



# Extending heat adaptation: examples from Italian regions

## MAIN FINDINGS

- Climate change threatens population health in many ways and effective adaptation measures targeted at alleviating this burden are required.
  - Extreme weather events are predicted to intensify in magnitude, frequency, and duration in the upcoming years.
  - Italy is already affected by regular heat waves; a national adaptation plan for protecting public health is implemented at local levels with some variation.
  - Education programmes for social and health workers are usually considered effective but are not mentioned in the regional plans of the 4 regions under study.
  - Cooling centres are mentioned only in 1 out of 4 regional plans.
- Health surveillance of vulnerable people is part of 2 of the 4 regional plans.

## Summary

This policy brief analyses Italian regional and city-level heat-adaptation strategies in the social and health care sector. Climate change already threatens population health in various ways and effective adaptation measures targeted at alleviating this burden are required. In this policy brief, we present the responses of responsible actors in the Italian health and social care sector. We conduct a comparison of local adaptation measures across Italian regions based on qualitative analysis of policy documents.

The results suggest that educational trainings for social and health workers, availability of air-conditioned places, and distribution of daily warning bulletins to the public are not diffused in the regions under investigation. Based on the findings, recommendations to decision-makers include the extension of the current heat strategies with educational programmes, heat-related mobile application, and the adoption of sustainable cooling approaches.

The brief is organized as follows: section 1 introduces the interrelation of climate change and health, followed by section 2 presenting the overview of the research project and section 3 discussing the results of the research findings. To conclude, section 4 suggests some recommendations for decision-makers. The policy brief is part of the CHAMPS project (Climate change and Health: Adapting to Mental, Physical and Societal challenges) funded by the Academy of Finland.

## 1. Health care adaptation is needed as extreme weather events become more common

The World Health Organization (2018) has defined climate change as the greatest challenge to public health in the 21st century. Health effects include direct challenges, for instance through extreme weather events, as well as indirect ones, including reduced food supplies resulting from agricultural losses. As future predictions estimate a great impact of climate change on societies even with mitigation strategies in place, complementary adaptation measures and evidence for improving such adaptation are of utmost importance. While mitigation strategies are aimed at “reducing greenhouse gas emissions now and in the future” (De Donato and Michelozzi, 2014), adaptation consists of “strategies, policies, and measures (...) undertaken now and in the future to reduce the burden of climate-sensitive health determinants and outcomes” (Kovats and Ebi, 2006).

Extreme weather events, such as heatwaves, already threaten public health. For example, the European 2003 heatwave had an estimated excess mortality of 70 000 people, 15 000 of which occurred in France alone (Robine et al., 2007). Such events are predicted to intensify in magnitude, frequency, and duration in the upcoming years, even in a low-emission scenario. These experiences and predictions have put pressure on developing strategies to cope with extreme weather events and protect public health. At a supranational level, the WHO/Europe has provided guidance on heat-health adaptation plans (HHAP) for European countries (Martinez et al., 2019). More recently, the European Union has also promoted “ClimateADAPT”, a new EU Adaptation Strategy to build climate-resilient societies equipped with the European Climate and Health Observatory, as a part of the broader Green Deal Action plan (European Climate and Health Observatory, 2021).

While literature on adaptation strategies on climate change is growing, heat adaptation and consequent research have usually focused on urban planning strategies, leaving the literature on the health and social care sector adaptation to be generally scarce.

In Europe, countries on the Mediterranean basin have been identified as being at the highest risk for heatwaves. Yet, in the upcoming decades, heatwaves are likely to affect also

**Alessia Greselin, research assistant**  
Finnish Institute for Health and Welfare

**Maria Vaalavuo, PhD, research manager**  
Finnish Institute for Health and Welfare

## How the research was conducted:

In our study, we have looked at whether and how national guidelines on social and health surveillance have been included as parts of the regional plans.

For that purpose, we have selected regional plans for 4 different regions in Italy based on digital accessibility in their official websites (e.g., Ministry of Health or Regional web pages). The chosen regions vary in their socio-economic as well as weather conditions.

The regional plans have been analysed in terms of 1) mentioning or not the social and health intervention points from the national guidelines, 2) how those points are mentioned, and 3) how do those 4 regional plans differ from one another.

Based on the results, we have proposed some recommendations for decision-makers.

countries that are not usually associated with heat anomalies, like the Nordic countries. Indeed, Kim et al. (2018) estimate an increase in the number of days above 20°C from 6.1 to 9.4 days per year in Finland, with consequent negative heat effects on public health in the country that have been experienced to some extent already during recent heatwaves (Astone & Vaalavuo, 2021; Kollanus et al., 2021).

Analysing adaptation strategies from countries on the frontline provides useful insights for other countries that might be faced with the same challenges at a later stage. In this policy brief, we shed light on local implementation and provide recommendations for decision-makers. Policy documents from regions constitute the main data for the study and are retrieved from public authorities' official communication channels, mainly those listed by the Ministry of Health in the heatwaves dedicated webpage. Based on the analysis, recommendations will address 1) Italian regional and city-level decision-makers with possibilities of improving the plan, and 2) Finnish decision-makers with suggestions of strategies that might suit the Finnish context.

## 2. Social vulnerability

Climate change risks are determined by the interconnection of different factors, including *hazard* (e.g., heatwave), *vulnerability* (e.g., old age), *exposure* (e.g., being in a hot environment) and *response* (Simpson et al., 2021). Social vulnerability represents a key aspect to be considered when adaptation in the health care sector is planned. The health effects of heatwaves vary considerably across population groups and not all individuals face a similar risk.

Previous studies on the effects of heatwaves on morbidity and mortality suggest that specific factors can increase the individual risk, for instance old-age (Cheng et al., 2018), low socio-economic status (Ellena et al., 2020), urban setting (D'Ippoliti et al., 2010; de' Donato and Michelozzi, 2014; Ellena et al., 2020), pre-existing medical conditions (de' Donato and Michelozzi, 2014; Xu et al., 2019), and living alone (Gronlund et al., 2015). Evidence shows that not only physical health, but also mental health diseases affect individual vulnerability to heatwaves and can even worsen patients' conditions, as for example in the case of Alzheimer's disease (Xu et al., 2019).

**Table 1. Heatwave adaptation strategies.**

Individual level	Population level
<ul style="list-style-type: none"> <li>• Rise in awareness</li> <li>• Behavioural changes</li> <li>• Use of air conditioning</li> </ul>	<ul style="list-style-type: none"> <li>• Warning systems</li> <li>• Social and public health prevention measures</li> <li>• Emergency protocols</li> </ul>

Source: adapted from De Donato and Michelozzi, 2014, p. 622.

Worldwide, heatwaves affect a considerable number of countries, forcing them to advance several adaptation policies. Considering developed countries, adaptation policies have mostly been pursued in responsive terms after a severe heatwave occurred, such as in the case of the heatwave in Europe in 2003, in Chicago, the USA, in 1995 and in Victoria, Australia, in 2009. While these places are located in different parts of the world, De Donato and Michelozzi (2014) highlight some common heat adaptation strategies, especially among European countries, that are usually carried out both at an individual and population level, briefly presented in Table 1.

However, realisation of heat adaptation strategies and their extent depend on national and local adaptation plans. As highlighted by Jurgilevich et al. (2017), vulnerability assessment to climate change is conducted differently in countries worldwide. While some countries draft adaptation plans based on current vulnerability to climate risk, others consider future risk. Furthermore, vulnerability assessment is either interpreted as a static or dynamical process by countries (Jurgilevich et al., 2017).

### 3. Italy as a case study

Italy is located on the Mediterranean Sea with a diverse landscape, including three different main climate types: warm temperature climate, snow climate, and polar climate (Ministry for the Environment, Land and Sea, 2017). Such differences in the national territory are associated with various climate change hazards, including flood, drought, and heatwave, and additional health risks resulting from exposure to air pollution among others (WHO, 2016). Considering the risk of heatwave, the National Heat Plan in Italy has entered into force in 2004 as a response to the intense 2003 heatwave in Europe, and it includes joint work of actors from the national (Ministry of Health) and the local (regions and cities) level, with guidelines being drafted by the former and implemented by the latter.

In contrast to Finland, where a national climate change adaptation plan for social and health care mentions also slips, mental health, health and safety at work, vector-borne diseases, and room air quality in addition to heatwaves, Italy has a more general climate change plan overviewing vulnerability, impacts, and adaptation in all sectors. However, both countries highlight the importance of research and up-to-date information to prepare effective adaptation plans.

While Italy is affected by several extreme weather events, we only focus on the national and regional plans on heat adaptation. The national heat plan has been later proposed as a blueprint for adaptation plans to other climate exposures threatening health, such as those resulting from air pollution (Ministero della Salute, Centro Nazionale Controllo e Prevenzione Malattie and Dipartimento di Epidemiologia del Servizio Sanitario Regionale - Regione Lazio, 2020). While health and safety at work are not specifically mentioned as key points in the Italian adaptation plan, a guide for employees and employers exposed to the phenomenon has been drafted.

As overviewed in Table 2, the national plan is developed alongside six key points, ranging from city-specific Heat Health Watch Warning Systems (HHWWS) to social and health interventions, providing a comprehensive framework to mitigate the effects of heat on people's wellbeing. The Lazio Region Department of Epidemiology represents the National Coordination Centre for the heat response and works jointly with national-level as well as regional-level and local-level authorities to implement the plan. In particular, regional and local actors are responsible for managing and implementing the points 3, 4 and 5 through a regional and/or a local heat plan.

**Table 2. Key components of the national heat-health effects prevention plan.**

Key points	Description	Actors involved
1. City-specific Heat Health Watch Warning Systems (HHWWS)	<ul style="list-style-type: none"> <li>Prediction models of city-specific mortality rates based on weather conditions</li> <li>National warning bulletins for 27 cities, including the following 24, 48 and 72 hours according to 4 levels, with Level 0 being the zero-risk level to Level 3 being the heatwave alert level</li> </ul>	Lazio Region Department of Epidemiology, Meteorological Service of the Department of Civil Protection
2. A rapid realtime mortality surveillance system	<ul style="list-style-type: none"> <li>Time series analysis of the relationship between weather and mortality</li> </ul>	Municipal Registry Offices, Lazio Region Department of Epidemiology
3. Local registries of at-risk subgroups of the population	<ul style="list-style-type: none"> <li>Identification of at-risk groups through population registries (in 17 cities) or general practitioners (GPs, in 8 cities)</li> <li>Registries updated every year before summer</li> </ul>	Ministry of Finance (income data), municipality (population registries, health information systems), region (Regional Hospital Discharge Registry), GPs, social workers → regional and local plans
4. National prevention guidelines – implemented by local authorities	<ul style="list-style-type: none"> <li>Social interventions (educational campaign, telephone helpline, social support services, availability of air-conditioned places, educational programmes for social and health workers)</li> <li>Health interventions (health surveillance of susceptible individuals, local registries of susceptible individuals, emergency protocols)</li> </ul>	Region (Regional Health Authority, Regional Department of Civil Protection), municipality, Local Health Authority, GPs, medical and social personnel → regional and local plans
5. Local network for the distribution of the warning bulletin	<ul style="list-style-type: none"> <li>Creation of city-specific warning bulletins at the national level</li> </ul>	→ regional and local plans
6. Evaluation of warning systems and prevention programmes	<ul style="list-style-type: none"> <li>Mortality surveillance data</li> </ul>	Lazio Region Department of Epidemiology

Source: Michelozzi et al. (2010).

Considering the Italian context, where cities are responsible for implementing the strategy in the social and health care sectors and where sub-national differences are significant, experiences from different regions and cities on how adaptation policies have been realised represent an interesting subject of study. Schifano et al. (2012) conducted an analysis of 16 Italian cities comparing heat mortality rates in years preceding and following the 2003 heatwave and the consequent introduction of the national plan in 2004. As a main result, heat mortality rates have mainly decreased across cities (e.g., Palermo, Sicily) with some exceptions (e.g., Bologna, Emilia-Romagna), highlighting the importance of introducing such heat adaptation plans.

## Main recommendations

- National-level mapping of social and health care workers' competences and educational programmes to prepare them against increasing climate change risks (e.g., from heatwaves).
- Digital tool to share the daily bulletin and the recommendations with the citizens (e.g., mobile phone application).
- Sustainable cooling strategies during heatwaves for health and social care centres.

In addition, significant sub-national socio-economic differences are portrayed by the EU NUTS 1 classification (European Commission, 2020) in 5 macro-regions, namely North-East, North-West, Centre, South and Islands (regions illustrated in Figure 1 in different colours). As such, chosen regions and cities for the research will be selected from different macro-regions to gain a more comprehensive perspective on the local plans. The regions of Emilia-Romagna (1), Umbria (2), Campania (3) and Sicily (4) were chosen due to the availability of data for the analysis. Additional information on the chosen cities and regions are overviewed in Table 3.

**Figure 1. Macro-regions in Italy according to NUTS 1 classification.**



**Table 3. Overview of the chosen regions and their capital cities.**

City Region	Regional GDP/capita (in 1000 euros)	Region population size		Capital city population size		City temperature anomaly in 2019* expressed in Celsius degrees (compared to 2000–2016)	Hot days anomaly** in 2019 expressed in days (compared to 1971– 2000)
			% of which aged >65 years		% of which aged >65 years		
Bologna Emilia- Romagna	36.7	4 445 549	24.2	1 019 539	24.4	+1.8	+65
Perugia Umbria	26.2	865 013	26.2	643 311	25.5	+2.4	+123
Naples Campania	17.3	5 679 759	19.7	3 017 658	18.7	+1.4	+47
Palermo Sicilia	17.9	4 840 876	22	1 214 291	21.6	+0.4	+4

Source: data retrieved from ISTAT database (ISTAT 2020a, 2020b, 2021)

\*most recent data on ISTAT.

\*\*number of days in which daily maximum temperature is above the 90 percentiles. Michelozzi et al. (2010).

#### 4. Education, cooling centres and health surveillance are limited

Heat plans from the chosen regions include the main points of regional and local interventions in health and social care (points 3 and 4 from Table 2), which are briefly presented in Table 4. Common points across the regions show that vulnerable groups are identified through a combination of municipal or regional registry information with medical conditions (through hospital discharges or GPs), the main difference being the age risk group being interpreted either as 65+ or 75+ years old. Considering social and health interventions, some points from the national guidelines are either missing in all or half of the regional plans.

**Table 4. Overview of the key findings from regional plans.**

		Emilia-Romagna	Umbria	Campania	Sicily
Local registries	Identification of at-risk groups	Elderly 75+, dismissed from hospital and living alone	Elderly 65+	Elderly, age group not specified	Elderly 65+, hospitalized in the previous 2 years
Social interventions	Educational campaign	Informative interventions	Recommended relief actions	Brochures with recommendations	Brochures with recommendations
	Telephone helpline	Call-centre	Contact with GPs	Call-centre	Call-centre
	Social support services	Support for vulnerable people at home and at home care	Social support for transferred and non-transferred vulnerable people	Strengthening of home care and elderly centres	Delivery of primary goods and help with commissions
	Availability of air-conditioned places	-***	- (availability of "adequate environments")	-	Opening of cooling centres
	Educational programmes for social and health workers	-	-	-	-
Health interventions	Health surveillance	-	Surveillance of both transferred and non-transferred vulnerable people	-	Regular calls or visits by health personnel
	Emergency protocols	- (coordination with Civil Protection mentioned)	Dedicated structures to host vulnerable people	Dedicated bed in hospitals and health care homes	Dedicated bed in hospitals and elderly care homes

#### 5. Recommendations

Heatwaves represent a current and increasing risk for population health and well-being in Italy. In line with results from other countries showing a decrease of heat-related mortality after actualising heat-health adaptation plans (HHAP) in the last decades (Martinez et al., 2019), the introduction of HHAP in 2004 has also suggested a decrease in heat mortality in Italian cities (Schifano et al., 2012). While analysing some of the regional plans, a considerable portion of points has been implemented by the four regions under study, with minor differences in the application. Yet, some points from the national guidelines have been detected as missing in either the half or the totality of the chosen regions. Our recommendations will primarily focus on those specific points.

To begin with, education programmes for social and health workers have been left aside of regional plans in all the chosen regions. While health and social care services are usually responsibility of regions and local health / social authorities, heatwaves and, more generally, climate change constitute a public health concern at a national level. We would therefore

suggest first a nation-level mapping of employees' knowledge and skills as planned in Finland and, based on this, develop an education plan to prepare social and health care workers in the front line to be prepared to manage the health risks resulting from extreme weather events, such as heatwaves. Even though Italian cities are now affected differently by heatwaves, evidence shows that even current low-risk areas might be affected in the future, and that heat-related morbidity and mortality are highest during the first heatwave of the season. As such, preparedness in the front line of social and health care workers in the whole country would be required. A framework for heat preparation in the health care sector has been advanced by Blashki et al. (2011, Table 5) for the Australian context and could be useful in Italy as well.

**Table 5. Heatwave preparation in the healthcare sector.**

PERSONNEL	INFRASTRUCTURE	COORDINATION
<p>Prepare the frontline of health workforce (e.g., ambulances and emergency services) to be prepared to manage the symptoms of heat stress</p> <p>Prepare, equip, and make available mobile personnel ready to respond to critical bushfire events</p>	<p>Develop strategies to ensure essential back-up power supplies (e.g., for crucial air conditioning)</p> <p>Develop capacity to deploy temporary infrastructure to ensure delivery of the range of health services required to respond to fire in affected regions</p>	<p>Develop fully integrated bushfire/heatwave health response plans (e.g., Heatwave plan)</p> <p>Heatwave warning systems and the use of prerecorded health messages</p> <p>Collaborate with urban planning and housing regulators to advocate for more appropriate housing design</p> <p>Communication in workplaces to reduce occupation-related heat stress</p>

Source: adapted from Blashki et al., 2011, pp. 138S-139S.

Furthermore, while HHWS daily bulletins and guidelines are shared in institutional websites or in public areas and vulnerable groups are usually reached by GPs, additional distribution of the news and recommendations could be extended to a greater portion of the society, including care givers or relatives of at-risk individuals. A valuable example would be the development of a city- or region-specific mobile app based on the “Caldo e Salute” [Heat and Health] app designed in Rome and Lazio Region, sharing daily bulletins and behavioural recommendations during heatwaves.

Lastly, while the creation of cooling centres and the recommendation to use air-conditioner can mitigate the heat burden on population health, further consideration on the impact of such energy-consuming strategies in the mitigation goals of the health sector should be mentioned. Evidence from hospitals in Argentina, China, and the Philippines on sustainable cooling in health care facilities (Healthcare Without Harm) provide an example on how to realise heat adaptation without interfering in the overall climate change mitigation objectives for the health care sector.

## 6. Conclusion

Extreme weather events have become more frequent and, as a consequence of global warming, are predicted to intensify in the future. Heatwaves represent a current and future threat to public health in Italy, and its effects are increasingly studied also in Finland as the phenomenon becomes more common. As a response to the heat risks, adaptation plans are drafted both in Italy and Finland, even though with some differences. While Italy has a more general climate change framework for all sectors and heat-specific health care adaptation plans, Finland has a new climate change adaptation plan focused on the health and social care sector (Ministry of Social Affairs and Health, 2021). Expected effects of climate change are considered under different perspectives in the country, with mental health effects being among the concerns in Finland, while mainly physical effects seem to be considered in Italy. For both countries, evidence on heatwaves represent an important point for adaptation

plans, monitoring and observing the phenomenon as well as investing in research. However, given the decentralisation of heat adaptation in Italy, it is not specified how the monitoring of local implementation of the plans is performed by the National Coordination Centre.

To conclude, as main recommendations to Italian decision-makers, further consideration of education for health and social care workers, extension of the coverage of people reached by HHWS news and heat recommendations, and sustainable cooling strategies are suggested as valuable points to consider in the regional and local plans. Considering the Finnish context, a heat-specific adaptation plan could provide a valuable framework to respond to the increasing risk in the upcoming decades.

---

## References

- Astone, R. and Vaalavuo, M. (2021) 'Climate change and health: Consequences of high temperatures among vulnerable groups in Finland', THL Discussion Paper 41/2021.
- Blashki, G. et al. (2011) 'Preparing Health Services for Climate Change in Australia', *Asia Pacific Journal of Public Health*, 23(2\_suppl).
- Cheng, J. et al. (2018) 'Heatwave and elderly mortality: An evaluation of death burden and health costs considering short-term mortality displacement', *Environment International*, 115.
- D'Ippoliti, D. et al. (2010) 'The impact of heatwaves on mortality in 9 European cities: results from the EuroHEAT project', *Environmental Health*, 9(1).
- De' Donato, F. and Michelozzi, P. (2014) 'Climate Change, Extreme Weather Events and Health Effects', in Goffredo, S. and Dubinsky, Z. (eds) *The Mediterranean Sea*. Dordrecht: Springer Netherlands.
- Ellena, M. et al. (2020) 'Social inequalities in heat-attributable mortality in the city of Turin, northwest of Italy: a time series analysis from 1982 to 2018', *Environmental Health*, 19(1).
- European Climate and Health Observatory (2021) EU adaptation policy. Available at: <https://climate-adapt.eea.europa.eu/observatory/policy-context/european-policy-framework/eu-adaptation-policy> (Accessed: 8 November 2021)
- European Commission. Statistical Office of the European Union. (2020) Statistical regions in the European Union and partner countries: NUTS and statistical regions 2021 : 2020 edition. LU: Publications Office. Available at: <https://data.europa.eu/doi/10.2785/850262> (Accessed: 29 October 2021)
- Gronlund, C.J. et al. (2015) 'Vulnerability to extreme heat by socio-demographic characteristics and area green space among the elderly in Michigan, 1990–2007', *Environmental Research*, 136.
- Healthcare Without Harm (2021) 'Energy efficiency and cooling audits in health care facilities in Argentina, China, and the Philippines'. Available at: <https://noharm-global.org/energy-and-cooling>
- ISTAT (2020a) 'Tavola 1 - Differenza della temperatura media annua 2018 dal valore medio del periodo 2007-2016 e rispettiva anomalia 2018 dal valore climatico 1971-2000 nei comuni capoluogo di provincia/città metropolitana - Anno 2018, periodo 2007-2016, valore climatico 1971-2000 (valori assoluti in gradi Celsius)'. Available at: <https://www.istat.it/it/archivio/242010>
- ISTAT (2020b) 'Tavola 5 - Indici di estremi di temperatura nei comuni capoluogo di regione. Anomalia del 2018 e del valore medio dell'indice 2007-2016 dal valore climatico 1971-2000 - Anno 2018, periodo 2007-2016, valore climatico 1971-2000 (valori in gradi Celsius e numero di giorni)'. Available at: <https://www.istat.it/it/archivio/242010>
- ISTAT (2021) 'Popolazione residente comunale per sesso anno di nascita e stato civile'. Available at: <http://dati.istat.it/Index.aspx?QueryId=18462>
- Kim, S. et al. (2018) 'Heatwaves in Finland: present and projected summertime extreme temperatures and their associated circulation patterns: HEATWAVES IN FINLAND', *International Journal of Climatology*, 38(3).



Kollanus, V. et al. (2021) 'Mortality risk related to heatwaves in Finland – Factors affecting vulnerability', *Environmental Research*, 201, 111503.

Kovats, R.S. and Ebi, K.L. (2006) 'Heatwaves and public health in Europe', *European Journal of Public Health*, 16(6).

Jurgilevich, A. et al. (2017) 'A systematic review of dynamics in climate risk and vulnerability assessments', *Environmental Research Letters*, 12(1), 013002.

Michelozzi, P. et al. (2010) 'Surveillance of Summer Mortality and Preparedness to Reduce the Health Impact of Heatwaves in Italy', *International Journal of Environmental Research and Public Health*, 7(5).

Ministero della Salute, Centro Nazionale Controllo e Prevenzione Malattie and Dipartimento di Epidemiologia del Servizio Sanitario Regionale - Regione Lazio (2020) 'Piano Attività estate 2020 in relazione all'epidemia COVID-19'. Available at: <https://www.salute.gov.it/portale/caldo/dettaglioPubblicazioniCaldo.jsp?lingua=italiano&id=2921>

Ministry for the Environment, Land and Sea (2017) Seventh National Communication under the UN. Framework Convention on Climate Change. Italy. Available at: [https://unfccc.int/sites/default/files/resource/258913076\\_Italy-NC7-2-Italy%20Seventh%20National%20Communication%20Final.pdf](https://unfccc.int/sites/default/files/resource/258913076_Italy-NC7-2-Italy%20Seventh%20National%20Communication%20Final.pdf)

Ministry of Social Affairs and Health (2021) Ilmastonmuutos terveys- ja sosiaalisektorilla. Sosiaali- ja terveysministeriön ilmastonmuutokseen sopeutumisen suunnitelma (2021-2031). [Climate change in health and social care sector. The adaptation plan (2021-2031) of the Ministry of Social Affairs and Health.] Helsinki: STM

Robine, J.-M. et al. (2008) 'Death toll exceeded 70,000 in Europe during the summer of 2003', *Comptes Rendus Biologies*, 331(2).

Schifano, P. et al. (2012) 'Changes in the effects of heat on mortality among the elderly from 1998–2010: results from a multicenter time series study in Italy', *Environmental Health*, 11(1).

Simpson, N.P. et al. (2021) 'A framework for complex climate change risk assessment', *One Earth*, 4(4).

World Health Organization (2016) 'Health and climate change: country profile 2015: Italy'. Available at: <https://www.who.int/publications/i/item/health-and-climate-change-country-profile-2015-italy> (Accessed: 29 December 2021)

World Health Organization (2018) Health and climate change. Available at: <https://www.who.int/news-room/facts-in-pictures/detail/health-and-climate-change> (Accessed: 14 September 2021)

Xu, Z. et al. (2019) 'Heatwaves, hospitalizations for Alzheimer's disease, and postdischarge deaths: A population-based cohort study', *Environmental Research*, 178, 108714.

#### **Suggested citation:**

Greselin, A., Vaalavuo, M. (2022) Extending heat adaptation: examples from Italian regions. Data Brief 3/2022. Finnish Institute for Health and Welfare, Helsinki.



**Finnish Institute for Health and Welfare**

ISBN 978-952-343-812-5 (online publication)

ISSN 2323-5179 (online publication)

<http://urn.fi/URN:ISBN:978-952-343-812-5>