Energy Research & Social Science 102 (2023) 103188

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Shifting sustainable lifestyle practices and behaviour during times of pandemic disruptive change: Implications for on-going socio-technical transitions

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ARTICLE INFO

Keywords:
COVID-19
Social practices
Behaviour change
Energy use
Transport
Food consumption

ABSTRACT

COVID-19 has extensively reshaped lifestyle practices, supply chain dynamics, and climate mitigation efforts. The resulting crises from the pandemic in relation to local and community sustainability practices have not yet been investigated in depth. There is a need to explore the individual characteristics and responses from rapid transitions of lifestyles at various scales. Analysing how the COVID-19 pandemic has shaped and altered sustainable living practices, and the motivations supporting them, has yet to be determined but is crucial to gain further insight to improve management responses to large-scale disruptive change. Presenting empirical findings from semi-structured interviews in New Haven County, Connecticut, this study elucidates the ways in which the lifestyles have been altered and how they responded while specifically highlighting the consequences for behavioural routines and sustainable lifestyle practices. As a result of lockdowns and pandemic mitigation responses, individual sustainability engagement fluctuated with participants shifting dietary, mobility, and energy and food consumption patterns. Specifically, participants emphasised substantial decrease in daily travel during initial phases of the pandemic alongside increased online shopping and energy use at home. Though changes to consumption practices were replaced former habits with unsustainable ones, individuals also noted how they co-opted the pandemic over time to pursue sustainable actions at home. As a macro-level 'window of opportunity' and disruptive change, this study illustrates how sustainable lifestyle practices were reshaped; some by choice, some by force, and some reflecting a forced choice. These findings have clear implications for the stability of maintaining sustainable practices influenced by landscape-level shocks.

1. Introduction

The COVID-19 pandemic has extensively changed lifestyle practices, supply chain dynamics, and climate mitigation efforts. The continued disruption of the pandemic coupled with the worsening state of the climate in the United States disproportionately impacts vulnerable populations, particularly socio-economically deprived communities [1]. These issues, combined, constitute compounding crises that make management responses and adaptation strategies to alleviate such disasters burdensome [2]. In the State of Connecticut, residents face multiple socio-economic, environmental and public health implications resulting in direct and indirect inequities and inequalities becoming more prominent. While Connecticut is among 10 states with the highest median household income and is one of the nation's healthiest states, major disparities exist by race and ethnicity. Black and Hispanic state residents are more likely to suffer severe health outcomes of chronic conditions like asthma and cancer, live in poor health, and die younger compared to white residents [3]. Prior to the pandemic, sustainable lifestyle practices became increasingly common among many communities to address the climate crisis [4–6]. Many cities and counties across Connecticut, such as New Haven, have taken preventative measures and created city-wide goals towards a cleaner and healthier environment for its residents and tourists, the COVID-19 pandemic prevented and halted progression [7].

The resulting crises from the pandemic in relation to local and community sustainability practices have not yet been investigated in

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https://doi.org/10.1016/j.erss.2023.103188
Received 16 November 2022; Received in revised form 25 April 2023; Accepted 22 June 2023
Available online 14 July 2023

depth; and there is a need to explore the individual characteristics and responses from rapid transitions of lifestyles at various scales. This is especially necessary for areas with recorded income disparities and systemic inequities, which includes the State of Connecticut [8,9]. Analysing how the COVID-19 pandemic has shaped and altered sustainable living practices, and the motivations supporting them, has yet to be determined but is crucial to gain further insight to improve management responses to large-scale disruptive change. The implications around how this influences sustainable practices have yet to be determined. From this, addressing issues such as widening inequalities and spatially concentrated environmental degradation such as littering and loss of employment, especially for ethnic and minority populations have become increasingly challenging. Consequently, the COVID-19 pandemic has shaped the way in which individuals live, socially interact, and communicate with one another [10]. It is apparent that empirical findings are essential to understand the specificities and nuanced impacts that COVID-19 has had on sustainability, especially lifestyle change and the implications for sustainable habit formation and continuation.

This study therefore contributes initial empirical findings to elucidate these issues. In so doing, it explores the ways in which the lifestyles of residents in New Haven County, Connecticut have been altered and how they responded while specifically highlighting the consequences for behavioural routines and sustainable lifestyle practices. This study specifically explores the ways in which the COVID-19 pandemic reshaped three lifestyle practices: (1) energy use; (2) transport dynamics; and (3) food consumption. Understanding the changes in these three areas of peoples' lives can indicate whether management responses have improved or exacerbated individual attempts to practice sustainable living while minimising the impacts of compounding crises in the form of the pandemic and climate change.

This article addresses the following research questions: What are the ways in which the COVID-19 pandemic has changed sustainable lifestyle patterns of residents in New Haven County, Connecticut? Secondly, what are the implications of these changes for sustainable practices impacted by disruptive change? These questions are important to answer to ascertain the long-term implications of the pandemic and responses to other disruptions to everyday actions for sustainable lifestyles. Therefore, the purpose of this research is to indicate what lifestyle practices have been impacted and in what ways this has implications for sustainability. The responses to COVID-19 globally have been diverse, which will reshape energy, transport, and consumption patterns variably. Understanding to what extent these have been altered and whether new practices are more carbon-intensive and unsustainable constitutes a necessary avenue for empirical studies and applied research to address sustainability challenges and social inequities and vulnerabilities. In addressing these research questions, this article generates new insights for identifying how social practices that comprise sustainable lifestyle patterns are variably reshaped, replaced, or abandoned by disruptive change. Insights from this study can illustrate how large-scale, rapid changes across various sectors and systems influence lifestyle practices over distinctive phases of disruptive change response management e.g., from initial uncertainty and new behaviours to stable practice. Presenting the implications of these findings within the context of social practices, sustainable lifestyles, and socio-technical transitions can provide avenues for reducing the magnitude and severity of disruptive changes for on-going transition pathways.

2. Literature review

Since the beginning of the pandemic, there has been an explosion of scholarly engagement across multiple environmental, social, and economic challenges that have resulted and continue to persist [11–13]. It evident is that the COVID-19 pandemic has disrupted local, national and global systems and practices regarding sustainability [6,11,14] COVID-19 rapidly forced society to transition into multiple periods of lockdowns, self-isolation and mask mandates [15] which changed the ways individuals prioritised and practiced their daily routines [16]. Notably, restricting movement apart from essential travel to the size of a person's living environment influenced fluctuations in the patterns of food consumption, energy use and transportation needs. Everyday lifestyle trends ranging from work, leisure, and education became centred in and around the home, emphasised by virtual engagements in these areas [18]. This has continued to expand new forms of remote education and work for many people [19]. The pandemic created a rare opportunity for creating a shift in daily lifestyles with the environment in mind. The blurring of space and time dedicated for the setting in which school, work, exercise, and leisure take place presented individuals with 'windows of opportunity' across multiple lifestyle practices that ultimately changed behavioural patterns, though not necessarily of their own volition.

Rojas-Rueda and Morales-Zamora [19] note that the COVID-19 pandemic sheds light on how societies and governance respond to address catastrophic disruptions as a preview to combatting other global crisis' such as climate change and biodiversity collapse. Though macro-level disruptive changes (e.g., war, pandemics, economic cycles etc.) directly impact civil society, markets, institutions, and actors, further research on the long-term implications for on-going socio-technical systems has yet to be emerge within sustainability transitions literature [20]. While activists hoped that the pandemic created a defining moment to mainstream sustainability within systems and practices to build resilience and decrease vulnerabilities for future crises [21], this has yet to be determined at scale and integrated meaningfully within environmental policy and practice. While everyday life will return to a sense of normalcy once restrictions are lifted, the long-term consequences will continue through multiple attitudinal and behavioural changes while increasing resiliency against future pandemics and environmental crises [16]. This study emphasises this statement and confirms that behavioural changes continue to persist and that sustainable lifestyle patterns have been reshaped, which inevitably has implications for sustainability transitions and how on-going processes will need to consider how future disruptive changes are likely to continue influencing practice changes.

The multi-level perspective (MLP) indicates that transition is understood to occur as an interplay between three levels: niche innovations, prevailing socio-technical regime, and exogenous landscape developments. Transition occurs when the prevailing regime changes and this can take place via distinctive pathways [22]. Instead of individual actors or everyday behaviours, the focus in MLP is predominately on organisational actors or socially coordinated actions of individuals in promoting transitions. Therefore, the complexity of lifestyle practices and behaviour as well as the different roles people engage in their daily lives is downplayed [22]. Widening insights with understandings of lifestyle, practice, and behavioural change because of landscape-level disruptive change provides useful avenues for developing MLP thinking. Exploring disruptive change within the MLP and transition theories more broadly is an emerging strand of research [23,24] yet requires clearer insights from socio-psychological and practice theories to understand the nature and character of everyday behaviours for on-going socio-technical transitions.

As a theoretical framework, social practice theory has much to offer for exploring how disruption shapes behaviour and practices. A focus on the composition and performance of social practices and how different practices related to different socio-technical systems are connected [22]. Energy consumption, for example, is related to various issues beyond the energy system e.g., work habits, leisure activities, habits, and living arrangements [25,26]. Fluctuations in any of these lifestyle practices can influence energy consumption. Various elements constitute practices such as know-how, materials, shared meanings, technologies, infrastructures, and skills [22,27]. Each practice contains a recognisable combination of these components and can be shared between different practices. Thus, a change in a shared element can change multiple

practices while established practices or bundles of practices can function as contexts for other practices [28]. Some practices are predictable and enduring while others are fluid and unstable [25], which explains why some disruptions and innovations turn into stable practices while others are unable to [24]. While experimentation and adaptation can disrupt the reproduction of practices and lead to change, the norms maintained by practices can make the diffusion of disruptive changes challenging [29]. Disruptions that stabilise need to be attached to a consistent reproduction of everyday practices. An understanding of social practices places actors (e.g., individuals and households) firmly in their contexts which makes everyday behaviour – and the disruptions to them – an important area of study for on-going sustainable and socio-technical transitions.

Various practices comprise a sustainable lifestyle that go beyond the home which include work-related activities, tourism, food consumption, and leisure [30,31]. In the home, sustainable practices are unable to be epistemologically separated from the everyday and embedded practices of values, consumption and identity [32,33]. The social practices approach to understanding sustainable living conceives them to be routine-driven, everyday activities in space and time being shared by groups of people as part of the fabric of everyday life [32,34]. Yet sustainability-related practices and actions are more complex than the rhetoric to address climate change would have it [30], as changes in one social practice does not, in isolation, constitute a sustainable lifestyle [35]. Sustainable lifestyles comprise relatively consistent bundles of social practices [36], and are thus characterised by changes across multiple practices e.g., driving, voting, and energy consumption [5,35]. Social practice theories and methods seek to connect micro and macro approaches to social analysis by indicating interconnections between routinised everyday conduct and larger-scale developments [27]. Rather than being driven by deliberative processes, drivers of action are located firmly in the site of the social [37]. Thus, routines and habits are conceptualised though the reproduction of stable and socially recognisable practices e.g. voting, driving or recycling [27,33]. While a significant body of work has explored individual engagements and interactions with elements of practice (knowhow, materials, and meanings) with respect to various dimensions of sustainable living [5,38], evaluating the extent to which COVID-19 has influenced sustainable practices has yet to be explored in detail.

Yet many practices and sustainable lifestyles engrained as part of the daily lives of many residents were upended following declarations of national and global public health emergencies [6,10]. Political agendas transitioned to focus on individual and community health as the virus travelled to prevent cases from developing. Many nations were guided by public health officials informing the pandemic response to reduce community spread of COVID-19. Travel arrangements, leisure activities, and everyday workplace engagements were temporarily suspended as social distancing, lockdowns, and mask mandates altered what was previously considered 'normal' practice. The traditional space-time barrier between leisure, work and household became interwoven as quarantine measures restricted mobility and people largely remained in their homes aside for essential travel [39]. Concurrently, public transport routes were halted, and restaurants and retail chains faced foreclosure as consumption-based activities stalled and many turned to online shopping [40,41]. This reduction in global and local travel combined with decreasing energy production and consumption activities resulted in a temporary reduction of pollution and greenhouse gases [42].

The International Energy Agency (IEA) found that the reduction in global energy demand after the initial lockdown is the result of the decrease in demand from the service and industry division [15]. Yet conversely there was an increase in energy use from households [15] demonstrating that the COVID-19 pandemic has shifted the burden of energy use away from public areas and workspaces to private residences. Cheshmehzangi [43] explored household electricity usage between January and May of 2019 and 2020, finding that while all months had higher electricity usage the months of February and March 2020 had nearly twice the household electricity consumption. While electricity demand is influenced by various daily factors including weather, time of day, and day of the week this rise in electricity consumption is the direct household response to the COVID adaptation measures. The COVID-19 pandemic significantly altered the traditional use of energy within a household. The time spent at home surged as lockdown measures were implemented. From this many individuals were forced to transition into a telework lifestyle as many professions and institutions shifted ordinary routines to virtual interactions. Rouleau and Gosselin ([15]: 253) found that "retail and recreation centres in Canada decreased by 63% during the first month of the pandemic whereas occupation of residential buildings increased by 21%". Energy-related behaviours within the home were inevitably impacted with remote working options continuing throughout the pandemic [17,18]. The accelerated use of energy from new lifestyle patterns resulting from lockdown life has shifted the burden of energy expenditure [14,44]. Evaluating New York residents and their energy use in the initial phases of the pandemic in 2020, Chen et al. [44] found that 48 % of respondents indicated that their electricity consumption was higher than pre-pandemic times. Another 42 % stated that their electricity usage remained the same.

Many countries and cities implemented lockdowns to prevent movement and transmission of the virus. Coupled with working from home and online education being more prevalent, private vehicle usage dropped. Kim [42] states that travel during the pandemic was used primarily for grocery trips and became slightly more frequent as 'panic buying' occurred. Furthermore, many people chose to purchase in bulk to decrease their travel time to reduce their exposure to COVID-19 as a preventative measure [45,46]. While this reduces emissions from private transport use, this action may lead to rebound effects [39] resulting in higher consumption of perishables, material goods and waste [46]. Equally, many people – particularly those without private transport - relied on public transportation infrastructure to continue travelling to work and for food shopping. Despite this, many cities observed a decline in mass transit as only essential workers and travel was permitted. Liu et al. [47] found that across the United States there was a significant decrease in transportation use. For example, "in Washington DC, Metrorail ridership declined by 90% and bus ridership declined by 75% by the end of March 2020" ([47]: 3). Many marginalised groups and low-income populations are known to be the most reliant on public transport and have been affected severely [42]. Consequently, many vulnerable populations including immunocompromised individuals faced exacerbated situational conditions that placed additional strain on severe health issues because they lack reliable transportation to access grocery stores, doctors' appointments, and other daily tasks [40,48]. Many urban areas are home to higher proportions of low-income families, so the loss of reliable transportation as a result of pandemic mitigation strategies exacerbates underlying health issues [48,49].

Consumption behaviour during the COVID-19 pandemic fluctuated as food shopping and visiting restaurants became less frequent, irrespective of income status [46]. Chenarides et al. [50] found that the initial phases of the pandemic caused stockpiling behaviour as consumers had a lack of confidence in the global supply chain. The panic buying behaviours of consumers began on 10th March 2020, as purchases of hand sanitizer, household cleaners, facial tissue, and toilet paper increased to nearly 30 times the rate from earlier weeks [50]. While consumption patterns of these items peaked and then fell towards the end of March, stockpiling actions of particular food items such as canned foods and flour persisted over a number of months. Data from The Economist [51] shows how household spending responded to the first few months of the pandemic which saw a 50 % increase for air travel, food deliveries, groceries, public transport, restaurants, and retail in mid to late February before falling sharply in March. The only category to maintain elevated spending of 7.5 % was grocery shopping through March 2020 [51]. While fresh foods such as fruits, vegetables, dairy products, and meats alongside sanitary equipment were

excessively purchased leading to shortages, supply chain disruptions and border restrictions exacerbated product shortages [52]. This has implications for vulnerable populations such as the elderly and socio-economically depressed communities who experience challenges when faced with accessing fresh food, unequal distribution of products, and price increases [53,54]. Due to the dynamics, food injustice and poverty results as vulnerable and marginalised groups do not have the same capacities of access as those with private transportation or finance to buy a satisfactory quantity and quality of food [54]. Consumption-based activities, particularly food shopping, altered during the pandemic with many choosing online purchasing methods to avoid in-person shopping [41,52,55]. While already an option, the rate of online shopping continues to rise with large online stores such as Amazon have increased their market leading to closures of smaller locally owned stores [41]. Evaluating how food shopping and consumption transitioned and continues to change throughout various phases of the pandemic will be of interest for food retailers and food manufacturers as they respond to rapidly changing consumer demands.

It is evident that the pandemic and management responses have resulted in numerous macro-level impacts for the economy and environment [12,13,51] yet identifying how individuals frame the extent to which this has influenced their lifestyles and sustainable practices has yet to be explored in-depth. Given that variants of COVID-19 continue to evolve, and communities respond variously, such research along with empirical data is essential to ascertain how large-scale disruptions influence everyday sustainable practices where habits are broken and accessibility to critical infrastructures are blocked. Consequently, such research not only adds to the ways in which sustainable practices are reshaped in the face of global pandemics but how management strategies can be implemented in response to more frequently occurring compounding crises such as COVID-19 and climate change which disproportionately impact vulnerable communities [56]. Therefore, this study presents data identifying to what extent the pandemic has shaped sustainable practices. Should future studies continue this line of research over time, it will be possible to identify how distinct phases of the pandemic influence consumption behaviours, energy patterns, and transportation usage and whether changes in behaviour will continue post-pandemic or if routines will slowly return to previous habits.

3. Methodology

A qualitative approach was chosen for this study to explore the extent to which COVID-19 influenced individual lifestyles since the pandemic began. While initial studies have undertaken large-scale energy justice and vulnerability studies [44], little research has applied a qualitative methodological approach to social practice and lifestyle pattern changes resulting from COVID-19 [57]. Qualitative approaches allow participants to use their voice as they articulate their attitudes, actions and experiences through their responses [58,59]. Semi-structured interviews consist of several questions that allow the interviewer to understand the interviewee's perspective in terms of how the individual views their life experiences. The flexibility of semi-structured interviews allows for the interview to explore elements that the interviewee or interviewer wish to focus on as aligned to the research question and can empower the interviewee to elaborate further on specific questions [58,60]. While other research methods and designs may be applied to address the research questions posed in this study (e.g., large panel data, questionnaires), semi-structured interviews provide participants with the opportunity to frame their lived experiences in their own words and in detail [60]. This avoids reductionism that is inherent in many quantitative approaches. Structured interviews would not allow for such flexibility and focus groups were not chosen as participants could share information that may be of a sensitive nature [59] given the severity of the consequences of the pandemic for millions of families globally. Though more time consuming than a questionnaire, a survey was not employed as it would not capture the subjective and emotional responses necessary to understand how the COVID-19 pandemic impacted sustainable practices [59].

New Haven County, Connecticut is a socially and geographically diverse county that closely mirrors the socio-demographic profile of the United States [61], as shown in Table 1. This is advantageous to gain insights into how pandemic disruptive changes influenced sustainable practices and lifestyles may be indicative more broadly. It is the third most populous county in Connecticut with a population of 855,000 people, and home to two of the largest cities in the state, New Haven and Waterbury [62]. Various towns comprise the county ranging from affluent shoreline towns e.g., Guilford and towns with socio-economically deprived communities in the City of New Haven. New Haven County has numerous communities that are racially and socially distinctive which can influence values, motivations, barriers, and participation in sustainable living as well as the infrastructure and systems that facilitate and support pro-environmental action [7,63]. Therefore, insights allow for identifying how communities in various towns within the county responded to disruptive changes. Cities in New Haven County, such as New Haven, are prominent in Connecticut's economy and the county itself has a vital role to play in addressing global issues such as climate change. The city of New Haven has made pledges and goals to become carbon neutral by 2050 and reduce greenhouse gas emissions by 55 % by 2030 [7]. However, these commitments cannot be realised without the participation of residents.

The COVID-19 pandemic substantially impacted New Haven County. As of July 2022, there have been over 222,000 cases and 2880 deaths in New Haven County, the second largest death toll by county in Connecticut [67], and revealed stark racial and ethnic disparities. A 2021 survey of 9139 residents across Connecticut highlights some of the broad

Table 1
Comparative Socio-Demographic Characteristics of New Haven County, State of Connecticut, and United States (adapted from [64–66]).

	New Haven County	State of Connecticut	United States
2020 Population	855,733	3,570,000	327,000,000
2020 Poverty rate	11.2 %	9.78 %	12.8 %
2020 Median household income	$71,370	$79,855	$64,994
Age and gender profile	Below 5 years: 6.3 % Under 18 years: 22.4 % Over 65 years: 10.5 % Female persons: 53.3 %	Below 5 years: 4.9 % Under 18 years: 20.2 % Over 65 years: 18.0 % Female persons: 50.9 %	Below 5 years: 5.7 % Under 18 years: 22.2 % Over 65 years: 16.8 % Female persons: 50.5 %
Race and ethnicity	White: 61.9 % Black or African American: 12.5 % Asian: 4.0 % Hispanic: 15.32 % Multiracial: 4.58 % Other: 6.46 %	White: 67.5 % Black or African American: 9.82 % Asian: 4.39 % Hispanic: 13.63 % Multiracial: 3.16 % Other: 1.5 %	White: 60.1 % Black or African American: 12.2 % Asian: 5.57 % Hispanic: 15.13 % Multiracial: 5.17 % Other: 1.83 %
Educational attainment	*Data available at state level only*	High school diploma: 20 % College credit, no degree: 15.96 % Associates Degree: 5.97 % Bachelor's Degree: 17.4 % Masters and Doctorate Degree: 10.61 % Other: 30.04 %	High school diploma: 19.2 % College credit, no degree: 18.05 % Associates Degree: 6.6 % Bachelor's Degree: 15.3 % Masters and Doctorate Degree: 7.99 % Other: 32.86 %
Home ownership	62.1 %	66.1 %	64.4 %

impacts of the pandemic, which justified the selection of a county in Connecticut. In the city of New Haven, 22 % of survey respondents noted that they had lost their job while 17 % said they had relied on food banks. Compared with the city of Waterbury, 31 % noted they had lost their job with 21 % relying on food banks [68]. In both cities, 11 % of respondents indicated that they struggle to pay for housing and over 17 % said that they felt anxious with over 10 % indicating they felt depressed [68]. While this data indicates broad quantitative findings, it is crucial to understand if sustainable lifestyles and practices have increased because people had more time concentrated in and around the home and did not have access to a common set of resources or if it diminished efforts as people became focused more about their own health and well-being over the environment, thus pushing sustainable practices and habits aside.

Participants were recruited through various methods including local flyer handouts, posters in local community spaces, and posts to local community groups on social media across New Haven County. These approaches requested interested individuals to respond to these recruitment methods to discuss how their actions and everyday life had changed since the beginning of the pandemic in March 2020. Thus, recruitment of interviewees was not restricted to those who live or actively transitioned towards more sustainable practices. Indeed, many of the participants reflected upon their various understandings of what they considered to be 'sustainable' and whether or not their consumption practices were beneficial or limiting within financial, wellbeing and environmental perspectives. Such reflections and narratives are an integral component of how complex labelling the variety of household activities that individuals practice to be either 'sustainable' or 'unsustainable'. Notably, such actions are rife with contradiction and uncertainty [69]. Put simply, while some actions may have positive impacts they may also be traded off against other losses. Whether these trade-offs are worth it, and if they lead to further actions and consequences e.g., rebound effects and spillovers, remains unclear [69–71]. Subsequently, it is not simple to label particular activities as 'sustainable' or 'unsustainable'. Therefore, the findings are situated within the context of participants' narratives of their perspectives and framings. Conducted between March and July 2022, interviewees were asked a series of questions corresponding to their attitudes and experiences during the pandemic. Such questions included how the pandemic influenced their perspectives towards sustainability, in what ways they adapted their lifestyle patterns as a result of the pandemic, and how their use of energy, transport, and consumption altered over various phases of the pandemic and mitigation strategies. No incentives were provided to facilitate participation in the study. Participants discussed these issues between 25 min and 45 min. The socio-demographic characteristics of participants are highlighted in Table 2.

Each interview was recorded with informed consent of the participant, transcribed verbatim and analysed as part of a thematic analysis approach [60,72,73]. Thematic analysis is an insightful approach to analyse qualitative data [74], particularly that which explores themes of living and/or action as aligned so social practices [27]. It offers immense flexibility and displays how a particular researcher goes about their analysis of data and the assumptions made as a result [72]. This was achieved by following the stages outlined by Clarke and Braun [75] noting several steps to implement this analytical approach: transcription, reading and familiarization, coding, searching for themes, reviewing themes, defining, and naming themes, and finalizing the analysis. Before advancing to the analysis of qualitative data, the research team first generated the initial codes, searched for themes, and then reviewed the themes to form a consensus about the data [74]. Clarke and Braun [75] state that a pattern-based analysis allows researchers to identify key features within the data, which is essential towards identifying the research question. All themes found are deemed to be important when considering the strategy of thematic analysis. This strategic approach allows sufficient flexibility for both the participant and the researcher while offering productive outcomes, and the outcome of this analysis is presented in the results section which follows.

Table 2
Socio demographics of participants.

Participant number	Gender	Race	Location	Household occupancy	Occupation
P1	Female	White	Hamden	3	Restaurant owner/ bookkeeper
P2	Female	White	Hamden	1	Musician/house painter
P3	Male	White	Hamden	4	Environmental Science teacher
P4	Female	White	Hamden	5	Stay at home mom
P5	Female	White	Hamden	4	Local business owner
P6	Female	Black	Hamden	2	Software development consultant
P7	Female	White	Guilford	3 during pandemic, 2 currently	Retired
P8	Female	White	Guilford	3	Teacher
P9	Male	White	Guilford	5	Contractor
P10	Female	White	Guilford	4	Nurse
P11	Male	White	Guilford	2	Retired
P12	Male	Black	Guilford	3	Student
P13	Male	White	Durham	4	Accountant
P14	Female	White	Durham	4	Teacher
P15	Male	Black	New Haven	1	Online retailer and influencer
P16	Male	Black	New Haven	3	Catering manager
P17	Male	Hispanic	New Haven	2	Student
P18	Female	White	New Haven	2	Online retailer
P19	Male	Hispanic	New Haven	4	Electrician
P20	Male	Black	New Haven	3	Unemployed

4. Results

All participants acknowledged that time during pandemic was challenging in numerous ways having upended daily routines. When considering sustainable lifestyle practices, individuals' daily actions were contextualised within numerous contexts highlights the extent to which participants were cognisant of the relative sustainability of their lifestyles and their personal feelings and values towards them. Sustainability demands changes in human behaviour for addressing climate change, shifting unsustainable behaviours into sustainable practices [5,76]. Yet how rapid macro-level disruptions influence individual sustainable practices within the context of global pandemics has yet to be fully explored. COVID-19 presented a "window of opportunity" as a rapid large-scale disruption potentially reshaping sustainable behavioural changes, and the findings of this study (as summarised in Fig. 1) demonstrate the implications the pandemic had on sustainable practices in New Haven County, Connecticut.

4.1. Everyday feelings and actions towards sustainability

Interviewees shared a positive attitude towards sustainability, with one major theme arising from the thematic analysis centring around efforts to try to take some action, especially during the COVID-19 pandemic. There was a sense of importance when self-evaluating individual sustainability perspectives, performance, and practices. Rather than scrutinising what should not be done, participants indicated they took initiative for themselves and their families by what they could do to promote sustainability. Climate change was noted as a significant factor

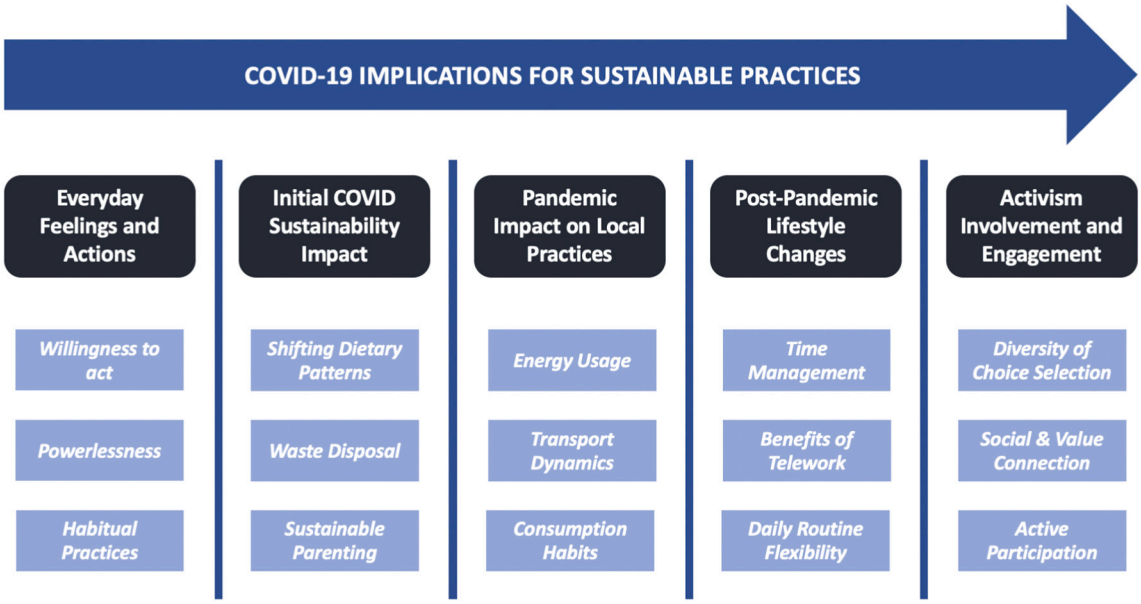

Fig. 1. Identified Impacts of COVID-19 on Sustainable Practices.

for why people felt obligated to do their part to help the environment. However, individuals also noted their struggle with feelings that doing their individual part is not enough:

> "If we don't do the small things and make them habits, then it becomes hard to do the big things. It can feel very hopeless and overwhelming when dealing with climate change" (P2),
>
> "It is something I am aware of, and I try to do what I can. The scope of the problem is too big" (P4),
>
> "I try to do my best at home and at work, but it is hard because there's not always the right equipment or system in place. At the hospital, we can't recycle everything because of contamination and medical waste but some of us carpool together. What's worse is that covid meant we were trashing out things that used to be reused or recycled because of transmission" (P10),
>
> "We do our best at home. We have 2 boys so teaching them to be more environmentally mindful is important so when they're older they'll do more than us and won't feel as hopeless about the state of the world" (P13),
>
> "There's so much climate destruction that it's hard to focus on what to do and not do. Like, I'm responsible but not as much as others. It's paralysing at times" (P17).

Many of the participants indicated they adopted new lifestyle practices that benefitted the environment and themselves, though noting that while considered 'positive' such actions are too small to combat such a global issue of climate change. These statements are contextualised by constraints to the extent to which they feel they can impact such a global issue. The focus on "trying" when undertaking pro-environmental actions can be related to feelings of powerlessness [77]. To this end, pro-environmental action is limited by perceived and actual psychological and infrastructural barriers in the minds of participants which presents itself as a cognitive and behavioural engagement challenge to increasing sustainable practices [78–80]. This has several implications, primarily identifying that COVID-19 influenced the location at which people acted (un)sustainably and the limitations on travel due to lockdowns prevented unsustainable actions in locations beyond the home [81]. Attempting to change behaviour outside of a pandemic without additional travel constraints may prove to be difficult.

Participants identified that if actions are not taken at an early stage, it can be challenging to continue with them and scale them up in the future. Statements like this reflect how habitual practices need to be facilitated during 'windows of opportunity' (i.e., during natural breaks in behaviour) to become engrained as regular action [30,31]. Reforming sustainable habits may be challenging should post-pandemic routines not revert to what individuals did prior to disruptive changes brought about by the pandemic. Notions of hopelessness as indicated by some participants can reflect climate anxiety [82]. Often, climate anxiety is viewed as an emotional reaction that can possibly motivate sustainable practices, but can also discourage change [83] particularly if individuals feel immobilised by their responses. The co-occurrence of pandemics and climate-related stressors increases the risk of anxiety disorders [83]. Climate change has exacerbated various extreme weather events and fluctuating temperature patterns in Connecticut [84], making it imperative to recognise climate anxiety as a prevalent emotional response among Connecticut residents.

4.2. *COVID-19 influences on individual sustainability*

Participants emphasised the need to create sustainable habits individually to defend against environmental changes, indicating that their daily participation in sustainable living had various implications. Most participants indicated their knowledge of sustainable practices arose through education, personal interest, or past experience, and that they attempted to continue such habits through pandemic mitigation responses e.g., lockdowns:

> "I try to eat plant-based to keep away from pesticides" (P1),
>
> "Anything that has the symbol, I am recycling it" (P6),
>
> "We knew we wanted to cloth diaper the baby, it was something I always wanted to do. It's saved us thousands of dollars not buying and throwing away disposable diapers" (P8),
>
> "We have solar panels, 13 chickens, and geothermal heating. We got good rebates for the geothermal and being at home during the first lockdown we decided to get the chickens. We eat the eggs but not the chickens because the boys have named some of them" (P14),
>
> "I lost my job because of covid. It got so bad that I did the recycle bottle deposit for any extra dollars I could. We stopped buying food

we didn't need or always eat and just trashed. Feels good to not trash off food and save some money on groceries" (P20).

The relationship between sustainable food selection and waste disposal with environmental health parameters are regular anchor actions for participants. Shifting dietary patterns is one of many solutions to address both environmental and health concerns [85]. Dietary changes such as avoiding meat and producing dairy products to move towards self-sufficiency reduces carbon intensity of individual lifestyles [86,87]. Given that "agriculture is the largest consumer of freshwater and the second largest contributor to anthropogenic greenhouse gas emissions worldwide" ([85]: 8), attempts to develop home-grown food and eat plant-based food demonstrates commitment to sustainable practices during the pandemic. The language in participants' comments indicates active participation in a range sustainable food and waste practices without equivocation. For example, reuse of diapers and sustainable disposal of plastics was commonly referenced while participants noted the high degree of "COVID-related debris" (P3) they could identify in their local community while lockdown measures were active and that this goes against their personal attitudes and actions towards waste disposal. This is of serious concern to participants indicating how collective action may differ from personal habits. Given the high demand for personal protective equipment such as face masks and its subsequent visible waste [88,89] reflects substantive concern regarding local environmental pollution. These statements confirm that individuals do demonstrate high degrees of cognitive, affective and behavioural engagement towards sustainability [80], which is reflected in their personal choices to promote sustainability. As a rapid societal disruption resulting in consequences for waste production and management, this demonstrates that the pandemic did not alter personal attitudes for individual or collective sustainable practices.

For some participants, transitioning to sustainable energy and heating and cooling systems was supported by financial incentives e.g., rebates. The IEA [90] estimate that around 55 % of cumulative emissions reductions towards a net zero pathway are linked with consumer choices e.g., installing heat pumps, purchasing electric vehicles, and installing energy efficient appliances. Behaviourcal changes, especially in advanced economies, account for 4 % of cumulative emissions reductions [90]. The latest Emissions Gap Report [91] indicates that to limit global heating to 1.5 °C, annual GHG emissions must be reduced by 45 % compared to policies currently in place in just 8 years and continue to decline rapidly after 2030.

Additionally, participants felt that the pandemic presented them with an awakening with respect to the quantity of waste as a household and made changes as necessary or in a minority of cases they became lax with sustainable practices that they used to partake in prior to the pandemic:

> "I definitely had times that I did not feel like cleaning out my containers and threw them away, instead of recycling like I normally would. There were moments that I was surprised with myself, because I just did not care" (P1),
>
> "It made me realise how much waste we produce as a family and actually considered cloth diapering our children at this time" (P4),
>
> "I think it has made me more aware about the supply chain more in terms of how far groceries and other items are traveling to get to me" (P7),
>
> "I was at home a lot before the pandemic because of work but once the pandemic started and my son was at home for Zoom school, I just didn't do what I used to. I didn't want to. Guess it was taking on the role of teacher and parent that I didn't have time to cook or clean. Time just wasn't the same in lockdown, it really messed with me giving a shit about things that I used to be all about" (P18).

Often during times of disruption that influence people directly, individuals report heightened levels of awareness of macro-level factors that shape their personal activities [92]. Despite increased awareness of supply chain dynamics and household waste levels, participants reported surprise at their own level of apathy and ambivalence towards continuing with sustainable practices that had been, previously, habitual. This finding is oppositional to the key features of behavioural routines as habits are embedded in repetition, automaticity and execution [33,93,94]. Yet participants justified how these habits were broken with respect to additional household responsibilities were included and overtook previously undertaken behaviours. Noting that such responsibilities were akin to another job, this not only influenced individual senses of time but also their behavioural self-identities. Given that habits are executed in stable contexts at the same time and same location [93,95], lockdown measures and wider pandemic measures reshaped perceptions of time, self-identity, and habitual routines.

4.3. COVID influences on community sustainability: energy, transport, and consumption dynamics

Participants emphasised a substantial decrease in their daily travel during the initial phases of the COVID-19 pandemic and as it progressed. Many said they only travelled for grocery shopping, though this was not without noticeable unsustainable behavioural side-effects as online shopping and energy use at home rose:

> "I took fewer grocery shopping trips out of fear from the virus. We definitely had to adjust our schedule as parents did not want to carpool because of COVID and the risk" (P4),
>
> "Even though people were at home, they were still creating garbage. All people did was order on Amazon. I saw a big increase in my energy use since my son had to constantly charge his devices for school and took more showers here after hockey since the school was closed indefinitely" (P6),
>
> "As a teacher and a parent, being home for months increased my energy use ten times over. My laptop was on all day and night with Zoom teaching, lesson prep and parent conferences. I've only recently gone back to working at the school so it should not be that expensive anymore" (P14),
>
> "I got into some bad habits. I still do 'em! I couldn't go out, so I made my videos, ate more food than I used to, ordered DoorDash 3 or 4 times weekly and gamed more. I have like 4 screens on at the same time; my phone, my laptop, TV and computer. Man, my heating and electricity was hella expensive! The price you pay to get over the same shit different day, you know what I'm saying?" (P15),
>
> "Most of my jobs were cancelled or rescheduled. I wasn't making money, I wasn't going to people's homes or businesses; they were closed. It didn't bother me at first because I was worried I was gonna get it [covid] so when things opened up my guy and I didn't travel together for a year to the same job. At times I didn't want to do a job. People are nasty!" (P19).

Many participants indicated that their household energy use increased as working from home became normalised. Specifically, those participants who were teachers, parents or students noted how the transition to online modalities of schooling utilised frequent use of energy-intensive devices. This reinforces findings that energy consumption in the residential buildings increased during the pandemic, particularly during initial phases of lockdown and social distancing [14,17,41]. In 2020, the energy supply sector contributed to 37 % of all emissions while transport accounted for 14 % and buildings added another 5.7 % [91]. Despite participants noting that their energy use increased during pandemic mitigation efforts, emissions reductions have been achieved in the energy sector though transport emissions have remained stable or continue to grow [96]. Though some individuals

were familiar with hybrid working conditions, working from home intensified over-consumption of other practices such as general food consumption in addition to having food delivered. Over-consumption in various sectors associated with the pandemic has led to substantive socio-economic and environmental impacts. The U.S. economy lost 22 million jobs from February to April 2020 and increased deprivation among socio-economically depressed communities led to increased poverty in already vulnerable populations because of economic disruption [97]. Spending on food away from home, services, entertainment and transport decreased during initial phases of the pandemic leading to a 3.41 % decline in real GDP in the U.S. [98,99]. Shifting sales online and consumers using their stimulus cheques were reasons why online retailers such as Amazon noted record profits of $8.1 billion in the first three months of 2021, a 220 % increase from the same period in 2020 [100]. Single-use plastic consumption increased by 250 % to 300 % during the pandemic due to public health measures (e.g., face masks, gloves, face shields etc.) and additional packaging for groceries and food, with the global demand for plastics to increase by 40 % [101,102]. The already out-of-control global plastic waste problem has exacerbated under COVID-19 leading to 8.4 ± 1.4 million tons being generated (up until August 2021), which will inevitably enter the global ocean [88].

While the consequences of lockdown measures and pandemic responses are not only environmental, they are also financial and health related; meaning that the individual bears the cost associated with accompanying lifestyle changes. Additionally, the pandemic increased anxieties of viral transmission in public settings. The consequence this had for some participants resulted in hesitancy around carpooling or undertaking a service job over concerns of other people's hygiene, becoming cautious and concerned about their own well-being. Studies show that fear can be an interfering variable when it comes to an individuals' protective behaviours [103,104]; and in the circumstances reported here resulted in the formation of unsustainable habit creation. This has clear implications for facilitating and maintaining sustainable lifestyles following macro-level disruptive changes should individuals choose unsustainable actions justified because of public health measures transitioning to 'personal responsibility' [105].

Throughout various phases of the pandemic, from initial lockdowns to the move towards personal responsibility, numerous participants indicated they chose to avoid eating out; instead opting to cook at home more and have food delivered. Participants contextualised their justifications for avoiding public dining as follows:

> "Going out to restaurants and bars is expensive when you have 3 teenagers and young adults in the house. That's really 4 if you count my son's girlfriend who has essentially moved in! Cooking at home is cheaper and we cook in bulk, so I have food to take with me for the next day. Delivery is just as expensive as eating out!" (P9).

> "I don't go out much, it's not worth the risk. I've got more chronic illnesses than you can count. I have my daughter grocery shop for me and bring it to me. If I catch covid, I'm done! Fortunately, I've got a pantry full of rice and pasta to last the next 40 years!" (P11).

> "I'm a catering manager, I know people all over with restaurant joints. Before the pandemic I ate out about 5 times a week. I didn't use to cook at home at all. The rona changed all that. I had to speak to some of the chefs at work and some buddies about how to cook for myself and my family because deliveries took too long" (P16).

Cost, time, and risk were mentioned as reasons for avoiding public dining spaces, yet participants also outlined what actions they did take and continue to take to when it comes to food preparation. References to meal preparation, batch cooking, and talking to social networks to enhance personal cooking skills demonstrates various active behavioural engagements with respect to eating habits [80]. For some, this marked a substantial transition from what their lifestyles used to be prior to the pandemic. The formation of new behavioural routines such as meal preparation and batch cooking, along with few references to panic buying as a new tactic to manage exposure to the virus, demonstrates how individuals adapted to continuously changing pandemic response measures, economic conditions, and perceptions of time and effort to cooking [103]. The food system accounts for a third of all emissions [206], and supply chain activities including consumption, transport, waste management, and retail equates to 29 % of food system emission [91]. Combining half of the various global food strategies presented by Clark et al. [106] including transitioning to plant-rich diets, healthy calories, preventing food loss and reducing waste, and high efficiency savings would be compatible with achieving a 1.5 °C temperature target. Though a minority of examples exist, the majority of participants denied participating in panic buying as many waited for items to come back into stock, modifying their purchases as necessary. In opposition to energy consumption habits, participants were more likely to participate in sustainable food preparation and consumption behaviours during the pandemic. While measuring the exact carbon intensities of pandemic-related lifestyle changes is beyond the scope of this paper, it is evident that COVID-19 influenced sustainable practices variably rather than uniformly.

4.4. COVID-19 lifestyle and consumption changes

As the pandemic continued, many participants used their time in more mentally, physically, and emotionally supportive ways enhancing their health and well-being which they perceived as being directly associated to a sustainable lifestyle. Where time had previously been taken with travelling, individuals stated that this time was used to reorient their lives, undertake home-based activities, or practice mindfulness and upskill themselves:

> "Instead of stressing over getting to work on time, I took the initiative and used that time to exercise more" (P3),

> "I spent more time in the garden clearing weeds and overgrown bushes, built a chicken coop, and cleared out the garage. We have 13 chickens now, they finally started producing eggs. It feels like home is much nicer to be around and I value it more. I'm sure it's increased in value too!" (P13),

> "My whole day switched! I used to work in a hotel but quit that the first couple months of corona. [It] was the best time to quit to do me and I'm flexible now. I'm trying to be an influencer, but also sell gym stuff online to make money. I work when I want, man! I go to the gym in the morning, run, shop, sell, see my mom, sell again, and maybe see who's around" (P15),

> "I eat so much more healthily now. No more processed crap. I even eat plant-based meats now!" (P18),

> "I built my own shed! I spent hours watching videos, reading articles and then decided to build it. I got all my tools in there so they['re] not around the house. It feels like home and work are now separate" (P19).

Lifestyle changes were referred to as "switches" with the emphasis on time savings being used to accommodate various practices. It is intriguing that participants outlined lifestyle changes that reflect combined pro-environmental and pro-health actions such as transitioning to plant-based diets, reducing processed food intake, creating local food production and consumption and upskilling for self-sufficiency alongside increasing time spent on exercise. The justifications for the transitions to such practices include concerns for personal health, home cleanliness, stress reduction and value in terms of personal affection for the household as well as financial value. While there are many motivations and barriers for sustainable actions, including time, convenience and effort [5,107,108], individuals in this study appear to have used the pandemic to justify their new lifestyles. Indeed, the ways In which

participants described their feelings towards such lifestyle changes is one of accomplishment and achievement. The emphasis and use of subjective language such as "I built" and "I value" alongside the impacts their actions have resulted in (e.g. home and work spaces being distinctive) substantiate these achievements in real terms for individuals. This has several implications for sustainable practices that have occurred due to macro-level disruptive change. Given that time and effort is often a substantial barrier to action [107], individuals require space and time to reflect upon *what*, *how* and *why* they want to progress in a sustainable lifestyle. This is central to a "what works" approach to sustainable lifestyles matching what people want to do with effective interventions that facilitate and maintain sustainable practices [5,27].

The utilisation of the traditional travel to work time in the morning and evening for upskilling and enhancing personal health has been beneficial to the overall well-being of participants. Ongevalle [109] reinforces this point, indicating that the pandemic allowed people to realise that personal care is not a luxury but should be a public health necessity. There are substantial challenges that remain to be addressed with respect to mental health, yet in some respects the pandemic unintentionally alleviated some of the difficulties individuals face with living in a time-pressured society [5,10,109]. Creating new structures and forming new habits, starting with the initial lockdown stage of the pandemic, presented some with opportunities to commence distinctive routines than pre-pandemic lifestyles and were able to maintain mental and physical health goals become a reality. This reinforces the notion that personal health and wellbeing are intimately connected with a sustainable lifestyle. However, it is here that the temporal dimensions of incorporating sustainability and health within existing lifestyles come into focus. If barriers to sustainable practices and lifestyles can only be broken during specific windows of opportunity or disruptive changes [35,93,107] then this presents public engagement challenges to support wider societal transitions to sustainability [80].

4.5. COVID-19 influences on personal involvement in sustainability projects

No participant joined a sustainability activist group or project as a result of the COVID-19 pandemic; as some participants were already activists or members of specific organisations or groups that involve sustainability to some degree. Groups and projects were more likely to be local-level or state-level organisations that prioritised various actions including collective action e.g., protesting and activism as well as personal action such as freecycling and information provision:

> "Through work, I was with CT League of Conservation Voters before the pandemic and I actually got to bring my students to lobby at the capitol, however it has been hard with the pandemic to make contact since then" (P3),
>
> "I am a part of different freecycle and buy-nothing groups and it is a great way to be a part of a local exchange of goods" (P4),
>
> "I am a part of gardening groups on Facebook and have gotten so much information on how to become even more sustainable" (P6),
>
> "I'm already a member of some groups in New Haven like the Sunrise Movement. I made so many friends there and it's really helped me. I joined before the pandemic but they didn't do much at the beginning, just virtual events. I want to do more so I joined online groups and follow activists on Instagram. To stop buying things I upcycle and freecycle furniture (P17).

Many of the groups that participants were members of, including activist groups, prioritise collective action and tangible behavioural responses. The value of involvement in sustainability for participants is particularly interesting as justification for participation. Individuals spoke of enhancing social networks, receiving information directly relevant to their interests, and feeling positive about their involvement. This reinforces the motivations and positive intentions of collective action groups enhancing a 'personal state of connection' with sustainability issues [78]. Participating in collective action groups and community sustainability projects offers individuals close social connections and interactions that enhance understanding, support and motivation with sustainably living [80,82,110]. Activist groups, virtual forums, and community organisations allow members to turn their words into action without feeling isolated from like-minded individuals. Membership of such groups provides members to have an increased sense of collaboration and support when it comes to environmental issues, given that some of the barriers to action include powerlessness from individual action [77,111]. Despite these positives, some participants indicated that there were some inhibitors to action as a result of the pandemic, resulting in alternative groups, actions and events being sought. This is an inherent challenge for community sustainability groups and activist organisations as they rely on the support of volunteers and highly engaged individuals who are at risk of burn-out and responsible for diverse activities to keep members involved.

There are various implications that involvement in sustainability projects and groups has with respect to disruptive change. Primarily, activist groups often voice justice, equity and inclusion concerns when socio-environmental pressures are threatened as a consequence of intended actions and unforeseen events [82,112]. With participants noting the diversity of groups involved with and identifying additional ways to participate in sustainability-related collective action, this enhances the potential for dissemination of activities as members socialise. This reflects the concept of 'scaling up' sustainable activities through interpersonal connections which is a key element of public engagement with sustainability and addressing climate change [79,80].

5. Conclusions and implications

The findings from this study demonstrate the extent to which disruption to daily habits influenced sustainable lifestyle practices due to the COVID-19 pandemic in New Haven County, Connecticut. As a macro-level 'window of opportunity' rippling through socio-scalar networks and practices opened, interviewees in this study provided examples of how their behavioural routines associated with energy use, transport dynamics, and food consumption were inevitably and variably reshaped. The events which followed transitioned individual to new lifestyle practices; some by choice, some by force, and some reflecting a forced choice. The findings from this study coalesce around the following points and their associated implications for communities, disruptive changes, and sustainability.

The challenges of individual action, that is oftentimes combined with collective action in particular sectors, is perceived to be insufficient. This was directly related to manifest in feelings of climate anxiety, paralysis, or powerlessness. Such feelings have become more frequently reported with respect to environmental challenges [83]. With participants feeling restricted or unsure on whether their actions are effectively sustainable, individuals need to be reassured of their efforts which require wider societal change integrating sustainable frameworks across industrial sectors, enhanced climate literacy, and proven forms of collective climate engagement [5,79]. This has clear implications for self-efficacy as there are distinctions between people undertaking actions versus people making changes and not understanding the reasoning behind completing the action. Beliefs in efficacy are determined by four influences: mastery experiences, vicarious experiences, social persuasion, and emotional states [113]. Yet, one avenue these can be addressed is through collective action. Enhancing self-efficacy is crucial for individuals to feel comfortable making sustainable changes while executing community-wide action so individual measures do not feel ineffective.

The home as a space was transformed to accommodate multiple activities that it had not been previously accustomed to e.g. work, school, exercise, and leisure etc. This presented distinct challenges to

participants in this study who identified their daily practices with energy, food and transport had markedly transformed. Participants stated that, overall, their energy use, food consumption, and waste had increased to being recognisably unhealthy and costly while individual transport use had decreased. Lockdown measures and wider pandemic responses directly influenced the location of previously heterogenous routines that were centred away from the home to be concentrated in one space – the household – while reshaping participants' sense of time, self-identity and habitual routines. Despite this, some sustainable food consumption and waste practices did emerge but only after reflection of cost and time elapsed. This does have clear implications for sustainable practices as the home is a key site of (un)sustainable actions [32,114] but has become an increasing site of diverse activity since the outset of the pandemic and continued remote work [14,18]. Given that many socio-economically deprived communities are located in New Haven County, the pressure of increased energy costs at home places additional pressures on already vulnerable households that may already face energy poverty and injustices [63]. This is a key challenge to confront so that vulnerable communities are not continually disproportionately impacted by environmental crises and/or disruptive changes.

The consequences of lockdown measures and pandemic responses are environmental, financial and health related. With increasing devolution of responsibility for viral mitigation and adaptation placed on the individual this adds further costs associated with disruptive change and subsequent lifestyle changes. These costs are not only economical but also impact physical and mental health. Fear and concern have been well-reported because of the pandemic [103,104] which this study has found to directly lead to the creation of unsustainable habit formation – that has not abated – in place of previous sustainable actions e.g. carpooling. However, not all reports of pandemic-related lifestyles changes are wholly negative as some participants did form new pro-environmental and pro-health actions that were viewed as significant accomplishments. There are implications resulting from these findings for future disruptive changes and windows of opportunity for sustainability engagement. Principally, an understanding that there are various emotional responses that lead individuals to, and result from, undertaking both sustainable and unsustainable actions [78–80]. However, these emotional responses are amplified in short periods of time that are understandable but from policy perspectives may seem irrational and not 'fit' within conventional management responses. This can result in challenging circumstances for those that are already disproportionately impacted by inequities and vulnerabilities [115] which are compounded by further crises. Consequently, it is paramount that lifestyle and practice changes that are rapidly altered by disruptive change be accounted for as part of climate and environmental justice initiatives at the appropriate level for intervention.

The findings presented in this article have notable implications for on-going socio-technical transitions, particularly those that are impacted by disruptive change. On-going socio-technical sustainability transitions will continue to be reshaped by future disruptive changes due to compounding socio-economic and environmental crises e.g., pandemics, war, climate change etc. [22,23]. Kivimaa et al. [24] expand on the definition of disruption in sustainability transitions to be understood as a high-intensity effect in the structure of the system demonstrated as a long-term change in practices, behaviour, and cultural models in addition to other elements e.g., markets, regulations, actors etc. The disruption to sustainable practices and behaviours analysed in this study are characterised by discontinuity and breakdown of habitual routines and systems brought about by the magnitude of rapid change comprises multiple system elements reshaping interactions with the energy, transport, and food systems. These findings indicate how the reorientation of everyday practices resulting from pandemic disruptive change altered consumption activities to online shopping, increased domestic energy use, and decreased personal mobility yet increased the stability of private vehicle ownership [116]. Disruptive change at the landscape level, therefore, does not necessarily provide the context for sustainable change across all practices. Wider transition of practices (e.g., diets) requires the support of disruptive policies to change everyday practices [117]. Interconnections between dimensions of disruption do not necessarily reinforce each other resulting in difficulty in identifying how disruptive change in different localities influences practices specifically.

Routines of office work, leisure, energy consumption and food provision have been suspended, altered, or replaced with new routines [118] leading to a global reshaping in social practices and sustainable lifestyles. The findings in this study confirm the suspension and subsequent replacement of energy, consumption, and transport practices. Social practice and lifestyle changes have the capacity to influence the trajectory of transition pathways, including changing consumption patterns that place further pressure on specific system elements such as supply chains and energy systems that have subsequent environmental and economic consequences [119]. This can accelerate, retard, or shift transition pathways or even change it altogether [20,118]. This further complicates on-going socio-technical transitions where the geographical site of innovation may also be altered e.g., away from public and commercial sites towards household and community locations [32]. Pandemic disruptive change, like other exogenous shocks, has various phases of response management given their long duration and collective, yet regionally distinctive, control approaches [120,121]. Within the context of the findings from this study, the exogenous shock is mediated to become a partially endogenous phenomenon within spatial and temporal confines to further reduce widespread collapse of socio-economic systems [118]. On-going transitions, particularly niche innovations, attempt to be disruptive by nature yet must also enhance their resiliency against increasing magnitude and frequency of compounding crises [2]. In response to landscape level disruptive change, newly formed governance mechanisms and policies may emerge that further disrupt existing frameworks may accelerate or hinder transition pathways [118,122] depending on which environmental or socio-economic priority is to be addressed e.g., stimulate growth and save industries or promote sustainable practice changes. The CARES Act [123] is a prime example to protect various industries (e.g., hospitality, transport, education) and minimise economic precarity yet had various unintended consequences such as permanent closure of small businesses and delayed implementation of response mechanisms [124].

Geels [23] notes how diffusion depends on external windows of opportunity, due to regime destabilisation because of landscape pressures or persistent internal problems. Pandemic disruptive change has demonstrated the fragility of current social practices in response to management strategies and the delayed implementation of control strategies, most notably the unsustainability of current economic models underpinned by relentless, mass consumption [125]. Participants in this study indicated that their consumption practices were largely altered to avoid high material consumptive practices and replaced with investing in their homes, gardens, and leisure activities. Morrissey [126] identifies that a "bounce-backwards" recovery sees sustainability transition dynamics slowed and even reversed which leads to negatively influencing the momentum of on-going transitions. With policies introduced to minimise the economic impact of the pandemic to continue to support an unsustainable socio-technical regime, such intervention can impede sustainable lifestyle and practice change. Such governance mechanisms and policy frameworks have adverse impacts precipitating a return to ecologically exploitative economies and lifestyles [126], ensuring further resistance to change [127]. With the fragility of current practices subject to rapid change and replacement, on-going transitions can gain a foothold in particular applications making them able to emerge amidst the radically prevailing socio-technical system and regime offering alternative social practices and sustainable lifestyles [5,23,118].

Declaration of competing interest

The authors wish to declare that there is no conflict of interest in the

writing of this manuscript or any gain from its publication.

Data availability

Data will be made available on request.

Acknowledgements

The authors would like to thank the participants in this study who graciously gave their time to participate in this study, and to the three anonymous reviewers who provided detailed and constructive comments and suggestions that inevitably improved this article.

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