

Gardening Motivations of U.S. Plant Purchasers During the COVID-19 Pandemic¹

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Abstract

Plant purchases experienced a surge during the COVID-19 pandemic quarantine of 2020. Researchers used an online survey instrument completed by 1,211 U.S. respondents to investigate the diverse motivations for making plant purchases. Researchers compared three age cohorts to understand which plant benefits they derived from their plant purchases. Millennials (born 1981 to 1995) derived the greatest social benefit from their plant purchases, followed by educational, physiological, and psychological benefits. Gen Z (born 1996 to 2012) derived more educational and physiological benefits compared to Baby Boomers (born 1946 to 1964). Individuals experiencing a high level of social benefits from plants may have contributed to the extensive use of social media during pandemic isolation, as plants appear to be a common interest or focal point for online social interaction. In other words, plants bought by Millennials (and to a lesser extent by Gen Z) served as an online social connection to others. The youngest age group, Gen Z, experienced the greatest boredom proneness and the most food insecurity. In comparing plant buyers with non-buyers, we found no difference in boredom proneness or shopping anxiety. Plant purchasers experienced greater food security compared to non-plant purchasers and individuals who purchased edible plants or food-producing plants or both a flowering plant and a food-producing plant had greater food security compared to non-plant buyers and individuals who purchased flowering plants. Results provide relevant topics (e.g., food security, boredom relief, and social connections) to inform on- and off-line communications with consumers.

Index words: consumer, online survey.

Significance to the Horticulture Industry

Motivations are reasons for taking an action; they literally drive behavior. Some government mandated restrictions for individuals to quarantine in place due to the COVID-19 pandemic motivated homeowners to enhance their interior and exterior environments, thus influencing the shopping behaviors and purchases of horticultural products. Many horticultural companies reported favorable sales in 2020 despite government-mandated restrictions to quarantine in place. Understanding what drove consumers to make plant purchases can help producers, wholesalers, and retailers learn more about behavioral drivers and utilize that information in future marketing programs. Researchers compared three age cohorts to understand which plant benefits they derived from their plant purchases. Of these benefits (economic, environmental, health/wellbeing, and social), Millennials obtained the most from social benefits, but these social benefits were derived during the pandemic isolation, so the benefit was most likely nearly all online. For horticultural businesses, this finding points to the increasing importance of using social media to connect with consumers. Social media can provide a platform to communicate other plant benefits to consumers, ultimately increasing their knowledge, awareness of, and appreciation for numerous plant-

related benefits. Boredom proneness was experienced more by Gen Z and retailers may seek to utilize messages that promote a change of pace by encouraging consumers to try a new plant to alleviate boredom. Food security was another motivational factor in plant purchases, with individuals who purchased herbs or food-producing plants experiencing greater food security compared to individuals who purchased only flowering plants or no plants. Findings suggest including information about food security, boredom relief, and social connections to promote plant purchases could be effectively incorporated into consumer communications.

Introduction

Researchers and retailers wonder why so many Americans made plant purchases during the isolation created by COVID-19 in spring and summer of 2020. One possible explanation lies in the motivation to participate in a leisure activity. People could not physically engage in conventional social leisure activities (e.g., gathering at a coffee shop, attending a concert, or going out for dinner) and had options that may have only included more screen time (e.g., computer games, reading, viewing streaming services, or watching more television) as a break from the monotony of being forced indoors for work and/or school. Being immersed in nature or participating in outdoor activities were, in some areas, limited when parks and trails were also closed. This left millions with few options, among which was gardening. Garden centers experienced an unprecedented demand for plants and garden related products (Beytes 2020). For example, over 16 million consumers may have made a purchase of a vegetable transplant by the end of March 2020 (Beytes 2020). Thus, understanding the initial motivations for this unprecedented demand can provide researchers and retailers with some

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insight to help recruit more consumers in the future while retaining existing customers.

A motivation is an impetus or reason for taking a particular action. Self-determination Theory (Deci and Ryan 1985) classifies motivations into two types. Intrinsic motivation refers to engaging in an activity because of its inherent value to the actor (e.g., fun, rewarding). By contrast, extrinsic motivation refers to undertaking an activity because there is an instrumental value to the outcome (e.g., earn more money, avoid punishment) (Ryan and Deci 2000); extrinsic motivation to participate in an activity leads to a separable outcome that is not the inherent pleasure from engaging in the activity (e.g. playing for fun) (Ryan and Deci 2000; Ramirez-Andreotta et al. 2019). There may be elements of motivation for engaging in plant purchases and activities that stem from a desire for leisure to provide time away or a distraction from work and school at home. Since leisure activities were severely restricted by state governors, plant activities were among the few options for many people of a wide range of ages. Yet we do not fully understand why this specific activity emerged as one to be undertaken during the COVID-19 pandemic.

Empirical studies investigated intrinsic motivations for engaging in home and community gardening. Intrinsic motivations for home and community gardening can be classified in several ways. First, several studies have found that engaging in gardening leads to mental well-being (Ramirez-Andreotta et al. 2019). The sense of mental well-being includes feelings of peace and tranquility, feeling calmer and more relaxed (McFarland et al. 2018, Relf et al. 1992). Reyes-Garcia et al. (2012) found that home gardens provide benefits associated with aspects of people's well-being (social, psychological, health). Other intrinsic motivations include gaining a sense of control over one's environment (Clayton 2007). Other work showed that participants valued spending time outdoors, observing nature and relaxing, and that gardening was an enjoyable pastime/hobby (Conway 2016, Reyes-Garcia et al. 2012). Intergenerational learning is another intrinsic motivation for gardening. For example, Conway (2016) found that participants valued being able to teach their children where food comes from and Ramirez-Andreotta et al. (2019) pinpointed intergenerational learning, i.e., parents and grandparents can share this activity with another generation. Closely related to intergenerational learning, Ramirez-Andreotta et al. (2019) found that nostalgia is also an intrinsic motivation for gardening. Finally, one study (Schupp and Sharp 2012) found that consumers who participated in the local food system (e.g., buying at a farmer's market) and engaged in beneficial environmental behaviors (recycling, carrying reusable bags) were more likely to have a home garden.

The research documenting plant benefits indicate that those benefits are numerous and diverse. Hall and Knuth (2019a, 2019b, 2019c, 2020) assimilated and classified the abundant plant benefits into the categories of emotional and mental health (Hall and Knuth 2019a), physiological health (Hall and Knuth 2019b), and social benefits (Hall and Knuth 2019c). Yet, scant work has been conducted to

determine which plant benefits most strongly resonate with consumers. One potentially useful measure to understand which consumers derive which plant benefits relative to other consumer segments was developed by Beard and Ragheb (1980). Their leisure satisfaction scale measures satisfaction with psychological, educational, social, emotional, physiological, and aesthetic dimensions of leisure activities with high validity and reliability. The six dimensions measured in the Beard and Ragheb (1980) scales align with most of the plant benefits classified by Hall and Knuth (2019a, 2019b, and 2019c). During the quarantine of 2020, understanding which consumer segments derived which plant benefits may help retailers better connect with consumers in the future.

Several studies on gardening motivations pinpointed demographic differences underlying these motivations. For example, women and more educated consumers were more likely to express mental well-being (feeling calmer around plants) as a key motivator, while younger consumers (ages 18-24 years) were less likely to do so (Relf et al. 1992). Behe and Dennis (2009) reported Baby Boomers were relatively the age cohort with the greatest plant purchasers. Furthermore, consumers with constrained income, specifically those facing economic hardship, were more likely to engage in home gardening (Schupp and Sharp 2012). McFarland (2018) found that motivators of food, health, nutrition, and nostalgia were more influential for men while personal productivity was more influential for women. However, men and women have similar perceptions of the therapeutic value of gardening (McFarland et al. 2018).

Demographic characteristics also shape life experiences, which in turn affect how consumers view products and make purchasing decisions. Baby Boomers, born between 1946 and 1964, comprise one quarter of the American population (Dimock 2019) and buy more floral products compared to Gen X and Gen Y (Dennis and Behe 2007, Rihn et al. 2012). Gen Y or Millennials were born between 1981 and 1995 who are currently between ages 25 and 40 years old (Smith and Nichols 2015). Generation X and Millennials are two distinct and younger age cohorts that have been recently studied because of their increasing influence on the economy (Barrow 1994, Littrell et al. 2005, Roberts and Manolis 2000, Silvergleit 2004). Generation X consists of 44 million people born between 1965 and 1976 (Dimock 2019). Consumers in this age group reportedly tend to value money, possessions, and the shopping experience more than older generations (Roberts and Manolis 2000) and are also characterized as well-educated, self-reliant, and practical (Littrell et al. 2005). Millennials represent 72 million Americans born between 1981 and 1995, who are the most ethnically and culturally diverse age cohort in America today; nearly 25% of this age group is African-American and 18% are Hispanic (Smith and Nichols 2015). Urban living has a strong appeal to them, and they appear to be more interested in social activities compared to older Americans (Smith and Nichols 2015). Millennials are digital natives, meaning they have always had access to the internet, and are comfortable with many technological innovations (Anonymous 2014). Gen Z consumers were born between 1996 and 2012 (Goldring

and Azab 2020). This generation is heavily reliant on social media for communication and has evolved to wield tremendous purchasing power (Goldring and Azab 2020). Since age appears to influence some plant purchases, researchers were curious to better understand which plant benefits appealed to which age groups.

While specific plant benefits are well-documented (Hall and Knuth 2019a, 2019b, 2019c), in a more general sense, nature relatedness (or having some relationship or affinity to nature) may play a role in motivating some individuals to purchase plants, in that having a relationship with nature may cause them to seek out the additional benefits that purchased plants may provide the purchaser in their home or work surroundings. Nisbit and Zelenski (2013) published a six-item scale to measure nature relatedness. Employing this scale for plant and non-plant purchasers may provide additional insight into plant purchase (or not) motivations.

With movement beyond one's residence restricted during much of 2020, researchers posited that consumers' boredom may have driven some plant sales. Vodanovich et al. (2005) published a boredom proneness scale which may be useful to quantify the level of boredom felt by plant purchasers (v. non-purchasers) to see if this was another possible driver. Furthermore, some consumers may have felt apprehension or anxiety about shopping and did not purchase plants. Quantifying anxiety about the shopping process may provide additional insight into gardening motivations. Oakman et al. (2003) developed a scale to measure shopping anxiety, useful to quantify apprehension about shopping during the COVID-19 pandemic.

Another motivation to engage in the purchase of transplants that produce food (e.g., tomatoes, peppers, etc.) may have been food security, especially fear of lack of available fresh produce. Pre-COVID-19 estimates were that 1 in 9 Americans (many of them children) were food insecure (Feeding America 2020). The four main components of food security include availability, access, utilization, and stability of a food source (Food Source 2020). Researchers posited that some consumer groups may experience food insecurity without being hungry, especially if they perceived their food supply to be greatly disrupted. Blumberg et al. (1999) published a scale to quantify food insecurity that could be useful to quantify the experience of plant and non-plant buyers. Of these components, it was the availability dimension of food security which we hypothesized may have contributed to the spike in demand for vegetable transplants.

The review of these studies leads us to the following research questions: RQ1) What motivations played a role in stimulating demand for plant purchases? RQ2) Did some consumer groups experience greater (v. lesser) plant benefits? RQ3) Were there motivational differences by a) age cohort (Gen X, Millennial, and Baby Boomer) or b) by plant purchased (no plants purchased, vegetable transplants, flowering transplants)? RQ4) Did some age cohorts feel greater (v. lesser) nature relatedness? RQ5) Did the physical restrictions of quarantine heighten a sense of boredom more (v. less) for plant purchasers (v. non-purchasers)? RQ6) Did some groups experience more (v.

less) shopping anxiety? RQ7) Did some consumer groups have more (v. less) concern over fresh food access, leading to concerns over food security? RQ8) With limits on physical indoor shopping in some regions and concerns in general about shopping in person, did remote (online and telephone) shoppers experience plant benefits differently? Little research to date has investigated which of these motivations are the reason(s) for why people made plant purchases during the pandemic.

Materials and Methods

With a grant from the Horticultural Research Institute, we developed an online survey from studies that had previously published metrics for the constructs of interest reflecting potential motivations for plant purchases: gardening motivations (Beard and Ragheb 1980), nature relatedness (Nisbit and Zelenski 2013), boredom proneness (Vodanovich et al. 2005), food insecurity (Blumberg et al. 1999), and shopping anxiety (Oakman et al. 2003). The Michigan State University ethics committee overseeing research involving human subjects reviewed and approved the protocol and instrument (exempt STUDY00004683). To maximize the budget, researchers focused on only three age cohorts. To qualify for the study, potential participants must have been in one of the following age groups: Baby Boomers (born 1946-1964), Millennial (born 1981 to 1995), or Gen Z (born 1996 and 2012). We developed the instrument on the Qualtrics (Provo, UT) platform with respondents provided by Dynata (Shelton, CT). Dynata emailed the survey link to selected panel members who would comprise, generally, a sample of 75% plant purchasers and 25% non-purchasers from the U.S. Data were collected from July 24 through August 21, 2020. We set a quota for each of the four age cohorts to strive to collect 25% of the estimated 1,000 responses from each age group. Responses over the quotas were not permitted. Four questions were added as data quality checks where the respondent was directed to provide a specific response (e.g., "Please check the box marked 'agree'").

Each scale (leisure satisfaction dimensions, nature relatedness, boredom proneness, food insecurity, and shopping anxiety) was analyzed with IBM SPSS version 26 (Chicago, IL). As per Hair et al. (2019), researchers employed a principal component analysis with varimax rotation to first see how many components emerged. Component number was established by using both eigenvalue and scree plot statistics where a substantial reduction in each indicated component number cutoff. Loadings range from 0 to 1.0 and show the relationship to the emerging factor(s). Variables with loadings explaining less than 0.50 were dropped, a second principal component analysis was employed, restricting the solution to the number of components identified in the first analysis, and the final loadings calculated as per Hair et al. (2019). Individual component scores were retained at that stage for additional analyses. Comparisons of mean component scores were conducted with a one-way ANOVA ($p=0.05$) using IBM SPSS version 26 (Chicago, IL) followed by Tamhane T2 difference tests where more than two groups were compared.

Table 1. Six leisure satisfaction scales adapted from Beard and Ragheb 1980 to quantify benefits derived from plant purchases measured using a seven-point Likert scale (strongly agree to strongly disagree)^z.

<i>Psychological</i>	Initial Loading	Final loading
My plant activities are very interesting to me.	0.866	0.866
My plant activities give me self-confidence.	0.837	0.837
My plant activities give me a sense of accomplishment.	0.839	0.839
I use my different skills and abilities in my plant activities.	0.856	0.856
<i>Educational</i>	Initial Loading	Final loading
My plant activities increase my knowledge about the things around me.	0.756	0.756
My plant activities provide opportunities to try new things.	0.709	0.709
My plant activities help me learn about myself.	0.746	0.746
My plant activities help me to learn about other people.	0.608	0.608
<i>Social</i>	Initial Loading	Final loading
I have social interaction with others through plant activities.	0.901	0.901
My plant activities have helped me to develop close relationships with others.	0.907	0.907
The people I meet regarding my plant activities are friendly.	0.804	0.804
I associate with the people in my free time who enjoy doing activities with plants a great deal.	0.868	0.868
<i>Relaxation</i>	Initial Loading	Final loading
My activities with plants help me to relax.	0.878	0.878
My activities with plants help me to relieve stress.	0.891	0.891
My activities with plants contribute to my emotional well-being.	0.862	0.862
I engage in activities with plants because I like doing them.	0.839	0.839
<i>Physiological</i>	Initial Loading	Final loading
My activities with plants are physically challenging.	0.762	0.782
My plant activities develop my physical fitness.	0.903	0.913
I take part in plant activities which restore me physically.	0.878	0.880
My plant activities help me to stay healthy.	0.361	dropped
<i>Aesthetic</i>	Initial Loading	Final loading
The areas or places where I engage in my activities with plants are fresh and clean.	0.189	dropped
The areas or places where I engage in my activities with plants are beautiful.	0.988	0.989
The areas or places where I engage in my activities with plants are interesting.	0.988	0.990
The areas or places where I engage in my activities with plants are well-designed.	0.986	0.988

^zAs per Hair et al. (2019) the initial factor analysis does not constrain the number of factors. Factor loadings range from 0 to 1.0. Questions with a loading of < 0.50 are dropped from the subsequent factor analysis and are designated “dropped” under the final loading column.

Results and Discussion

A total of 20,684 potential respondents attempted the survey: 9,788 did not qualify due to their age, 8,256 were excluded when quotas were filled, 555 provided incomplete (< 25% of questions had a response), and 874 failed one or more of the four data quality checks. This yielded 1,211 useful, complete responses.

Sample. The sample contained 33.4% males and 61.4% females (5.2% non-responses). Each household had an average of 1.47 adults and 0.37 children. Slightly more than 50% of the sample (50.5%) had earned a two-year college degree or had more advanced education with an average education of 14.9 years. Mean income was \$76,968 (s.d.=54,430) while the median household income for survey respondents was in the \$60,000 to \$79,999 income category. Mean age was 38.6 years (s.d.=17.95) and the distribution among age groups was 29.9% Millennial, 40.2% Gen Z, and 23.6% Baby Boomer (n=1135) with 6.3% missing an age categorization.

Of the 1,211 responses, 31.4% had made no plant purchases. Of the total sample, 50.9% purchased a flowering plant and 62.7% purchased a plant that produced food (e.g., herb or vegetable transplant). Nearly a third

(32.8%) purchased both a flowering and food producing plant. Only 18.2% bought a flowering plant only while 10.2% bought a food-producing plant only. An additional 7.4% bought some other type of indoor or outdoor plant in the five months preceding data collection. We asked how the plant purchase was made; 76.7% were made in-person while 23.3% were made online or by telephone; these were combined and classified as “remote” purchases.

Component analyses. The leisure satisfaction component analysis retained all four psychological items and the final solution accounted for 72.131% of the variance (Table 1). Analyses of the educational component of the leisure satisfaction component retained all four items and the solution accounted for 70.483% of the variance. The same was true for the social dimension with that final solution accounting for 75.865% of the variance. All four of the items in the relaxation dimension were retained and that final solution accounted for 75.288% of the variance. Three of the four physiological items were retained with the final solution accounting for 75.288% of the variance. Three of the four aesthetic items were retained and the final accounted for 97.796% of the variance.

Table 2. Six-item nature relatedness scale adapted from Nisbet and Zelenski 2013 measured on a 5-point Likert scale (strongly agree to strongly disagree)^z.

Item	Initial loading	Final loading
My ideal vacation spot would be a remote, wilderness area.	0.037	dropped
I always think about how my actions affect the environment.	0.732	0.732
My connections to nature and the environment is a part of my spirituality.	0.805	0.805
I will take notice of wildlife wherever I am.	0.730	0.730
My relationship with nature is an important part of who I am.	0.842	0.843
I feel very connected to all living things and the earth.	0.837	0.837

^zAs per Hair et al. (2019) the initial factor analysis does not constrain the number of factors. Factor loadings range from 0 to 1.0. Questions with a loading of < 0.50 are dropped from the subsequent factor analysis and are designated “dropped” under the final loading column.

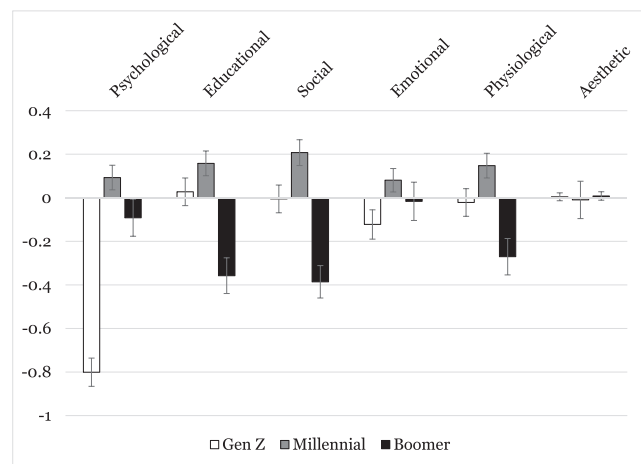
All six of the nature relatedness components were retained and accounted for 62.557% of the variance (Table 2). Seven of the eight boredom proneness items were retained, and the final solution explained 63.5% of the variance (Table 3). All seven food insecurity questions were retained, and the final solution accounted for 74.733% of the variance. All nine of the shopping anxiety questions were retained and the final solution accounted for 60.053% of the variance. Thus, all the motivational dimensions measures in the present study utilized scales similar to those originally published in the cited scales.

Comparisons by age cohort. To address if RQ Motivations demand (RQ1) for plant purchases were different by age cohort), we first compared the component scores for the leisure motivations by age cohort. This analysis

Table 3. Eight items in the boredom proneness scale adapted from Vodanovich et al. 2005 measured on a seven-point Likert scale (strongly agree to strongly disagree)^z.

Item	Initial loading	Final loading
I often find myself at “loose ends” not knowing what to do.	0.779	0.781
I find it hard to entertain myself.	0.477	dropped
Many things I have to do are repetitive and monotonous.	0.676	0.679
It takes more stimulation to get me going than most people.	0.835	0.840
I don’t feel motivated by most things that I do.	0.815	0.819
In most situations, it is hard for me to find something to do or see to keep me interested.	0.868	0.870
Much of the time, I just sit around doing nothing.	0.804	0.808
Unless I am doing something exciting, even dangerous, I feel half-dead and dull.	0.761	0.783

^zAs per Hair et al. (2019) the initial factor analysis does not constrain the number of factors. Factor loadings range from 0 to 1.0. Questions with a loading of < 0.50 are dropped from the subsequent factor analysis and are designated “dropped” under the final loading column.

**Fig. 1.** Mean (s.e.) leisure factor scores for three age cohorts from online survey respondents indicating which age cohorts derived which plant benefits. Mean factor scores show the relative standing between groups with positive scores indicated more benefit and negative scores indicating less benefit derived. Gen Z individuals were born 1996 to 2012, Millennials were born 1981 and 1995, and Baby Boomers were born between 1946 and 1964.

indicated which age groups derived greater versus lesser plant benefits (Fig. 1). We observed differences by age cohort in educational ($F=14.424$, $p=0.000$), social ($F=18.940$, $p=0.000$) and physiological ($F=9.352$, $p=0.000$) benefits. There was no difference by age group for emotional ($F=2.649$, $p=0.0710$), psychological ($F=2.685$, $p=0.069$), or aesthetic ($F=0.021$, $p=0.9790$) benefits. Millennials derived the greatest benefits compared to the Baby Boomers and Gen Z. Of the various benefits, Millennials derived the greatest from social ones, followed by educational, physiological, and psychological. Gen Z derived more educational and physiological benefits compared to Baby Boomers. Given that these data were collected during the mid-year of quarantine, it was surprising that the social benefits received the highest score. Plants appeared to be a common interest or focal point for online social interaction during the pandemic. In other words, plants brought Millennials (and to a lesser extent Gen Z) together online. “The reason these social benefits of plants are so important is that when social bonds are severed, or simply absent, society suffers. At a time when the polarization and fragmentation of society is of growing concern, we need to actively seek ways to strengthen human connections among us and build stronger communities” (Hall and Knuth 2019c, p.136). While this quote was written pre-pandemic, the results in this study support that this statement came true in 2020.

We found differences in the level of perceived boredom proneness ($F=124.183$, $p=0.000$), food security ($F=65.411$, $p=0.000$), and shopping anxiety ($F=13.099$, $p=0.000$) by age group (Fig. 2). The youngest age group, Gen Z, experienced the greatest boredom proneness. This was not surprising since they were unable to physically meet with friends or engage in physically proximate social activities in which they might normally be engaged.

For RQ4 (Nature relatedness by age cohort), there were no differences by age group for nature relatedness

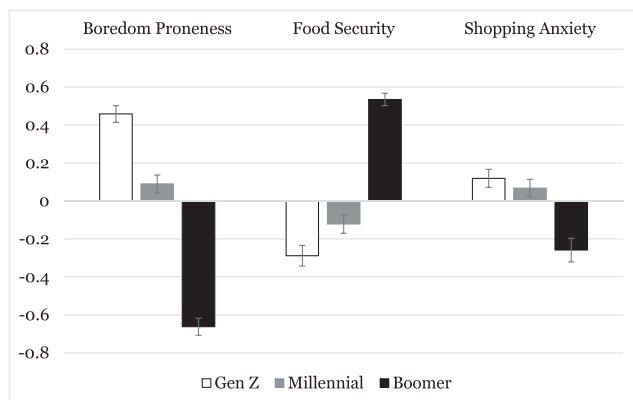


Fig. 2. Mean (s.e.) factor scores for boredom proneness, food security, and shopping anxiety for online survey respondents for three age cohorts. Mean factor scores show the relative standing between groups with positive scores indicated more benefit and negative scores indicating less benefit derived. Gen Z individuals were born 1996 to 2012, Millennials were born 1981 and 1995, and Baby Boomers were born between 1946 and 1964.

($F=1.422$, $p=0.2420$). This may indicate that it was more specific interactions with plants that brought about differences in perceived benefits, not nature in general.

Results for RQ6 (shopping anxiety by age cohort) indicated that Baby Boomers experienced less shopping anxiety compared to Millennials and Gen Z (Fig. 2) ($F=13.099$, $p=0.000$). This was surprising since many more of them may have been at risk of severe health impacts from contracting COVID-19. Or, perhaps Baby Boomers felt they could manage the risk by having products delivered or picked up via curbside service.

In the analysis of RQ7 (Food security concerns by age cohort), we reversed the coding of the food insecurity scale (to avoid a double negative). Baby Boomers experienced the greatest food security while Gen Z experienced the least ($F=65.411$, $p=0.000$) (Fig. 2). Perhaps Baby Boomers were more optimistic about their food supply, had greater means to make those purchases, or simply ate less compared to the younger age cohorts.

Comparison of plant purchasers versus non-purchasers and by plant type purchased. In comparing plant buyers with non-buyers (RQ3, RQ5), we found no difference in boredom proneness ($F=2.963$, $p=0.085$) or shopping anxiety score ($F=1.329$, $p=0.249$). However, we did find differences on food security ($F=7.724$, $p=0.006$) and nature relatedness ($F=29.583$, $p=0.000$). Plant purchasers experienced greater food security (mean=0.0536339) compared to non-plant purchasers (mean=-0.1172890). Furthermore, individuals who purchased food-producing plants or food-producing plants or both a flowering plant and a food-producing plant scored higher on food security compared to non-plant buyers and individuals who purchased flowering plants (Fig. 3). Having purchased plants helped consumers feel better about having access to fresh food. Plant purchasers also exhibited greater nature relatedness (mean=0.1039882) compared to non-plant buyers (mean=-0.2274058). In general terms, plant buyers did relate more strongly to nature and plants in general compared to non-buyers.

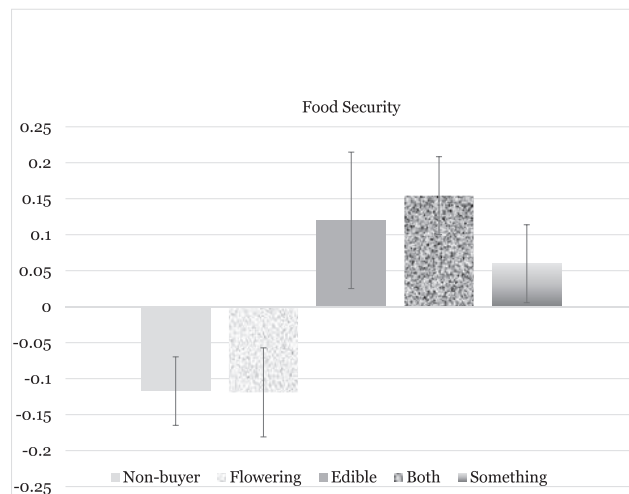


Fig. 3. Comparison of mean (s.e.) food security score by type of plant purchased. Mean factor scores show the relative standing between groups with positive scores indicated more benefit and negative scores indicating less benefit derived. Non-buyers purchased no plants, flowering plant buyers purchased only flowering annuals or perennials, edible plant buyers purchased an herb or vegetable transplant, both purchasers made a purchase of flowering and edible plants, something purchasers purchased a plant not listed in the prior categories.

Comparison of in-person versus remote shoppers. We also compared the component scores of people who made their plant purchases in person as contrasted with remote purchases (defined as a combination of online and telephone purchases). Online plant purchasers were substantially more prone to boredom ($F=34.925$, $p=0.000$), were more food secure ($F=93.641$, $p=0.000$) and experienced more shopping anxiety ($F=31.810$, $p=0.000$) compared to in-person plant buyers. We found no differences between those groups on nature relatedness ($F=0.689$, $p=0.407$). The boredom proneness may be partly explained by a sense of restriction from government-imposed restrictions. Greater food security may be an indication of their sense of control over being able to order plants online, thus exerting some control of what they may eat in the future. The lack of difference in nature relatedness may stem from a similar desire of enjoying nature and plants and wanting to have some close by in the home.

Furthermore, we found differences between the in-person vs. remote purchase groups for social ($F=25.591$, $p=0.000$), educational ($F=6.404$, $p=0.012$), and physiological ($F=17.886$, $p=0.000$) components (Fig. 5) but not psychological ($F=0.019$, $p=0.889$), emotional ($F=0.487$, $p=0.485$), or aesthetic ($F=0.090$, $p=0.764$). Remote shoppers experienced greater social, educational, and physiological plant benefits compared to in-person shoppers. The findings for the social component parallel the findings for the younger age cohorts in that the online social connection brought about by interacting with plants appears to create or strengthen social bonds with other individuals, even online and at a distance. Higher educational and exercise (physiological) benefits were slightly surprising for remote shoppers. It could be that even though the plants were purchased remotely, the buyer engaged in outdoor activity

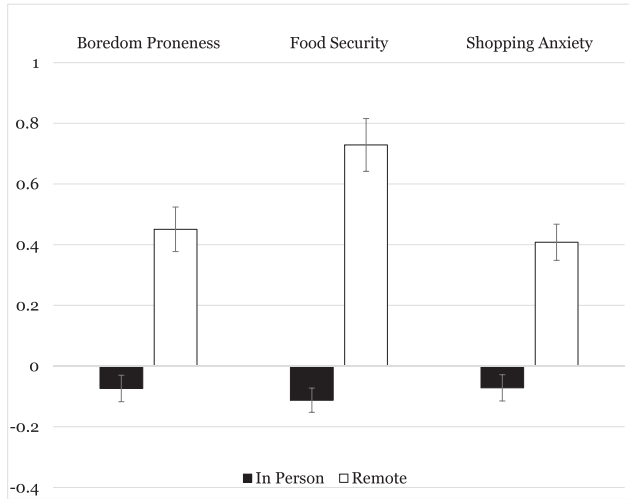


Fig. 4. Mean (s.e.) comparison of component scores for boredom proneness, food security, and shopping anxiety components by mode of plant purchase (in-person or remote). Mean factor scores show the relative standing between groups with positive scores indicated more benefit and negative scores indicating less benefit derived.

in planting and maintain the plant. For the higher educational benefits for the remote shoppers, it is possible that the buyer spent time online researching the plant before purchasing it. That could lead to the perception of becoming more educated about the plant.

In conclusion, different plant benefits were experienced differently by age cohorts during the pandemic, lending insight as to the some of the motivations to make these plant purchases. The plant benefit type that resonated most was the social benefit derived by Millennials. Given the physical restrictions in place due to the quarantine, these benefits could only have been derived through online interaction. Statista (2021) reported that 67.6% of U.S. consumers were spending more than one to two hours additional time on social media during March 2020. Consumers appear to have been connecting to other individuals through their plant interactions. Given the

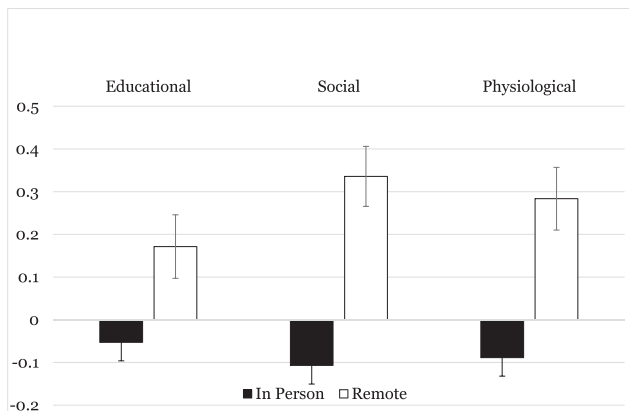


Fig. 5. Comparison of mean (s.e.) component scores for educational, social, and physiological benefits by mode of plant purchase (in-person or remote). Mean factor scores show the relative standing between groups with positive scores indicated more benefit and negative scores indicating less benefit derived.

Table 4. Seven item food insecurity scale adapted from Blumberg et al. 1999 measured using a 3-point scale (often, sometimes, never)^z.

Item	Initial loading	Final loading
How often was this true for you in the last 5 months? I/we worried whether my/our food would run out before I/we got money to buy more.	0.855	0.855
How often was this true for you in the last 5 months? The food I/we bought just didn't last and I/we didn't have the money to get more.	0.866	0.866
How often was this true for you in the last 5 months? I/we couldn't afford to eat balanced meals.	0.851	0.851
How often was this true for you in the last 5 months? I/we relied on only a few kinds of low-cost food to feed our family because I was/ we were running out of money to buy food.	0.866	0.866
How often was this true for you in the last 5 months? I/we couldn't feed the family a balanced meal because I/we couldn't afford that.	0.853	0.853
How often was this true for you in the last 5 months? I/we worried whether my/our food would run out before I/we got money to buy more.	0.883	0.883
In the last 5 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?	0.876	0.876

^zAs per Hair et al. (2019) the initial factor analysis does not constrain the number of factors. Factor loadings range from 0 to 1.0. Questions with a loading of < 0.50 are dropped from the subsequent factor analysis and are designated "dropped" under the final loading column.

Table 5. Nine item shopping anxiety scale adapted from Liebowitz Social Anxiety scale (Oakman et al. 2003) using a seven-point Likert scale (strongly agree to strongly disagree)^z.

Item	Initial loading	Final loading
I don't like touching shopping carts.	0.685	0.682
Lately, I feel apprehensive about going shopping in person.	0.850	0.856
I don't like to be near people who do not wear face masks in public.	0.421	dropped
I avoid shopping in person these days.	0.848	0.854
Lately, I hesitate to go shopping in person.	0.870	0.873
Stores don't do enough to keep customers safe from COVID-19.	0.698	0.704
Stores don't do enough to keep employees safe from COVID-19.	0.686	0.695
I try to avoid being in crowds.	0.632	0.616
I have been reluctant to go shopping in person lately.	0.866	0.870

^zAs per Hair et al. (2019) the initial factor analysis does not constrain the number of factors. Factor loadings range from 0 to 1.0. Questions with a loading of < 0.50 are dropped from the subsequent factor analysis and are designated "dropped" under the final loading column.

perception of disrupted supply chains, it was understandable that some consumers perceived some food insecurity; this was alleviated somewhat by the purchase of food-producing plants. Boredom proneness and shopping anxiety were more profoundly experienced by younger age cohorts (Millennials and Gen Z) compared to their elders (Baby Boomers). Garden retailers could highlight newer cultivars, different types of plants, or fun activities involving plants to help alleviate potential boredom. Online shopping and curb-side pick-up or delivery, now common among many food retailers and restaurants, may help to alleviate some concerns over shopping in-store. Retailers may consider hosting virtual plant seminars where a garden center could sell (deliver) kits to a group of people and then guide them through planting and caring for the plant(s), much like a virtual cooking class.

One possible limitation of this study is associated with Dynata's panel from which the sample was derived. Although the panel contains millions of participants, it is not possible for the research team to determine whether any potential bias was introduced by those self-selecting to participate in the study. Additionally, researchers could not anticipate the pandemic to collect data prior to the event to make before and after comparisons. Future research may investigate how benefits change as consumers age and the COVID-19 pandemic subsides.

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