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Geographical Health Education
for knowing and preventing risk factors

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Abstract

In this contribution the importance of a geographical health education perspective is underlined, and the need to promote a widespread and shared awareness of this topic has led to the introduction of a new type of feature focused to the related aspects with this number of J-READING. In particular, in the present work, first of all the potential added value of harmonious and coordinated health education actions is underlined, aimed at translating the findings of scientific research for social usefulness, also focussing the attention on the need to avoid incorrect behaviour which can put people at risk of specific diseases and disorders. Secondly, a reflection is provided about the leading causes of death and risk factors, highlighting the differences among geographical areas and countries on the basis of a number of indicators which continue to show considerable inequalities and reveal facets and problematic conditions of many contexts with development delay, above all in Sub-Saharan Africa. The imbalances in basic maternal and children health services continue to be burdensome and the system too feeble to face communicable diseases, often easily preventable and treatable, even if some encouraging achievements have been recorded in the last years. Thirdly, the attention is dedicated to the health risk factors and noncommunicable diseases in the developed countries and a focus is provided on the European countries. The use of tobacco, the abuse of alcohol, an unbalanced diet and physical inactivity (which together contribute to overweight and obesity) here are remarkable risk factors for chronic diseases, but their incidence could be easily reduced by encouraging and supporting at school and at educational level adequate programmes, "best buys" and supplementary interventions for assuming better behaviour. Some perspectives for geographical health education are finally discussed considering the potentialities of geotechnologies, WebGIS and open source GIS, specific app and services, story maps and digital storytelling.

Keywords: Causes of Death, Communicable Diseases, GIS and WebGIS, Health Education, Noncommunicable Diseases, Risk Factors

1. Remembering the past… thinking to the future

Seven years have passed since that April 2012, when Gino De Vecchis (National Presi-

dent of the Italian Association of Geography Teachers – AIIG in the 2002-2018 period) invited me and the colleagues Riccardo Morri (now National President of AIIG) and Marco Maggio-

li (at present member of the Scientific Committee of the Journal) to discuss: J-READING's (Journal of Research and Didactics in Geography) main aims; its template and the author's guidelines; the peer review process; the web site map; the sponsoring organizations and other related issues. It was the first briefing aimed at discussing some basic elements useful to have a flexible structure to debate and expand with the contribution of the Italian Association of Geography Teachers National council, starting with a well thought out frame. I clearly remember that a shared enthusiasm united us and made us part of a common project, ardently desired by Gino De Vecchis, the Founder and past Editor in Chief of J-READING, and welcomed by us all.

So, in the contribution *J-Reading is born*, many focal points were underlined, starting from the following consideration (De Vecchis, 2012, p. 7).

> The aim of contributing to the construction of a bridge between didactics and research, strategic for the development of the subject, is at the basis of this new editorial project, which, inserted in the history of the AIIG, sets out to highlight its international approach that is so essential in a globalised world. The terms didactics and research, in fact, complement each other and combine for a solid cultural education in order to deal with analytical-interpretative and educational-professional needs.

And then specific aspects and themes, research lines, educational perspectives were advanced and proposed, since there is the need for this at international level (De Vecchis, 2012, p. 8)

> to show the diversity of paths and approaches of contemporary geography, including the elaborations of new models and theories, mathematical data processing, the application of new mapping and statistical calculation techniques in computerised cartography and in the geographical information systems (GIS), which have considerable application possibilities in the sociodemographic and economic-tourist fields, in terms of environmental and cultural heritage and risk analysis etc.

giving also considerable importance to the geographies of perception and behaviour and the thorny relationships among different forms of

development and technological progress, resources and landscape preservation, social inclusion and territorial identity.

To face these issues and reach important aims, the importance was also highlighted: to create a synergy between scientific theory and didactic practice; to promote educational and scientific-disciplinary transversalities; and to support exchanges between researchers and teachers, in order to set up a virtuous circle able to provide tangible added value in the field of research and modalities and strategies in didactics.

Successively, in the contribution *Some keywords of J-Reading*, three keywords were discussed as they were considered particularly worthy of note (De Vecchis, 2013, pp. 5-6): international comparison that "makes it possible to evaluate, from a comparative point of view, the state of the art relative to the teaching of geography at the various levels of school and university"; interdisciplinarity that is necessary to pursue ambitious results which "require joint planning among the various sectors of scientific research"; and geospatial technologies since "the use of dedicated instruments, digital cartography software, the analytical interpretation of satellite images represent a crux of a geography in *progress*, the scope of which is to unite theoretical-methodological skills with practical-operational ones".

Therefore, in order to promote a periodical sectorialisation and a profitable discussion and deal with specific aspects, some features were introduced in addition to the customary scientific papers.

In this perspective, with the present number of J-READING another type of column has been introduced and it is dedicated to "Health Education" since a considerable need for rigorous input and clarity is advised and perceived on these topics and because there is a close relationship between the health of the environment and population.

Furthermore, a widespread educational attainment, obtained with school and university learning but also through specific pathways and multifaceted actions for the completion of formal training, is considered a crucial determinant

of health and lengthening of life (Yamashita et al., 2019, p. 329). So, health education (HE) is given by the proactive combination of learning experiences and situations aimed at promoting voluntary actions conducive to psycho-physical well-being and health literacy plays an essential role in terms of the promotion of health at school and social-pedagogical implications useful for life (Fane et al., 2019, pp. 289, 291).

Furthermore, the role of health education increases at the light of global migration flows, since they can have a tangible "impact on those who move and those who stay behind, through a whole range of new stresses, pressures and demands" (Thomas et al., 2019, p. 3), reappearance of (partially) eradicated infections and combinations of diseases. The amount of these flows brings about important effects "including the challenges presented to global health systems as the consequence of escalating health care demand" (Spencer et al., 2019, p. 97) and it requires an inclusive aptitude and correct behaviour right from the school years, in order to facilitate a virtuous health system and give everyone the possibility to guarantee their health status.

The profitable repercussions on the educational process regarding themes and aspects of great social usefulness can be countless and manifold. The possibilities of geographical and interdisciplinary analysis are rich in many facets, from conducting detailed territorial screening to recognizing anomalies, analogies and differences. Remarkable perspectives can be opened up in order to add additional tiles to the present state of the art, towards a scientific progress which can provide tangible benefits for people and especially young people. There are various approaches which can lead to the identification of risk factors (endogenous and exogenous), polluting sources, abnormal incidences and the prevalence of diseases, areas with insufficient levels of sanitary services or subject to people fleeing owing to their inefficacy and inefficiency. There are many possibilities whereby to evaluate the imbalance factors, territorial inequalities, gap levels at international level or in a kind of "Chinese box", varying the administrative levels for successive comparisons.

In all these cases, the use and elaboration of quantitative and qualitative data, the sample research and the direct involvement of residents in cohorts and case-control studies, GIS applications along with the WebGIS and ArcGIS Online functionalities can support important findings which must be widespread and shared in different ways, so as to reach a greater number of people and to support an adequate awareness and education process to health, in addition to promoting innovative and rigorous research lines and projects.

Similar reflections acquire particular emphasis considering that, for example in Europe and in North America, a widespread increase of diseases seems to have been recorded (such as some neoplasms) with high mortality often related to the alteration of the environment due to: impressive cementation; poisonous emissions; impactful activities; indiscriminate disposal of hazardous waste and toxic substances; massive use of pesticides and antiparasitic substances in agriculture or glues and noxious materials in constructions, furniture and cosmetics; pollution of soils and water sources; spasmodic research of all at once. Moreover, cardiovascular and cerebrovascular diseases continue to represent the first causes of death in the developed countries sometimes for incorrect behaviour (i.e. smoking, use of alcohol and drugs, overweight and obesity, sedentary life, irregular rest etc.) which could be rectified through shared educational projects on a large radius, with tangible improvements. Moreover, with the lengthening of life expectancy, an increase in the cases of the loss of cognitive abilities is recorded and determines the adaptation of the social and healthcare systems to the needs of people of fourth and fifth age, with a rise in expenditure and the need for specific planning.

On the other hand, there are countries, for example in Sub-Saharan Africa and the Middle East, where the leading killers of children continue to be diseases that are easily preventable and treatable: causes of death due to risk and transmission factors which are intolerable and the symptoms of huge disparities. In fact: "Every year, millions of children under 5 years of age die, mostly from preventable causes such as pneumonia, diarrhoea and malaria. In almost half of the cases, malnutrition plays a role, while unsafe water, sanitation and hygiene are also significant contributing factors" (UN IGME,

2017, p. 2). Similar infectious diseases represent urgent priorities since they are widespread plagues and ruinous scourges which show the other side of the coin: the side of underdevelopment. For example, wasting, stunting, underweight, the low amount of daily calories or diets that are very poor in protein and necessary micronutrients for an adequate growth and psychophysical development are the all too obvious signs of highly problematic conditions and severe states of debilitation which can put children at risk of the onset of diseases.

Thus, the social and health conditions of a country, the problems that weigh on the population but also the progress recorded over time can be analyzed in a perspective of interdisciplinary research by means of various combined indicators and elaborations, which make it possible to assess the international disparities in terms of development, risk factors and quality of life. It is possible to draw synthetic and detailed multitemporal and geospatial frameworks, bringing out and quantifying the main critical aspects of each context. In terms of strategic planning, this permits to recognize the weak points of specific areas and elements of common exhaustion of macro-areas, which should be faced with streamlined and focused programs; and this also helps to identify strong points and successful actions which could be replicated with particular and adaptable expedients in order to spread winning solutions for public usefulness (Palagiano and Pesaresi, 2011, p. 231). In fact, the documenting and monitoring of the successes of specific countries offer practical guidance for targeted interventions able to reduce the mortality of vulnerable age classes (newborns, children, pregnant mothers, people affected by particular diseases) and to face the major risk factors, inspiring potential solutions that can be translated into concrete planning (Alkema et al., 2016, p. 471).

Moreover, accurate studies are required to establish some essential key aspects which must represent the basis of appropriate behaviour and widespread education. There are numerous contributions shared by the web or with the publication of volumes without scientific foundations which can be misleading, contributing to feeding incorrect information and knowledge. It is for example the case of works on unbalanced diets, or on arbitrary and unapproved methods of fac-

ing serious diseases. It can also be the case of commercials and documents that exacerbate the use of new technologies (i.e. for the mobile network) leading to a deleterious abuse, both for the repercussions in terms of mood-apathy-irritability, and for the departure from the aspects of real life and the direct effects on health due to particular kinds of emissions, now being monitored and evaluated in health research.

2. Leading causes of death and risk factors… monitoring health, with particular attention to countries with delay in development

A comparative and diachronic analysis "of the burden of diseases and injuries, and the risk factors that cause them, is an important input to health decision-making and planning processes" (World Health Organization, 2018a, p. 1). At the same time: "Tracking age-sex-specific death rates by cause is an essential component of health surveillance" and systematically observing "levels and trends in premature mortality is crucial to understanding how societies can address prominent sources of early death" (GBD 2016 Causes of Death Collaborators, 2017, pp. 1151-1152).

According to recent estimates (World Health Organization, 2018b)[1]:

More than half of all deaths in low-income countries in 2016 were caused by the so-called 'Group I' conditions, which include communicable diseases, maternal causes, conditions arising during pregnancy and childbirth, and nutritional deficiencies. By contrast, less than 7% of deaths in high-income countries were due to such causes. Lower respiratory infections were among the leading causes of death across all income groups.

Noncommunicable [Group II] diseases (NCDs) caused 71% of deaths globally, ranging from 37% in low-income countries to 88% in high-income countries. […]. […][2].

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[1] Synthetic data and information are also reported at https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death.

[2] Noncommunicable diseases correspond to chronic diseases, which generally have long duration and contemporaneous slow progress and degeneration.

Injuries [Group III] claimed 4.9 million lives in 2016. More than a quarter (29%) of these deaths were due to road traffic injuries. Low-income countries had the highest mortality rate due to road traffic injuries with 29.4 deaths per 100,000 population – the global rate was 18.8. Road traffic injuries were also among the leading 10 causes of death in low, lower-middle- and upper-middle-income countries.

The various risk factors, social and economic status, demographic structure, healthcare system and the capability to respond to the general request and needs, the cultural level of the population determine a series of combinations which have direct repercussions on the incidence and prevalence of different diseases and injuries and consequently on the main causes of death and life expectancy.

For example, life expectancy – which can be considered one of the first basic symptoms of the development achieved by a country – shows remarkable geographic differences and a gap of some years between females and males. At the top of the ranking there are above all the countries of Western Europe and East Asia, while at the bottom the African countries are to be found. As far as concerns females (Figure 1), according to the De Agostini – DeA WING 2019 data collection, some countries exceed the threshold of 85, with the maximum recorded in: Monaco (88.2), Japan (87.1), San Marino (86.8), Spain (85.7), France and Switzerland (85.3), South Korea (85.2), Singapore (85.1). The lowest values are instead recorded in Sierra Leone (52.4), Central African Republic (54), Chad (54.1), Nigeria (54.2), with a life expectancy of less than 55 years. There is, therefore, a difference of almost 36 years between Monaco and Sierra Leone. With regard to males (Figure 1), the values are generally lower with respect to females, but some countries are near or exceed the threshold

of 81 years, with the maximum recorded in: San Marino (82.7), Monaco (82.1), Switzerland (81.5), Japan (81), Liechtenstein and Norway (80.9). On the other hand, the lowest values concern countries that are below the threshold of 52 years: Central African Republic (50.3), Sierra Leone (51.3), Chad and Lesotho (51.7). Thus, the difference between San Marino and Central African Republic is about 32.

In a diachronic perspective, important achievements have been recorded during the last twenty years, both in developed countries and (relatively) above all in countries with a development delay where, nevertheless, many other steps must be taken. In fact, on the basis of the De Agostini – DeA WING 2000 data collection, for the females, the highest values amounted to 85 in San Marino and 84 in Japan, and the lowest values barely amounted to 37 in Malawi and 40 in Niger. For the males, the highest values, again observed in San Marino and Japan, amounted to 77, and the lowest, recorded in Malawi, barely amounted to 36, followed by Niger and Tanzania with 41.

Then, other essential inputs are provided by the under-five mortality rate, which depends on a series of aspects that can show the critical conditions related to "the limited access of children and communities to basic health interventions such as vaccination, medical treatment of infectious diseases, adequate nutrition and clean water and sanitation", in addition to cultural aspects which surround young mothers and carers accompanying children during this crucial and frail period of life (UN IGME, 2018, p. 4). The complexity and variety of the aspects that can contribute to maintaining the under-five mortality rate high are so many that some contributions have highlighted the need to assess different kinds of variables (defined "traditional and additional") in organic frameworks functional to operative actions and interventions, because these variables reflect the geographic and economic barriers to healthcare and involve indicators socially and culturally relevant to the planning setting (Rutherford et al., 2010, p. 517). "Mortality is the most direct and important indicator of health at the population level" and the under-five mortality rate becomes the mirror able to provide multiple reflection elements, especially if considered in the double perspective of spatial

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The main categories of noncommunicable diseases are: cardiovascular diseases (heart disease and stroke); cancer; chronic respiratory diseases; diabetes. Since these diseases are strongly related to unhealthy lifestyles and daily risky behaviours, which lead to problematic conditions and metabolic changes, an appropriate lifestyle during childhood and youth, promoted by health education programmes, can help to prevent the onset of noncommunicable diseases in adulthood (World Health Organization, 2013, p. 7).

distribution and diachronic dimension (Li et al., 2019, pp. 1-2). Quantitative data, globally considered, shows very tangible improvements that in turn mean good results in the prevention, treatment, management of situations that ten-twenty years ago would have led to death. Synthetically (UN IGME, 2018, p. 6):

> Around the world remarkable progress in child survival has been made and millions of children have better survival chances than in 1990. The under-five mortality rate fell to 39 deaths per 1,000 live births in 2017 from 93 in 1990 […]. This is equivalent to 1 in 11 children dying before reaching age 5 in 1990, compared to 1 in 26 in 2017. In most of the SDG [Sustainable Development Goal] regions the under-five mortality rate was reduced by at least half since 1990. In 74 countries, the under-five mortality rate was reduced by more than two-thirds. […]. The total number of under-five deaths dropped to 5.4 […] million in 2017 from 12.6 […] million in 1990. On average, 15,000 children died every day in 2017, compared to 34,000 in 1990.

Despite this considerable progress, the under-five mortality rate continues to record very high values in many countries (Figure 2), where – according to the De Agostini – DeA WING 2019 data collection – sometimes it is more than 100‰: Somalia (132.5‰), Chad (127.3‰), Central African Republic (123.6‰), Sierra Leone (113.5‰), Mali (110.6‰), Nigeria (104.3‰). Overall, Sub-Saharan Africa is constituted by a compact block of countries which report serious levels of criticality. To think that in some contexts 100 or more children die before reaching their fifth year of age is a symptom of heart-rending graveness, which must be framed in a global picture where several other countries have values of more than 80 and 90‰. These data appear very mismatched considering that the levels are below the threshold of 3‰ in several European and East Asian countries, as proof of the possible achievable goal and they are very near 2‰ in Liechtenstein and Iceland (2.1‰), Slovenia and Finland (2.3‰), Luxembourg (2.4‰).

In the perspective of the potential results obtainable in the medium-short period through a programmatic and shared task at national level with the support of international organizations, to starkly flay stagnation conditions, a virtuous example is provided by Ethiopia, that has showed a notable trend in the last years: on the basis of the 2003 De Agostini – DeA WING data collection, a value of 174‰; according to the 2008 data collection, a rate of 164‰; on the basis of the 2013 data collection, a value of 105.9‰; according to the 2019 data collection, a rate of 58.4‰.

The keys to the success recorded in Ethiopia have been synthetically summarized below and represent the basic elements for promoting similar actions to expand and deepen their own responsibility and commitment to save newborn babies' and children's lives (VV.AA., 2015, p. 3).

• Sustained high level commitment and multi-sectoral policy platform — *contributions from inside and outside the health system, including economic development, agriculture, and education*;

• Broader access to basic infrastructure — *improved roads, electricity, telecommunications*;

• Rapid increase in growth in health funding, especially from international donors — *helped expansion of health infrastructure and health work force*;

• Comprehensive health sector planning and Health Extension Programme — *brought essential health services to rural areas*;

• Early adoption of global initiatives including MDGs [Millennium Development Goals] — *mobilised funding and drove stronger collaboration and partnership*.

Therefore, a series of integrated policies and multi-sectoral guidelines at community level has made it possible to feed a system able to accelerate the potential results achievable, directly neutralizing the main weak points and the determinant factors of the high under-five mortality rate, as for example: immunization; treatment of childhood illnesses; diet imbalances and food safety; access to health services and sources of drinking water; education and involvement of young women to reduce the burden of preventable childhood diseases also related to undernutrition-malnutrition; the funds allocated for improving the health care system and the primary services (Tadesse et al., 2015, p. 15).
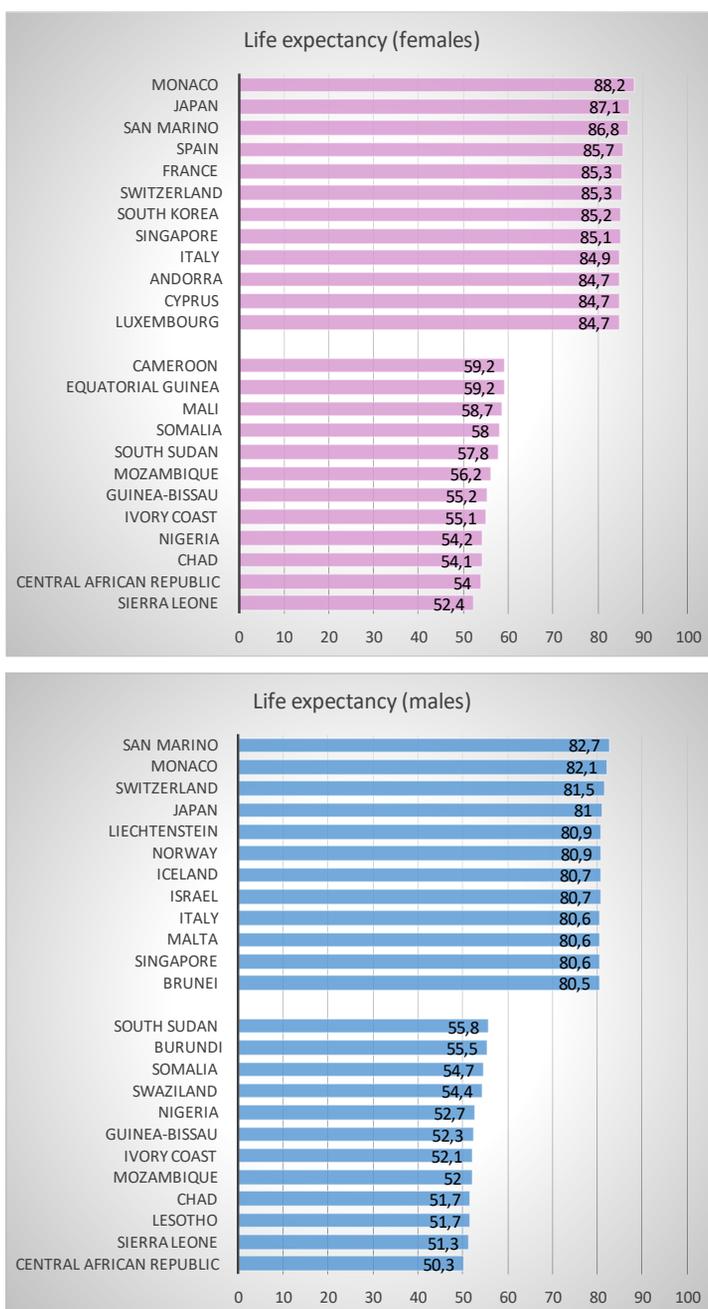
Figure 1. Life expectancy for females and males in the 12 countries with the highest and lowest values according to the 2019 data collection. Source: Author's elaboration on data De Agostini – DeA WING 2019.
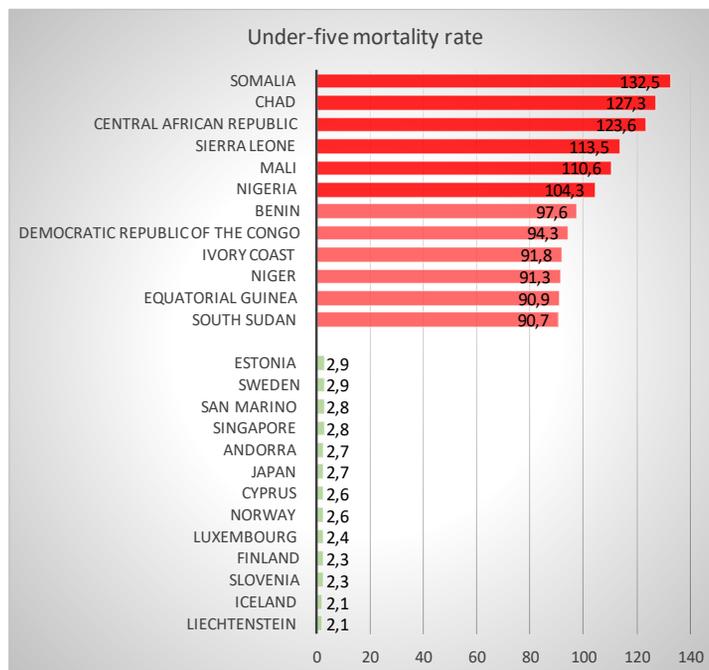
Figure 2. Under-five mortality rate (‰) in the 12 countries with the highest and in the 13 countries with the lowest values according to the 2019 data collection. Source: Author's elaboration on data De Agostini – DeA WING 2019.

There are many variables which can be considered in order to underline the remarkable imbalances and problems that characterise countries and macro-areas and to better understand the causes of high childhood mortality and the incidence and prevalence of specific diseases. These elements of frailty are often interconnected, triggering worrying vicious circles and exposing the bases of the already weak social-healthcare system.

Among the combined indicators used at international level, in 2010 the Multidimensional Poverty Index (MPI) was introduced to contribute to understanding and evaluating "how many people experience overlapping deprivations and how many deprivations they face on average", providing useful input and reflection elements for national and international policies. In fact (UNDP, 2010, p. 95):

The MPI is the product of the multidimensional poverty headcount (the share of people who are multidimensionally poor) and the average number of deprivations each multidimensionally poor household experiences (the intensity of their poverty). It has three dimensions mirroring the HDI [Human Development Index]—health, education and living standards—which are reflected in 10 indicators, each with equal weight within its dimension.

Despite some limitations due to the sometimes limited availability of the combined data, the Multidimensional Poverty Index helps to refine the measures of the most serious forms of poverty and deprivation, since it "is an index of acute multidimensional poverty. It reflects deprivations in very rudimentary services and core human functionings for people" and it "reveals a different pattern of poverty than income poverty, as it illuminates a different set of deprivations". From a statistical and practical point of view (Alkire and Santos, 2011, p. 7):

The MPI reveals the combination of deprivations that batter a household at the same time. A household is identified as multidimensionally poor if, and only if, it is deprived in some combination of indicators whose weighted sum is 30 percent or more of the dimensions. The dimensions, indicators, and deprivation criteria are presented below and explained with detail in the following section.

1. Health (each indicator weighted equally at 1/6)

    • Child Mortality: If any child has died in the family

- Nutrition: If any adult or child in the family is malnourished
2. Education (each indicator weighted equally at 1/6)
    - Years of Schooling If no household member has completed 5 years of schooling
    - Child School Attendance If any school-aged child is out of school in years 1 to 8
3. Standard of Living (each of the six indicators weighted equally at 1/18)
    - Electricity If household does not have electricity
    - Drinking water If does not meet MDG definitions, or is more than 30 mins walk
    - Sanitation If does not meet MDG definitions, or the toilet is shared
    - Flooring If the floor is dirt, sand, or dung
    - Cooking Fuel If they cook with wood, charcoal, or dung
    - Assets If do *not* own *more than one* of: radio, tv, telephone, bike, motorbike or refrigerator and do not own a car or truck.

The MPI is the product of two numbers: the Headcount *H* or percentage of people who are poor, and the Average Intensity of deprivation *A* – which reflects the proportion of dimensions in which households are deprived.

According to the 2019 data collection (Figure 3), the Multidimensional Poverty Index shows the seriousness of African countries, where Niger (0.584), South Sudan (0.551), Chad (0.545), Ethiopia (0.537), Burkina Faso (0.508) and Somalia (0.5) sadly emerge for their values that are more than or equal to the threshold of 0.5. Particularly, Sub-Saharan Africa confirms its status of widespread delay and strongly summons attention. Nevertheless, the situation of some countries of South Asia is also worthy of note for the amount of population exposed to poverty. It is for example the case of India (with an MPI equal to 0.282) in 27th place of the ranking, and Afghanistan too (with an MPI equal to 0.293) in 23rd place.

Other data that can contribute to fuelling a discussion on the remarkable imbalances at international level and which reveal different facets of problematic conditions concern nutrition and consequently food safety, undernutrition, and malnutrition, both owing to the deficiency of specific nutrients and their overload, which determines overweight and obesity. There are, in fact, two categorical and counterpoised sides of the same coin: the side constituted by the countries where hunger is still an urgent and injurious problem which – with many features – involves a considerable part of the population and children, predisposing them to the onset of diseases, due to the debilitating state of the organism and its inability to respond to and counteract the infections; the side made up of the countries where overweight and obesity – together with other risk factors related to incorrect behaviour – are an assertive menace for the onset of chronic and degenerative diseases that are rife in these contexts and for different nutritional imbalances. There are also the mixed situations due to the coexistence of imbalances in deficit and in excess due to the fact that the possible combinations are multiple.

As recently summarized in the *Foreword* of the volume *2018. The State of Food Security and Nutrition in the World 2018. Building climate resilience for food security and nutrition* (da Silva et al., 2018, pp. V-VI):

In 2017, the number of undernourished people is estimated to have reached 821 million – around one person out of every nine in the world. Undernourishment and severe food insecurity appear to be increasing in almost all subregions of Africa, as well as in South America, whereas the undernourishment situation is stable in most regions of Asia. […]. […], we are concerned that in 2017, nearly 151 million children under five have stunted growth, while the lives of over 50 million children in the world continue to be threatened by wasting. Such children are at a higher risk of mortality and poor health, growth and development. […]. In addition to contributing to undernutrition, the food insecurity we are witnessing today also contributes to overweight and obesity, which partly explains the coexistence of these forms of malnutrition in many countries. […]. […]. The problem of obesity is most significant [for example] in North America, but it is worrying that even Africa and Asia, which still show the lowest rates of obesity, are also experiencing an upward trend. Furthermore, overweight and obesity are increasing the risk of non-communicable diseases such as type 2 diabetes, high blood pressure, heart attacks and some forms of cancer.

Some inputs to frame the remarkable differences and variegated combinations can for example come from the kcal/inhabitants per day, which express the ratio between the estimated average of the number of calories (kcal) which are available daily in each country and the total population of the same country (Figure 4). Considering the countries at the top and bottom of the ranking, according to the 2019 data collection, a considerable gap appears, since the maximum recorded in Austria is equal to 3812 kcal/inhabitants per day, while the minimum, recorded in the Democratic Republic of the Congo, is equal to 1590 kcal/inhabitants per day. Therefore, while several African countries denote a number of kcal/inhabitants per day less than the threshold of 2000, various countries record about the double of the values and these contexts are rather geographically spread (in addition to Austria): Belgium (3776), United States of America (3724), Turkey (3715), Montenegro (3701), Israel (3665), San Marino (3608), Ireland (3604), Italy (3583), Luxembourg (3547), Liechtenstein (3531), Egypt (3526). Obviously, the excessive number of calories can derive from a disproportionate assumption of fats, carbohydrates or animal proteins, or by a general heavy food intake. An important "duty" is related to the incorrect behaviour learnt during childhood, as for example the repeated daily assumption of chips, pizza, candies, pre-packaged snacks, sausages, sodas and the concurrent lack of the habit eating vegetables and soup, fibres, juices and centrifuges and low-fat meat. Another negative contribution can derive from an abuse of alcohol that sometimes becomes unrestrained or above all in the case of young people concentrated on specific days, for example at the week end, with serious repercussions from different points of view. Furthermore, all these aspects are combined with a sedentary lifestyle that in young people can be also worsened by an excessive use of technologies and networks, video-games, mobile phones and other mobile tools, which steal time from physical activities and outdoor games.

Similar aspects and data act as a *trait d'union* to open up the way to more detailed considerations concerning some risk factors and preventable incorrect attitudes which strongly contribute to maintaining the incidence and prevalence of chronic diseases in developed countries high.
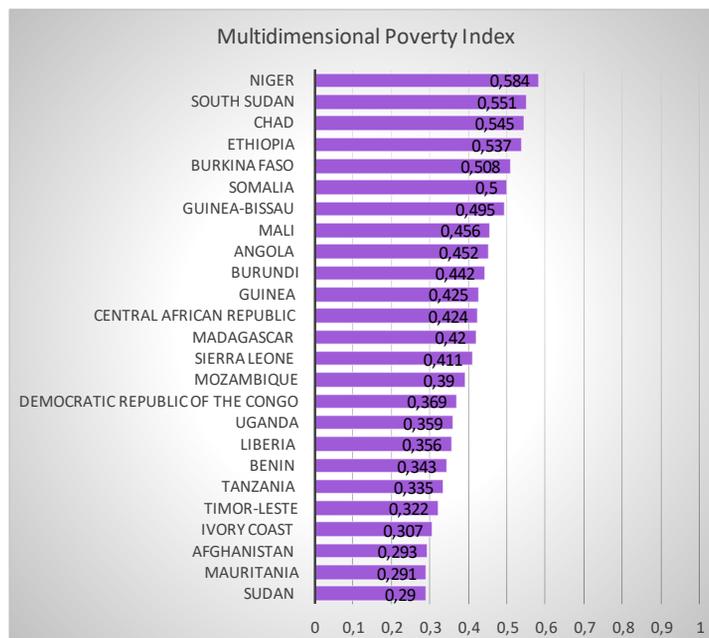

Figure 3. Multidimensional Poverty Index in the 25 countries with the highest values according to the 2019 data collection. Source: Author's elaboration on data De Agostini – DeA WING 2019.
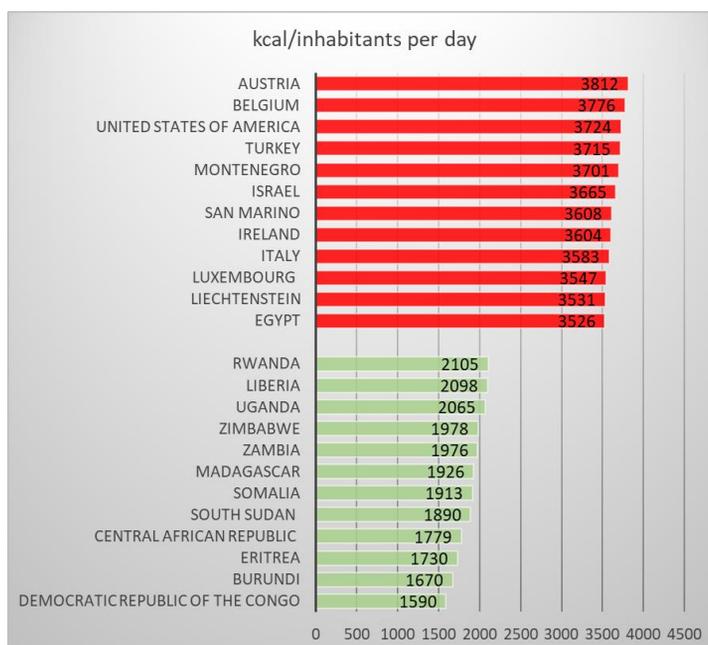
Figure 4. kcal/inhabitants per day in the 12 countries with the highest and in the 12 countries with the lowest values according to the 2019 data collection. Source: Author's elaboration on data De Agostini – DeA WING 2019.

3. Health risk factors, with particular attention to developed countries

With the improvement of the quality of life, public health interventions and vaccinations beyond the adequate coverage threshold and the related increase of life expectancy, populations are subject to other risk factors and the main causes of disability and death shift to the non-communicable diseases. Many of the risk factors that influence the onset of these diseases are constituted by correctable risk factors, since it seems that a considerable number of premature deaths due to chronic diseases could be prevented and avoided through an adequate primary prevention and by reinforcing the healthcare systems with ad hoc solutions, enabling them to respond more promptly and effectively to health care needs (D'Andrea et al., 2015, p. 34).

Therefore, cardiovascular diseases and cancer are today's scourges of developed countries and of the European countries for example, where their contribution gives rise to different combinations.

As far as concerns ischaemic heart diseases

by NUTS 2 regions, on the basis of the 2010[3] Eurostat standardized death rate per 100,000 inhabitants (Figure 5), the geographical distribution shows a considerable range of values (minimum value 29.2; maximum 590.8), with generally the highest impact in the Eastern and Northern contexts. A remarkable block of regions subject to the values of the highest class involves, in the East part of Europe, Bulgaria, Romania, Hungary, Slovakia, Czechia, and partially arrives into Austria, Germany and Poland; Finland, Sweden and Ireland also emerge in the Northern part. In the Western area, Portugal, Spain, France, Belgium and the Netherlands record widespread values falling in the lower class and Greece represents an exception with respect to the other Eastern countries. The regions of Italy, in this comparative optic, have above all values pertaining to the medium-low class.

With regard to cancer by NUTS 2 regions, according to the 2010 Eurostat standardized death rate per 100,000 inhabitants (Figure 6), the geographical distribution denotes a more restrained range of values (minimum value 184.8;

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[3] At the moment of this study, these are the most recent comparable standardised data available from the Eurostat online database in a re-processable way.

maximum 375.4) and underlines heavier conditions in the regions of Hungary, Slovenia, Slovakia, Czech Republic and Poland, in the Eastern part of Europe, and in the Netherlands and Ireland, in the Western area. In a polychrome situation, where some regions denote high values are to be found the United Kingdom, the North of France, the West part of Romania, and the North-East Greece, and also Italy is characterized by a certain variability but without values of the highest class. The regions of Switzerland, Austria, South Germany, East part of Spain, Finland and Sweden show virtuous conditions.

So, some years ago, specific interventions were recognized as "best buys", that it is to say, actions able "to produce accelerated results in terms of lives saved, diseases prevented and heavy costs avoided" (World Health Organization, 2011, p. 4):

- Protecting people from tobacco smoke and banning smoking in public places;
- Warning about the dangers of tobacco use;
- Enforcing bans on tobacco advertising, promotion and sponsorship;
- Raising taxes on tobacco;
- Restricting access to retailed alcohol;
- Enforcing bans on alcohol advertising;
- Raising taxes on alcohol;
- Reduce salt intake and salt content of food;
- Replacing trans-fat in food with polyunsaturated fat;
- Promoting public awareness about diet and physical activity, including through mass media.

In addition to these, other actions were defined by highlighting the crucial role of school and education to create the prerequisites and the environment able to accept and adopt suitable measures. They are simple and easily achievable goals that however require a context ready to absorb them and to profitably put them into practice; they also require adequate solutions for diffusion, for example through geotechnologies, web, social networks and other mass devices that can leave a tangible impression on the collective imagination. Particularly, the integrative interventions would concern (World Health Organization, 2011, p. 4):

- Healthy nutrition environments in schools;
- Nutrition information and counselling in

health care;
- National physical activity guidelines;
- School-based physical activity programmes for children;
- Workplace programmes for physical activity and healthy diets;
- Community programmes for physical activity and healthy diets;
- Designing the built environment to promote physical activity.

Synthetically, the use of tobacco, an inadequate diet and scarce physical activity (which together contribute to overweight and obesity) and the heavy use of alcohol are recognized as the main risk factors both in the "best buys" and supplementary interventions, which should be encouraged at school and at educational level. Similar measures can simultaneously produce benefits for cardiovascular diseases and cancer, and with particular reference to neoplasms the following actions have also been recommended: vaccination against Hepatitis B – a main cause of liver cancer – and human papillomavirus (HPV) – the main cause of cervical cancer; adequate attention against exposure to specific risk factors at housing or occupational level, as for example asbestos, radon and contaminants in drinking-water; screening for breast, cervical and prostate cancer.

The scientific literature (D'Andrea et al., 2015, pp. 42-47), as far as concerns cardiovascular disease (CVD), added to the above (the use of tobacco, an inadequate diet and poor physical activity, the heavy use of alcohol), other modifiable risk factors: high blood pressure; diabetes; dyslipidaemia; social determinants (i.e. work-related stress and depression have been linked to the development of cardiovascular risk factors, such as hypertension and atherosclerosis).

At the same time, the scientific literature (Boccia et al., 2015, pp. 68-75), on cancer, added to the previous other risk factors on which it is possible to intervene with suitable practices, as for example related to: eradication actions and changes in hasty dietary practices (i.e. avoidance of raw fish above all in conditions with poor hygienic measures, or incorrect cooking methods which for example cause burns and release harmful substances); evaluation and measurement of the presence of specific pollutants; aspects concerning reproductive factors and exog-

enous hormones; an indiscriminate exposure to solar radiation, particularly during childhood; assumption of some types of drugs.

As previously underlined, tobacco smoke is a critical factor for the onset of cardiovascular diseases and some neoplasms, particularly those to the lungs, especially if people approach this habit when very young and living in contexts where smoking is a rooted tradition (and moreover the exposure to passive smoke is greater) and if the number of daily cigarettes is high (more than 20 per day), above all when these are characterized by a relevant tar content (Palagiano and Pesaresi, 2011, pp. 286-287). Many studies have evaluated the impressive impact of tobacco on overall health, considering crucial aspects as for example duration, type, quantity of cigarettes and mode of smoking, and ending up by affirming that smoking has the potential faculty to kill 50% more people than HIV/AIDS and to be responsible for 10% of all deaths globally (Mathers and Loncar, 2006, pp. 2013, 2021). Therefore, smoking should be considered the most significant preventable cause of death in the developed countries, causing some million premature deaths globally each year. And it is very important because: "Cigarette smoke is a major risk factor for cardiovascular disease (CVD) and the second leading cause for CVD mortality after high blood pressure" (Keto et al., 2016, p. 1); "Tobacco use is the leading cause of lung cancer; 55% of lung cancer deaths in women and over 70% of lung cancer deaths in men are due to smoking" (O'Keeffe et al., 2018, p. 1).

In this examination, one must also bear in mind that (Schane et al., 2010, pp. 5-6):

> Complete cessation is one of the most cost-effective interventions and provides a benefit nearly as large, if not greater, than other widely used forms of treatment for the secondary prevention of cardiovascular disease. Cessation is the only known primary therapy that can significantly reduce the risk of cancer and obstructive lung disease. [And also] Light and intermittent smokers often go undetected be-

cause many of them do not view themselves as smokers and will deny their habit when asked.

Moreover, in a systematic review of up-to-date epidemiological research and evidence, it has been highlighted that "passive smoking is significantly associated with an increasing risk of many diseases and health problems, especially diseases in children and cancers" (Cao et al., 2015, p. 10). There are consequently various aspects and implications that must be considered because cigarette smoke is a huge menace for severe morbid forms and complications.

Another plague, albeit with different facets, is constituted by alcohol, which seriously contributes to serious psychiatric disorders and comorbidities (Yang et al., 2018) and causes negative implications on cardiovascular diseases and different forms of cancers, in addition to nutritional imbalances and liver cirrhosis, above all in the case of chronic abuse (Palagiano and Pesaresi, 2011, pp. 291-292). A particular risk factor, related to alcohol consumption, is represented by *binge drinking* "commonly defined as consuming five or more standard drinks per occasion [in about two hours] for men and four or more drinks for women, typically begins in adolescence" and it "is known as the '5+/4+' binge definition". In terms of acute health damage, binge drinking is connected to alcohol poisoning, impairment in cognitive functioning and motor coordination, involvement in car crashes, physical offense and sexual crime, and an increase of the risk concerning sexually transmitted infection (Chung et al., 2015, pp. 1-2). All these negative effects are obviously further accentuated in case of an even more risky behaviour, known as *high-intensity drinking* that increases the threshold to "8+/10+" or "12+/15+" drinks for women/men (Patrick and Azar, 2018, p. 6). Synthetically, the immediate possible consequences have been summarized in physical, legal, social, emotional and cognitive outcomes and disorders (Krieger et al., 2018, pp. 5-6), to the point of developing into potential different diseases in cases of prolonged use.
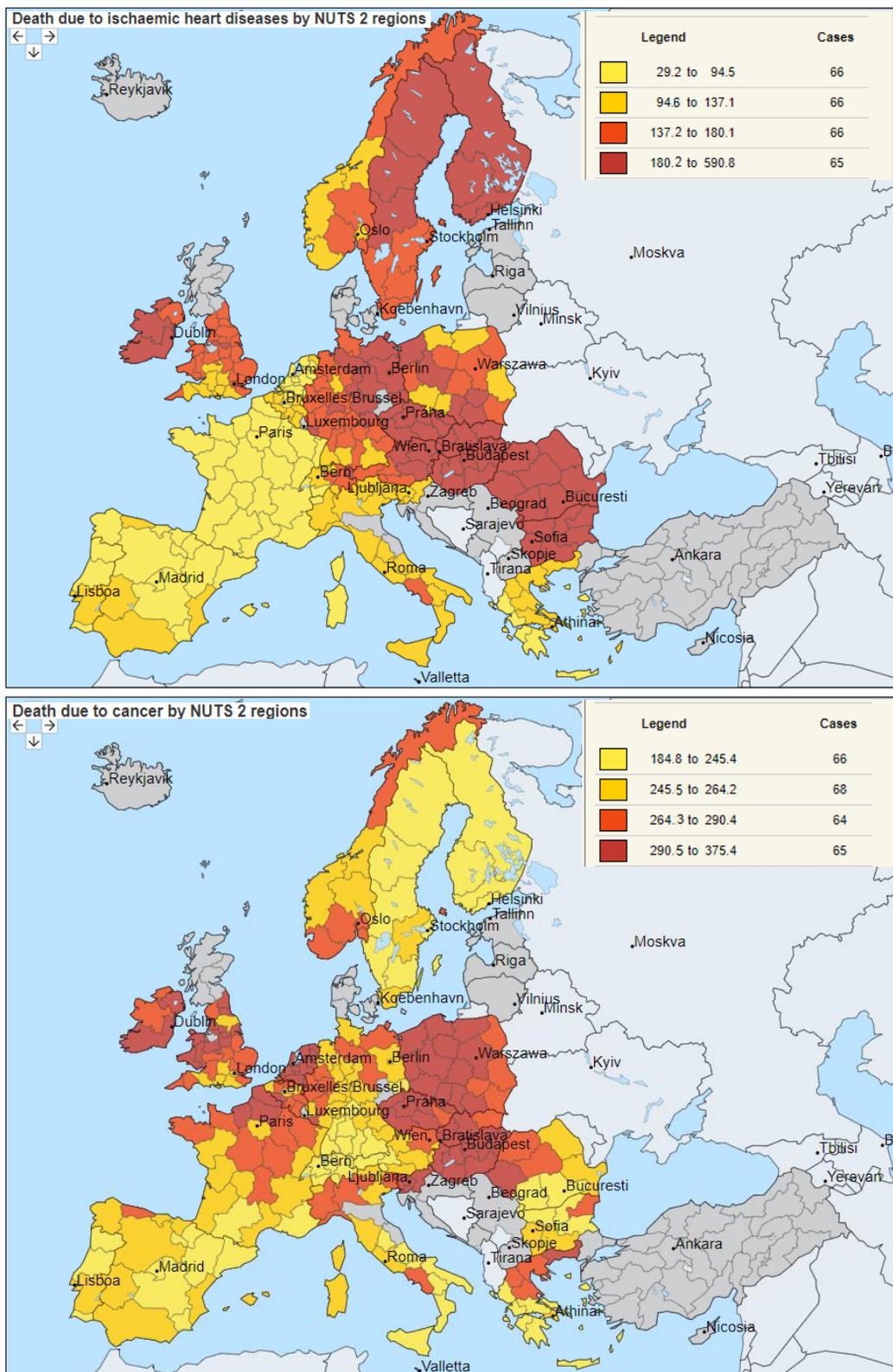
Figures 5 and 6. Above, death due to ischaemic heart diseases by NUTS 2 regions, on the basis of the 2010 Eurostat standardized death rate per 100,000 inhabitants, in the European countries. Below, death due to cancer by NUTS 2 regions, according to the 2010 Eurostat standardized death rate per 100,000 inhabitants, in the European countries. Source: Author's elaborations on data and system Eurostat (https://ec.europa.eu/eurostat/data/database) using the quantiles method.

Moreover, the unbalanced dietary intake – with high and ongoing consumption of fat sugary foods and drinks from childhood, very often with the consumption of trash food – and physical inactivity (caused by the daily routine, the sedentary attitude of many works and the exaggerated use of digital devices also in children and young people) were conducive to the spreading of overweight people and obesity (Foley et al., 2019, p. 139) that for the developed countries is considered one of the worst non-infectious global epidemics in history (Bracale et al., 2013, p. 184). Worldwide obesity, which has nearly doubled since 1980, is one of the most dramatic risk factors for various chronic diseases, above all if it remains untreated. In fact, at global scale, 44% of diabetes, 23% of ischaemic heart disease and an amount of 7%-41% of some cancers are related to overweight and obesity and an alarming number of at least 2.8 million deaths each year is caused by being overweight or obese (Colao et al., 2017, p. 1; World Health Organization, 2015)[4]. These data highlight the need for a rigorous control of the early ages first of all by parents and schools, in a proactive synergy that can improve the quality of life and reduce the number of deaths related to overweight and obesity. An excessive weight during childhood and in mid-adolescence puts children at risk of different kinds of health problems and can also affect the possibility of having a balanced and muscular body during the following years, with other repercussions at psychological level. Moreover, it sometimes makes people adopt poor diets to lose weight quickly and it causes other deficiencies in important nutrients and a loosening of muscle fibers. Therefore, since adolescent obesity tends to predict adult obesity and related morbidity, this period is an essential life phase for correct guidelines and for the active presence of parents and educators, who must carefully follow young people, both in food choice and in removing accentuated sedentary behaviour, and establishing healthy lifestyle aptitudes (Patton et al., 2016). Generally, overweight and obesity, causing severe social, psychological and physical repercussions, seem to be associated with an amplified risk of morbidity and mortality due to considerable metabolic changes connected to dyslipidaemia, sleep apnoea, type II diabetes mellitus, osteoarthritis, pulmonary diseases and hypertension, in addition to ischaemic heart diseases and some types of cancer (Materko et al., 2017, p. 108).

An excessive body mass index (BMI, calculated as the weight, in kilograms, divided by the square of the height in meters)[5] and waist circumference[6] can be predictive and symptomatic elements of future problems and must not neglected and should become aspects to be kept under systematic control. In order to consider various delicate implications of the problem, it has been recently suggested to evaluate the BMI, waist circumference (WC), waist-to-hip ratio (WHR), waist-to-height ratio (WHtR) and waist/height$^{0.5}$ (WHT.5R) as the five anthropometric predictors of the whole-body fat percentage and visceral adipose tissue mass, able to improve and analyse the characterisation of obesity (Swainson et al., 2017).

Similar attention and precautions are increasingly needed because much incorrect behaviour is widespread among the population and, in the field of diet and nutrition, an alarming tendency seems to have developed in the spreading of misleading and sometimes harmful guidelines through media channels that convincingly suggests, albeit with no scientific consensus, foods to consume or avoid. As a result, in some cases, the adherence to these (not)guidelines is conducive to the onset of deficiencies, for example, in important nutrients, vitamins and minerals, thus causing negative effects and impairment in the short-medium term.

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[4] For further synthetic data and information see also https://easo.org/media-portal/statistics/.

[5] Synthetically, a person can be considered overweight if the BMI is ≥25 and <30, while is considered obese if the BMI is ≥30. Then, in analytical studies different thresholds for women and men can be adopted, according to various countries and in order to have detailed subdivisions. For example, Calle et al. (1999, p. 1098) defined the following 12 BMI categories: lower than 18.5, 18.5 to 20.4, 20.5 to 21.9, 22.0 to 23.4, 23.5 to 24.9, 25.0 to 26.4, 26.5 to 27.9, 28.0 to 29.9, 30.0 to 31.9, 32.0 to 34.9, 35.0 to 39.9, and 40.0 or higher.

[6] According to different studies, recommended cut-off points for waist circumference can be <94 cm for men and <80 cm for women (Flegal, 2007; Abbasi et al., 2013).

4. Some perspectives for Geographical Health Education

In terms of geographical health education, the disciplinary approach – also in collaboration with other research sectors such as social medicine, epidemiology, chemistry and biology, healthcare statistics etc. – can contribute to adding innovative elements to the state of the art, both by defining shared operating systems and methodology and by finding new geo-tools for a widespread awareness to the problems.

Important inputs and perspectives are associated with the use of geotechnologies and GIS which can open up important and diversified paths to socially useful planning and research, on the basis of the needs of the population and public decision makers according to the characteristics and problems of the different contexts.

As underlined in a previous contribution, GIS applications and geotechnologies make it possible to (Palagiano and Pesaresi, 2011, pp. 317-318):

- support comparisons among different contexts, at various geographical scale, to identify the main noncommunicable diseases and causes of death, underlining analogies and dissimilarities, recognizing macro-areas with similar patterns and trends, identifying the possible causes and reflecting in a relational optic;
- conduct meticulous territorial screening, loading together detailed quantitative and qualitative data, census sections shape files, satellite basemaps, in order to conduct analytical virtual surveys in areas most affected by specific diseases, in search of sources of pollution and risk factors, displayable and geolocalizable on digital maps;
- identify the preferential ways of the spreading of infectious diseases which are transmitted through unsafe water, contamination with waste or through carriers, after identifying the location of the polluted sources or areas of the thickening of insects carrying the infection, and also calculating the possible spread radius and directions of the diseases;
- recognize the source of risk and the means of transmission of a pathology on the basis of its strong concentration in a specific zone;
- compare areas with different levels of naturalness to advance hypotheses and conduct relational analysis of air quality, expressed by predefined environmental indicators, and prevalent diseases;
- verify if there is a direct relation between the increased use of pesticides, or the massive development of industrial activities and a higher risk of contracting certain diseases, and this being the case, how far away from the context in question;
- evaluate the relationship between a high concentration of pollutants, or fine dust or other presumed harmful substances, and the prevalence of certain diseases, according to the data obtained with field surveys;
- understand if the population, observed by age group, lives appropriately close to basic health and hospital services, evaluating the need to open new facilities in areas that are poorly served;
- find the optimal localization for future care services or paediatric services in relation to the population density, the number of elderly people (since there are different needs also on the basis of the third, fourth and fifth age) or children, to the presence of similar facilities;
- make assessments, on a detailed scale, taking into account the number of public and private facilities, the relative number of beds, the medical and nursing staff who work there and, at the same time, the actual request, so as to reason over the general adequacy and recognize the areas that require an imminent strengthening of the system.

Furthermore, GIS applications and geotechnologies can provide a considerable added value for particular functionalities of spatial and temporal analysis, for example about how to draw upon hospital emergency departments to:
- process, represent and examine the access and eventual admission data, in order to identify on digital maps the areas from which the largest number of requests and inadequate requests for assistance arrive and to investigate them according to the presence of basic health services, the population's level of education, professional position and the percentage of foreign immigrants.

In fact, different studies have underlined that overcrowding in emergency departments is a pressing problem to the point of speaking of a national crisis in different countries, requiring strategical planning and strategies to decrease this critical situation (Yarmohammadian et al., 2017; Barish et al., 2012; Caporaletti et al., 2018).

As far as concerns the applied and conceptual studies which have demonstrated the important role of geotechnologies in scientific health research, they can for example be highlighted as follows:

-   "Using GIS analysis combined with molecular epidemiological surveillance can be an effective method for identifying tuberculosis transmission not identified during standard contact tracing methods" (Moonan et al., 2004, p. 9).
-   "The spatial scan statistics methodology […] has a potential use in surveillance of tuberculosis for detecting the true clusters of the disease" (Tiwari et al., 2006, p. 1).
-   "The first step in cancer control is identifying where the cancer burden is elevated, which suggests locations where interventions are needed. Geographic information systems (GIS) and other spatial analytic methods provide such a solution and thus can play a major role in cancer control" (Pickle et al., 2006, p. 1).
-   "A validated dispersion model was used as a proxy for dioxin exposure, yielding [different] exposure categories. The latter were linked to individual places of residence, using Geographic Information System technology", in order to evaluate the related risk of invasive breast cancer (Viel et al., 2008, p. 1).
-   "GIS can dynamically map malaria hot spots it also point outs the geographic locations of hot pockets within to carry out accelerated focused malaria control by State Health Authorities. […]. The main advantage of the GIS platform is fast data updating, as soon as data is entered revised maps are ready highlighting the trouble spots. […]. Web hosting can give a new perception to malaria data management, global information dissemination and sharing" (Srivastava et al., 2009, p. 8).

At the same time, various examples of WebGIS and open source GIS have been structured and tested: for HIV/AIDS management in under-resourced contexts (Vanmeulebrouk et al., 2008); to enable a suitable visualization, exploration and diffusion of prevailing vulnerabilities to vector-borne viral infections (such as dengue fever) in a dynamic online environment (Kienberger et al., 2013); to create an interactive and user-friendly geographical interface aimed at assessing primary care performance ratings (Boulos, 2004); for publishing health maps and connecting to remote Web Map Service (WMS) sources to represent and share useful geo-spatial information, data and images in an effective way (Boulos and Honda, 2006).

These possibilities are increased by specific extensions and functionalities that can provide considerable benefits in the field of geographical health education. For example, *apps* such as "Survey123" for ArcGIS[7] make it possible to submit geolocalized questionnaires which can rapidly involve a huge number of people from anywhere at all and according to a user-friendly structure. It is a digital solution that helps to capture and record information at any time and from anywhere, producing an orderly data collection directly available and processable in a GIS platform for a graphic and cartographic representation and deeper analysis. On the other hand, geocoding services with ArcGIS[8] make it possible to convert addresses into coordinates, to turn coordinates into addresses, to identify hot spots or to locate copious sensitive facilities or ones exposed to risk. In a GIS platform, highly effective 2D and 3D visualizations of multiple and related variables can be created.

The importance also has to be underlined of introducing WebGIS into public health education in schools which – in a horizontal and vertical cooperative and stimulating environment – offers much promise for learning as it can be thought and designed for proactive digital map utilization, thereby mobilizing and increasing student awareness to a better understanding of health both at local and global levels. It enables students

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[7] For an overview and specific information, with the possibility to make a free subscription for 21 days, see https://www.esri.com/en-us/arcgis/products/survey123/overview.
[8] For a general framework and some examples see https:// developers.arcgis.com/features/geocoding/.

to nurture critical and spatial thinking in a diachronic key, in order to have increased knowledge of the future problematic scenarios and to incorporate useful mental modeling into their educational process (Reed and Bodzin, 2016, pp. 6317-6318)[9].

It has also been affirmed that (Baker, 2015, p. 114):

> The capacity for webGIS to support educational priorities like STEM [Science, Technology, Engineering, Mathematics] and career readiness, instructional practices like Project Based Learning and constructivism, and overcome previous technical issues like data scale, size, and complexity all add to the advancement of webGIS in education. […]. The influences of webGIS will, if it hasn't already, change the landscape of geographic and science education in schools and universities around the world.

Further captivating perspectives are opened, in a profitable process of geographical health education, by the possibilities offered by story maps and digital storytelling which make it possible to give space to creativity within an environment of (space-time) representation that maintains strict criteria of data and image restoration. It is possible to elaborate very incisive story maps focused on different topics of health, by choosing among the different available templates, according to the aims of the applications and on the basis of the documents which students (coordinated by the teachers) desire to enhance. After having produced their conscientious story maps, students can share them by the web in an atmosphere of colourful enthusiasm, activing a circuit of shared applications that can act as a stimulus for similar experiences. It also permits them to use and test a new way to document, moving towards a particular form of digital geographic journalism which pushes to integrate different kinds of maps, photos (also shooting during field surveys) and texts in a pre-structured harmonious template.

From a didactical point of view – using geotechnologies and similar GIS applications,

where geography, interdisciplinary approach and specific geo-tools are synergically connected to pursue goals of community usefulness – it makes possible to move towards enterprising actions, as for example to (Pasquinelli d'Allegra, 2016, pp. 55-60): organize and animate learning situations in an innovative way; manage and finalize (on contingent problems) the progression of learning; engage and inspire in an active learning process, starting from the cooperative learning and arriving at the flipped classroom; encourage working group strategies also through common projects and elaborations; support the profitable conjunction between applied research and laboratory didactics; use geotechnologies for stimulating critical approaches and translate theoretical contents into concrete skills; promote an active citizenship, in a transcalar perspective.

All these represent a founding nucleus, focussing the attention on aspects related to health, quality of life, correct behaviour to adopt and the respect for inequalities.

In this way and with the support of various social networks, it is also possible to think of spreading guidelines and recommendations through immediate and vivid modalities that can help to reach remarkable goals, involving a huge audience, according to shared and regulated planning. Health education also needs to pass through ad hoc awareness campaigns that – enhancing the involvement capacity of GIS and geotechnologies web applications and the impressive use of social networks – can help to rectify incorrect behaviour and to reduce preventable causes of disorders and deaths, efficaciously acting on risk factors right from childhood and adolescence.

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[9] Lesson series supported by geotechnologies seem to significantly concur to the development of students' spatial and relational thinking, also supporting interdisciplinary approach and proactive interactions (Favier and van der Schee, 2014).

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