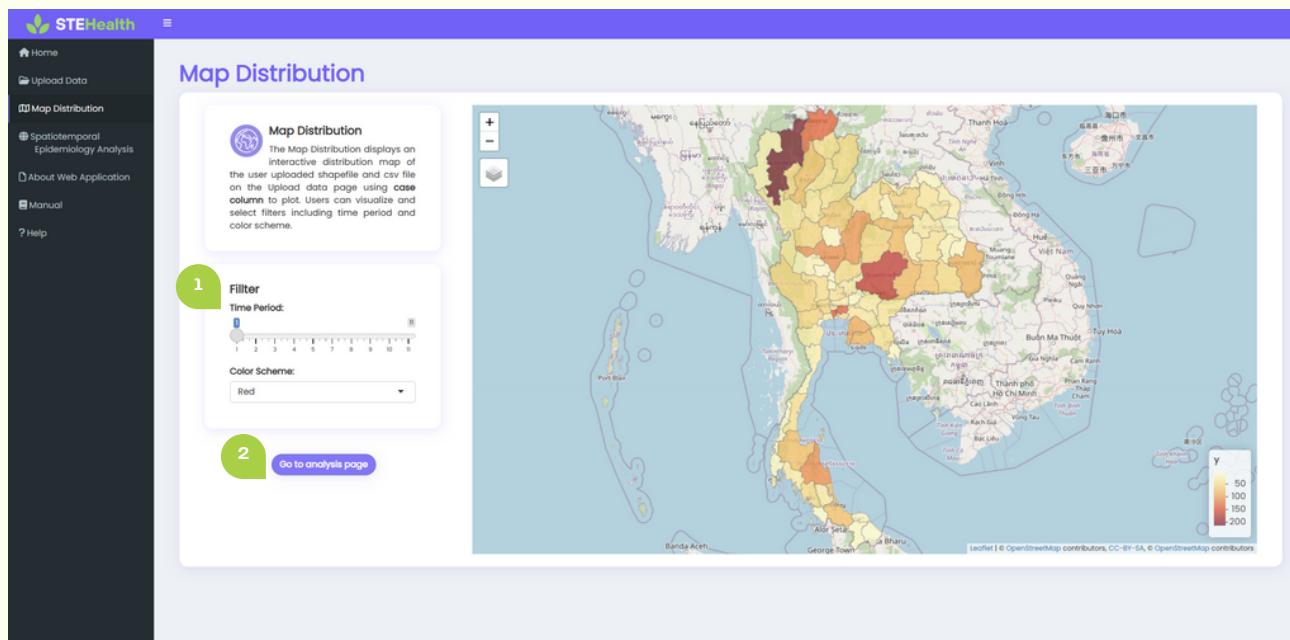


The screenshot shows the STEHealth application's 'Upload Data' and 'Preview Input Data' sections. The setup is identical to Step 5: 'expected value' is 'E', 'cases' is 'Y', and seven covariates are selected. A green circle highlights the '1' button next to the 'Preview Map Distribution' button. The 'Preview Input Data' section displays the same detailed data preview as in Step 5.

Step 7

-Users can visualize **Map Distribution** by using filters including time period and color scheme.

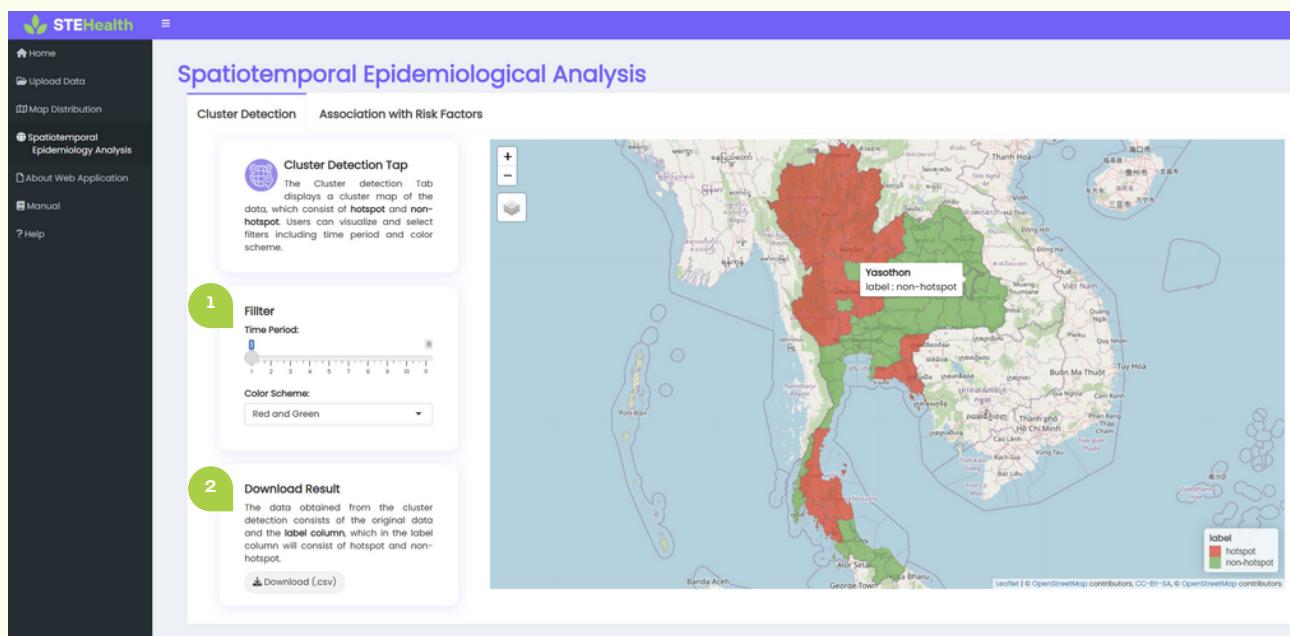
-Press [Go to analysis page](#) button.



Step 8

In Cluster Detection Tab:

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



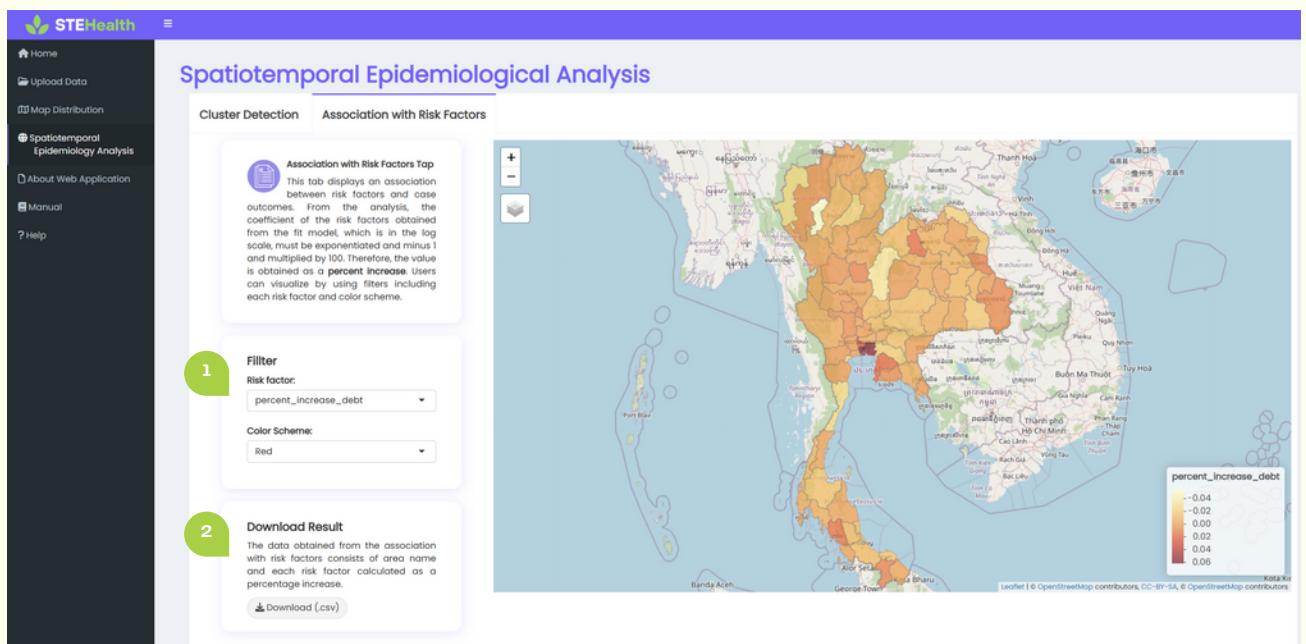
Note that: The Spatiotemporal Epidemiological Analysis page may take 1-3 minutes to calculate depending on computer performance.

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.



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
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

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.

