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Sustainable Urban Mobility Plan and Health Security

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Abstract: The topic of sustainable mobility is now a priority at the urban level. Today's cities are often very busy, polluted, and dangerous. Therefore, to encourage sustainable mobility is important; it brings territorial development, environment, health, society, and economy benefits. The corona virus disease-19 (COVID) emergency, which occurred at the beginning of 2020, highlighted the already critical situation in many cities and how our mobility habits were not, even before, so sustainable. Within sustainable mobility, the concept of safety and security is important to consider. In the literature, safe mobility is often associated with the theme of accidents. The pandemic has highlighted the need to consider safety also from a health point of view. Municipalities, as known, also according to European guidelines, have a specific tool at their disposal to promote sustainable mobility: the Sustainable Urban Mobility Plan (SUMP). This paper intends to propose a methodological approach aimed at integrating the health security aspect in the SUMP. In this research, in order to promote safe mobility, different aspects were considered: accidents, risk perception, and health emergencies. For each aspect, specific indicators and good practices were proposed for the achievement and monitoring of the expected results. The paper refers to the European context with particular attention to Italy; La Spezia was chosen as a case study.

Keywords: safety; sustainable mobility; Sustainable Urban Mobility Plan; sanitary emergency

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1. Introduction

1.1. Sustainable Mobility Pre- and during Corona Virus Disease-19 (COVID)

The current health emergency has highlighted various critical issues in our cities, in different fields, but in particular, mobility is one of the most involved issues.

This emergency has had significant long-term effects on the times, uses, and organization of cities. Adaptability requires the synergic work of all actors who live or work in a city. From healthcare to high street retail, transport to food and medical supply chains, the COVID outbreak has exposed the limited resilience of our cities [1].

Mobility is certainly one of the most delicate issues to manage post lockdown. Mobility, at least in the short term, will be revolutionized by significant changes in the modal choices induced by the search for safety from contagion [2]. In today's situation (i.e., circulation of COVID, according to the Italian National Institute for Insurance against Accidents at Work classification (Inail, 2020), the entire public transport system must be considered a medium–high risk environment, with the possibility of higher risk during peak times for metropolitan areas with high urbanization [3,4].

For years we have been trying to target urban mobility toward sustainability. Encouraging the shift towards sustainable mobility strategies based on public transport and active modes of travel (i.e., Sustainable Urban Mobility Plan) is one of the main challenges of European cities [5].

Sustainable mobility aims to ensure that transport systems correspond to the economic, social, and environmental needs of society while minimizing the negative repercussions on the economy, society, and the environment [6].

The issue of sustainable mobility is one of the most debated topics in local, national, and international environmental policies aimed at reducing the environmental impact resulting from the mobility of people and goods [7].

European legislation focuses mainly on improving the quality of fuel, on the differentiation of energy sources used in the transport sector, on the improvement of emission standards, and on the promotion of good practices [8,9].

The expression sustainable mobility indicates modes of travel capable of reducing the environmental, social, and economic effects generated by private vehicles, namely, air pollution, noise pollution [10], road congestion, accidents, degradation of urban areas (often caused by the space occupied by vehicles to the detriment of pedestrians), the consumption of land (linked to the construction of roads and infrastructures), and the costs of travel (both to the community and to the individual) [11].

So sustainable mobility is an ideal system that allows for the reduction in environmental impacts while making travel more effective and faster. The term smart is increasingly associated with sustainable mobility, i.e., intelligent, smart mobility. The tools to achieve real results in the development of sustainable mobility are technology, innovation, and people's behavior (ICT tools) [12].

The main forms of alternative mobility refer to soft mobility (non-motorized): on foot or by bicycle; the use of means of transport: public (bus, tram, metropolitan railway system) or shared (carpooling, car sharing or bike -sharing); finally, electric vehicles [13,14].

In the pre-COVID situation, urban mobility aimed at achieving levels of sustainability, but the preponderant use of private vehicles has always caused traffic congestion and deterioration of the livability of the cities themselves. Furthermore, the excessive use of private cars has always resulted in a significant occupation of urban and road space with a deterioration in the quality and usability of the city, loss of time due to the long waits in cars, and air pollution, despite the technological progress of vehicles and fuels, noise pollution, and a high number of road accidents [15].

Thus, the urban mobility system of our cities needs to be rethought in a more sustainable way. As highlighted by the 2030 Agenda for Sustainable development goals (SDGs) adopted by the United Nations in 2016, there are several targets directly linked with this topic and to making walking a primary travel mode, beyond a first-and-last-mile solution to connect to public transport, most notably SDG 11.2—Sustainable Transport for All, SDG 3.6—Reduced road deaths, and SDG 3.9—Reduced exposure to air pollution [16–18].

To measure the level of sustainability of the transport system, some parameters are used such as:

- to allow safe, economically feasible and socially acceptable access to people, places, goods, and services;
- to be designed in a way that is compatible with the health and safety of the population;
- to meet the needs of different categories in society and for different generations;
- to use renewable resources at a level below their regeneration rate and non-renewable resources at a level below the development rates of renewable substitutes;
- to achieve generally accepted goals for health and environmental quality;
- to protect ecosystems by avoiding excess loads and critical levels for their integrity;
- not to aggravate adverse global phenomena such as climate change;
- promote education and community participation in transport decisions;
- to put the overall capacity of the system before the peak performance of some of its components and the efficiency and regularity at maximum speed;
- to bring mobility back to its actual role as a means of accessibility, which, however, can also be satisfied by operating on other areas of intervention such as technological innovation and urban and territorial planning [19–25].

Today's systems of technological innovation are also fundamental [26]. But are our cities really sustainable? Were they sustainable before COVID? Moreover, today, in the current period of COVID, how are they?

Corona virus disease-19 has changed the habits of modern society, limiting travel, imposing spatial distancing, making some structures inaccessible, etc. Cities have had to face this sudden change in the short term and now have to plan new policies for the future [27–34].

The evolution of urban mobility trends will depend on the pre-COVID situation of each city and country and on the policies that will be promoted at the European, national, and local level [35,36]. In this regard, four scenarios have been identified (see Table 1).

Table 1. Evolution of urban mobility trends: possible scenarios [35,36].

Scenario 1: Return of the urban mobility system to the pre-corona virus disease-19 (COVID) situation	This scenario seems unrealistic in the short term today. In this circumstance, if the virus is eradicated quickly, without significant intervention by the authorities, people will return to their previous habits of transport including travel to the workplace and leisure. Some will be resistant to the use of public transport, but others will be forced by the economic crisis. The increase in active modes, due to the local measures, such as new cycle paths, will have little effect.
Scenario 2: Prevalence of demand for private mobility (use of the car)	In a situation of uncertainty, characterized by a high risk of contagion, the demand for private transport will continue to increase in the short to medium term. Its type and scope will depend on the presence of subsidies or incentives for the purchase of cars, including electric ones.
Scenario 3: Reduction in the demand for mobility	The need to travel and the duration of the journey can be reduced if the mobility system is well organized. Maintaining full or partial teleworking, flexible working hours, and store openings can reduce the demand for transportation. On the one hand, the pandemic has favored the growth of e-commerce, which can lead to fewer trips to shop and the rediscovery of shops and neighborhood businesses.
Scenario 4: Achievement of integrated multimodal mobility (active mobility, public transport, and shared mobility)	This scenario promotes a multimodal and integrated transport system in which sustainable mobility is a key element and in which cities are redesigned for people. A system in which the most efficient and sustainable modes are a priority and the transport offer is integrated both from the point of view of planning and user experience.

In order to avoid conflicts between these soft modes, to adapt the infrastructure and reorganize the management of the spaces, possibly, in a flexible way is necessary [35,36]. These scenarios, and all the actions to be implemented in order to be effective, should be integrated into an urban mobility tool. As is known, municipalities, also according to the European Guidelines, have at their disposal the Sustainable Urban Mobility Plan (SUMP). Municipalities with more than 100,000 inhabitants were forced to build one by 2017. The health crisis we are experiencing can therefore turn into an opportunity to revisit or integrate these urban plans for sustainable mobility by individual cities also in terms of health security to achieve truly sustainable mobility.

1.2. Safe Mobility in Health Emergency: Virtuous Experiences

Regarding best practices, cities around the world are addressing the problem of mobility in the current health emergency, and they are defining what short- and medium-term actions need to be implemented [34,37,38].

In many countries, measures have been introduced to contain the virus, for example on local public transport. In the current context of the COVID pandemic that is affecting most countries on a global scale, the issue of organizational and preventive measures to contain the spread of the infection on collective public transport has been considered of primary importance. This includes the issue of prescriptive indications and/or recommendations [34].

Among the most common actions are maintaining a safe distance on platforms and escalators inside the metro and at bus stops; leaving enough space to allow descent; using masks at the station and at the stops and on means of transport; sitting in alternate seats and leaving central corridors free; reducing the maximum capacity of passengers in buses;

repeatedly sanitizing trains and metro wagons and disinfecting buses and stations every day [39,40].

In Europe in 2020, many cities have encouraged and promoted the use of new sustainable means, enhancing the use of bicycles as a means of dealing with mobility problems during a health emergency. The European Commission (2020) has recently provided guidelines to promote sustainable and safe mobility. In these guidelines, there is a specific focus on "Active Mobility" and, therefore, on pedestrians and cycling:

> "Many European cities are taking steps to make active mobility (e.g., walking and cycling) a safe and more attractive mobility option during the COrona VIrus Disease-19 (COVID) outbreak. Urban areas could consider temporary enlargements of pavements and increased space on the road for active mobility options to facilitate the needs of the population to move in a safe and efficient way, while reducing speed limits of vehicles in increased active mobility areas" [34].

The research carried out showed that in France, in 2020, there was an increase in the use of bicycles by 27% compared to the same period in 2019, and in urban centers there was a 21% increase in daily trips. Paris spearheaded this change, and in June 2020, mobility was redesigned in one of the iconic streets, connecting Bastille Square with Concord Square, Rue de Rivoli, which has become a true cycle boulevard. The French capital has thus developed an important cycling and traffic control network. The results were as expected: to increase travel by bicycle, on foot, and with electric scooters. The use of alternative means of transport, such as those of electric micro-mobility and, in general, the implementation of pedestrianization and traffic moderation interventions, was also important [34,41].

Emergency cycle paths have sprung up all over Europe [34,41]. In Brussels in the city center, a 20 km/h zone and new cycling infrastructures have been created, thus creating new spaces for bicycles along the city's arteries. Along some central axes of the center, new cycle lanes have appeared that have taken the place of the previous paths located on the sidewalks, thus significantly expanding the space for bicycles and pedestrians to the detriment of the space available for cars.

London has introduced some measures aimed at reducing private cars in order to give space to its citizens, the "car-free zone", with the aim that London citizens could move in a safer, cleaner, and greener way. A livability model aimed at leaving room for gentle mobility. In addition, it was a way to revive retail trade, reduce travel times, increase property values, and increase urban resilience to climate change. Today, in the central areas of the city, such as London Bridge, cars can no longer circulate but you can only circulate by bike, on foot or by public transport or taxis with zero emissions. As in the various countries mentioned, in Italy there are also cities that have carried out virtuous interventions.

In the Milan experience, the COVID emergency's crucial issues were already the hidden weaknesses of the city and its region: the limited capacity of transit, roads, and public spaces, with crowding problems for both work and leisure. The challenge is to regenerate the competitive "human measure" of Milan, based on its unique relationship between public spaces and mobility, overcoming its health risk [42].

Milan, to limit the use of cars, has implemented a plan that has provided for wider sidewalks and an extensive network of new cycle paths, to guarantee smooth mobility and social distancing. This plan provided for the construction of 35 km of cycle paths and pedestrian paths at low cost. In order to implement the plan in a short time, curbs were not built but the signage was revised with simple color strips on the asphalt, created next to the sidewalk by moving parked cars. What developed in Milan, and also in many other Italian cities, has contributed to increasing the number of accidents. These emergency tracks sometimes did not, in fact, comply with the appropriate safety requirements and the cyclists themselves did not always use them as tracks created to respond to the health emergency situation [42].

Even Genoa, which does not see the bicycle in its cultural tradition, given the steepness of its territory and the average age of its population, has created emergency cycle paths (Figure 1). Other proposed activities were the widening of the sidewalks to allow better

pedestrian mobility, eliminating unnecessary parking spaces and street furniture, the increase in pedestrian areas, such as via XX Settembre and Piazza Colombo, and the increase of speed 30 zones3.

Figure 1. Emergency cycle paths in Genoa.

In Italy, as in various European countries, at the regulatory level in July 2020, the Relaunch Decree was issued (Law of 17 July 2020, n 77, which entered into force on 19 July 2020) that introduced measures to encourage sustainable mobility. It has introduced funds for the design and construction of cyclostations and interventions concerning the safety of city cycling as well as incentives for the purchase of low-emission vehicles [43,44].

2. Conceptual Section

The research developed focuses on the concept of security in sustainable mobility [45–47]. This section analyzes the concept of security in sustainable mobility strategies and in the current SUMP.

Securitas/secures, from the Latin is derived from sine cura. Sine meaning "without" and cura meaning troubling, solicitude, care, anxiety, attention, pains, grief and sorrow, guardianship, concern for persons, and things. Together they give us sine cura: to be without care, free from cares, and untroubled. Securitas is consequently defined as freedom from concern and danger, or, looked at from a slightly different angle, safety, and security. [48]. Therefore, total safety comes in the absence of dangers or at least a better quality of life. Safety and security are closely linked to sustainability. Internationally the English term "security" is the prevention of intentional unpleasant activities by people—such as robbery, mugging, and terrorist activities—while the term "safety" concerns the prevention of non-intentional accidents such as floods, earthquakes, and accidents at work.

> "The basic idea of both is protecting assets from hazards/threats creating safe/secure conditions. The condition safety is about being protected, while the condition security is about being free from danger" [49].

In Italian, the two aspects are enclosed in a word that has a very broad and difficult meaning to define precisely. Over time, the concept of safety and security evolved along with the mentality of people and cities that changed.

In the research carried out, safety in mobility is approached from two points of view: accident and health.

Safety is usually associated with the subject of accident.

In Italy, an Italian National Institute of Statistics (Istat) analysis shows that in 2019 there were 172,183 road accidents with injuries, slightly down compared to 2018 (−0.2%), with 3173 victims (dead within 30 days of the event) and 241,384 injured (−0.6%). The number of deaths decreased compared to 2018 (−161, equal to −4.8%). In 2019, the casualties on

all road areas decreased, especially on motorways (including ring roads and motorway junctions), equal to 6.1% (310 victims). In urban streets, compared to 2018, it decreased by 5.0% with 1331 deaths; a more contained decrease is recorded, however, on extra-urban roads with a reduction of −4.4% and with 1532 victims [50,51].

These values are still far from the target that had been set at the European level for 2020, i.e., a 50% reduction in deaths, compared to the values of 2010 [17,18].

The main causes of accidents are distraction while driving, failure to comply with priority, and speed that is too high (overall 38.2% of cases). Technology and new safety systems on board cars are essential to lower road risk together with the development of sustainable transport and the correct management of urban traffic.

The main interventions to reduce the risk of accidents in urban centers can be [52,53]:

- traffic calming measures in residential areas ("traffic calming" actions). These actions aim to increase the safety of the most vulnerable users (such as pedestrians and cyclists) by reducing the speed of vehicles through the use, for example, of slowdown bumps, mini-rotatory, limited speed zones (zone 30);
- redistribution of traffic (blocking roads, one-way streets or restricted traffic areas);
- changes in the road environment (for example, the introduction of trees and plants);
- improvement in road visibility (changes in the illumination or treatment of the road's surface;
- incentives for the use of immobility;
- incentives for the use of bicycles through the creation or improvement of cycle paths.

As for the second aspect (i.e., health safety), air pollution produced by road vehicles and noise pollution due to the fact of car use have emerged as critical issues.

The circulation of cars is one of the main causes of atmospheric pollution, understood as modification of the air due to the emissions of gases, fine dust, and fumes that are extremely harmful to human health. Air pollution mainly affects those living in large urban areas, where road emissions contribute the most to the degradation of air quality [54]. In developing countries [55], the problem is more serious due to the fact of overpopulation and uncontrolled urbanization along with the development of industrialization. This leads to poor air quality, especially in countries with social disparities and a lack of information on sustainable management of the environment [56]. One of the problems is the significant increase in polluting emissions of carbon dioxide into the atmosphere. In cities, where the concentration of industries and cars is the highest, the widespread diffusion of polluting emissions in the air is responsible for the formation of fog and smog, and this is precisely one of the reasons that led the European Union to directives for the reduction in polluting emissions (from Euro 0 to Euro 6) [57,58].

Another factor in air pollution from road traffic is wear on brakes, tires, and the road surface and particles raised by the road as vehicles pass. The circulation of cars on the road surface, therefore, in addition to being responsible for emissions of toxic gases for the environment and human health, also generates pollution due to the solid materials that are reduced into smaller parts and raised by the wind or by the passage of the vehicles themselves. The emission of the main air pollutants differs depending on the traction technology and the fuel used.

Cardiovascular disease and heart attack are the most common cause of premature death attributable to air contamination and are responsible for 80% of cases. Following are lung diseases and cancer. In addition to causing premature deaths, air pollution increases the incidence of a wide range of diseases (e.g., respiratory and cardiovascular diseases, cancer) with short- and long-term health effects [59–61].

A very important aspect of the pollution caused by the use of the car is the acoustic one [62]. Noise pollution, in fact, causes various physical and mental illnesses linked to the stress of living in an excessively noisy environment. The European Union, after having decided on limits on atmospheric pollution, has now also decided on limits on acoustic pollution, establishing to lower the average decibels produced by cars from the current 74 to 68 by 2025 [63].

Currently, given the pandemic situation, the research developed introduces the aspect of safety in the health field.

In order to intervene in an effective and unambiguous way in terms of sustainable mobility in the various Member States of the EU, the SUMP [64] was introduced in Europe. The SUMP is a strategic plan that is based on existing planning tools and takes into due consideration the principles of integration, participation, and evaluation to meet the mobility needs of people and goods with the aim of improving the quality of life in cities and their surroundings. The policies and measures defined in a SUMP must cover all modes and forms of transport throughout the entire urban agglomeration, public and private, passengers and goods, motorized and non-motorized, and circulation and parking.

Sustainable Urban Mobility Plan's have a ten-year time horizon and are updated at least every five years. It must be monitored constantly and any deviations from the expected objectives and the related corrective measures must be checked every two years [65,66].

In 2014, the European Community developed the Guidelines to draw up and implement an SUMP. Its objectives are the improvement of Local Public Transport (LPT), accessibility, modal rebalancing, reduction of congestion, integration with the territorial structure, reduction of road accidents, improvement of air quality, and socio-economic sustainability [67].

Therefore, among its aims, the Plan mainly pursues sustainable mobility and the guarantee of safety, health, accessibility, and information for all.

The main and innovative characteristics of a SUMP are [67]:

- Long-term vision and clear implementation plan;
- Participatory approach;
- Balanced and integrated development of all transport modes;
- Horizontal and vertical integration;
- Assessment of current and future performance;
- Regular monitoring, reviewing, and reporting;
- Consideration of external costs for all transport modes.

The Guidelines aim to create an urban system accessible to all, safe and with acceptable levels of environmental and noise pollution. These Guidelines were updated in 2019 and in Italy they were implemented with the transport ministerial decree of 28 August 2019, no.396, made public in the Official Gazette of 30 October 2019, no 255.

There are four phases that characterize the development of the Plan [68] (Figure 2):

Figure 2. The 12 Steps of Sustainable Urban Mobility Plan (SUMP) and the new circular approach of the Sustainable and Safe Urban Mobility Plan.

Phase 1: Preparation and analysis: the geographical limits of intervention are defined taking into account the area of influence, then we proceed with the recognition of the planning tools to be considered, the available data, and those necessary for the reconstruction of the state of affairs are verified.

Phase 2: Strategy development: the strategies, objectives, targets, and indicators for monitoring the plan are defined, taking into account the reconstruction of the framework and the analysis of critical issues.

Phase 3: Measure planning: once the strategies and objectives have been defined, the possible measures to be evaluated and finalized in the plan are explored.

Phase 4: Implementation and monitoring: this phase involves the implementation of the Plan's actions (i.e., measurement, monitoring, and review of the Plan).

Each phase is divided into themes that investigate particular topics related to urban mobility; it is a cyclical process subject to monitoring and periodic updating.

In the Section 3, a new methodology is introduced to integrate health security into the Sustainable Urban Mobility Plan. This Plan was applied in the city of La Spezia (in the Liguria Region, in the north west of Italy, Section 4) with the new objective of defining actions/interventions for sustainable and safe mobility, also with respect to the health emergency at the time of COVID. Finally, in the discussion and conclusions sections, the important aspects that emerged during the research and the best practices for considering the pandemic as an opportunity for a more sustainable urban renaissance are reported.

3. Methodology

The research proposes a new approach to integrate health security into the Sustainable Urban Mobility Plan [69–74]. This approach starts from what is foreseen in the EU Guidelines for drafting a SUMP.

The guidelines are fundamental as they contain the uniform procedure for the preparation, approval, and identification of the reference strategies; the macro and specific objectives; the actions that contribute to the concrete implementation of the strategies; indicators to be used for verifying the achievement of the SUMP objectives [68].

Currently, these Guidelines do not consider the aspect of the health emergency which today appears to be one of the fundamental elements in the context of urban mobility, fundamental for containing the infection and continuing to live everyday life (starting from the elaborations of Rapallini, 2020) [75].

The safety considered by the SUMP is mainly linked to accidents.

The research proposes some integrations concerning health security in the different stages of development of a SUMP (see Figure 2) [71–73].

The main additions are:

Phase 1. Preparation and analysis: Starting from the analysis of the area under study, definition of the strategies to be adopted to deal with the health emergency, and collection of data of interest (for example, increase in private mobility or pollution level). Introduction of new indicators (objective and subjective via survey) to evaluate health security (real health risk of contagion) and the perception of risk from the health point of view. During this phase the SWOT analysis is also developed that allows to identify strengths, weaknesses, opportunities, and threats. The SWOT analysis has the prospects of being used in policymaking, defining strategic directions, and the implementation of measures towards the fulfilment of sustainable urban mobility [76].

Phase 2. Strategies development: At this stage, it is important to envisage new objectives, such as improving the quality of sanitation in public transport, the adoption of prevention initiatives, greater incentives for soft mobility (bike sharing, electric vehicles, etc.), introduction of new technologies (e.g., an app), reorganization of the public transport service (for social distancing) or mobility infrastructures.

Greater participation of the population to understand their point of view and therefore estimate the perception of risk and adopt a good intervention strategy is essential to promote.

Phase 3. Planning of the Plan's actions: In line with the pre-established objectives, actions are defined to make mobility safe also from the health point of view. The interventions can be different, such as the definition of new green areas (parks, promenades), new urban cycle paths, wider sidewalks, new regulations for electric bikes and scooters, and incentives for electric cars. These actions, in addition to addressing the current health situation, contribute to improving the quality of life and a healthier lifestyle.

Phase 4. Implementation and monitoring: this phase involves monitoring the Plan and any revision/calibration (circular approach).

As part of the research carried out, health safety was characterized according to two different aspects: objective and subjective, linked to the perception of risk by the population.

Regarding the first aspect, the new COVID emergency has highlighted that health security is a weakness in the current legislation. Health safety is achieved through all the activities aimed at preventing and managing the risk associated with the provision of health services and the appropriate use of structural, technological, and organizational resources.

Regarding the second aspect, the perception of risk can be defined as a cognitive process involved in various daily activities and which guides the behavior of people in the face of decisions involving potential risks. The perception of risk involves different dimensions such as, for example, both immediate and future consequences and their implications both on a rational and objective level and on an emotional and subjective level [77]. There are several reasons that lead people to perceive some risky activities and others less and there are also marked differences among different individuals [78]. The perception of risk is personal; people can overestimate or underestimate a risk.

In the approach to the two aspects of the in-depth topic, namely, objective health safety and the perception of risk, a system of indicators was defined to be able to quantify and monitor them.

For objective health security the following indicators have been proposed:

- trend/number of deaths per day, week, etc.;
- trend/number of infected daily, weekly, etc.;
- trend/number of healed daily;
- prevention actions by law (social distancing to be guaranteed in public transport places and services; self-protection health devices/protective devices—masks, gloves, etc.; sanitation).

For the perception of health risk, the indicators are:

- perceived social distancing;
- presence of protective factors;
- sanitation;
- prevention.

To analyze the perceived risk of the population in the research, a specific survey was prepared to be administered to the population. Inside, closed questions and some open questions were formulated. Table 2 shows an extract of the main questions asked aimed at understanding mobility habits before and during COVID.

Table 2. Extract from a survey aimed at assessing the perceived risk of the population.

EXTRACT FROM SURVEY
PRE-COVID SITUATION
Before the pandemic what means/methods did you use to get to work/school?
How many minutes did it take to get to school/work?
He/She owned a pass for public transport
. . .
DURING COVID SITUATION

Table 2. *Cont.*

EXTRACT FROM SURVEY
What means/mobility do you currently use to go to work/school/other?
Do you feel safe (from a health point of view) to take the bus/train/subway or any shared vehicle?
In this period of health emergency, how much economic incentives have affected your purchases of means of mobility (electric scooter, electric bike/bike, electric car)
If possible, would you be available to change the time slots and/or days of your academic/work activity in order to avoid the excessive concentration of people moving at the same time?
In your opinion, how many meters are needed as a safe distance?
Do you think the mask is useful?
Do you think it is useful to sanitize your hands often?
. . .
OPEN QUESTIONS
Would use public transport (bus, train, subway) if: . . .
Would you use the bike if: . . .
What interventions would you propose to improve mobility from the health point of view? . . .
What incentives would you propose to promote sustainable mobility? . . .
. . .

4. Application and Results

The research developed has led to the definition of a new SUMP that also considers safety from the point of view of health [79]. This Plan was applied to the city of La Spezia in the Liguria Region in the north west of Italy. This locality was chosen because La Spezia has, in previous years, equipped itself with an urban plan for sustainable mobility and in line with the current health situation is trying to implement safe mobility policies.

The existing SUMP was integrated according to the approach set out in Section 3.

Phase 1 was initially implemented. Basic information relating to existing mobility systems and the health situation was collected and the urban context of La Spezia was analyzed thanks to the SWOT analysis (see Figure 3).

Subsequently, the indicators proposed to analyze objective and subjective health safety–risk perception were quantified.

As regards the former, for example, in the months of September and October 2020 the data provided at the regional level by the Ligurian Health Authority (Alisa) and at a local level from the Local Health Units of La Spezia (Asl 4) were analyzed. To define the perception of risk, the questionnaire received responses from a sample of approximately 40 people, equally divided between sex and age.

From the analysis of online studies and the responses of questionnaires emerged that most of the citizens interviewed do not feel safe using shared media due to the overcrowding; for non-compliance with the use of individual protective devices and social distancing by other parties (non-compliance with regulations); due to the poor sanitation of public transport; for poor controls; for the infections in the area and, therefore, for the objectively critical situation, etc. Most of the people also declared that the incentives provided for soft and sustainable mobility did not affect the choice of means of transport.

STRENGTHS	WEAKNESSES
Green city Economic and social interconnection Sustainable mobility plan Pedestrian accessibility ….	Degraded public spaces Poor sanitation conditions in public transport Lack of cycle paths Very busy area …
OPPORTUNITIES	**THREATS**
Interventions on shared mobility to safeguard hygiene SUMP update Soft mobility regulations Construction of cycle paths Increased controls Widening of the sidewalks …	Closure of some areas Risk of virus contamination Increased traffic Increase in accidents Increase in pollution ….

Figure 3. Extract from SWOT analysis carried out for La Spezia.

To the question "what interventions would you propose to improve mobility from the health point of view?" the answers were: compliance with safety standards; more livable and wider sidewalks; sanitation of vehicles; increase in the number and, therefore, in the frequency of public transport; increased checks on compliance with the rules; flexible working hours; presence of hand sanitizers; signs that testify to the daily sanitation of the vehicle; delays in school hours to avoid overcrowding; extension of cycle paths; provision of swabs for the population; improvement of the health service (inefficient and confusing); sanitization of external environments; compulsory sanitation while boarding the vehicles. The questionnaires revealed a further detail related to the little use of public transport even before the health emergency, demonstrating the poor efficiency of the local public transport system in La Spezia.

In Phase 2 of the approach, new objectives were defined, specified, and aimed at sustainable and safe mobility during the time of COVID and identified actions/interventions to be implemented. Among the structural interventions, it was proposed to strengthen the existing cycle paths and equip them with more services (such as racks) and to create new emergency tracks, as has happened in many European and Italian cities (see Section 1). Some examples are shown in Figure 4.

Existing cycle paths: examples of services—box, park, e-bike charging station

Realization of a new cycle path in the pedestrian area and to replace the side car parks

Figure 4. Some structural examples proposed in the SUMP during COVID for La Spezia.

Among the interventions was proposed the strengthening of the bike sharing program named "Speziainbici (Spezia in bicycle)", implemented for some time in La Spezia, and the punctual control of the new vehicles in the city, namely, electric scooters. The city has made 300 scooters available throughout the territory. The service is widely used as the bus service in the evening is not guaranteed, while scooter sharing is guaranteed 24 h a day.

With regard to public transport, to foresee and implement many interventions is necessary including frequent sanitation of vehicles, greater controls for compliance with health safety regulations, to install sanitizer dispensers in buses and at each stop, to increase the frequency of rides to reduce crowding. Furthermore, thanks to the new existing technologies to create apps or devices that warn not only about the frequency of buses but also about the crowding capacity of vehicles, so that the perceived—subjective risk can be partially contained thanks to objective information.

5. Discussion

The COVID health emergency has upset our daily lives. The mobility sector, as already reported in the paper, was one of the themes, together with health, education, etc., to be most impressed.

Cities, particularly in Italy, where the study was applied, already very often lacking in terms of sustainable mobility, have been severely hit by this unexpected situation. The concept of sustainability in this historical context must be addressed with concrete policies and actions [80,81].

With the pandemic, the critical issues that were once tolerated (traffic congestion, crowding on public transport, etc.) were brought to the fore. The pandemic should be seen as an opportunity for a more sustainable urban renaissance. To do this, to start by mobility planning strategies within the main planning tool which is the SUMP is important.

The Sustainable Urban Mobility Plan is a very important tool for the present and future city as it considers all the modes and forms of transport (public and private, passengers and goods, motorized and non-motorized, circulation and parking) present in a city [82,83]. This Plan should also become an integral part of a city's sustainable policies [84–89].

Specifically, analyzing the challenges of urban mobility present in the Guidelines for the definition of the SUMP [68], the issue of safety also emerges (see Table 3). Congestion—to obtain sustainable cities accessible to all—is considered as challenges to be faced; safety—understood as road safety (accidents); health—that is, an environment with pollution values below the required regulatory limit and with a healthy lifestyle; strategic planning—to achieve pre-established political objectives to ensure safe mobility and safeguarding the needs of the population; climate change—to reduce pollutant emissions—and participation, that is the involvement of citizens. In addition to the best practices, Tables 3 and 4 provide a priority scale (from 1 to 4) of how much the good practice can contribute to the achievement of the different challenges.

The research developed in the paper proposes a review of the issue of safety aimed at defining good practices to respond to this challenge in a broader sense, thus considering, in addition to accidents, the aspects related to the health emergency in an objective and subjective way (see Table 4).

Another aspect not considered in this research but fundamental in the design of sustainable and safe mobility is the concept of resilience [2,90]. Cities are complexes of interdependent systems and the health emergency cannot be understood with sectoral and disciplinary approaches alone [91]. The creation of new resilient and dynamic scenarios that consider time, space, infrastructures, and key actors in innovation processes—public authorities, researchers, businesses, and citizens—can play a fundamental role in the analysis of the urban context as a complex system [92]. These actors are part of the so-called quadruple helix, a model of interaction and interdependence necessary for territorial development [93] and, therefore, also to increase urban resilience.

Table 3. Policy challenges in urban mobility and transport and possible solutions (reworking of 59).

		CHALLENGE					
		CONGESTION	**HEALTH**	**SAFETY AND SECURITY**	**PARTECIPATION**	**STRATEGIC PLANNING**	**GLOBAL CLIMATE CHANGE**
SOLUTIONS/GOOD PRACTICES	**CLEAN FUEL AND VEHICLES** For example, hybrid or electric machines						
	URBAN FREIGHT: less polluting freight transport						
	DEMAND MANAGEMENT STRATEGIES: promote sustainable public transport or increase the frequency of public transport						
	ACCESS RESTRICTIONS, ENVIRONMENTAL ZONES: 30 zones or restricted traffic zones						
	CONGESTION CHARGE, PRICING POLICIES: Reduce the cost of bus tickets or incentives for sustainable mobility						
	. . . .	. . . .	. . .	. . .	. . .	. . .	. . .
	SUSTAINABLE URBAN MOBILITY PLAN						

Table 4. Solutions in relation to the new health security challenges.

		CHALLENGES	
		Objective Health Security	**Subjective Health Safety (Risk Perception)**
SOLUTIONS	CLEAN FUEL AND VEHICLES		
	URBAN FREIGHT		
	DEMAND MANAGEMENT STRATEGIES		
	ACCESS RESTRICTIONS, ENVIRONMENTAL ZONES		
	CONGESTION CHARGE, PRICING POLICIES		
	COLLECTIVE TRANSPORT		
	NEW FORMS OF PUBLIC TRANSPORT SERVICES		
	ACCESS ELDERLY, DISABLED PASSENGERS		
	INTEGRATION OF MODES		
	TRANSPORT TELEMATICS		
	E-TICKETING		
	TRAFFIC MANAGEMENT AND CONTROL		
	CAR SHARING		

Table 4. *Cont.*

	CHALLENGES	
	Objective Health Security	**Subjective Health Safety (Risk Perception)**
CAR POOLING	🌿🌿🌿	🌿🌿🌿🌿
WALKING AND CYCLING	🌿🌿🌿🌿	🌿🌿🌿
...	...	...
SUSTAINABLE URBAN MOBILITY PLAN	🌿🌿🌿🌿	🌿🌿🌿

In this paper, therefore, the approach to safe and sustainable mobility also passes from resilience and, therefore, from the ability to adapt, in this case to the health emergency due to the fact of COVID, of the individual public and private actors who live in the territories. The resilience of territorial systems can therefore be calculated as a function of the resilience of all the actors involved. The cooperation, the skills put into the system and the resilience of the single actors lead to the innovation that each actor of the quadruple helix can bring in the context of the SUMP revised according to the logic of the health emergency.

The integrated approach allows the administrations responsible for defining sustainable mobility strategies to be able to choose from a pool of solutions/good practices that should be integrated into the existing SUMP with today's logic [94–102].

6. Conclusions

The methodological approach developed in Section 3 and applied in La Spezia in Section 4 proposed a logical path of the activities that should be carried out in the definition of a the SUMP to consider health security in an objective and subjective way. The concept of safety in urban areas must become a fundamental challenge and one of the main objectives of planning, in fact safety (understood as accidents and health), together with objective health and the perception of risk, deeply influence the choice of sustainable mobility and contribute to the creation of an environment conducive to economic growth.

In planning interventions to consider both aspects to have a clear vision of the context in which to intervene is essential. The objective indicators, supported by the regulatory context, indicate the design limits dictated by the law. Subjective indicators, on the other hand, help us to understand the population's perception of risk. In fact, we must not forget that the end user to whom the safe and sustainable mobility we are planning is aimed is precisely that population. Only by knowing the opinion of the population to propose good practices to will they be more widely applied, because they are also chosen based on their needs and expectations.

The health crisis therefore provides an opportunity to improve the city and life through new regulations and good practices specifically aimed at health security. The opportunity granted by the restrictions on travelling, still underway, might be taken advantage of to maximize the potential of underused mobility spaces, also thanks to the employment of new applications [103].

Regardless of the crisis in our cities, increasing sustainable mobility remains a priority. Based on the proposed approach that complements the SUMP guidelines, for planners to choose good practices that address the challenges of sustainable and safe mobility is possible. This is achieved thanks to the integration of the challenges as reported in Tables 3 and 4. In these tables, in addition to the best practices, an effectiveness priority is foreseen with respect to the different challenges to be achieved. A priority in this approach, in line with the logic of the SUMP, is therefore the awareness and involvement of the population to have participatory good practices, that is, desired by the territory.

Wanting to identify a vademecum of good practices that go in the direction of sustainable and safe mobility, discouraging the use of private vehicles is a priority, as they significantly contribute to congestion and pollution of the city. At the same time, encouraging soft mobility (bicycles, pedi-buses, etc.), with the necessary health precautions, also

reducing the overcrowding of public transport is desirable. Soft mobility (bicycles, scooters, etc.) is a great alternative to focus on, especially in cities where it is "uncomfortable" to travel on foot but perfectly accessible by bicycle. It will therefore be necessary to identify protected routes for bicycles, which may be able to use the corridors of the LPT [104].

Promoting safer ways and means of sustainable mobility also means reviewing the design of some parts or entire cities [105–107]. In reaching conflicts between these modes of transport, to create new infrastructures, reorganize the existing ones and, in general, think about the management of urban spaces is necessary. In this context, new technologies can be a valid support both for forms of remote work and for making travel more accessible thanks to intermodality, and therefore to travel planning with different means. Making a network of parking and cyclostations where you can rent and share car, bicycle, scouter with other people, or reach the nearest bus and metro stations, is important. The sustainable transport service must be widely distributed throughout the territory and be safe and accessible. Cities must be greener and more compact to facilitate accessibility and be able to return to live them safely. Finally, the economic and social incentives (discounts for local public transport tickets, prizes for virtuous behavior, etc.) to be provided to raise awareness of sustainable mobility forms are nowadays effective tools with respect to restrictive policies (traffic calming, limited traffic areas, fines, . . .) (Figure 5).

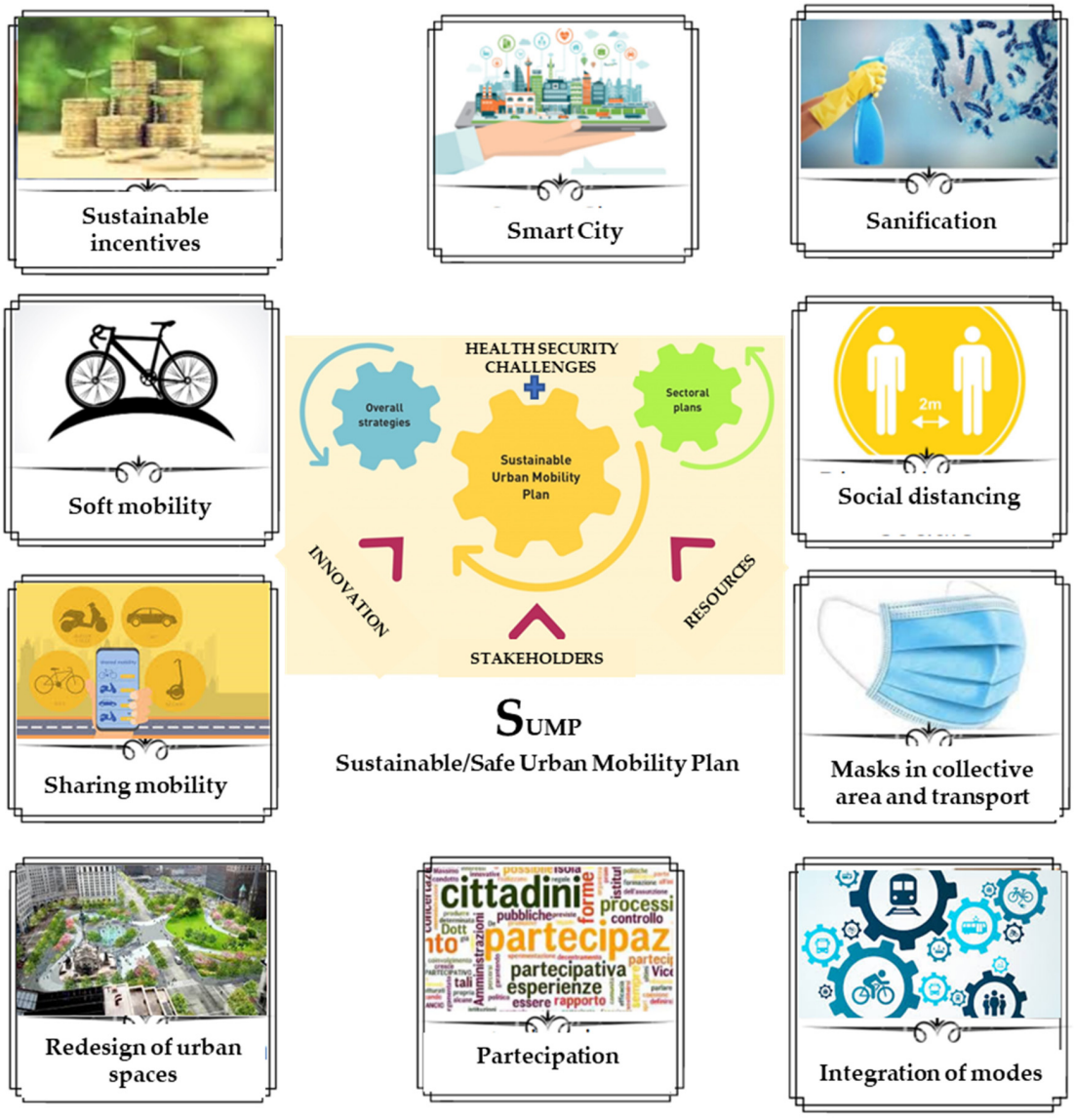

Figure 5. The decalogue of the actions of the new Sustainable and Safe Urban Mobility Plan.

The approach presented here therefore offers the opportunity for strategic planning to define and implement interventions and good practices that lead to safe and sustainable mobility, also contributing to the improvement of the quality of life in urban areas.

7. Limitations and Recommendations for Future Studies

The limitations and recommendations for future research primarily relate to the conditions linked to the pandemic, which is still ongoing, and the short period of time available to analyze the pre-COVID period and the current COVID one.

In this study, a partially online and face-to-face survey was applied to evaluate the changes in the mobility habits of the inhabitants of La Spezia, receiving about forty responses. It would be good to increase this number of interviews in future studies that also involve several cities in other Italian regions. This is to have a more meaningful response to changes in times and in the means of mobility used that are closely linked to the characteristics of the individual city analyzed. It is known that the orography and the mobility services that each city offers strongly influence the choices of its users.

The research lays the foundation for future studies that will include a larger sample of people, different national contexts, and further indicators to assess sustainable mobility, first of all resilience and the quadruple helix strategy. With these further investigations, the approach makes it possible to integrate the SUMP with considerations related to the perception of risk, the adaptability of man and the environment (human and environmental factors), and related to the characteristics of the territory and the means of transport and connections available.

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