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Statistics Canada: Pilot Study on Everyday Well-being (PSEW) using the Vitali-T-Stat App

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Abstract

The Pilot Study on Everyday Wellbeing (PSEW) was conducted by Statistics Canada from November 8, 2021 to March 31, 2022 with the cooperation and support of Canadian Heritage and Canada Council for the Arts. This innovative pilot study asked Canadians in-the-moment questions about their activities and feelings to gain a better understanding of the factors that influence well-being. The data provide insight on the connections between activities and well-being and could be used to develop programs that enhance people's lives. This study also represents Statistics Canada's first use of an application (app) for mobile devices for survey collection and first use of the Experience Sampling Method (ESM; Fujiwara & MacKerron, 2015) to measure subjective well-being.

Two different approaches were employed for data collection of the PSEW: a probabilistic sampling method, and a non-probabilistic crowdsourcing method. A probabilistic sampling method was used for the portion of the study which ran from November 8 to December 31, 2021, through voluntary response with the Vitali-T-Stat mobile application (app). The crowdsourcing component ran from January 10 to March 31, 2022.

Two questionnaires were developed for this survey, which integrated seamlessly with the Vitali-T-Stat app: a demographic questionnaire and an ESM questionnaire. The demographic questionnaire, completed once per respondent, collected demographic information and information regarding the impact of COVID-19 on overall mental health, ability to meet financial obligations and daily routine. The subsequent ESM questionnaire asked respondents to provide information regarding their subjective well-being and was completed multiple times per respondent. During a 30-day period, respondents were invited to complete the ESM questionnaire via push notifications at random times throughout the day.

Statistics Canada released the data from this study on February 27, 2023. More information may be found at: https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5333.

Introduction

Statistics Canada's Pilot Study on Everyday Well-being was largely inspired by and modelled on a 2015 paper for Arts Council England by D. Fujiwara & G. MacKerron called "Cultural activities, artforms and wellbeing" which used data from a mobile phone application called Mappiness to determine impacts of participating in culture activities in relation to activities of daily life, measured in terms of subjective well-being. The Canadian federal department supporting arts, heritage and sport, Canadian Heritage, and the Canadian arts granting organization, the Canada Council for the Arts approached Statistics Canada to pilot this approach, in the hopes that a data gap on impacts of culture activities could be filled.

Subjective well-being is defined as the extent to which an individual would describe their lives as positive or favourable (Voukelatou et al., 2021). This assessment of an individual's well-being indicators, such as happiness or satisfaction with life, cannot be directly measured by an outside observer. This

topic has grown in prominence as a key measure of social progress among intergovernmental organizations, such as the Organisation for Economic Co-operation and Development (OECD). In 2013, the OECD provided guidelines on measuring subjective well-being (OECD Guidelines on Measuring Subjective Well-being). Moreover, in Budget 2021 the Government of Canada introduced a Quality of Life Framework for Canada to be used in budgeting and policy development that is grounded in evidence about subjective well-being and its determinants.

Subjective well-being may further be broken down into evaluative and affective subjective well-being (Fujiwara & MacKerron, 2015). Evaluative subjective well-being refers to the individual's overall assessment of their life. Affective well-being refers to "in-the-moment" assessments of positive (e.g., happiness, relaxation) and negative feelings (e.g., anxiety).

Affective well-being is measured through the ESM. As described by Larson and Csikszentmihalyi (2014), the ESM is a research procedure for studying what people do, feel, and think during their daily lives. It consists of asking individuals to provide systematic self-reports at random occasions during the waking hours of a normal week.

According to Fisher & To (2012), there are three different ESM techniques, namely interval based, signal-based, and event-based. Interval-based ESM involves sending a notification at regularly scheduled times, signal-based ESM involves sending a notification at random, unscheduled times, and event-based ESM requires participants to complete a survey after a specific event. The randomness of signal-based ESM makes it an ideal way to track an individual's affective well-being.

An ideal mode for a random, signal-based ESM use is an application on mobile devices.

Statistics Canada conducted consultations with Canadians in 2016 regarding their interest in using a mobile device to complete surveys (Canadians were receptive to the idea) and began thinking of use cases. When the project partners approached Statistics Canada in 2017, it was recognized that this was an opportunity for all organizations to test a novel method and mode to address data gaps.

The project comprised of work to develop the mobile device application, the technical requirements to integrate into Statistics Canada's collection infrastructure, the user interface and app store documentation, the questionnaires in English and French (the official languages of Canada), assurance that Canadian privacy laws were respected (including two privacy impact assessments, one for the technology and one for subject matter content), rigorous testing (technology, questionnaires and communication materials), collection, processing data, data validation and release of data files into Research Data Centres at 33 universities across Canada[1]. Further qualitative testing with Canadians was completed following collection to gather information on reasons people participated or did not, concerns they may have had about privacy or the nature or the study.

[1] A Research Data Centre (RDC) is a university-based laboratory, staffed by a Statistics Canada Analyst, which offers researchers: Secure access to confidential microdata – Statistics Canada census and surveys, plus a growing range of administrative data, in addition to fully-equipped workstations, statistical software and technical support (https://crdcn.ca/about/research-data-centres/)

This was the first use of a mobile device application to collect data by Statistics Canada and to the authors' knowledge, this was the first use of a mobile device application to collect data by a National Statistical Organization. It was also the first use of the Experience Sampling Method at Statistics Canada.

Collection Design and Outcomes

App and Survey Design

Two questionnaires[2] were developed for this survey which resided in a mobile device application developed internally[3] at Statistics Canada for the project, called the Vitali-T-Stat app. The app was only available to residents of Canada. To participate, a person needed to download the Vitali-T-Stat app from Google Play or the Apple Store onto a mobile device (phone or tablet). Upon opening the installed app, the respondent needed to accept the terms and conditions, was invited to adjust settings (language, time of day for notifications, etc.) then proceeded to the first questionnaire. This first, demographic questionnaire comprised a combination of harmonized content (standardized variables used in Statistics Canada social surveys) and other commonly asked questions from Statistics Canada surveys. When the project was delayed due to the COVID-19 pandemic in 2020, three questions were added to the first questionnaire regarding the impact of COVID-19 on overall mental health, ability to meet financial obligations and daily routine. After completing the demographic questionnaire, respondents moved directly to the ESM questionnaire, which included the questions related to subjective well-being and current activities. This questionnaire was developed based on the Arts Council England paper as well as other research related to affective subjective well-being (Fujiwara, 2013; OECD, 2013; Parkinson et al., 2019). After the first completion, the ESM questionnaire was completed multiple times per respondent, prompted by notifications from the Vitali-T-Stat app[4]. A submission of the ESM questionnaire is referred to as a well-being check throughout this paper.

The Vitali-T-Stat app importantly included four results dashboards, which displayed to users the cumulative results for their ESM questionnaire submissions. The first dashboard displayed a personal snapshot of averages of the five feelings: happy, relaxed, focused, in control of your emotions and anxious. The remaining three displayed graphs of the five feelings in relation to location, activity and whether the person was alone or with others. The results dashboards were included as an incentive to continued participation, as they functioned as a type of individual well-being tracker.

Content of both questionnaires was thoroughly tested via two rounds of qualitative interviews with Canadians by the Questionnaire Design Resource Centre at Statistics Canada. Changes to the questionnaires and accompanying help text were made to improve completeness, clarity and

[2] All questions from both questionnaires are listed in Appendix A.
[3] Off the shelf options were considered for the project but none were found that could meet the full requirements of the project.
[4] Notifications were prompts for users to complete an ESM questionnaire, with 2 being the default number per day and 5 being the maximum number that could be selected. However, a user could complete an ESM questionnaire at any time, without prompts.

comprehension. [5] The app itself, with the questionnaires, was further beta tested by approximately 100 employees of Statistics Canada and the partner organizations, using a range of devices, to ensure the download process, notifications, questionnaires and results dashboards functioned as intended.

Respondents were invited to complete the ESM questionnaire over a 30-day period via push notifications at random times throughout the day. After completing the demographic questionnaire, a unique device identifier was created for each respondent that remained the same throughout the 30-day period. This identifier was used to link each respondent's demographic questionnaire with their ESM questionnaire throughout the collection period and was retired along with the app at the end of the collection.

Collection occurred in two steps that comprised of a probabilistic component and a non-probabilistic, crowdsourcing component.

Probabilistic Component

The probabilistic sampling component is a two-stage address-based design, with each of the ten Canadian provinces forming a stratum[6]. In the first stage, dwellings were selected randomly with replacement within each stratum, and in the second stage, one person was selected from within the household using the age-order selection method (Bosa et al. 2019). The age-order selection algorithm, as stated in the instructions provided in the letter sent to the selected household, was based on the number of eligible people in the household and the ordered age of each member.

The survey used the Dwelling Universe File (DUF), a list of Canadian residential addresses produced at Statistics Canada, as the sampling frame. This was done to facilitate an initial contact by mail for the invitation to complete the questionnaire via an application for mobile devices.

Since the survey was conducted using a sample of addresses, all households could be contacted by paper mail. Dwellings that were identified as vacant at the time the sampling frame was created or didn't have a full mailable address were excluded from the sampling frame. However, the survey estimates were weighted to include persons living in these dwellings.

A random sample of 50,000 dwellings were selected. The number of dwellings selected in each province is available in Table 1.

Table 1: PSEW Sample Size by Province

Province	Sample Size
Newfoundland	3,491
Prince Edward Island	3,468
Nova Scotia	3,553
New Brunswick	3,522
Quebec	7,767
Ontario	11,239

[5] Notably, the category "Pet" was added to the list of who you were with, and, as will be seen, Pets were a statistically significant coefficient in most models.

[6] The three Canadian territories, Yukon, Northwest Territories and Nunavut, were not included in the probabilistic component of the pilot due to small population sizes.

Manitoba	3,594
Saskatchewan	3,564
Alberta	4,585
British Columbia	5,217

Collection strategy

Paper invitation letters were mailed to all 50,000 households in the sample on November 8, 2021. An additional 3 reminder letters were mailed to all 50,000 households on November 22, December 6, and December 16, 2021. The letters included Age-Order selection instructions to determine the individual selected for the survey.

Respondents were asked to download the Vitali-T-Stat application from Google Play or the Apple App Store and proceed with the study. Data were collected on a voluntary basis through the Vitali-T-Stat application. The app was compatible with different operating systems (i.e., iOS and Android) and the respondent could use a mobile device of their choice (i.e., phone or tablet). The survey could not be completed on laptop or desktop computers.

Data collection

Collection of the PSEW probabilistic phase ran from November 8 to December 31, 2021. The first time respondents used the Vitali-T-Stat app they were asked to complete both the demographic and ESM questionnaires, which would take approximately 3-5 minutes. Respondents were also able to set a time range and the number of notifications they would receive in this time range (up to a maximum of five) to be reminded to complete the ESM questionnaire for the remainder of the study (requested participation was 30 days). The ESM questionnaire took 1-2 minutes to complete each time.

Crowdsourcing Component

The crowdsourcing component was launched January 10, 2022, and collection continued until March 31, 2022[7]. The crowdsourcing was advertised through various media channels, as well as being promoted by partners of Statistics Canada, who encouraged staff and stakeholders to participate. Participants who were connected to the crowdsourcing via Statistics Canada partnerships were encouraged to use the access code 'CULTURE'. Other participants of the crowdsourcing component received no access code and therefore left that field empty. The crowdsourcing component targeted Canadians 15 years and older, living in the provinces and territories.

Collection Outcomes

For both components of the project, people were asked to participate in the study for 30 days. However, as shown in Table 8.9, only 3% of the crowdsourcing participants and 9% of the probabilistic component

[7] The Vitali-T-Stat application was available until June 30, 2022. Data collected after March 31, 2022 were excluded from the analysis.

respondents remained for the requested time. The majority of the PSEW participants and respondents stayed in the survey between three and seven days.

Table 2: Number of days of participation to the study

Number of days in the study	Crowdsourcing %	Probabilistic %
1 day	27.0	35.1
2 days	12.8	10.8
3-7 days	22.6	18.6
8-14 days	15.2	11.9
15-21 days	11.2	6.7
22-28 days	7.8	7.9
29-35 days	3.3	8.8
More than 35 days	0.1	0.3
Total	100.0	100.0

The average number of well-being checks that were completed per day by the people in the study is presented in Table 3. As mentioned previously, the number of notifications sent per day was between two and five (two was the default, five was the maximum that could be selected in the app by the individual). While the maximum number of notifications an individual could receive was five, individuals were able to go into the application at any time and complete well-being checks (i.e., without a specific notification). Table 3 suggests that individuals kept the original application settings, two notifications per day. Additionally, it also suggests that individuals were not consistent in the number of well-being checks completed per day (perhaps two the first day, one the next…).

Table 3: Average number of well-being checks per day

Average number of well-being checks per day	Crowdsourcing %	Probabilistic %
[1]	37.5	47.9
]1, 1.5[	21.1	21.3
[1.5, 2[	23.7	19.5
[2, 2.5[	13.9	9.4
[2.5, 3[	2.0	1.3
[3, 3.5[	1.2	0.4
[3.5, 4[	0.2	0.1
[4, 4.5[	0.3	0.0
[4.5, 5[	0.1	0.0
[5, 5.5[	0.1	0

Among the people with an average number of well-being checks of two or more per day, 31% of the participants and 25% of the respondents remained only 1 or 2 days in the study, 13% of the participants and 11% of the respondents stayed between 3 and 7 days, 46% of participants and 23% of respondents remained 8 to 28 days in the study. Around 10% of the participants and 41% of the respondents stayed

for 29 days or more in the study and completed an average number of two or more well-being checks per day.

Probabilistic Component

The overall response rate for the probabilistic component was 8.8% or 4,381 respondents[8]. This was in line with pre-collection expectations based on data from the 2015 General Social Survey on Time Use and the participation rates in arts, culture and sport activities.

Table 4 details the response rate by each province. Quebec had the highest response rate (11.6%). The lowest response rate, 6.6%, occurred in New Brunswick and Prince Edward Island.

Table 4: Response Rate by Province

Province	Response Rate
Newfoundland	8.2%
PEI	6.6%
Nova Scotia	8.6%
New Brunswick	6.6%
Quebec	11.6%
Ontario	8.4%
Manitoba	9.4%
Saskatchewan	8.7%
Alberta	8.1%
British Columbia	9.2%

As seen in Table 5, individuals falling into the gender category of women+ were more likely to participate in the study.

Table 5: Gender Distribution of the Respondents

Gender	%
Men+[9]	41.5
Women+[10]	58.4
Not stated	0.1

The PSEW respondents were more likely to be middle-aged, as can be seen in Table 6. The older age groups are less represented when compared to other surveys (often in social surveys, older age groups, retirees in particular, are overrepresented after collection), this may be due to the technology requirement of the PSEW[11].

Table 6: Age Group Distribution of the Respondents

Age Group	%
15-24	7.3

[8] A respondent refers to an individual, 15 years of age or older residing in one of the 10 provinces, who completed at least one ESM questionnaire during the collection period.
[9] Men+ includes men, transgender and non-binary individuals.
[10] Women+ includes women, transgender and non-binary individuals.
[11] Based on the 2021 Census of Population, people aged between 15-24 years represent 14% of the Canadian population of 15 years and over and people aged 65+ represent 23%.

25-34	16.3
35-44	20.9
45-54	19.7
55-64	18.5
65+	18.3

In Table 7, the family income distribution is detailed. Among the respondents to the PSEW, individuals were from households with a higher family income when comparing to the target population. In particular, the highest family income group, $140 000+, is strongly overrepresented among the PSEW respondents[12].

Table 7: Family income of the Respondents

Family Income	%
Less than $20,000	4.1
$20,000 to $39,999	9.5
$40,000 to $59,999	12.4
$60,000 to $79,999	13.3
$80,000 to $99,999	12.2
$100,000 to $119,999	10.1
$120,000 to $139,999	8.7
$140,000 or more	29.6

Crowdsourcing Component

A total of 3,543 demographic questionnaires were submitted by people living in Canada during the collection period. Crowdsourcing was introduced at Statistics Canada as a pilot in 2018 and is now used on an ad hoc basis as an innovative way to collect valuable information for statistical purposes, with participation rates varying considerably.[13] For PSEW, it was difficult to predict how many responses would be obtained, however, the number of submissions was lower than expected, almost certainly due to the COVID-19 pandemic and restrictions throughout much of the country during the collection period. These restrictions particularly prevented people from participating in some cultural events or visiting cultural locations (i.e., museums, art galleries, etc.).

[12] The median family income of the PSEW respondents was $97,629 compared to a Canadian median (including the territories) of $84,000 in 2020.

[13] https://www.statcan.gc.ca/en/our-data/where/crowdsourcing

The table below provides the breakdown of participants by province and territory, age group, and gender.

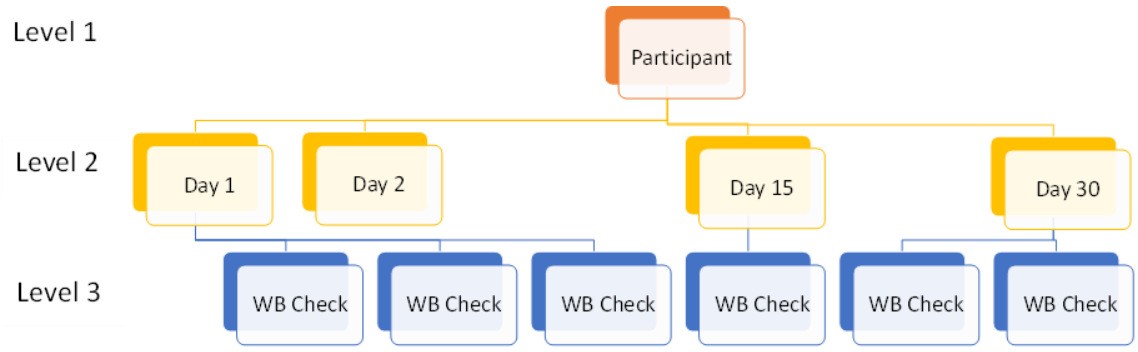
Table 8: Breakdown of participants by geography, age group, and gender

Dimension	**Domain**	***Percent of Total***
Geography	Newfoundland	0.9%
	PEI	0.6%
	Nova Scotia	5.4%
	New Brunswick	2.9%
	Quebec	31.8%
	Ontario	39.1%
	Manitoba	3.6%
	Saskatchewan	1.9%
	Alberta	5.3%
	British Columbia	7.7%
	Yukon	0.5%
	Northwest Territories	0.2%
	Nunavut	0.1%
Age group	15-24	2.5%
	25-34	18.7%
	35-44	26.7%
	45-54	22.9%
	55-64	17.9%
	65+	11.3%
Gender	Male+	28.8%
	Female+	71.2%
	Not stated	0.1%

Analysis Methodology and Modelling Approach

Hierarchical Linear Modelling Approach

Data analysis for the PSEW was conducted using a 3-level Hierarchical Linear Model (HLM) in which we have a fixed effect for the population as well as a different random effect for each individual and each day.



Within an HLM, it is possible to observe the average associations between predictors (e.g., participating in cultural activities) and outcomes (e.g., subjective well-being), in addition to how nested individuals vary around the average. These average associations are the fixed effects of the model, while the variations around the average are the random effects. The random effects of a HLM allow the regression lines to vary between respondents and days of participation, ensuring that the fixed effect average line has the appropriate slope and intercept. Otherwise, in extreme cluster data situations, it would be possible for the regression line to estimate associations completely opposite of the true association.

The HLM used for this study has the following structure:

$$y_{ijk} = \mathbf{x}_{ijk}^T\boldsymbol{\beta} + \mathbf{z}_{ijk}^T\boldsymbol{\gamma}_i + \mathbf{w}_{ijk}^T\boldsymbol{\delta}_{ij} + \varepsilon_{ijk}$$

- i is the index of the participant, j is the index of the day, k is the index of the response of a well-being check
- y_{ijk} is the response value for the k^{th} well-being check on the j^{th} day for the i^{th} participant
- $\mathbf{x}_{ijk}^T$ is the vector of fixed effect covariates, $\mathbf{z}_{ijk}^T$ is the vector of random effect covariates for the participant level, and $\mathbf{w}_{ijk}^T$ is the vector of random effect covariates for the day level nested within the participant level.
- $\boldsymbol{\beta}$ is the vector of fixed effect parameters, $\boldsymbol{\gamma}_i$ is the vector of random effect parameters for the participant level, and $\boldsymbol{\delta}_{ij}$ is the vector of random effect parameters for the day level nested within the participant level.
- ε_{ijk} is the error term.

The fit of HLMs is influenced by four different factors, namely the number of levels in the model, the random slopes and intercepts included in each level, the covariance structure between random effects, and the method of estimating the degrees of freedom for each covariate. HLM models are complex but can explain more of the variation between observations than simpler models; they are able to measure the association within clusters therefore the association between the variables of interest are properly estimated. However, this required many more parameters to be estimated, which can have no solution.

For this study, a 3-level model was used to capture the variation in affective well-being not only across participants but also across different days within each participant. Moreover, the 'between-within' method was used to calculate the degrees of freedom to ensure convergence when producing estimates.

To analyze the PSEW data, the dependent variable in the HLM is the well-being measure of interest (i.e., happiness, anxious, focused, relaxed, in control of emotions) and the independent covariates are the well-being checks (ESM questionnaire) and person-level data (demographic questionnaire containing sociodemographic variables).

For the top level of the model, that is, the participants, both random slope and random intercept terms were included, as it seemed reasonable to allow the base well-being level as well as the impact of cultural activities to be different between participants. For the lower level, that is, days within participants, only the random intercept was included. This specification allowed the base well-being level to change between days within each individual but required the impact of cultural activities to remain the same over multiple days. Due to the high number of one-time participants, adding a random slope to this lower level causes over specification, hence keeping just the random intercept was a reasonable way to slightly simplify the model.

Lastly, for the days within participant level, the covariance structure was allowed to remain unstructured. For the participant level, most covariance structures had too many parameters to estimate, causing a non-positive definite covariance matrix; thus, the covariance structure was set to compound symmetry. This structure assumes the correlations between a participant's responses within a day are constant. Other correlation structures such as the AR(1) or Toeplitz are not reasonable to use as they require equally spaced observations. These were the final specifications chosen for the HLM for the non-probabilistic sample, which remained unweighted due to its limited size.

Analysis of arts, culture and sport participation

The main objective of this pilot study was to evaluate the impact of arts, culture and sport activities on subjective affective well-being. Individuals completed well-being checks and reported their in-the-moment emotions. In addition, they also reported the activity they were participating in and who they were with. It is the association between the emotion scores and activities--emotion scores as they relate to arts and culture activities that we are interested in measuring. Before looking at the modeling analysis and this interaction, we will look at the number of people who reported participating in cultural activities and sport activities during the study.

The list of possible activities from which an individual could select was quite comprehensive and granular (the list can be found in Appendix A.

Expectations for the participation rate in arts, culture and sport activities were based on data from the 2015 General Social Survey on Time Use. It is worth mentioning that with the COVID-19 pandemic, some restrictions were put in place during the collection period. This prevented people from participating in some cultural events or visiting cultural locations (i.e., museums, art galleries, etc.) which led to a participation rate lower than expected. In general, as a result of the COVID-19 restrictions, home-based activities were quite popular. For the probabilistic component, 77% of the completed well-being checks

were completed from home, while for the crowdsourcing component, 80% of the well-being checks were completed from home.

As a result of the granularity of the original activity options and the low participation rate, creating broader art and culture categories was required to analyze the data appropriately. Table A1, Categories of interest for the study, found in Appendix B, details the activities included in each of the four arts and culture categories.

The following tables look at the number of people in the study who participated in cultural activities.

Table 9 gives an overview of the percentage of people who reported at least one well-being check in each of the four categories of interest. These categories are not mutually exclusive, for example, individuals may have at least one instance of consuming culture and at least once instance of sport activities. Unsurprisingly, the highest art and culture activity reported at least once is consuming culture (both for the crowdsourcing and probabilistic components), which includes many home-based activities such as watching TV, movies, or other videos, and playing video games. For both components, participating in culture at least once is the lowest reported arts and culture activity.

Table 9: Percentage of People who Participated in at least one Arts, Culture or Sport Activity

Arts & Culture Activities	Crowdsourcing %	Probabilistic %
Consuming Culture	65.6	66.6
Participating in culture	8.2	6.6
Sport activities	22.5	19.5
Hobbies & Crafts	13.3	12.1

The percentage of people who reported multiple well-being checks for the four categories of interest for each component of the study are presented in tables 10 and 11.

As shown in table 10, 64% of the respondents in the probabilistic component who reported consuming culture at least once, overall completed between 1 and 5 well-being checks where they indicated they consumed culture. The percentage rose to respectively 90% for sports activities, 92% for hobbies and crafts, and 95% for participating in culture activities.

Table 10: Table 10: Distribution of well-being checks among the respondents in the probabilistic component who reported at least one arts and culture activity

	Number of well-being checks				
Arts & Culture Activities	**1 -5**	**6-10**	**11-15**	**16 – 20**	**20+**
Consuming Culture (%)	64.0	15.7	7.9	5.5	6.9
Participating in culture activities (%)	94.8	4.8	0.3	0.0	0.0
Sport activities (%)	89.6	8.9	1.2	0.1	0.2
Hobbies & Crafts (%)	92.3	6.8	0.6	0.2	0.2

Similarly, for the crowdsourcing component we see that the majority of participants who answered, reported one to five instances of consuming culture, participating in culture activities, sport activities and hobbies and crafts.

Table 11: Distribution of well-being checks among the participants in the crowdsourcing component who reported at least one arts and culture activity

	Number of Well-being Checks				
Arts & Culture Activities	**1 -5**	**6-10**	**11-15**	**16 – 20**	**20+**
Consuming Culture (%)	66.0	18.0	7.9	4.3	3.8
Participating in culture activities (%)	93.1	6.9	0.0	0.0	0.0
Sport activities (%)	91.8	7.0	0.9	0.1	0.1
Hobbies & Crafts (%)	91.9	7.5	0.4	0.0	0.2

Data Limitations

Firstly, it should be noted that as the PSEW was only available using a smartphone or tablet, the type of individuals that were able to participate was expected to be limited. For example, we see in the data that respondents/participants tended to be younger and in higher income brackets. A reasonable assumption is that older and/or retired individuals may not have been as tech savvy or comfortable downloading an application as younger Canadians, resulting in lower rates of response/participation in the PSEW. Based on this, there are reasons to believe that individuals who do not have a mobile device have different characteristics than people who do, which would increase the risk of having bias in the survey estimates.

To measure affective subjective well-being, information on people's reported feelings must be collected during random moments through the day on multiple days. Due to technology limits people could do a well-being check without receiving a notification and we did not receive information in the data file that would have allowed us to distinguish the well-being checks without prompting by notification from the random well-being checks prompted by notification. Therefore, there may be some effects in the modeling analysis, where ideally it would have been important to consider only the random well-being check received, i.e., the one completed after receiving a notification. Furthermore, the low numbers of people who participated in the study for multiple days, had an impact on the quality of the well-being measure obtained with modelling analysis.

Another limitation was that fact that if an individual changed devices, i.e., downloading the app on a new mobile device, the demographic questionnaire had to be redone and a new DEVICE_ID was created for the same person, it was not possible to link the two different IDs, other than for cases in the probabilistic component where the person entered the 6-digit code from the invitation letter.

A limit that points to the challenges of language was the fact that, despite professional transition and qualitative testing in both Canadian official languages, the final data file pointed to differences in how French and English respondents/participants understood the disability concept. In the English question, the concept refers to disability status, whereas the French question refers to handicap status. It is not recommended to use the disability variable for analysis purposes.

Ideally, the weighting process (including the non-response adjustments) would eliminate the non-response bias in a probabilistic sample. However, the response rate for the PSEW was very low and there

are reasons to believe that the characteristics of the respondents and the non-respondents were not fully accounted for in the weighting process which means that there is likely bias remaining.

Due to the nature of a crowdsourcing initiative, the collected information in the **crowdsourcing component** is not representative of the Canadian population. Benchmarking factors for the crowdsourcing component of PSEW were not created as the number of participants was low and not significantly larger than the number of respondents from the probabilistic component.

Despite the limits, interesting results are found in the data. Statistically significant relationships were found between the well-being covariates and affective subjective well-being, as will be seen below.

Results of Regression Analysis

The goal of the analysis is to assess the relationship between cultural engagement and momentary affective well-being, in particular reproducing the study completed by Fujiwara and MacKerron (2015) with the modification of considering the hierarchical nature of the data. The idea is that culture and sport activities have a positive effect on subjective well-being. The model will result in coefficients that will allow us to determine whether there is a positive or negative association between the well-being measures (happiness, relaxation, focus, in control of emotions and anxiety) and the covariates. The covariates are divided into three categories: main effects, interaction effects and demographic covariates.

Please note, all modeling was completed separately on the probabilistic component and crowdsourcing component; this is due to a difference in design as well as different reference periods.

Regression model

The main effects included the variables that are of particular interest for the hypothesis. The number of individuals participating in each culture or sport variable is small, therefore we need to regroup the activities into broader categories, namely: consuming culture, participating in culture, consuming or participating in sports, and hobbies & crafts. For further details on what was included in the four categories, please refer to Appendix A, Table A.1 Categories of interest for the study. All activity covariates are binary variables, where one means the individual did participate in that activity.

<u>OUTCOME VARIABLE</u>

As it was explained earlier, the study was measuring five different emotions: happiness, relaxation, focus, in control of emotions, and anxiety. We are interested in knowing what factors have an influence on each of them. Five different models will be created, one for each emotion.

<u>MAIN EFFECTS</u>

Activities:

- Consuming culture
- Participating in culture
- Consuming or participating in sport activities
- Hobbies & crafts

Who you are with includes:

- Alone
- With spouse
- With child or children under 15
- With child or children over 15
- With parents or parents-in-law
- With pets
- With other relatives
- With friend(s)
- With colleague(s) or classmate(s)
- With other social contact

INTERACTION EFFECTS

The interaction effects considered for the model are between the four activity categories and the 'who you are with' covariates (the 'who you are with' includes multiple binary variables, one for each person identified in the list above). Because of low frequencies, some of the interactions were not included in the models (see table 12).

Table 12: Interactions removed from the models

PSEW component	Interactions removed
Crowdsourcing component	Consuming culture with coworkers/classmates
	Participating in culture with parents or parents-in-law
	Hobbies & crafts with coworkers/classmates
	Hobbies & crafts with 'other' contacts
Probabilistic component	Hobbies & crafts with coworkers/classmates
	Hobbies & crafts with 'other' contacts

DEMOGRAPHIC COVARIATES

The demographic covariates included in the model are: gender, age group (by 20-year groups), Indigenous person flag, household size, visible minority flag, family income group. Additionally, three covariates related to the impact of COVID-19 questions (daily habits, ability to meet financial obligations, and mental health) were included. For each model performed, demographic covariates not showing significant impact on the well-being measure were removed from the model.

The hierarchical linear model analysis will be completed separately on the probabilistic and crowdsourcing component, with each well-being measure as the response variable (10 models in total). For the probabilistic component, a model-based approach was taken, i.e., the survey weights were not considered in the hierarchical model. This means the results can only be applied to the respondents of the study. Because of the low response rate, the respondents cannot be assumed to be representative of the Canadian population 15 years and over in the provinces. Moreover, due to the nature of a crowdsourcing initiative, the collected information is not representative of the Canadian population; results of the crowdsourcing models can only apply to the participants of the study.

Main results

For each model in the table below, the significant variables are listed in order of influence. The bolded text indicates the concept is one of the main effects. The direction (positive or negative) of influence is provided in parenthesis for each significant concept. Caution with respect to directionality should be taken when analyzing the anxious model. The response variable is the anxiety score, where 0 is 'Not at all anxious' and 10 is 'Completely anxious.' Therefore, a positive association means that anxiety is increasing, and a negative association means that the covariate decreases anxiety. Note this is opposite to the scales for the four other well-being measures, i.e., the positive emotion is associated with a higher score from 0 to 10.

The reference category for activities is all other activities beyond art, culture and sport (all regrouped into one category). For the social contact, the reference category is being alone. Any significant impact, positive or negative, shows a significant difference compared to the reference category.

Table 13: Significant effects for each model

	Probabilistic Analysis	**Crowdsourcing Analysis**
Happy Model	• Friends (+) • **Participating in culture (+)** • **Participating or consuming in sport activities (+)** • **Hobbies & crafts (+)** • Participating or consuming in sport activities with friends (-) • Other relatives (+) • Hobbies & crafts with spouse (-) • Participating or consuming in sport activities with spouse (-) • Spouse (+) • **Consuming culture (+)** • Children above 15 (+) • Children under 15 (+) • Pets (+) • Parents or parents-in-law (+)	• **Participating in culture (+)** • Friends (+) • **Participating or consuming in sport activities (+)** • **Hobbies & crafts (+)** • Participating in culture with friends (-) • Other relatives (+) • Participating in culture with spouse (-) • Participating or consuming in sport activities with friends (-) • Parents or parents-in-law (+) • Consuming culture with other relatives (-) • **Consuming culture (+)** • Spouse (+) • Children above 15 (+) • 'Other' contacts (+) • Pets (+) • Consuming culture with children under 15 (+) • Children under 15 (+)
Relaxed Model	• Participating or consuming in sport activities with coworkers/classmates (+) • Consuming culture with 'other' contacts (+) • **Consuming culture (+)** • **Hobbies & crafts (+)** • Friends (+) • **Participating in culture (+)** • Hobbies & crafts with spouse (-) • **Participating or consuming in sport activities (+)** • Coworkers/classmates (-) • 'Other' contacts (-) • Spouse (+) • Other relatives (+) • Parents or parents-in-law (+) • Children above 15 (+)	• Consuming culture with 'other' contacts (-) • **Hobbies & crafts (+)** • **Consuming culture (+)** • **Participating in culture (+)** • Friends (+) • Consuming culture with friends (-) • **Participating or consuming in sport activities (+)** • Consuming culture with parents/in-laws (-) • Coworkers/classmates (-) • Parents or parents-in-law (+) • Spouse (+) • Other relatives (+) • Consuming culture with spouse (-) • Pets (+)

	• Pets (+)	
Focused Model	• Participating in culture with coworkers/classmates (+) • **Participating or consuming in sport activities (+)** • **Hobbies & crafts (+)** • Coworkers/classmates (+) • Children above 15 (+)	• **Participating in culture (+)** • **Participating or consuming in sport activities (+)** • **Hobbies & crafts (+)** • Coworkers/classmates (+) • Friends (+) • Consuming culture with spouse (+) • Children under 15 (-)
In Control of Emotions Model	• Participating in culture with parents/in-law (+) • Hobbies & crafts with pets (+) • **Hobbies & crafts (+)** • Friends (+) • **Participating or consuming in sport activities (+)** • Other relatives (+) • **Consuming culture (+)**	• **Participating in culture (+)** • Friends (+) • **Hobbies & crafts (+)** • **Participating or consuming in sport activities (+)** • Consuming culture with children under 15 (+) • **Consuming culture (+)** • Coworkers/classmates (+) • Children under 15 (-) • Pets (+)
Anxious Model	• Participating or consuming in sport activities with children above 15 (+) • Hobbies & crafts with spouse (+) • **Hobbies & crafts (-)** • Friends (-) • **Participating or consuming in sport activities (-)** • **Consuming culture (-)** • Consuming culture with children above 15 (+) • Other relatives (-) • Children above 15 (-) • Pets (-) • Spouse (-) • Coworkers/classmates (+)	• Participating in culture with pets (+) • **Participating or consuming in sport activities (-)** • **Participating in culture (-)** • Consuming culture with friends (+) • Friends (-) • **Hobbies & crafts (-)** • Hobbies & crafts with spouse (+) • **Consuming culture (-)** • Other relatives (-) • Parents/in-law (-) • Pets (-) • Spouse (-) • Children under 15 (-)

From the table above, we can see that consuming culture had a positive and significant impact on all well-being measures except the focused model for both probabilistic and crowdsourcing components. For participating in culture, we see that there was a positive impact on the happiness and relaxation in the probabilistic component; in the crowdsourcing component, it was a significant and positive impact on all well-being measures investigated. In the case of consuming or participating in sport activities, it was positively significant for happiness, relaxation, focus and in control of emotions, and negatively significant for anxiety, meaning it reduced anxiety, for both the probabilistic and crowdsourcing components. Finally, hobbies and crafts had a positive impact on all well-being measures for both the probabilistic and crowdsourcing components.

Conclusion

The PSEW was conducted to gain a better understanding of the factors that influence well-being and more precisely, to understand if culture and sport activities had a positive impact on subjective affective well-being. To gain this understanding, the Experience Sampling Method was used for the first time at Statistics Canada. The PSEW also tested for the first time, the utility of using a mobile device application to collect data from Canadians at Statistics Canada. The pilot study produced meaningful data for the project partners, the department of Canadian Heritage and the Canada Council for the Arts and proved to Statistics Canada that the technology can work.

A total of five well-being measures were assessed during the project: happiness, anxiety, relaxation, focus, and control of emotions. Culture and sport activities were divided in four main categories: consuming culture, participating in culture, participating or consuming sporting activities, and hobbies and crafts.

COVID-19 pandemic restrictions almost certainly resulted in fewer people than expected participating in arts, culture or sport activities. Bias potentially remains in the probabilistic component after the weighting due to the low response rate. Furthermore, the fact that only people with a mobile device could participate and the length of the requested participation in the study likely limited the numbers of Canadians who participated. Caution should be taken when analysing and interpreting the results of each component as they cannot be extrapolated to the entire Canadian population.

Despite the limits, statistically significant relationships were found between the well-being covariates and affective subjective well-being.

A hierarchical linear modeling approach was built to determine which activities had a positive effect on subjective well-being to account for the correlation between the data points. Results from the model can only be applied to the people who were in the study. In general, consuming culture had a positive impact on all the well-being measures except on focus for both components. Participating in culture had a positive impact on the happiness and relaxation in the probabilistic component; in the crowdsourcing portion, it was a significant and positive impact on all well-being measures investigated. In the case of consuming or participating in sport activities, it was positively significant for happiness, relaxation, focus and in control of emotions, and negatively significant for anxiety, for both the probabilistic and crowdsourcing portions. Finally, hobbies and crafts had a positive impact on all well-being measures for both the probabilistic and crowdsourcing portions.

Qualitative interviews were conducted with Canadians from the probabilistic component (both those who had participated and those who did not) following the pilot to receive information about what worked or did not work about the study. Some people felt the paper communication materials were too detailed and did not sufficiently explain the reasons to participate, some felt that the requested 30 days of participation was too long, but by far the most prominent barrier or frustration shared was the requirement to enter a password each time you opened the app to complete a questionnaire (this was also found in the comments on the app stores). On the positive side, no one shared security concerns, people found the results dashboards interesting and an incentive to participate and there were cases where respondents came to rely on the app to monitor their well-being, necessitating an extended period of the app availability and increased communications on the app stores to ensure Canadians could transition to another app to monitor their well-being.

Now that all restrictions on cultural activities and sports have been lifted, it would be interesting to repeat this project to try to garner more responses and a wider variety of activities. If given this opportunity, some adjustments would be made to the technology, notably exploring the ability to relax the

requirement to enter a password for each ESM questionnaire and to take the opportunity to improve the model. One thing that could be tried, would be to use a scale of 0-100 rather than a 0-10 scale so that the variable can be fully continuous. The creation of an overall well-being score (calculated as the mean of the five well-being measure scores) could also be considered for future work along with the analysis on this variable to make sure not to violate the hypothesis that the response variable is continuous.

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Appendix A: List of Questions

Demographic Questionnaire including COVID-19 Questions

Demographic Questions

Variable	Question	Response
DOB	What is your date of birth?	Year-Month-Day
Name	What is your name?	First Name, Last Name
Postal Code	To determine which geographic region you live in, please provide your postal code	Postal Code Fill In
Sex at Birth	What was your sex at birth	Male Female
Gender	What is your gender?	Male Female Or please specify
Size of household	Including yourself, how many persons live in your household?	Number of persons Fill In
Over age 15	How many of these persons are 15 years of age or older?	Number of persons fill in
Indigenous Identity	Are you an Indigenous person, that is First Nations (North American Indian), Métis or Inuk (Inuit)?	Would you say: No, not an Indigenous person OR Yes, First Nations (North American Indian Yes, Métis Yes, Inuk (Inuit)
Ethnicity	The following question collections information in accordance with the Employment Equity Act and it Regulations and Guidelines to support programs that promote equal opportunity for everyone to share in the social, cultural, and economic life of Canada. Are you:	White South Asian (for example, East Indian, Pakistani, Sri Lankan) Chinese Black Filipino Arab Latin American Southeast Asian (for example, Vietnamese, Cambodian, Laotian, Thai) West Asian (for example Iranian, Afghan) Korean Japanese Other: Specify Other
Disability	Are you a person with a disability? A person with a disability has a long-term or recurring physical, mental, sensory, psychiatric or learning impairment and considers himself or herself to be disadvantaged within society by reason of that impairment, or believes that individuals within society are likely to consider him or her to be disadvantaged by reason of that impairment.	Yes No

	Persons with disabilities are also those whose functional limitations owing to their impairment have been accommodated in their current job or workplace.	
Language	What language do you speak most often at home?	English French Other: Specify other language

Impacts of COVID-19 Questions

Variable	Question	Response
Daily Routine	Which of the following best describes the impact of COVID-19 on your usual daily routine?	Major impact Moderate impact Minor impact No impact at all Don't know Prefer not to say
Mental Health	Which of the following best describes the impact of COvID-19 on your mental health?	Major impact Moderate impact Minor impact No impact at all Don't know Prefer not to say
Financial Obligations	Which of the following best describes the impact of COVID-19 on your ability to meet financial obligations or essential needs? For example rent or mortgage payments, utilities and groceries	Major impact Moderate impact Minor impact No impact at all Don't know Prefer not to say

Experience Sampling Method Questionnaire

Subjective well-being

Variable	Concept	Scale
ESM_01	how happy do you feel at this moment?	11 categories from: 0 - Not at all happy to 10 - Completely happy
ESM_05	how anxious do you feel at this moment?	11 categories from: 0 - Not at all anxious to 10 - Completely anxious
ESM_02	how relaxed do you feel at this moment?	11 categories from: 0 - Not at all relaxed to 10 - Completely relaxed
ESM_03	how focused do you feel at this moment?	11 categories from: 0 - Not at all focused to

		10 - Completely focused
ESM_04	how in control of your emotions do you feel at this moment?	11 categories from: 0 - 0 - Not at all in control of your emotions to 10 - Completely in control of your emotions

ESM_06: Where are you at this moment?

CODE	Where were you
1	At home
2	At work or school
3	In transit ESM_06A 1: Car passenger 2: On public transit 3: Walking 4: Other mode of transportation
4	At someone else's home
5	Grocery store, other stores or mall
6	Restaurant, bar or club
7	Outdoors
8	Sports centre, community centre, field or arena
9	In my neighbourhood
10	Medical, dental or other health clinic
11	Place of worship
12	Away on business
13	Library, gallery, museum or theatre
14	Other

ESM_07: What activity are you doing at this moment?

CODE	Activity
1	Paid work activities
2	Studying or learning
3	Personal care (For example grooming, bathing.)
4	Eating or drinking (Include alcohol.)
5	Using social media
6	Socializing or communicating (Include in person or using any type of technology, such as Skype, FaceTime.)
7	Watching television
8	Watching a movie (Include both online or in theatre.)
9	Watching other videos (For example YouTube.)
10	Reading (Include books, magazines, news, online browsing.)
11	Listening to music, radio or podcasts
12	Playing video games or computer games
13	Walking, hiking, birdwatching, hunting, fishing, camping, foraging, et cetera
14	Exercising
15	Participating in competitive or recreational sports
16	Household chores or maintenance (Include pet care, cleaning, preparation of meals, gardening.)
17	Caring for others
18	Civic, religious or organizational activities
19	Shopping

20	Creating online content (For example reviews, blogging, tutorials, live streams.)
21	Hobbies and crafting (For example woodworking, sewing, playing board games, et cetera.)
22	Playing a musical instrument, singing
23	Painting, sculpting or other artistic activity
24	Attending live music or a music festival
25	Visiting a museum (Exclude art museums.)
26	Visiting an art museum or gallery
27	Attending a sporting event
28	Attending other live performance, public celebration or other festival
29	Other activity (Include relaxing, waiting, thinking, smoking, sleeping.)

ESM_08: Who are you with at this moment?

CODE	Who you were with
ESM_08A	On my own
ESM_08B	Spouse, partner
ESM_08C	Child or children under 15
ESM_08D	Child or children 15 or over
ESM_08E	Parents or parents in-law
ESM_08F	Pet(s)
ESM_08G	Other relative(s)
ESM_08H	Friend(s)
ESM_08I	Colleague(s) or classmate(s)
ESM_08J	Other

Appendix B: Cultural categories for modelling

As it was explained, because of the low number of responses, broader art and culture categories were created for the analysis. The full list of possible activities was the following (variable ESM_07 on the datafile).

- Paid work activities
- Studying or learning
- Personal care
- Eating or drinking
- Using social media
- Socializing or communicating
- Watching television
- Watching a movie
- Watching other videos
- Reading
- Listening to music, radio, or podcasts
- Playing video games or computer games
- Walking, hiking, birdwatching, hunting, fishing, camping...
- Exercising
- Participating in competitive or recreational sports
- Household chores or maintenance
- Caring for others
- Civic, religious or organizational activities
- Shopping
- Creating online content
- Hobbies and crafting
- Playing a musical instrument, singing
- Painting, sculpting or other artistic activity
- Attending live music or a music festival
- Visiting a museum
- Visiting an art museum or gallery
- Attending a sporting event
- Attending other live performance, public celebration...
- Other activity

The table below presents the activities included in each of the four categories created for this project.

Table A.1 Categories of interest for the study

Arts and Culture Category	Activities included	ESM_07 code
Consuming culture	Watching television	07
	Watching a movie	08
	Watching other videos	09
	Reading	10
	Listening to music, radio, or podcasts	11
	Playing video games or computer games	12
Participating in culture	Playing a musical instrument, singing	22
	Painting, sculpting or other artistic activity	23
	Attending live music or a music festival	24
	Visiting a museum	25
	Visiting an art museum or gallery	26
	Attending other live performance, public celebration	28
Consuming or participating in sport activities	Walking, hiking, birdwatching, hunting, fishing, camping	13
	Exercising	14
	Participating in competitive or recreational sports	15
	Attending a sporting event	27
Hobbies & crafts	Hobbies & crafts	21