Knowledge, attitude and practices concerning dengue fever in South of France: a quantitative study

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Dengue fever is a mosquito-borne viral disease transmitted principally by *Aedes aegypti* and to a lesser extent by *Aedes albopictus*. According to the world health organization, 390 million persons are infected every year, with around 25000 deaths, mostly children. Dengue fever is mostly distributed in tropical and sub-tropical areas but in recent years has spread to Southern Europe and North America. Few dengue outbreaks have occurred in Southern Europe during the past years, where dengue virus is being transmitted by *Aedes albopictus* who is nowadays implanted and active. Mathematical models estimate that Southern Europe is at risk of major dengue outbreaks in the future due to climate change and globalization. As there is not yet vaccines or prophylactic drugs against dengue fever, vector management and prevention against mosquito bites are the best preventive ways.

The goal of this study was to assess the level of knowledge concerning dengue fever symptoms, transmission, prevention and management among individuals in Southern France as well as to assess the attitude concerning dengue fever.

The survey was a cross sectional quantitative study using an online questionnaire. The data was collected during April and July 2019 and 170 questionnaires were returned. The data was analyzed using SPSS 23. Non parametric analyses were done to find correlations between the dependent variables, knowledge and attitude, and the independent factors.

Knowledge concerning dengue fever symptoms, prevention, transmission and management was poor in South of France, with a total score of 54,2%±19,4. Level of knowledge was associated with prior information concerning dengue fever, age and travel history in dengue endemic areas. 70% of the respondents showed a good attitude as the majority was aware that dengue is a dangerous disease, that they are at risk of being contaminated by dengue virus, and that it is possible to prevent dengue fever. No significant correlation was found between attitude and knowledge

While this study was the first one done in Southern France, the results in this study are similar with previous studies done in dengue endemic areas. Even in South of France is not a dengue endemic area, risks of dengue outbreaks in the future are existent. It is thus important to be prepared and raise knowledge and awareness among the population and dengue educational and prevention programs should be put in place.

Keywords:	Dengue fever, knowledge, attitude, practices, *Aedes albopictus*, vector-borne.
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1 INTRODUCTION

Dengue virus is an arbovirus and is responsible for the dengue fever, which is listed among World Health Organization's (WHO) 17 neglected tropical diseases (NTDs) (Hotez, 2016). Dengue is one of the most important viral mosquito-borne disease, with dramatic consequences on global health. According to statistics, 50 to 390 million people are affected with dengue per year (Semenza et al., 2014) resulting in approximately 20000-25000 deaths annually, mostly children (Semenza, 2015). Moreover, dengue virus has the largest increase in infection rate over the past 20 years (Liu-Helmersson et al., 2016). The symptoms of dengue fever are usually mild (severe flu-like symptoms) but 1% of infections can lead to dengue hemorrhagic fever, nowadays called severe dengue fever, which is a potentially deadly complication (Monaghan et al., 2018; Shuaib et al., 2010; WHO, 2017). Dengue has been listed as one of the ten bigger threats on global health for 2019, as seen in figure 1 (WHO, 2019)

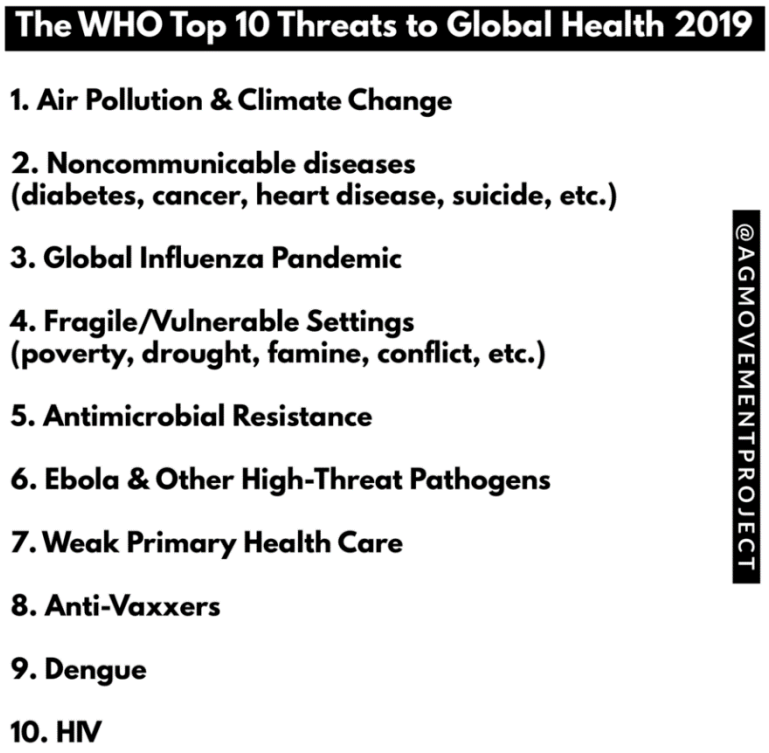

Figure 1. The WHO top ten threats to global health 2019

Dengue virus is transmitted by two species of mosquitoes, *Aedes aegypti* (principal vector) and *Aedes albopictus* (less effective vector) (Liu-Helmersson et al., 2016; Monaghan et al., 2018; Semenza et al., 2014; Shuaib et al., 2010,). *Aedes aegypti* is currently distributed in Africa, South-east Asia, Northern Australia, Middle-East, Pacific islands and South-eastern United States. Moreover, *Aedes aegypti* has recently established in Madeira (Portugal), Georgia and has been introduced in the Netherlands (ECDC, 2016; Seixas et al., 2018). *Aedes albopictus*, although a less effective vector than its counterpart *Aedes aegypti*, possesses a larger distribution area and is nowadays present in Africa, Asia, Australia, South-America, Central America, the Caribbean and in a large number of European countries, mostly in Southern Europe, such as Portugal, Spain, South of France, Italy, Greece, Croatia, Albania and has been introduced in Germany, United Kingdom, France, and in Eastern Europe, as seen in figure 2. The distribution area of *A. albopictus* is constantly growing and *A. albopictus* has been listed in top 100 most invasive species. (Di Luca et al., 2017; ECDC, 2016; Liu-Helmersson et al., 2016; Semenza et al., 2014)

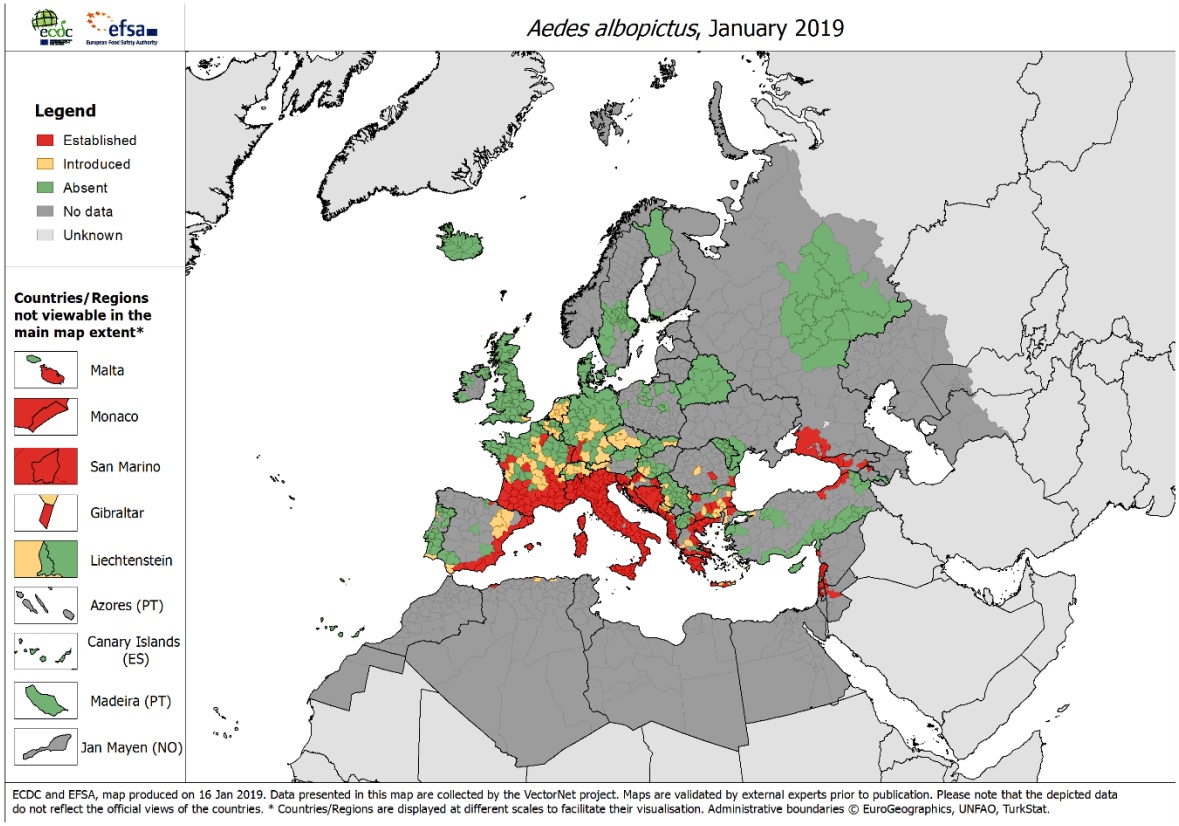

Figure 2. Distribution of Aedes albopictus in Europe as of January 2019

Over the last decade, dengue fever has re-emerged in Southern Europe, potentially affecting the public health and raising concerns (Di Luca et al., 2017; Hotez, 2016; Seixas et al., 2018). Although dengue is a tropical disease, there was a recent outbreak in Madeira in 2012, affecting 2000 people and autochthonous (from one host to another host via a vector) transmissions have occurred in Croatia and France in 2010 (Liu-Helmersson et al., 2016; Semenza, 2015).

There are numerous factors influencing the possibility of dengue outbreak in Europe and they can be classified in biotic and abiotic factors. Biotic factors focus only on the *Aedes* mosquito itself while abiotic factors focus on globalization, climate change, social and demographic factors such as migration and poverty, and public health including prevention, surveillance and education. (Di Luca et al., 2017; Hotez, 2016; Liu-Helmersson et al., 2016; Semenza, 2015). Air traffic, and especially holiday travelers to dengue endemic areas, is the main cause of dengue cases in Europe (Massad et al., 2018; Semenza et al., 2014). According to the latest statistical data, in 2017, there have been over 2000 cases of dengue reported in EU, with the majority of cases reported in Germany (635), United Kingdom (465), France (264) and Spain (128). Finland and Sweden had respectively 25 and 106 cases in 2017. It is important to note that all those cases are imported cases from dengue epidemic areas. (ECDC, 2018)

Southern Europe is at risk of future dengue outbreaks according to mathematical models based on temperature change and vectoral capacity (capability for disease transmission by a vector to a host based on behavioral, ecological and environmental factors) (Liu-Helmersson et al., 2016; Liu-Helmersson, 2018; Massad et al., 2018; Monaghan et al., 2018) and according to some studies, cities like Milan, Rome, Barcelona, Athens, Malaga and Nice possess the highest risk of dengue outbreak in the near future, mostly due to air and maritime traffic, population growth and changes in temperature (Liu-Helmersson, 2018; Semenza et al., 2014).

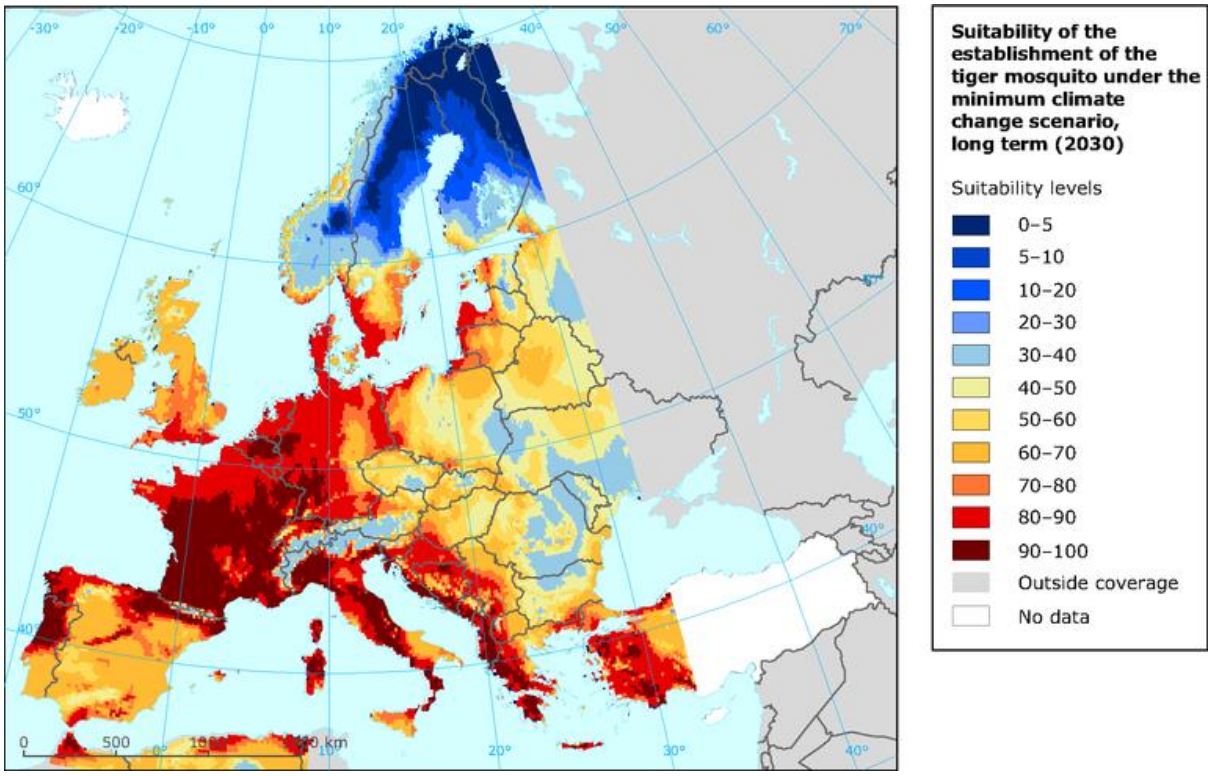

Figure 3. Distribution of Aedes albopictus in Europe in 2030 based on mathematical models

It is important to note that *Aedes aegypti* and *Aedes albopictus* are also responsible for the transmission of other diseases including Chikungunya and Zika virus (ECDC, 2016; Jupille et al., 2016; Monaghan et al., 2018) as Chikungunya emerged in Italy in 2007 and Spain in 2015 and an outbreak occurred in France in 2010 (Hotez, 2016; Liu-Helmersson et al., 2016; Seixas et al., 2018) and any countries where *Aedes aegypti* and *Aedes albopictus* are present are at risk for future Zika virus outbreaks (Jupille et al., 2016). Concerning dengue fever, there is no effective vaccine and no treatment (Semenza et al., 2014) and thus emphasis is placed on vector control and prevention (Kumaran et al., 2018; Shuaib et al., 2010).

There is a strong need to tackle emerging neglected tropical diseases (NTDs) such as dengue fever in Europe and especially Southern Europe as there is an elevated risk that outbreaks happen in the future, and thus emphasis must be done on surveillance, vector control, education and prevention (Di Luca et al., 2017; Hotez, 2016; Seixas et al., 2018; Semenza et al., 2014; Vega-Rua et al., 2015). In 2012, WHO published a global strategy for dengue prevention and control which has the objective of reducing mortality and morbidity from dengue by respectively 50% and 25% by 2020. According to WHO, dengue morbidity can be reduced, among other, by vector management and education programs (WHO, 2012).

South of France has been chosen for this study as there has been few outbreaks of dengue fever in this area over the past few years, even if the number of autochthonous cases stays very low (<10 cases per outbreak) (Gossner et al., 2018; Succo et al., 2018; Succo et al., 2016). With *A. albopictus* well installed in South of France, increased globalization and travels, and climate change, the risk of dengue outbreaks in South of France should not be underestimated. In France, there is a growing number of imported dengue cases from dengue-endemic countries, with 759 confirmed cases between 2015 and 2018 with most cases from Thailand and Indonesia (ECDC, 2019). In French Reunion's island, situated in the Pacific, 7700 cases of dengue have been confirmed between January and April 2018, leading to 14 deaths (WHO, 2019). Moreover, this cross-sectional quantitative study about knowledge, attitude and practices concerning dengue fever is the first one done in Europe.

2 THEORETICAL BACKGROUND

As this study deals with knowledge, attitude and practice concerning dengue fever, this chapter will review dengue fever symptoms, prevention, transmission and management. Dengue fever being a global health issue, the Social Ecological Model will be used as theoretical framework.

2.1 Dengue fever

This chapter will go through the symptoms, transmission, prevention and management of dengue fever, as background information concerning the questionnaire used during the survey.

2.1.1 Symptoms of dengue fever

Following a mosquito bite infected with dengue virus, the symptoms appear between 3 and 15 days. Initial symptoms that appear during the first hours of sickness are headache, chills, pain during eye movement and lower back pain. Few days later fever as high as 40 degree Celsius appear, as well as rashes from the extremities to the whole body, except the face, and joint pain. (Javid, 2015). This phase is called the febrile phase and usually lasts from 2 to 7 days. The critical phase occurs in 5% of all cases of dengue fever and includes fluid accumulation in the chest and abdominal cavity, severe abdominal pain, organ failure and hemorrhage. This phase lasts one to two days and starts with a normalization of the body temperature, meaning that there is no fever anymore. In the most dramatic cases, there might be brain infection by the dengue virus, neurological disorders and liver failure. Dehydration, mouth bleeding and gastrointestinal tract bleeding usually occur during this phase. The symptoms of the critical phase have given the name of dengue hemorrhagic fever. It is important to note that only individuals who have been infected previously by DENV (dengue virus) are at risk of developing dengue hemorrhagic fever when infected a second time. (Srinivas & Srinivas, 2015).

2.1.2 Transmission of dengue fever

Dengue virus is transmitted mainly from mosquito bites. However, the literature shows that other ways of transmission exist, even if they have been rarely documented. For instance, in 2002 a 76-year-old woman contracted dengue fever via a blood transfusion in Hong-Kong. A blood transfusion was also responsible for the infection of 3 individuals in 2008 in Singapore,

as well as the contamination of one individual in Puerto-Rico in 2007. (Pozzetto et al., 2015). In 2014 in South Korea, a 30-year-old laboratory worker got infected with dengue virus after accidentally injure herself with a needlestick (Lee et al., 2016). Concerning the transmission of dengue virus via sexual intercourse, no cases have been documented in the literature. However, dengue virus was discovered in the semen of a returning traveler in Italy, as well as in vaginal secretions of a woman returning from Sri Lanka in Italy in 2017 (Lalle et al., 2018).

2.1.3 Prevention against dengue fever

As all vector-borne transmittable diseases, the best way to prevent dengue fever is vector management and vaccination. Concerning vector management, control of the main vector *Aedes aegypti* and the second vector *Aedes albopictus* is essential in areas where dengue fever is endemic, as well as areas where the vectors are well established, in case of outbreaks caused by infected travelers returning in a non-endemic area. (Srinivas & Srinivas, 2015). Preventive measures such as removing all sources of stagnant water or covering them to deny the *Aedes* mosquito of any chance to breed, using insect repellent, keeping mosquitoes outside of the house by using mosquito nets, pouring chemicals in stagnant waters to kill the mosquito larvae or cutting the bushes in the yard to reduce mosquitoes are efficient in vector management (Shuaib et al., 2010).

Concerning vaccination, there is no efficient vaccine available at the moment. However, a vaccine attempt, called CYD-TDV, was synthetized in 2014 by Sanofi Pasteur and licensed in 2015 and approved in 19 countries. However, clinical trials found out in 2017 that the vaccine can increase the risk of severe dengue if administrated to individuals who never contracted dengue fever, especially in children aged 2-5. In 2017, WHO approved the vaccine only for individuals from 9 to 45 years old and only in a highly dengue seroprevalence area, as the vaccine is efficient only for individuals having been infected prior to the vaccination. Later in 2018, WHO approved the vaccine only for individuals with proven past dengue infection (Lancet, 2018)

2.1.4 Management of dengue fever

There is no medication available to cure dengue fever. In most of the cases, dengue fever lasts about 3 to 7 days and symptomatic individuals recover automatically. The management of dengue fever concerning the mild cases is symptomatic. Medication such as Paracetamol must be used to reduce fever and joint pain can be relieved with analgesics. Moreover, oral fluid intake is important to avoid dehydration. Aspirin should be avoided to reduce the risk of bleeding. During the critical phase, patients might require blood transfusion due to excessive bleeding from the gastrointestinal tract, as well as intravenous fluid therapy. It is very important for individuals who do not have fever anymore after 3 to 7 days to pay attention to early symptoms of dengue hemorrhagic fever, such as bleeding from gums, abdominal pain, vomiting or disorientation. (Javid, 2015; Srinivas & Srinivas, 2015)

2.2 The Social Ecological Model

The health care system possesses an important role in detecting, treating and preventing diseases and injuries. The objectives of public health are thus promoting general health and preventing diseases by applying epidemiological techniques. (Ali & Katz, 2015). However, even if public health has made significant progress towards his objectives, population growth, globalization, climate change, international travel and immigration, transportation of food and other products are factors for rapid spreading of infectious diseases on a global level with projections suggesting that over the next decades, infectious diseases will still be responsible for 20 percent of deaths globally (Blazes et al., 2015).

The theory used for this thesis will be the Social Ecological Model (SEM). The SEM is a theory-based framework developed in the 1970s by sociologists and aimed at understanding the effects of personal and environmental factors that determine behaviors concerning health promotion and prevention. As shown in Figure 4, the SEM comprises of five levels: individual (knowledge, attitude, behavior), interpersonal (families, friends, social networks), community (relationships between organizations), organizational (organizations and social institutions) and policy (national, state, local laws). (McLeroy et al. 1988)

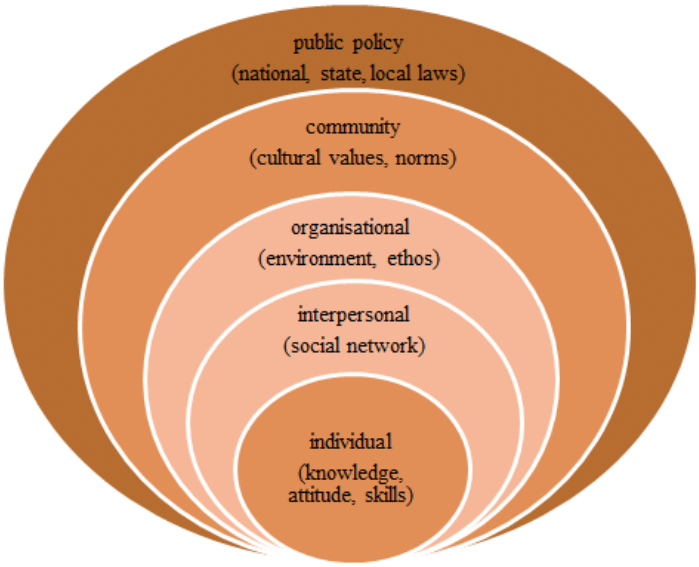

Figure 4: The five levels of the Social Ecological Model (SEM)

The individual level (level 1) deals with an individual's knowledge and skills. Knowledge about a disease and its symptoms, transmission, prevention is beneficial to the individual as it provides information about the danger of the disease, how to protect itself from the disease, and when to seek help from health professionals. The interpersonal level (level 2) deals with the individual's social network such as parents, family, neighbours and so on. Social network is important as it is an important source of knowledge and advices concerning a health issue. On the other hand, social network can also be a source of inaccurate knowledge. The organisational level (level 3) deals with various organisations such as schools, workplaces, who can provide accurate information and knowledge, provide counselling, screening to an extended group of individuals. The community level (level 4) deals with the cultural norms and values of the group of the individuals, which affect behaviours and efficiency at every level. At this level, group or community leaders have an important role. The community level can also refer to the sum of all organisations working together at a regional level, such as a city or province. The public policy level (level 5) refers to governing bodies and authorities who are making health strategies and legislations concerning a health problem. Those strategies or legislations can affect every level of the SEM. (Golden & Earp, 2012)

Public health organisations might struggle to find an effective strategy or legislation if they focus on only one level, for example on the individual level. It is primordial to encompass and to take into account other factors that might influence the health behaviours of an individual, such as for example the cultural values and/or existing legislations. The SEM is thus seen as

an interconnecting multifaceted network that takes into account different factors and determinants of health. To treat a problem at the global health level, it is important to address the issues at all levels and not to focus only on one level. The SEM is nowadays used by many organisations such as the Centre of Diseases Control (CDC) or UNICEF.

2.3 French program for dengue prevention and control

In France, an anti-dengue fever and chikuyanga program has existed since 2006. It consists of a multidisciplinary approach in surveillance and control of the vector *Aedes albopictus*, and public health issues. The plan is reviewed every year before its activation, from May to November, when *A. albopictus* is active. The goal of the program is to monitor imported cases of dengue to avoid spreading on the French territory and to rapidly detect autochthonous cases in order to react efficiently. Since 2015, health professionals receive additional education concerning dengue in areas where *A. albopictus* is active and implemented. (French Minister of Social Affairs, Health and Women's Rights, 2015) Moreover, on the French Minister of Health website, there is information and numerous links related to dengue fever symptoms, prevention, personal protection against the vector, *Aedes albopictu*s, as well as information specifically targeted to health care professionals. This amount of information is in concordance with the national program in order to detect rapidly suspect cases of dengue and to prevent dengue fever spreading via vector control and protective behavior (Agence regionale de la sante 2019).

2.4 Research background

Several studies on knowledge, attitude and practice concerning dengue fever have been done over the past years but the researcher hasn't found any article or study done in Europe. Results differ from country. According to a study done in Jamaica in 2010 (Shuaib et al., 2010), most respondents could not relate all the symptoms, as fever being the most related symptom of dengue fever. This study is comparable in findings with similar studies done in Grenada, Thailand, Malaysia (Chandren et al., 2015), and Cambodia (Kumaran et al., 2018). On the other hand, a study done in Pakistan in 2008 (Itrat et al., 2008) showed that respondents listed most of the symptoms of dengue fever. This difference in knowledge on symptoms and preventive practices is mostly due to a difference on education program on dengue fever (Kumaran et al 2018) and education level of the respondents (Harapan et al., 2018).

Concerning attitude about dengue fever, several studies showed that the majority of respondents consider dengue fever a dangerous disease, but do not consider themselves at risk of being infected by dengue virus (Shuaib et al. 2010, Van Nguyen et al. 2019). On the other hand, a study done in Malaysia showed that the vas majority of respondents are afraid of being infected by dengue virus (Ghani et al 2019). While some studies show a correlation between attitude and preventive practices (Ghani et al 2019, Shuaib et al 2010), some studies do not show any correlation (Kumaran et al. 2018).

The vast majority of studies showed that there were some gaps in knowledge concerning preventive practices against dengue fever (Chandren et al. 2015, Ghani et al. 2019, Shuaib et al. 2010, Van Nguyen et al. 2019).

3 AIMS AND QUESTIONS

The goal of this study was to assess the level of knowledge concerning dengue fever and dengue fever prevention (or preventive practices), transmission and management in Southern France, as well as to assess the attitude of the people towards dengue fever.

The purpose of this study was to provide information to public health authorities concerning dengue fever in Southern France in order to implement educational or prevention programs in France. The results of this study will be made available and sent to different French health authorities. The purpose of this study was in accordance with the Social Ecological Model (SEM) as this study dealt mostly with the individual level (level 1 of the SEM) by analyzing the knowledge, attitude and behavior. Moreover, this study also dealt with the interpersonal level (level 2) of the SEM by analyzing the sources of information that can influence individual behavior. The results concerning the analysis of the two first levels of the SEM might influence health authorities and so the organizational (level 3) and public policy (level 5) level of the SEM. (See Figure 1). In other words, French health authorities might adapt or create new legislations concerning dengue fever prevention and education (level 5) which might impact different organizations (level 3) such as schools, hospitals and regional authorities. In the long term, communities (level 4) might have a different approach and point of view concerning dengue fever, as a result of changes in health strategies and legislations. All those different levels, organizational, community and public policy, might in turn influence the individual (level 1) and interpersonal (level 2) levels.

The research questions are:

1. “What is the level of knowledge in Southern France concerning dengue fever symptoms, transmission and prevention (or preventive practices)? “
2. “What is the attitude of the population of Southern France concerning dengue fever?”
3. “What are the factors associated with the level of knowledge in Southern France concerning dengue fever? “
4. “What are the factors associated with the attitude in Southern France concerning dengue fever? “

4 METHODOLOGY – A CROSS-SECTIONAL QUANTITATIVE STUDY

A cross-sectional study is a type of observational study that analyses data from a population at a specific point in time. A quantitative study utilizes quantitative methodology by analyzing numerical data usually collected from survey, polls or questionnaires.

4.1 Knowledge, attitude and practices (KAP) survey

A KAP survey means knowledge, attitude and practice survey. Knowledge is considered as the understanding of science, and in this case the knowledge of dengue symptoms and dengue transmission. Assessing the level of knowledge helps locate areas where information and education needs to be reinforced. Attitude is a way of being, a way of thinking. Attitude can influence health behavior even if the level of knowledge is sufficient. Attitudinal data is important for design or modification of legislations. Moreover, attitudinal data can identify factors that influence attitude. Many theories concerning attitudes and behavior exist and the most common is Ajzen's theory of planned behavior which stipulates that attitudes are significantly correlated to behavioral intentions. (Ajzen & Fishbein, 2000).

In this study, attitude analysis attempted to show what the population thinks about the potential health risk of dengue fever. Practices are observable behaviors or actions in response to a stimulus. In this study, practices are defined by preventive measures concerning dengue fever and health seeking behavior. As explained earlier, knowledge, attitude and practice data are important in order to create or modify legislations or policies concerning a precise subject, in this context, dengue fever.

4.2 Material

The study was conducted using a cross-sectional online questionnaire survey. The questionnaire comprises 40 questions and is shown in Appendix 1. The questionnaire was divided in 4 parts. The first part concerned the socio-economic status of the respondent (questions 1 to 6), the second part dealt with knowledge of dengue fever (symptoms, transmission and management) (questions 7 to 36), the third part dealt with sources of information on dengue fever (question 37) and the fourth part dealt with attitude of the respondent towards dengue fever

(questions 38 to 40). The questionnaire used is a modified version of a questionnaire used for a similar study in Jamaica (Shuaib et al., 2010).

4.2.1 Population and study sample

The target population was all habitants aged over 18 living in South of France. South of France comprises four regions, Provence-Alpes-Côte d'Azur, Languedoc-Roussillon, Midi-Pyrenees and Aquitaine. The South of France has been chosen since *Aedes albopictus*, one of the mosquitoes responsible from spreading dengue virus, is implemented and active in this area, as shown in Figure 5.

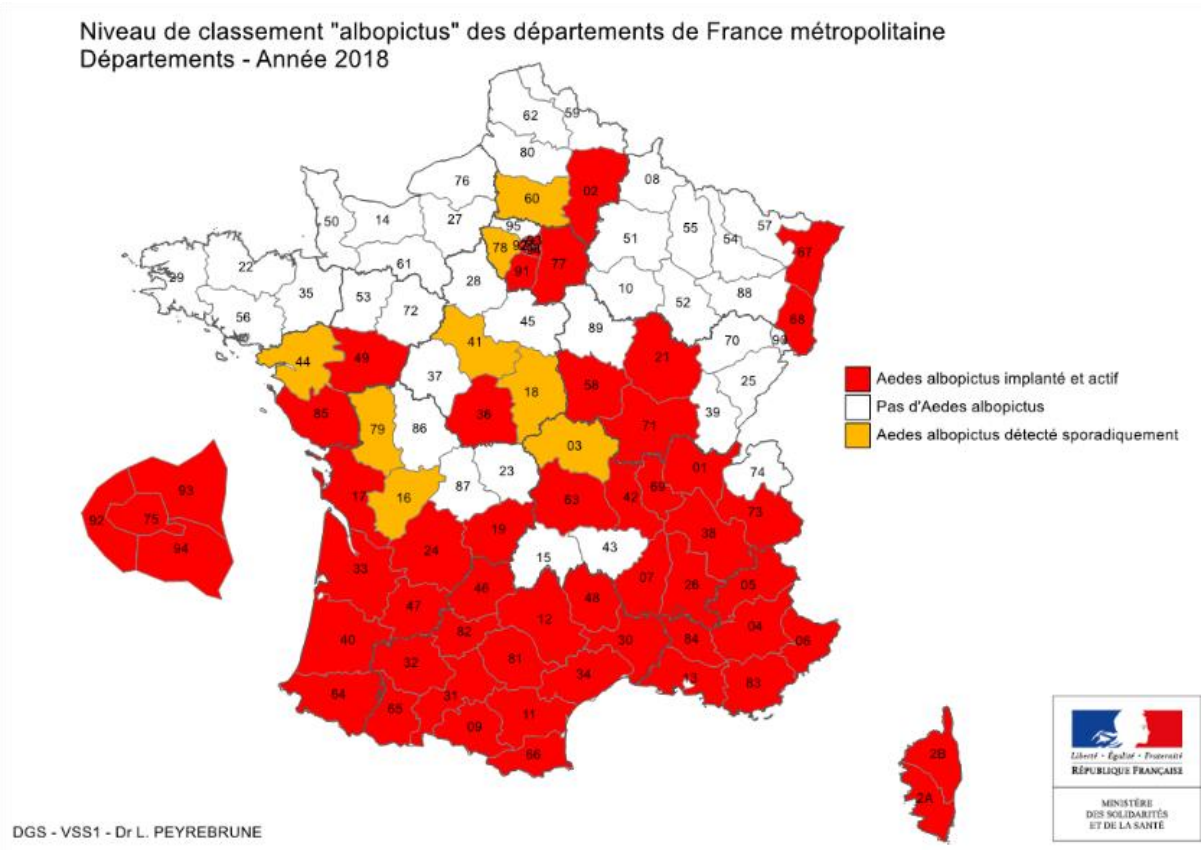

Figure 5:Area in France where A.Albopictus is implemented and active (in red). Source: Ministere des solidarites et de la san-te (2019)

Moreover, since 2004, A. *Albopictus* has extended his habitat. Figure 6 shows the evolution of the number of departments in France reaching level 1, which means that *A*. *Albopictus* is implemented and able to reproduce.

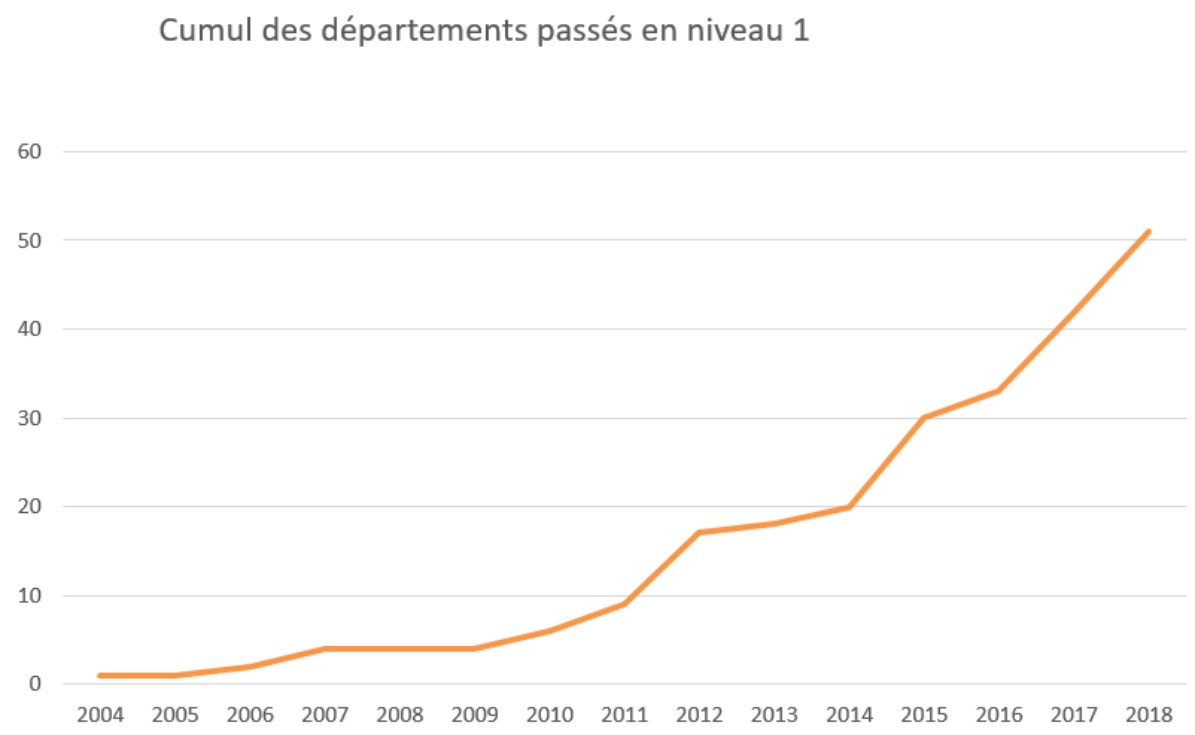

Figure 6. Evolution from 2004 to 2018 of the number of departments in France having reached level 1 (active and implemented) concerning A.albopictus. Source: Ministere des solidarites et de la santé (2019)

4.2.2 Sample size and selection of sample

According to the latest demographic statistics, the number of habitants in the south of France was approximately 14 million in the beginning of 2019. Based on the sample size calculator (http://www.raosoft.com/samplesize.html), with a margin of error of 5% and a confidence level of 95%, the minimum sample size would have been 385. The sample was selected randomly using social media. In practice, a link to the questionnaires was sent on various Facebook groups whose members were supposedly living in south of France. An additional question on the questionnaire confirmed that the respondents were living in the area of study.

4.2.3 Source and collection of data

The data was collected in a form of an online questionnaire (see Appendix 1). The online questionnaire was built in a way that respondents had to answer each question in order to go through with the questionnaire. In this way, there were no unanswered questions which reduced loss of data. Moreover, the questionnaire was translated in French by the researcher as French is the researcher's mother tongue.

The questionnaire was built using a google survey application. The link to the questionnaire was then sent to various Facebook public groups based on their target audience, which was individuals living in South of France. The questionnaire was sent first to the groups' administrators, and after their approval, the link to the questionnaire was posted to the Facebook group. Every two weeks, the link was sent again on the Facebook group in order to remind individuals to answer the questionnaire. The questionnaire was anonymous as the researcher doesn't know which member of the Facebook group filled the questionnaire via the link.

The data collected was quantitative as questions were yes/no/don't know or Likert-scale questions or respondents had to choose between multiple choices. The data was collected between the 15th of April and the 31st of July 2019.

4.2.4 Data analysis

The data was analyzed using IBM Statistics SPSS 23. Simple frequency tables were prepared for socio-economic variables and variables for knowledge, attitude and practices. Concerning the source of information, which was a multiple-choice question, a multiple-variable set was created for analysis and was later used for further analysis. Concerning correlation between knowledge and independent factors, the first choice of use was ANOVA but the researcher found out that one of the assumptions for ANOVA was violated, as the dependent data (in this case knowledge) was not normally distributed. This was proven using the Shapiro-Wilk test. This test, according to the literature, can handle sample size up to 2000. Thus, non-parametric statistical analyses were used such as Kruskal-Wallis one way analyze of variance if the independent variable had more than two categories or the Mann-Whitney U test if the independent variable had two categories. Post-hoc analyses using Bonferroni-Dunn's test were done to have a better insight of possible significant correlations between the dependent variable knowledge and independent variables. (Samuels, 2015)

Concerning the level of knowledge, the researcher determined as 80percent and over of correct answers mean good knowledge, 60-<80 percent sufficient knowledge, and <60percent was considered as poor knowledge. Those levels of knowledge were determined by the researcher. Moreover, those same levels of knowledge have been used in a previous study concerning knowledge, attitude and practice for dengue fever (Shuaib et al., 2010).

Concerning attitude, defining attitude based on the Likert scales questions was problematic. In the literature, researchers who have done similar research concerning attitude used terms such as favorable/unfavorable/neutral (Yusuf and Ibrahim, 2018), good/poor/neutral (Ajibola et al., 2018; Firdous et al., 2017; Ghani et al., 2018; Mohapatri & Alsami, 2016; Van Nguyen et al., 2019), positive/negative/neutral (Shuaib et al,. 2010) or did not use specific terms at all (Kumaran *et al*. 2018). In order to compare results with other studies, the researcher decided to use terms good/poor/neutral, as in the majority of similar studies. Attitude was measured using 3 Likert scale questions ranging from Totally disagree to totally agree. Responses "Totally agree" and "agree" were considered as good attitude, responses "totally disagree" and "disagree" were considered as poor attitude, and response "no opinion" was considered as neutral attitude. Concerning statistical analysis, Fisher exact test and crosstabs were used to find correlation between attitude and independent variables.

4.3 Ethical consideration

A cover letter explained the goal and purpose of the study and the study was conducted anonymously. The study was voluntary. Respondents had to read and agree that they had read the consent letter prior to responding to the online questionnaire. Only respondents who were aged 18 or over at the time of the study were allowed to respond to the questionnaire as only individuals over 18 are allowed to possess a Facebook account. The researcher contacted the Finish National Board on Research Integrity (TENK), the Internal Office of the French National Institute of Health and Medical Research (INSERM) and the board of research committee of the ARCADA university. No authorization was needed from the board of committee of the university as well as from French authorities as the way of collecting the data via the questionnaire followed ethical guidelines, such as respect for human dignity, respect for the participants' autonomy, integrity, freedom and right of co-determination, duty to inform as the cover letter provided information about the research and the researcher, consent and obligation to notify as the participants had to read and approve the consent letter, confidentiality as the questionnaire was anonymous, responsibility for avoiding harm, and protection of children as the minimum age required to take part to the survey was 18 years old.

5 FINDINGS

This chapter deals with the findings from the statistical analyses using SPSS 23, such as results concerning socio-demographics, knowledge about dengue fever, attitude and correlations between independent factors and knowledge and attitude.

5.1 Sample Size

Between the 15th of April and the 31st of July 2019, 170 questionnaires were collected, which is less that the minimum sample needed (385). According to the sample size calculator, a sample size of 170 will give a margin of error of 7,52% (confidence interval 95%), which is more than the margin of error of 5% usually used in scientific research.

5.2 Socio-demographic results

As seen in Appendix 1, the questions 1 to 6 dealt with socio-demographic data. Question 4 concerning marital status was not analyzed during this study as a problem in the built-in questionnaire occurred. Concerning the variable “occupation”, answers were grouped in three categories, “health profession”, “education”, and “other”. A data frequency analysis was done using SPSS for the variables gender, age, occupation, level of education and travel in a dengue endemic area. Concerning gender, 22,9% of the respondents were male and 76,5% were female. The more represented age group were individuals aged from 18 to 29 years old with 45,9%. More than half of the respondents (52,4%) had a bachelor’s degree or higher. 8.8% of the respondents worked in health care. And lastly, a bit less than half of the respondents (44,7%) have never travelled in a dengue endemic area. The detailed results of the frequency analysis are summarized in table 1.

Table 1. Socio-demographic frequency analysis

Gender	% (n=170)
Male	22.9
Female	76.5
Age	
18-29	45.9
30-39	12.4
40-49	20.6
50-59	13.5
60-69	5.3
70+	2.4
Level of education	
No diploma	1.2
Vocational school	4.7
Secondary school	20.6
Higher national diploma	21.2
Bachelor degree or higher	52.4
Travel in dengue endemic area	
Never	44.7
During the last 12 months	15.3
Between 1 and 5 years	13.5
Over 5 years	26.5
Occupation	
Health profession	8.8
Education	7.1
Other	84.1

5.3 Knowledge on symptoms of dengue fever

The knowledge of symptoms was assessed by the researcher using six questions (questions 7 to 13). The questionnaire in Appendix 1 shows the questions in detail. The questions concerned fever, headache, muscle and joint pain, retroorbital pain, rash and abdominal pain. Question 9 concerning joint pain has been combined with the question 10 concerning muscle pain in the final online questionnaire. The first five cited symptoms occur usually during the febrile phase while abdominal pain occur during the critical phase, with a decrease or disappearance of the first five symptoms. The choice for the responses where “yes/no/don’t know”, and the correct answer for all the questions was “yes”. The number of correct responses per respondent was then transformed in a percentage.

Table 2. Average percentage concerning the knowledge of symptoms in dengue fever

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
knowledge symptoms	170	.00	100.00	44.7782	29.52555
Valid N (listwise)	170				

As seen is the table 2, the average percentage concerning the knowledge of symptoms of dengue fever is 44,78%±29,52. As explained in the methodology, a knowledge percentage lower than 60% is considered as poor knowledge. Thus, we can conclude that the population of Southern France has a poor knowledge concerning the symptoms of dengue fever.

Table 3. Frequency table of correct answers concerning the knowledge of symptoms in dengue fever

Number of correct answers given	**Frequency**	**Percent**
0	28	16.5
1	18	10.6
2	26	15.3
3	44	25.9
4	28	16.5
5	13	7.6
6	13	7.6
Total	170	100

The table 3 shows us the detailed percentages per number of correct answers given, from 0 correct answer to six correct answers given. We can see that the majority of respondents (25.9%) provided 3 correct answers.

As seen in figure 7, the majority of the respondents cited fever and muscle and joint pain as a symptom of dengue fever with respectively 75.9% and 70%. Headache was cited by 56.5% of the respondents. Pain behind the eyes, skin rash and abdominal pain was cited by less than one fourth of the respondents.

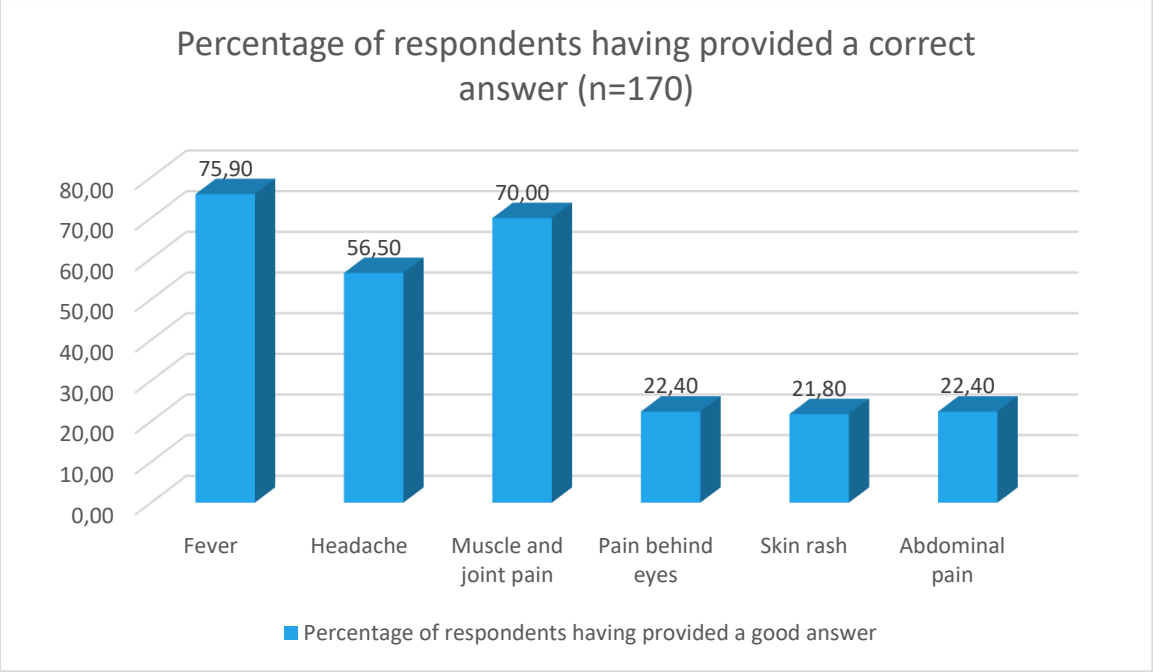

Figure 7. Percentage of respondents having provided a correct answer per symptom.

5.4 Knowledge on transmission of dengue fever

The questions concerning the knowledge of transmission were divided in two sub-categories. The first category dealt with knowledge of the vector responsible for the transmission of dengue virus (questions 14 to 17). The questions were: "do flies transmit dengue fever?", "do ticks transmit dengue fever?", "do all mosquitoes transmit dengue fever?" and "do mosquitoes of the *Aedes* species transmit dengue fever?". For the three first questions, "no" was the correct answer while "yes" was the good answer for the fourth question. It is important to note that the respondents could answer "yes/no/don't know" to all four questions.

Table 4. Frequency table of the percentage of respondents concerning the vector of dengue fever.

N=170	**Yes**	**No**	**Don't know**
Flies	6.5	68.2	25.3
Ticks	10.6	55.3	34.1
All mosquitoes	27.1	49.4	23.5
***Aedes* mosquitos**	71.8	4.7	23.5

The table 4 shows us that 71.8% of the respondents answered that mosquitoes of the *Aedes* species are responsible for the transmission of dengue, while 27.1% thought that all mosquitoes were transmitting dengue fever.

The second category dealt with knowledge on alternative ways of transmission of dengue virus (questions 18 to 21). The questions concerned transmission via person to person, blood transfusion, needle-stick and/or sexual intercourse. The dengue virus is transmitted only by the bite of an *Aedes* mosquito. However, the literature shows very rare cases of other ways of transmission. For this research, we will consider that those other ways of transmission are not valid and "no" was the only correct answer at all the four questions.

Table 5. Percentage of answers concerning alternative ways of transmission of dengue virus.

N=170	**Yes**	**No**	**Don't know**
Person to person	5.9	57.6	36.5
Blood transfusion	37.6	15.3	47.1
Needle	31.8	21.2	47.1
Sexual intercourse	8.2	48.8	42.9

Table 5 shows us that 37.6% of the respondents think that dengue virus can be transmitted via blood transfusion, 31.8% via a contaminated needle stick, 8.2% via sexual intercourse and 5.9% via contact from person to person. It is also interesting to note that a lot of respondents, from 36.5% to 47.1%, didn't know the answer.

All in all, 8 questions (questions 14 to 21) concerning knowledge of transmission were proposed and the number of correct answers ranged from 0 to 8. The detailed results are presented in figure 8.

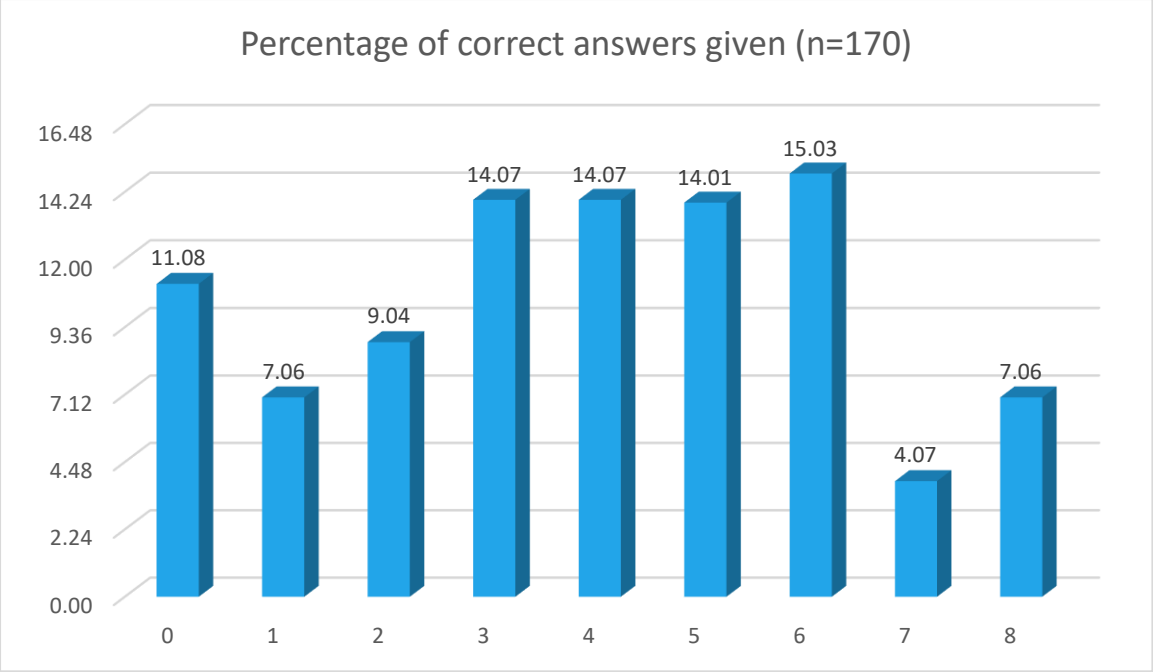

Figure 8. Percentage of respondents having provided correct answers (from 0 to 8) concerning knowledge about transmission of dengue virus.

When changing the number of good answers in percentage, we find out that the knowledge concerning transmission of dengue virus among the population in Southern France is 48,38%±29,21, as seen in table 6. This level is considered as poor knowledge (threshold <60%).

Table 6. Average percentage concerning the knowledge on transmission of dengue fever

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Knowledge transmission in percent	170	.00	100.00	48.3824	29.21484
Valid N (listwise)	170				

5.5 Knowledge on prevention against dengue fever

Questions 22 to 30 of the questionnaire dealt with knowledge concerning prevention or preventive practices of dengue fever. The knowledge concerning prevention against dengue fever dealt with questions about personal protection against mosquito bites, elimination or reduction of mosquitoes breeding sites, and at what time of the day *Aedes* species were the most active. A full detail of the questions can be found in appendix 1. In total there were 9 questions. The questions 23 to 30 proposed yes/no/don't know as answers and the correct answer to all 8

questions was ‘yes’. The question 22 was about the time of the day where *Aedes* mosquitoes were the most active and the answers proposed were “during the evening and night/during the day/all the time (24 hours)/don’t know”. The correct answer to question 22 was ‘during the day’.

Table 7. Percentage of respondents having provided correct answers given (from 0 to 9) concerning prevention against dengue fever

Number of correct answers given	**Frequency**	**Percentage (n=170)**
0	0	0
1	3	1,8
2	10	5,9
3	17	10
4	34	20
5	33	19,4
6	37	21,8
7	22	12,9
8	14	8,2
9	0	0
Total	170	100

Table 7 shows the number of correct answers given by the respondents concerning dengue fever prevention. As seen in the table 7, 6 correct answers were given by the majority of respondents (21,8%).

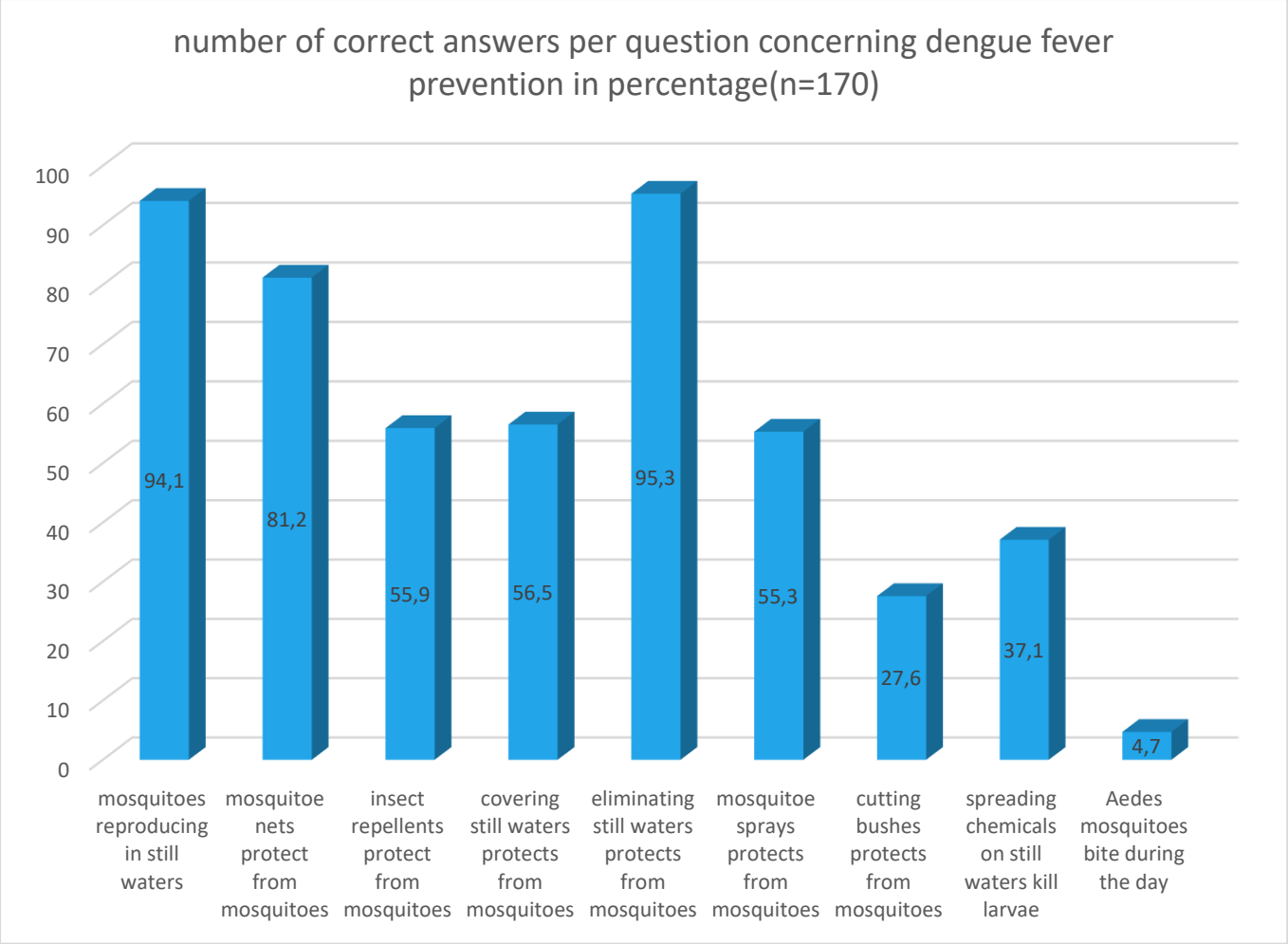

Figure 9. number of correct answers per question concerning dengue fever prevention in percentage.

As seen in figure 9, the vast majority of respondents responded correctly that 'mosquitoes reproduce in still waters' and 'eliminating still waters protects from mosquitoes' with respectively 94,1% and 95,3%. On the other hand, less than one third knew that 'cutting bushes protects from mosquitoes' with only 27,6% of correct answers. A surprising and important finding was that only 4,7% of the respondents knew that *Aedes* species bite during day time.

Figure 10 below shows a more detailed analysis of the answers of the question 9. An important finding concerning prevention against dengue fever is that almost one third (28,8%) of the respondents think that *Aedes* species bite during the evening and night time.

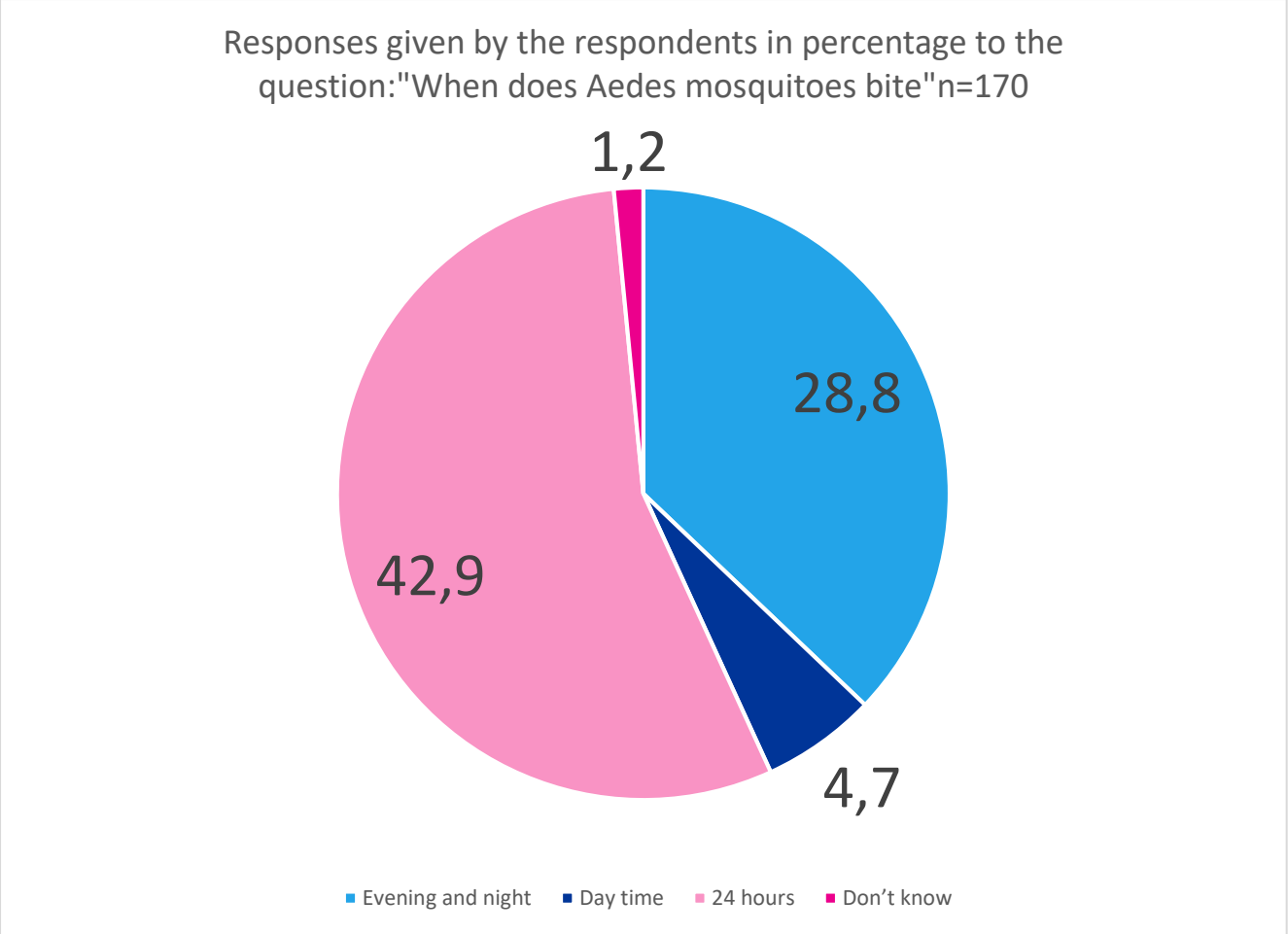

Figure 10. Number of answers in percentage concerning the question 9: 'When does Aedes mosquitoes bite?

When changing the number of good answers in percentage, we find out that the knowledge concerning prevention of dengue virus among the population in Southern France is 56,39%±18,94, as seen in table 8. This level is considered as poor knowledge (threshold <60%).

Table 8. Average percentage concerning the knowledge on prevention of dengue fever

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
knowledge prevention	170	11.10	88.90	56.3918	18.94163
Valid N (listwise)	170				

5.6 Knowledge on management of dengue fever

The knowledge concerning management of dengue fever was assessed with 6 questions (questions 31 to 36) concerning self-care, aspirin use, vaccination and existing treatment. A detail of the questions can be found in appendix 1. As seen in table 9, 31,8% of the respondents (n=170) provided 4 correct answers.

Table 9. Number of correct answers given (from 0 to 6) concerning management of dengue fever

Number of correct answers given	Frequency	Percentage (n=170)
0	3	1,8
1	15	8,8
2	13	7,6
3	44	25,9
4	54	31,8
5	23	13,5
6	18	10,6
total	170	100

A more detailed analysis of the answers provided can be seen in figure 11. This graph shows us the percentage of respondents having provided a correct answer for each question. As explained in the introduction chapter and the theoretical background, there is no specific treatment nor vaccination available against dengue fever. Aspirin is not recommended because it increases risk of bleeding. As for the other 3 questions, rest, drinking lots of water and visiting a doctor are recommended.

As shown in figure 12, it is very interesting to note that the vast majority of the respondents didn't know if a specific treatment against dengue fever exists as well as if vaccination is available with respectively 64,1% and 54,7%.

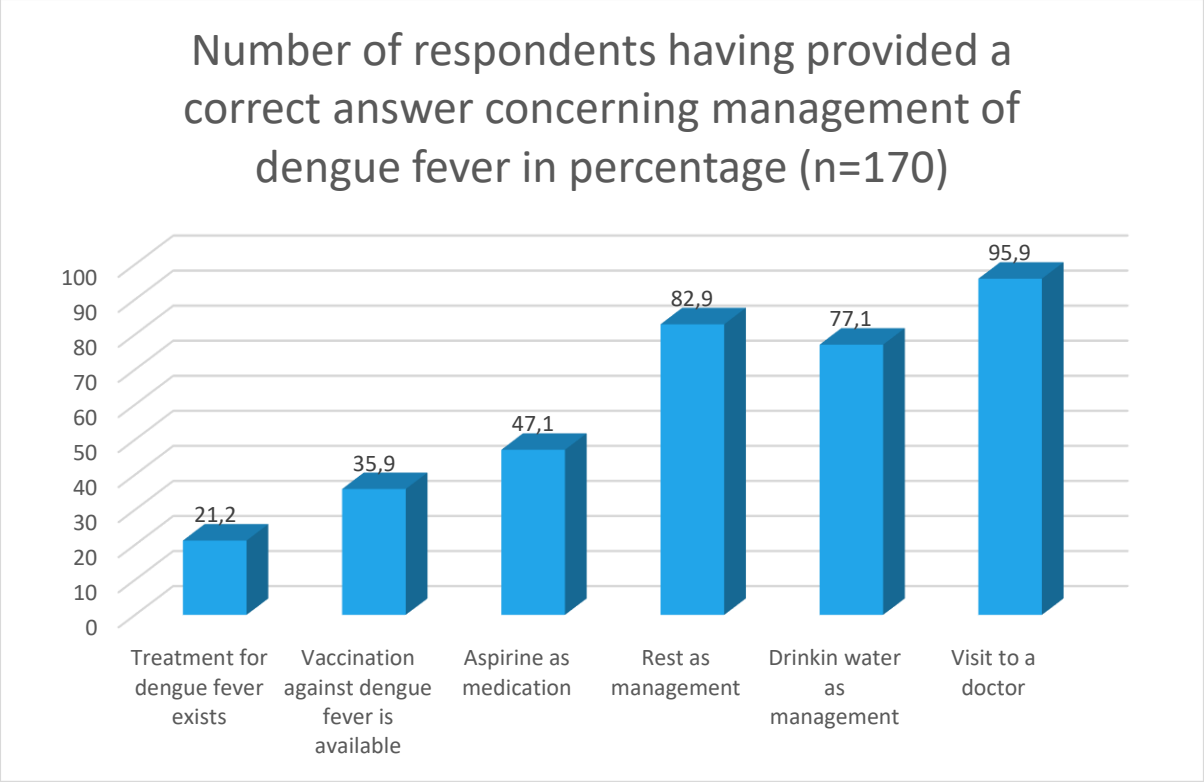

Figure 11. number of correct answers per question concerning dengue fever management in percent-age.

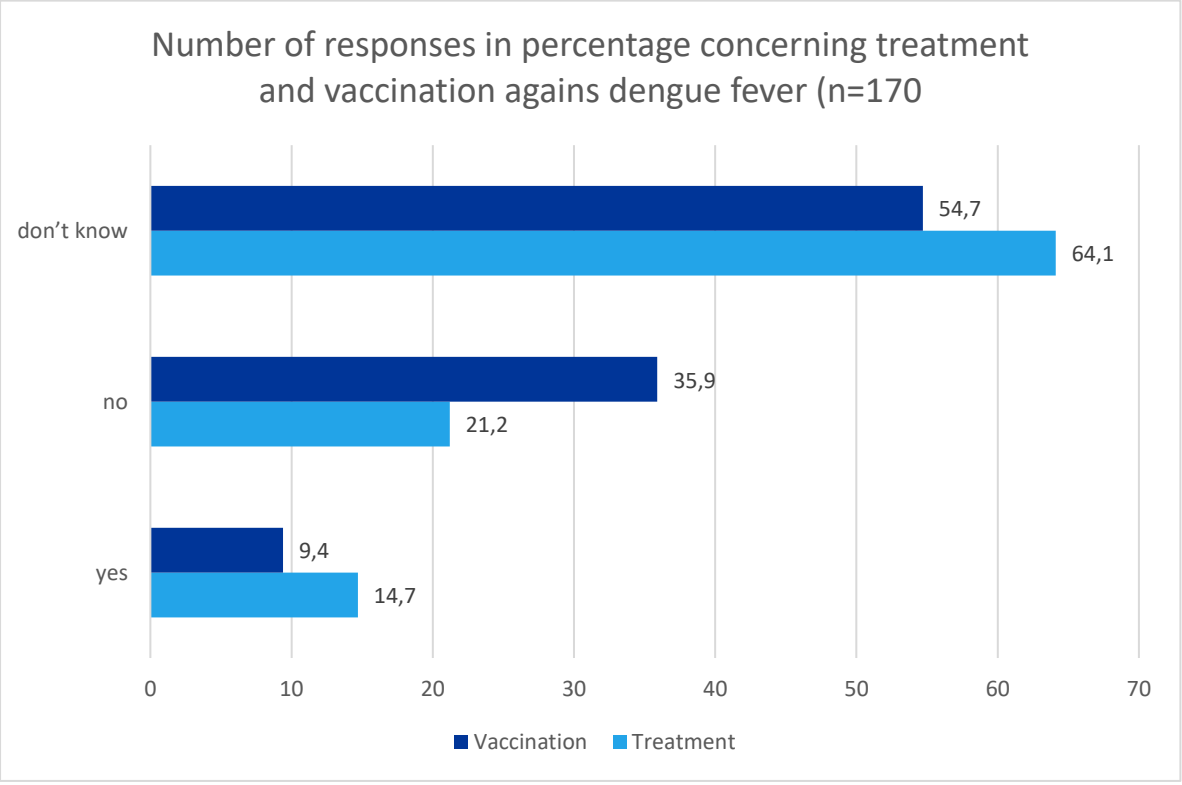

Figure 12. Detailed analysis of the answers concerning treatment and vaccination against dengue fever.

Table 10. Average percentage concerning the knowledge on prevention of dengue fever

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
knowledge management	170	.00	100.00	59.9659	23.87833
Valid N (listwise)	170				

When changing the number of good answers in percentage, we find out that the knowledge concerning management of dengue fever among the population in Southern France is 59,96%±23,87, as seen in table 10. This level is considered as poor knowledge (threshold <60%).

5.7 Total knowledge concerning dengue fever

The questionnaire concerning knowledge of dengue fever comprised a total of 29 questions (see appendix 1), and by transforming the total number of correct answers in percentages, we found out that the average knowledge of respondents in South of France concerning dengue fever is 54,2%±19,42, which is considered as poor knowledge (threshold < 60%), as seen in table 11.

Table 11. Average percentage concerning the knowledge based on the questionnaire concerning den-gue fever

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
knowledge total	170	7.14	92.86	54.2017	19.42738
Valid N (listwise)	170				

Total knowledge was also analyzed against the different components of the total knowledge (symptoms, transmission, prevention, management) using correlation bivariate analysis. (Pearson r) in SPSS 23. Pearson R is a value comprised between -1 and 1 that indicates how strongly two variables are correlated. A positive Pearson R value indicates a positive correlation. A table explaining the strength of correlation according to the Pearson R value can be found in the literature (Akoglu, 2018). The next table 12 summarizes the findings.

Table 12. correlation analysis (Pearson r) between total knowledge and components of knowledge.

Total knowledge components	Pearson r	P value	Strength of correlation
Knowledge of symptoms	R=0,742	<0,001	Strong
Knowledge of transmission	R=0,864	<0,001	Strong
Knowledge of prevention	R=0,623	<0,001	moderate
Knowledge of management	R=0,740	<0,001	Strong

As seen in table 12, total knowledge is significantly correlated with all the components of knowledge ($p<0,001$) and is strongly positively correlated with knowledge of symptoms, knowledge of transmission and knowledge of management and moderately positively correlated with knowledge of prevention.

5.8 Source of information concerning dengue fever

The question 37 dealt with the source of information concerning dengue fever. The question was a multichoice and thus respondents had the possibility to answer one or multiple sources of information. The respondents were asked if they heard about dengue fever prior to the questionnaire and if yes, what was/were the source of information. The results show that 85,9% of the respondents have heard about dengue fever prior to the questionnaire and the main source of information was television or radio. A detailed analysis of the different sources of information is shown in figure 13.

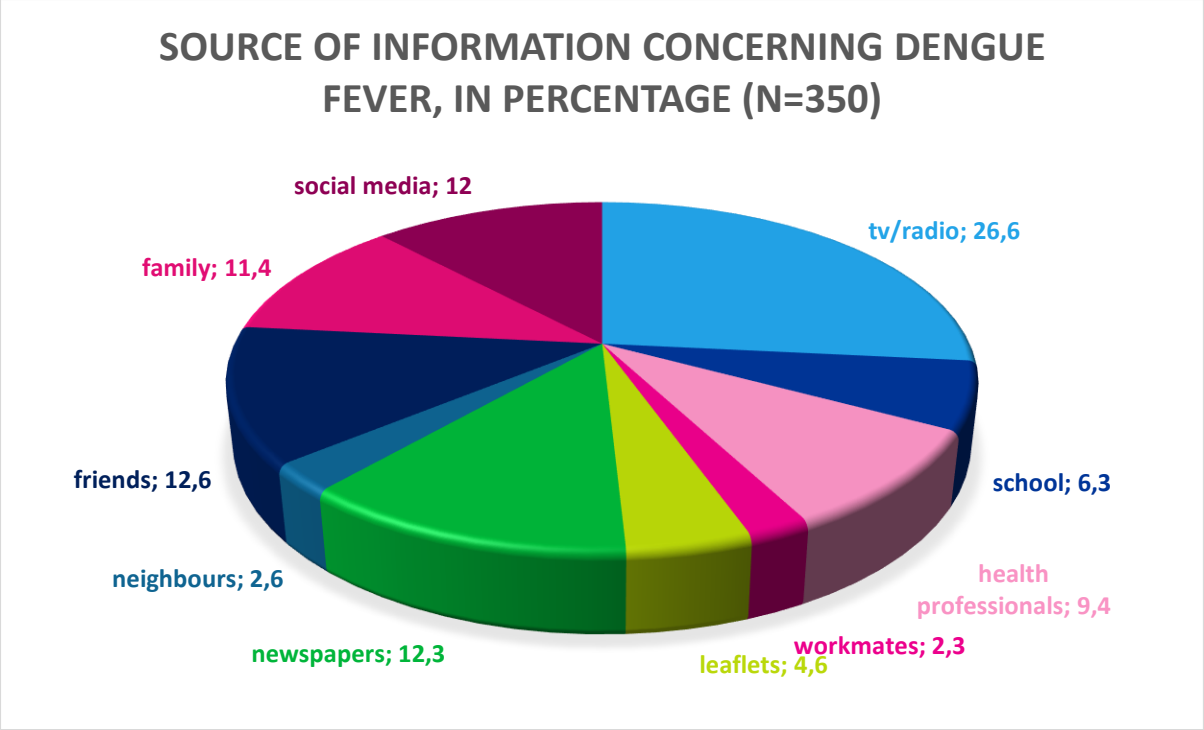

Figure 13. Source of information concerning dengue fever among the respondents in Southern France.

5.9 Attitude concerning dengue fever

The attitude of the respondents towards dengue fever was measured via 3 Likert-scale questions (questions 38 to 40). The first question was about perception of danger of dengue fever, the second question was about perception of contamination risk by dengue virus, and the third question was about perception of possibility of prevention against dengue fever. The responses totally agree and agree were considered as a good attitude towards dengue fever, the responses disagree and totally disagree were considered as a poor attitude towards dengue fever, and the response no opinion was considered as a neutral attitude towards dengue fever. Table 13 shows the detailed results of the answers concerning attitude towards dengue fever. It is important to note that even if the vast majority (84,7%) agrees or totally agrees that dengue fever is a dangerous disease, 21,2% of the respondents think that they are not at risk of being contaminated by dengue virus. On average, 70,8% of the respondents showed a good attitude towards dengue fever, 10,4% showed a poor attitude and 18,8% had a neutral attitude.

Table 13. Attitude towards dengue fever among the respondents in Southern France, in percentage

Attitude towards dengue fever (n=170)	Dengue fever is a dangerous disease (in percentage)	You are at risk of being contaminated by dengue virus (in percentage)	It is possible to prevent dengue fever (in percentage)	Average attitude (in percentage)
Totally agree (good)	45,9	22,9	21,8	**Good attitude 70.8**
Agree (good)	38,8	37,1	45,9	
total	**84.7**	**60**	**67.7**	
No opinion (neutral)	12,4	18,8	25,3	**Neutral attitude 18.8**
Disagree (poor)	2,4	12,4	7,1	**Poor attitude 10.4**
Totally disagree (poor)	0,6	8,8	0	
total	**3**	**21.2**	**7.1**	

5.10 Correlation analysis – total knowledge concerning dengue fever

First, in order to know if parametric or non-parametric tests have to be used, the researcher conducted a test for normality (Shapiro-Wilk) for the five different dependent variables analyzed, which are the four different levels of knowledge (symptoms, transmission, prevention, management) and the total knowledge. The results in table 14 show that none of the dependent variables passed the normality test ($p<0,001$) which means that the parametric test ANOVA (Analyze of variance) cannot be used as the assumption concerning normality is violated, and thus non parametric tests will be used for further analysis.

Table 14. Normality test for the 5 dependent variables.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
knowledge symptoms	.147	170	.000	.933	170	.000
Knowledge transmission in percent	.103	170	.000	.950	170	.000
knowledge prevention	.136	170	.000	.956	170	.000
knowledge management	.168	170	.000	.934	170	.000
knowledge total	.090	170	.002	.980	170	.016

a. Lilliefors Significance Correction

The non-parametric tests used were Kruskal-Wallis if the independent variable had 3 or more categories and Mann-Withney U if the independent variable had 2 categories. Total Knowledge had been analyzed against all the independent variables. The detailed results are summarized in table 16. In bold are the values showing a significant difference among the categories of the independent variable.

Table 15. Summary of non-parametric statistical analyses conducted to find correlation between total knowledge and gender, age, level of education, travel in dengue endemic areas, heard about dengue fever and profession.

Total knowledge vs	Result of the non-parametric analyze (p value)
Gender	P=0,129 (K-W)
Age	**P=0,001** (K-W)
Level of education	P=0,599 (K-W)
Travel in dengue endemic areas	**P=0,005** (K-W)
Heard about dengue fever	**P<0,001** (M-W U)
Profession	P=0,315 (K-W)

As seen in table 15, there was a significant correlation between total knowledge and age (p=0,001), total knowledge and travel in endemic area (p=0,005), and total knowledge and heard about dengue fever (p<0,001).

Concerning the independent variable age, a post hoc analyze using Bonferroni-Dunn test was conducted and found out that there was a significant difference between the age group 18-29 and the age group 40-49 (p=0,036) as well as a significant difference between the age group

18-29 and the age group 50-59 (p=0,037). By using t-test, the researcher found out that the mean for total knowledge was significantly lower for the age group 18-29 comparing to the age group 40-49 (p=0,004) and the age group 50-59 (p=0,004). There was no significant difference between the other age groups.

Concerning the independent variable "travel in dengue endemic area", a post-hoc analysis using Bonferroni-Dunn test found out that there is a significant difference concerning the level of knowledge about dengue between respondents who have never travelled in a dengue endemic area compared to respondents who have travelled during the last 12 months (p=0,023), as well as a significant difference between respondents who have never travelled in a dengue endemic area compared to respondents who have travelled over 5 years ago (p=0,026) For those two correlations, the level of knowledge was lower for people who never travelled . There was no significant difference between other travelers' groups.

Concerning the independent variable "heard about dengue fever", a Mann-Withney U test was conducted. The respondents who heard about dengue had significantly more knowledge about dengue than respondents who never heard about dengue (p<0,001).

The independent variable "source of information" was also analyzed to find any correlation between the level of knowledge of respondents about dengue and the source of information. First the data was filtered and only data concerning respondents who had answered that they had previously heard about dengue fever was used for analysis. The level of knowledge was similar concerning all sources of information except for "health professionals". Results show that respondents who had "health professionals" as a source of information had a significant higher level of knowledge than the respondents who didn't have "health professionals" as a source of knowledge (p=0,001).

A correlation between total knowledge and attitude was also analyzed using Kruskal-Wallis. First, concerning the question:" is dengue fever a dangerous disease?", respondents with no opinion had a significant lower knowledge than the respondents who agreed or totally agreed, with respectively p<0,001 and p<0,001. There was no significant difference between other categories. Second, concerning the question: "are you at risk of being contaminated by dengue fever?", respondents with no opinion had significantly lower knowledge than respondents who

agreed, totally agreed or totally disagreed with respectively p=0,006, p=0,001 and p=0,008. There was no significant difference between other categories. Last, concerning the question: "do you think that dengue fever can be prevented?", respondents with no opinion had significantly lower knowledge that the respondents who agreed or totally agreed with respectively p=0,001 and p<0,001. There was no difference between other categories.

5.11 Correlation analysis – Attitude concerning dengue fever

Correlation was studied between attitude of the respondents towards dengue fever and various independent variables. Bi-variate statistical methodology using Fisher exact test was used using SPSS 23. The three questions concerning attitude were separately analyzed.

First, concerning the question: "Is dengue fever a dangerous disease?", the data analysis showed that there was no correlation with gender, age, level of education, but there was a significant correlation with the independent variable "travelled in dengue endemic area" (p=0,022) and the independent variable "heard about dengue" (p<0,001). Further crosstab analyses show that respondents who had never travelled had answered more that they had no opinion than respondents who had travelled as seen in table 16. Moreover, respondents who never heard about dengue had no opinion or disagree more than respondents who heard about dengue. On the other hand, respondents who heard about dengue agreed totally more than respondents that never heard about dengue as seen in table 17.

Table 16. crosstabs concerning "attitude about dengue being a dangerous disease" and "travelled in a dengue endemic area" (n=170)

Travel in dengue endemic areas * dangerous disease Crosstabulation

% within Travel in dengue endemic areas

		dangerous disease					
		totally agree	agree	no opinion	disagree	totally disagree	Total
Travel in dengue endemic areas	never	36.8%	43.4%	17.1%	2.6%		100.0%
	during the last 12 months	65.4%	19.2%	7.7%	3.8%	3.8%	100.0%
	between 1 and 5 years	65.2%	21.7%	8.7%	4.3%		100.0%
	over 5 years	40.0%	51.1%	8.9%			100.0%
Total		45.9%	38.8%	12.4%	2.4%	0.6%	100.0%

Table 17. crosstabs concerning "attitude about dengue being a dangerous disease" and "heard about dengue" (n=170)

about dengue * dangerous disease Crosstabulation

% within about dengue

		dangerous disease					
		totally agree	agree	no opinion	disagree	totally disagree	Total
about dengue	yes	52.7%	38.4%	6.8%	1.4%	0.7%	100.0%
	no	4.2%	41.7%	45.8%	8.3%		100.0%
Total		45.9%	38.8%	12.4%	2.4%	0.6%	100.0%

The second question concerning attitude: "Are you at risk of being contaminated by dengue virus" has also been analyzed using the same methodology. The statistical analyze using Fisher exact test showed no correlation with the independent variable gender, age, level of education, travel in dengue endemic area, but there was a significant correlation with the variable "heard about dengue" ($p<0,001$). As seen in table 18, respondents who never heard about dengue tended to disagree more, agree less and have more no opinion than respondents who heard about dengue fever.

Table 18. crosstabs concerning "attitude about being at risk of being contaminated by dengue virus" and "heard about dengue" (n=170)

about dengue * contamination risk Crosstabulation

% within about dengue

		contamination risk					
		totally agree	agree	no opinion	disagree	totally disagree	Total
about dengue	yes	24.7%	41.1%	13.0%	11.0%	10.3%	100.0%
	no	12.5%	12.5%	54.2%	20.8%		100.0%
Total		22.9%	37.1%	18.8%	12.4%	8.8%	100.0%

The third question concerning attitude: "Is dengue virus a preventable disease" has also been analyzed using the same methodology. The statistical analysis using Fisher exact test showed no correlation with the independent variable gender, age, travel in dengue endemic area, but there was a significant correlation with the variable level of education ($p=0,036$) and the variable heard about dengue ($p=0,034$).

Table 19. crosstabs concerning "attitude about dengue prevention is possible" and "level of education" (n=170)

Level of education * prevention possible Crosstabulation

% within Level of education

		prevention possible				
		totally agree	agree	no opinion	disagree	Total
Level of education	no diploma	50.0%	50.0%			100.0%
	vocational school	12.5%	62.5%		25.0%	100.0%
	secondary school	25.7%	40.0%	22.9%	11.4%	100.0%
	higher national diploma	8.3%	66.7%	22.2%	2.8%	100.0%
	bachelor degree or higher	25.8%	38.2%	30.3%	5.6%	100.0%
Total		21.8%	45.9%	25.3%	7.1%	100.0%

As seen is table 19, respondents with a vocational school education tended to disagree more that dengue prevention is possible.

Table 20. crosstabs concerning "attitude about dengue prevention is possible" and "heard about dengue" (n=170)

about dengue * prevention possible Crosstabulation

% within about dengue

		prevention possible				
		totally agree	agree	no opinion	disagree	Total
about dengue	yes	23.3%	47.3%	21.2%	8.2%	100.0%
	no	12.5%	37.5%	50.0%		100.0%
Total		21.8%	45.9%	25.3%	7.1%	100.0%

As seen in table 20, respondents who never heard about dengue tended to have more no opinion than people who heard about dengue. On the other hand, only respondents who heard about dengue disagree with the fact that dengue is possible to prevent.

The independent variable "source of information" was also analyzed to find any correlation between attitude of respondents about dengue and the source of information. First the data was filtered and only data concerning respondents who had answered that they had previously heard about dengue fever was used for analysis. Concerning the question "is dengue a dangerous disease?", there was no correlation with the source of information. Concerning the question "are you at risk of being infected by dengue virus?", there was a correlation with the source information "newspaper" (p=0,032). Crosstabulation shows that respondents answered more

that they totally agreed when newspaper was the source of information. Concerning the question “Is it possible to prevent dengue fever?”, there was a correlation with the source of information “school” ($p<0,001$) but crosstabulations show contradictory results and so no conclusion could be made.

5.12 Summary of results

In summary, the study showed that respondents in South of France had a poor knowledge concerning dengue fever symptoms, transmission, prevention and management. Factors negatively influencing knowledge were previous information on dengue fever, being aged between 18 and 30 years old, and never have travelled in a dengue endemic area. On the other hand, respondents had a positive attitude concerning dengue fever. Factors influencing knowledge were similar to factors influencing attitude.

6 DISCUSSION OF FINDINGS

The study sought to assess public knowledge, attitudes and practice concerning dengue fever in South of France, France. Several studies on knowledge, attitude and practice (KAP) concerning dengue fever have been done over the past years and the vast majority of those KAP analyses showed that lack of knowledge concerning symptoms and/or control measures is common. (Chandren et al., 2015; Harapan et al., 2018; Kumaran et al., 2018; Shuaib et al., 2010). This KAP analysis done in South of France also showed a low level of knowledge concerning symptoms of dengue, transmission, prevention and management. This is the first time a KAP analysis concerning dengue fever was done in Europe.

Average knowledge level of symptoms was considered low in this study with an average score of 44,7% of correct answers given, even if most respondents cited fever (75%) and headache (70%) as a symptom of dengue fever. Those two symptoms are quite usual symptoms for most of usual diseases such as flu. Other typical dengue fever symptoms such as pain behind the eyes and rash were cited by less than 25% of the respondents. Those results are similar with other studies done in Jamaica (Shuaib, 2010), Malaysia (Chandren, 2015), Cambodia (Kumaran, 2018) and Indonesia (Harapan, 2018). A similar study done in Australia showed that the average knowledge concerning symptoms of dengue fever was 46% (Gyawali et al., 2016). This Australian study is the only one done in the past 10 years concerning dengue fever in a non-endemic country. A country's human development index (HDI) influences education, technology and media. As the results concerning the knowledge of symptoms of dengue fever are similar in both countries with a low and a high human development index (HDI), we cannot conclude that knowledge of symptoms of dengue fever is related to a country's HDI. The poor knowledge concerning the full spectrum of symptoms for dengue fever might have for consequences that individuals will misinterpret dengue fever as a another more benign disease such as flu and presentation to the clinic may be delayed, leading to further complications.

The results showed that 71,2% of respondents knew that *Aedes* mosquitoes are responsible for the transmission of dengue fever, while 21% answered that all mosquitoes were responsible for the transmission of dengue fever. This result is slightly better than previous similar studies as in Jamaica and Malaysia respectively 62,6% and 64,2% answered that *Aedes* mosquitoes are responsible for the transmission of dengue fever (Chandren, 2015; Shuaib, 2010,). This slightly better result might be explained that in this study the majority of the respondents (52,5%) had

a bachelor degree or higher while in other similar studies done in Jamaica and South-East Asia the average level of education was lower. A similar study done in Cambodia showed a significant correlation between level of knowledge and education (Harapan; 2018). This study didn't show any correlation between education and level of knowledge (p=0,059). On the other hand, this result was lower than a recent study done in Australia, a non-endemic dengue country where outbreaks of dengue fever have occurred in the 90s. According to the Australian study, 97,55% of the participants knew that dengue fever was transmitted by *Aedes* mosquitoes. (Gyawali et al., 2016). This better result in Australia might be explained by the fact that major dengue outbreaks have occurred in Australia and there have been over 2000 cases of dengue confirmed in the last decade, which might have raised awareness concerning vector transmission.

Dengue virus is transmitted via the bite of an infected mosquito to a host, usually a human. In the literature, there are rare cases where dengue virus can be transmitted via blood transfusion or via an infected needle (Lee et al., 2015; Pozetto et al., 2015). However, the world health organization still cites transmission via mosquito bite as the only way of getting infected (WHO, 2017). The results of this study show that around 30% of respondents think that dengue fever can be transmitted via blood transfusion or via an infected needle, while 5,8% and 8,2% respectively think that dengue fever can be transmitted via person to person or sexual intercourse. Those results are similar with the study done in Jamaica (Shuaib, 2010). A reason for those results might be that respondents received wrong information from non-official sources, or that they mistook dengue fever for another disease. Concerning transmission of dengue fever, it is clear that more education and accurate information is needed to the general public, as this research showed that the average knowledge about transmission of dengue fever is poor (44,3% of correct answers).

Vector control in disease prevention is one of the most important factors, and concerning dengue fever, control of mosquitoes as well as protection against mosquitoes' bites is primordial to reduce dengue fever around the world (WHO, 2012). This study shows that the average level of knowledge concerning dengue fever is low with respondents having answered correctly 56,4% of the questions. The vast majority of respondents knew that mosquitoes breed in still waters (94,1%), as well as eliminating still waters (90,8%) and using mosquito nets (81%)

protect from mosquitoes. Those results were better than similar previous studies done in Jamaica (Shuaib, 2010) and similar than results from a similar study in Malaysia (Chandren, 2015). On the other hand, cutting bushes or spreading chemicals on still waters to kill mosquitoes' larvae was not a known practice or was not a used practice among respondents in this study with respectively 27,6% and 37,1%. Those results are lower than in other similar studies. In Jamaica for example, around 70% of respondents cut bushes to prevent mosquitoes from breeding or spread chemicals on still waters to kill larvae (Shuaib, 2010). On the other hand, in Malaysia, only 18% are using chemicals to kill larvae and in a similar study in Cambodia 13% of the respondents are spraying chemicals and 15% are cutting bushes (Kumaran, 2018). Contrary to Southern France, Jamaica, Malaysia and Cambodia are dengue endemic areas and studies show that preventive practices are very different from one country to another. The difference in preventive measures and vector control among countries might be the result of different education campaigns. Moreover, the WHO guidelines concerning spraying chemicals on still waters stipulate that chemicals should only be used in case of emergency and on non-drinkable still waters as chemicals can cause poisoning of waters, and according to WHO, some communities are not keen on using chemicals due to possible adverse effects. (WHO, 2009). This might be the case for South of France where 37% knew that using chemicals kill mosquito larvae in still water, and around 50% of the respondents agree that the use of insect repellent or mosquito spray protects from mosquitoes.

Another important factor to consider considering prevention is the time of the day when *Aedes* mosquitoes bite. *Aedes* mosquitoes bite during the day. Surprisingly this result show that only 4,7% of the respondents knew that *Aedes* mosquitoes bite during the day while almost one third of the respondents (28,8%) responded that *Aedes* mosquitoes bite only during evening and night time. On the other hand, around 40% of the respondents answered that *Aedes* mosquitoes bite on a 24-hours basis. Those results are similar with previous studies. In Jamaica, only 2,6% of respondents knew that *Aedes* mosquitoes bite during the day (Shuaib, 2010) while in Malaysia 61,6% of respondents answered that *Aedes* mosquitoes bite during dusk and dawn (Chandren, 2015). On the other hand, those results are not consistent with a similar study done in Cambodia where 74% of respondents answered that *Aedes* mosquitoes bite during the day (Kumaran et al., 2018).

Concerning management, the vast majority of respondent would go visit a doctor if they would have dengue fever (96%), drink plenty of fluids (83%) and rest (77%). Those are good practices concerning dengue fever as one of the possible consequences of being infected with dengue fever is dehydration and so drinking plenty of fluids is important. Those results are similar than a study done in Jamaica (Shuaib, 2010) and better than the ones in a study done in rural Cambodia (Kumaran, 2018), where only 32% of respondents would seek help from health professionals if they had dengue. On the other hand, 47% of the respondents would take aspirin as medication for the symptoms of dengue fever. Aspirin would also be used by 66% of the respondents in a similar study in Jamaica (Shuabai, 2010). Aspirin use is dangerous in case of an infection with dengue fever as one of the possible consequences of the infection is reduction of thrombocytes which could lead in bleedings. Aspirin is known to increase bleeding, which in case of dengue fever could be fatal. (Javid, 2015)

The most important tool for raising awareness and education of individuals concerning infectious diseases is information and communication, as it can lower the incidence of the disease and also prevent the disease from growing into an epidemic (Funk et al., 2009). This study shows that 14% of the respondents have never heard about dengue fever. This result is higher than in previous studies where the percentage of respondents who never heard about dengue is much lower with 3% in a study done in North India (Chinnakali et al., 2012), 6% in a study done in India (Chellaiyan et al., 2017), and 3% in a study done in Pakistan (Abbas et al., 2016). The difference in those results can be explained by the fact that India and Pakistan are dengue endemic areas and dengue fever is common, having for consequences that the general population has heard about dengue a lot more than in South of France where no major outbreaks have occurred. No data was found concerning non endemic countries. Moreover, this study showed that there was a significant correlation between absence of information concerning dengue fever and the knowledge and attitude of respondents towards dengue fever. Statistical analysis showed that respondents who never heard about dengue fever had significantly lower total knowledge concerning dengue fever and had no opinion or a less favorable attitude concerning dengue fever. As information is an important tool to raise knowledge and awareness, and thus reduce the burden of dengue fever, it is thus very important that new health legislations or policies are aimed at informing a larger part of the population concerning dengue fever.

Information can be obtained via many ways, such as internet, from newspapers, from television and radio, social media and family and friends. This study showed that respondents in South of France obtained information concerning dengue mostly from television and radio (26%). Other sources of information were social media, health professionals, family, friends and newspapers (±10%). These results are similar with similar studies done in Indonesia (Harapan et al., 2018) and Jamaica (Shuaib, 2010) where television and radio were the main source of information, followed by newspapers, school and health professionals. As noted in a similar study done in Australia (Gyawali et al., 2016), the quality of information relayed by mass media should be reviewed or verified in order to provide correct knowledge about dengue fever.

It is well known that attitude towards a health topic can influence health behavior. This is especially true concerning self-health care (for example diabetes or cardio vascular diseases) where positive or negative attitude towards the disease or towards practices can greatly influence the outcomes. Concerning infectious diseases, attitude can impact preventive behavior. There are numerous factors that can influence attitude, such as level of education, knowledge about the topic, received information, past experience, social acquaintances, and many more. Concerning dengue fever, attitude can affect vector control behavioral practices, personal protection against. This study shows that 82% of respondents agreed or totally agreed that dengue fever is a dangerous disease. This is an important that shows that respondents are aware of the possible negative health consequences of being infected by dengue fever. In this study, 21.2% of respondents answered that they are not at risk of being infected by dengue virus and 67% answered that dengue fever can be prevented. Those results are similar with a study done in Jamaica (Shuaib, 2010). However, in Cambodia, a similar study showed that only 6% answered that they are not at risk of being infected by dengue fever (Kumaran, 2018).

Even if it is true that South of France is not a dengue endemic area, contamination risk by dengue virus is still existent. Every year people return from dengue endemic areas and get infected by dengue virus, and autochthonous cases are being detected every year. The fact that people don’t think they are at risk of being infected by dengue virus might impact their preventive behavior concerning dengue fever. Moreover, dengue fever is a preventable disease and information and education about dengue fever prevention should be more available or distributed to the general public to raise awareness and knowledge concerning prevention.

This study show that poorer or neutral attitude is correlated with lack of information concerning dengue fever, less or no history of travel in a dengue endemic area, and lower education level. This study also shows that knowledge concerning dengue fever is not correlated with a poor or good attitude. Those results are different with similar studies done in Vietnam (Van Nguyen, 2019), Indonesia (Harapan, 2018) and Malaysia (Ghani, 2019) where good attitude was correlated with higher knowledge. On the other hand, this study showed that respondents with no opinion (neutral attitude) displayed lower level of knowledge. This can be explained by the fact that respondents who never heard about dengue fever, and thus have no information, displayed significantly less knowledge and didn't want to express any opinion concerning attitudinal questions.

To raise awareness and knowledge concerning dengue fever symptoms, transmission, prevention and treatment, further education to the public is thus primordial to avoid delay to visit to the doctors, improve prevention and treatment. The results of this study showed that about 10% of the respondents possessed health professionals as a source of information concerning dengue fever and those respondents had a significant higher level of knowledge, pointing the importance of education by health professionals concerning dengue fever. Similar results were found in a similar study in Indonesia where respondents had less history of dengue fever when receiving information from health care workers (Harapan et al., 2018). However, in this study, respondents working in the health care sector did not possess a significant higher level of knowledge compared with other respondents. This result was similar with a KAP analysis on healthcare professionals concerning dengue fever done in southern Taiwan (Ho et al., 2013). Education of health care professionals concerning dengue fever is important as they can relay their knowledge to the public, having a positive impact on general knowledge and preventive measures among the population.

One of the biggest risks concerning dengue fever outbreak is the introduction of the virus from a visiting traveler or a returning traveler from an endemic area. Once an infected individual return into the country, outbreaks can occur if an *Aedes* mosquito bites this person and becomes infected, and then transmits the virus to another person. This is called autochthonous transmission. This study shows that 53,6% of the respondents have travelled in a dengue endemic area and 15,3% during the last 12 months. In France, there is a growing number of imported dengue cases from dengue-endemic countries, with 759 confirmed cases between 2015 and 2018 with

most cases from Thailand and Indonesia (ECDC, 2019). In French Reunion's island, situated in the Pacific, 7700 cases of dengue have been confirmed between January and April 2018, leading to 14 deaths (WHO, 2019). Moreover, this study shows that respondents who never travelled in a dengue endemic area showed less knowledge that respondents who have travelled in a dengue endemic area. Thus, there might be a need to raise awareness in international airports in South of France to educate travelers about symptoms and protection concerning dengue fever. A recent study based on a network-based risk model stipulates that the airport Paris Charles de Gaulle, situated in Paris, is a highly risk airport in importing dengue infected passengers (Gardner and Sarkar, 2013). Moreover, a study on imported dengue cases shows that the annual imported dengue cases in Paris Charles de Gaulle in 2015 was 1259, which places it third in the world after Miami International Airport and Los Angeles international airport (Liebig et al., 2018). The airports in South of France don't have direct connections with dengue endemic countries but mostly Europe and Northern America, so we can assume than the vast majority of travelers to and from dengue endemic areas are travelling via Paris Charles de Gaulle.

7 LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

The findings of this study have to be seen in light of some limitations. The first limitation is the sample size. 170 questionnaires were collected, which is less that the minimum sample needed (385). According to the sample size calculator, a sample size of 170 will give a margin of error of 7,52%, which is more than the margin of error of 5% usually used in scientific research. Future research should use a bigger sample. Moreover, this KAP analysis study concerning dengue fever was the first one done in Europe. The literature shows that other areas in Europe (Italy, Croatia, Greece) possess a risk of dengue outbreaks in the future, while in some areas (Portugal, Spain), there has already been dengue outbreaks in the past few years. It would been interesting to conduct KAP analysis studies in those countries in order to compare with South of France. Also, as all these countries are part of EU, results could give insight to EU health policies actors in order to create new legislations or policies concerning education on dengue, or other mosquito-borne diseases.

The second limitation was the building of the questionnaire concerning prevention of dengue fever. The questions asked were about knowledge of preventive measures but not about if respondents actually practiced preventive behaviors. It is not uncommon in health care or self-health care that individuals are aware and knowledgeable of what should be done but don't actually practice. Still, knowledge and awareness are the first step and the researcher thought that it was important to evaluate. Further studies could assess if the knowledge is actually put in place concerning preventive behaviors, in order to have a better insight on the practice part of the KAP survey.

A third limitation is about the survey methodology. Social media, and especially Facebook, was used to target audience and respondents answered an online questionnaire. It is difficult to assess if there was a demographic bias by using this methodology, as we could expect that young people, or people with more time to spend on computers are more active social media users. No information was found about internet coverage in South of France but it is expected that the coverage is wide, as France is an advanced country in technology and communication. More traditional ways of collecting data such as face to face interviews might be more appropriate but are a more time and money consuming.

8 RELIABILITY AND VALIDITY

Reliability is the first measure of quality in a quantitative study and measures the accuracy of the instrument, or the questionnaire. The reliability of a variable refers to its constancy, which assumes that the variable to be measured is stable or constant, meaning that similar results should be obtained with the same individuals in identical conditions. The internal consistency of a questionnaire can be assessed by calculating Cronbach Alpha index (Heale and Twycross 2015). By using SPSS 23, the Cronbach Alpha of the questionnaire used in this research was calculated, and the result was 0,808, meaning that the questionnaire is reliable.

Validity in quantitative studies refers to the extent to which a questionnaire measures what it aims to measure (Heale and Twycross 2015). The questionnaire used in this study was based on theoretical knowledge concerning dengue fever and has been used in previous studies, and thus is expected to be valid.

9 CONCLUSION

Dengue is one of the most important viral mosquito-borne disease, with dramatic consequences on global health. The World Health Organization has listed dengue fever among the top ten threats concerning public health in 2019. Worldwide, 50 to 390millions people are affected with dengue per year resulting in approximately 20000-25000 deaths annually, mostly children. There is no treatment for dengue fever as the treatment is symptomatic and vaccination development is still ongoing. South of France might not be yet a dengue endemic area but studies and mathematical models show that dengue outbreaks are possible in the future, due to climate change, globalization, and the spreading of the two vectors *A. aegypti* and *A. albopictus*. *A. albopictus*, even if being a weaker vector than *A. aegypti*, is already implemented and active in South of France. In 2017, there has been over 200 cases of dengue fever reported in France, the vast majority of them are imported from endemic countries, as travelers return to France after being contaminated. However, every year, few autochthonous cases are detected, meaning that the contamination has occurred in France via the mosquito A. *albopictus*, which could lead to outbreaks, as it occurred in Madeira in 2010 where 200 cases of autochthonous cases have been detected. As most of vector borne diseases, vector management and prevention are primordial to avoid spreading of the disease.

This study was a knowledge, attitude and practice (KAP) analysis concerning dengue ever in South of France. This study showed that there is a poor knowledge concerning symptoms, transmission, prevention and management of dengue fever among respondents in South of France. This study highlighted that there was a lack of information as 15% of the respondents never heard about dengue fever, and those respondents had significantly less knowledge. With a lack of knowledge in symptoms, infected individuals might not be aware that they might be infected with dengue virus and thus delay their visit to the doctor, which could help the disease spread. Moreover, outbreaks in non-endemic areas start with traveler imported cases from dengue endemic areas, thus it is primordial to raise awareness and education among travelers by providing more information about mosquito bite prevention in international airports.

New health care policies should been put in place in the near future to raise awareness and education of the public in order to be prepared for possible dengue epidemics. This study might serve as a reference to design new plans of actions concerning dengue fever based on the Social Ecological Model, which was used as a theoretical framework for this study.

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APPENDIX 1

Questionnaire

Part 1: Socio-demographic characteristics of the respondents. Choose only one answer.

1.Gender	Male Female
2.Age group	<20 20-29 30-39 40-49 50-59 60 and over
3.Education	Primary school Secondary school Technical training or college University degree
4.Marital status	Single, divorced or widowed Married/commom-law union
5.Occupation	Unemployed Occupation:.
6.Travel in dengue endemic destination Have you travelled in one or more of these areas of the world. South East Asia, India, Pakistan, Philippines, Northern Australia, South America, Central America, Caribbean, Mexico, Africa	IF yes: which country/countries? In the past 12 months Between 1 year and 5 years Over five years Never

Part 2: Knowledge about dengue fever (choose one answer per question)

SYMPTOMS	
7.Is fever a symptom of dengue	**Yes** No Don't Know
8.Is headache a symptom of dengue fever	**Yes** No Don't Know
9.Is joint pain a symptom of dengue fever	**Yes** No Don't Know
10.Is muscle pain a symptom of dengue fever	**Yes** No Don't Know
11.Is pain behind the eyes a symptom of dengue fever	**Yes** No Don't Know
12.Is rash a symptom of dengue fever	**Yes** No Don't Know
13.Is abdominal pain a symptom of dengue fever	Yes **No** Don't Know
TRANSMISSION	
14.Do flies transmit Dengue fever	Yes **No** Don't Know
15.Do ticks transmit dengue fever	Yes **No** Don't Know
16.Do all types of mosquitoes transmit dengue fever	Yes **No** Don't Know
17.Does the *Aedes* mosquito transmit dengue fever (Asian tiger mosquito and yellow fever mosquito)	**Yes** No Don't Know
18.Does person to person contact transmit dengue fever	Yes **No** Don't Know
19.Can dengue fever be transmitted by blood transfusion	**Yes** No

	Don't Know
20.Can dengue fever be transmitted by a needle stick	**Yes** No Don't Know
21.Can dengue fever be transmitted by sexual intercourse	Yes **No** Don't Know
22.When are the Dengue mosquitoes likely to feed/bite	Night time **Day time** Both day and night Don't know
23.Mosquitoes breed in standing water	Yes No Don't Know
24.Window screens and bed nets reduce mosquitoes	**Yes** No Don't Know
25.Insecticide sprays reduce mosquitoes and prevent dengue	**Yes** No Don't Know
26.Covering water containers reduce mosquitoes	**Yes** No Don't Know
27.Removal of standing water can prevent mosquito breeding	**Yes** No Don't Know
28.Mosquito repellents prevent mosquitoes	**Yes** No Don't Know
29.Cutting down bushes can reduce mosquitoes and dengue	**Yes** No Don't Know
30.Pouring chemicals in standing water can kill mosquito larvae	**Yes** No Don't Know
MANAGEMENT	
31.Would you take aspirin for dengue	Yes **No** Don't Know
32.Would you get plenty of rest for dengue fever	**Yes** No Don't Know

33.Would you drink plenty of water for dengue fever	**Yes** No Don't Know
34.Would you consult a physician for dengue fever	**Yes** No Don't Know
35.Is there a treatment for dengue fever	Yes **No** Don't Know
36.Is there a vaccine for dengue fever	Yes **No** Don't Know

Comments: the correct answers are found on the WHO and or CDC website. The level of knowledge is based on the percentage of correct answers as explained in the chapter Material and methods.

Part 3: Source of information (choose one or more)

37.Have you ever heard of dengue fever? YES/NO If YES choose one or multiple answers from below
TV/Radio
School
Health worker
Mass meetings
Workmates
Brochures
Newspapers
Neighbors
Friends
Family
Social media

Part 4: Attitude towards dengue fever (choose one answer per question)

38.Dengue is a serious illness	**Strongly agree** **Agree** Disagree Strongly disagree Not sure
39.You are at risk of getting dengue	**Strongly agree** **Agree** Disagree Strongly disagree Not sure
40.Dengue fever can be prevented	**Strongly agree** **Agree** Disagree Strongly disagree Not sure

CONSENT LETTER

TITLE OF STUDY

Knowledge, attitude and practice regarding dengue fever in South of France, a quantitative study

PRINCIPAL INVESTIGATOR

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PURPOSE OF STUDY

You are being asked to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.

The goal of this study is to assess the level of knowledge concerning dengue fever and dengue fever prevention in South of France. The purpose of this study is to provide information to public health authorities concerning dengue fever in South of France in order to implement educational or prevention programs in France.

STUDY PROCEDURES

The study will be conducted via an online questionnaire. The respondent will be asked multiple choice questions. The interview lasts about 20 minutes.

RISKS

There are no risks conducting this study.

You may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

BENEFITS

There will be no direct benefits for the respondent. However, the data collected will provide important information to the health authorities concerning dengue prevention in Southern France

CONFIDENTIALITY

Your responses to this survey will be anonymous.

CONTACT INFORMATION

If you have questions at any time about this study, you may contact the researcher whose contact information is provided on the first page.

VOLUNTARY PARTICIPATION

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to click a box on the online questionnaire confirming that you will take part in the study. The data collected for this study will be destroyed once the data has been analyzed.

CONSENT

I have read, and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I voluntarily agree to take part in this study.

Participant's signature _____ Date _____