

Risk Assessment Model for Multi-Family Residential Sites Time Activity Patterns

Ray Copes, MD, MSc
Cornel Lencar, MSc



Scope of the project

- To review the exposure scenarios intended for use at residential sites in Canada and elsewhere and that are relevant to multi-family residential sites.
- To review available literature regarding time activity patterns of residents of multi-family dwelling units.
- To develop exposure scenarios appropriate for multi-family residential site that can be incorporated into a model in order to estimate exposure to residents based on all pathways operating at multi-family residential site.
- To collect epidemiological data to support and to refine the exposure scenarios so that the constructed model could be used for setting 'default' standards or for site specific risk assessments.

Exposure scenarios at residential sites – theoretical framework

- The basis of the generally used theoretical frameworks in developing exposure scenarios for contaminated soil are the land use categories developed by various jurisdictions around the world.
- There is only an implicit recognition of time activity patterns related to different land uses.
- Environment's attributes are inconsistently recognized when developing land use categories and exposure scenarios.

Soil exposure pathways for residential land use as defined in various jurisdictions (1)

Jurisdiction	Agency	Publication	Pathways suggested
Canada	Canadian Council of Ministers of the Environment	A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines, 2006	<ul style="list-style-type: none"> - Soil ingestion - Dermal contact - Particle inhalation - Groundwater consumption - Inhalation of indoor air volatiles - Garden produce consumption (10% grown on-site)
British Columbia	Science advisory Board for Contaminated Sites in British Columbia	Report on: Scientific Review of British Columbia CSST Soil Standards Derivation Protocol, 2005	<ul style="list-style-type: none"> - Soil ingestion - Absorption through skin due to dermal contact - Ingestion of contaminated water - Inhalation of soil contaminants in indoor air. - Inhalation of dust

Soil exposure pathways for residential land use as defined in various jurisdictions (2)

Jurisdiction	Agency	Publication	Pathways suggested
Australia	National Environment Protection Council	Schedule B (7b) Guideline on Exposure Scenarios and Exposure Settings, 1999	<ul style="list-style-type: none">- Direct soil and dust ingestion (limited)- Direct soil particulate inhalation
Germany	Federal and state agencies	The UMS system for exposure assessment in soil, 1997	<ul style="list-style-type: none">- Ingestion of dust- Inhalation of volatiles

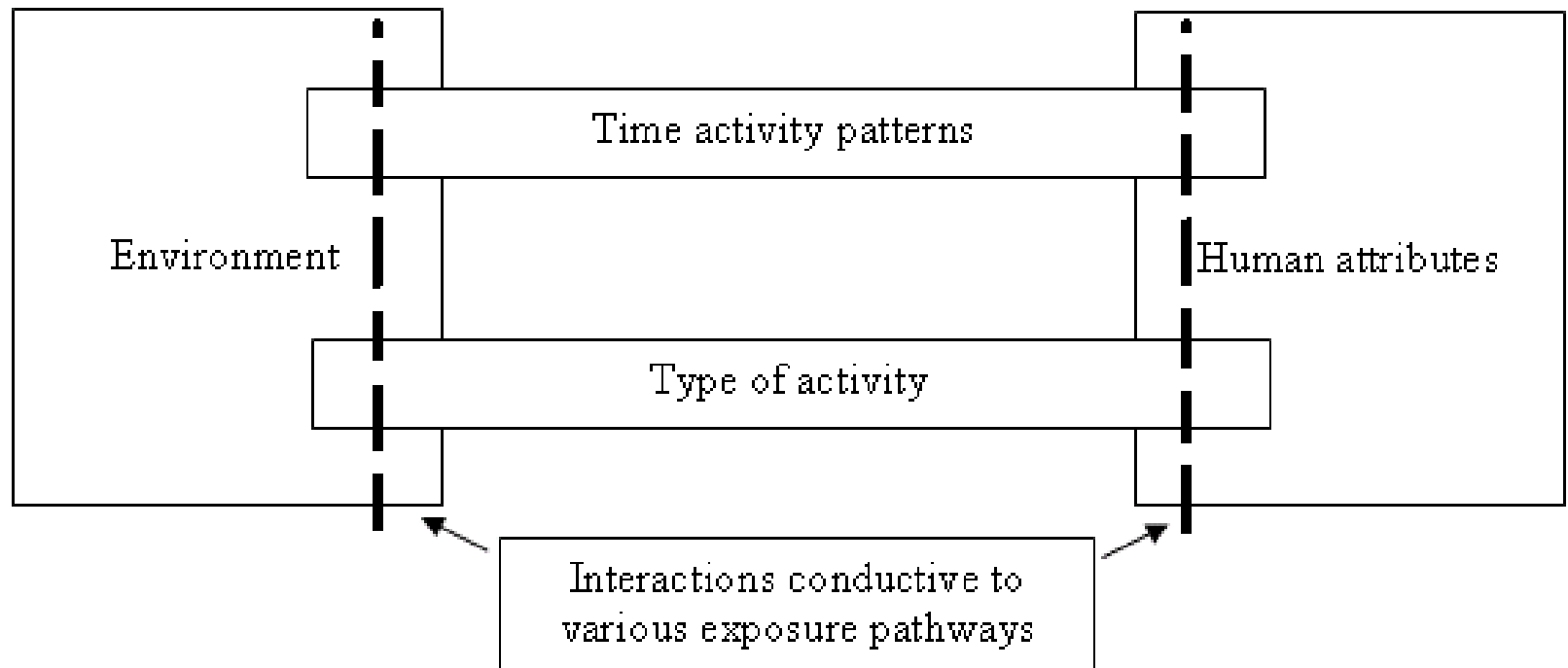
Soil exposure pathways for residential land use as defined in various jurisdictions (3)

Jurisdiction	Agency	Publication	Pathways suggested
United Kingdom	Department for Environment Food&Rural Affairs. Environment Agency	The Contaminated Land Exposure Assessment Model (CLEA): Technical basis and algorithms, 2002	<ul style="list-style-type: none"> - Ingestion of soil - Ingestion of household dust - Ingestion of contaminated vegetables - Ingestion of soil attached to vegetables - Dermal contact with soil - Dermal contact with household dust - Inhalation of fugitive soil dust - Inhalation of fugitive household dust - Inhalation of vapours outside - Inhalation of vapours inside

Soil exposure pathways for residential land use as defined in various jurisdictions (4)

Jurisdiction	Agency	Publication	Pathways suggested
The Netherlands	National Institute of Public Health and the Environment	2001. Technical evaluation of the Intervention Values for Soil, sediment and Groundwater. Human and ecotoxicological risk assessment and derivation of risk limits for soil	<ul style="list-style-type: none"> - Inhalation of soil particles - Dermal contact with soil - Inhalation during showering - Intake of drinking water - Dermal contact during showering - Soil ingestion - Crop consumption from gardens on contaminated land - Inhalation of indoor and outdoor air (particularly indoor air)

General model defining the determinants of exposure and their interactions



Examples of factors to be considered in the model

- Environmental attributes:
 - the level of soil contamination;
 - the type of vegetation present, if any;
 - the level of access to that particular land;
 - the constructions representing the indoor environment;
 - the surrounding infrastructure that defines the outdoor environment.
- Human attributes:
 - age;
 - sex;
 - body weight
 - body height
 - skin surface area
 - breathing rates

Potential types of multi-unit residential buildings

- Multi-unit residential building (i) with foundation not permissive to infiltrations from exterior, and (ii) with potentially exposed soils and managed plantings that are found in courtyards, walking areas, and/or strategically located near entry points.
- Multi-unit residential building (i) with foundation not permissive to infiltrations from exterior, and (ii) with no potentially exposed soils.
- Multi-unit residential building (i) with foundation permissive to infiltrations from exterior, and (ii) with potentially exposed soils and managed plantings that are found in courtyards, walking areas, and/or strategically located near entry points.
- Multi-unit residential building (i) with foundation permissive to infiltrations from exterior and (ii) with no potentially exposed soils.

Potential pathways of exposure to contaminated soil for High Density Urban Land Use

No Infiltration & Exposed Soil	No Infiltration & No Exposed Soil	Infiltration & Exposed Soil	Infiltration & No Exposed Soil
Ingestion of soil		Ingestion of soil	
Ingestion of household dust ¹		Ingestion of household dust ¹	
Ingestion of contaminated vegetables		Ingestion of contaminated vegetables	
Ingestion of soil attached to vegetables		Ingestion of soil attached to vegetables	
Dermal contact with soil		Dermal contact with soil	
Dermal contact with household dust ¹		Dermal contact with household dust ¹	
		Inhalation of vapor inside	Inhalation of vapor inside

¹ We refer only to the portion of household dust originating from soil from the outside of the residence

Review of time activity pattern literature relevant to multi-unit residences

- No relevant literature specific to multi-unit residences was found.
- Examples of non-specific sources:
 - It's about time: A comparison of Canadian and American time–activity patterns (Leech et al 2002)
 - The National Human Activity Pattern Survey (NHAPS): a resource for assessing exposure to environmental pollutants (Klepeis et al 2001)

More relevant sources:

- U.S. EPA Consolidated Human Activity Database (contains U.S. NHAPS) – available.
- Canadian Human Activity Pattern Survey – not available.
- Canadian General Social Survey 2005 – available.

Canadian General Social Survey 2005

- Surveyed subjects over 14 years of age.
- Has information on the number of children in the household and time spent supervising children.
- Can be used to infer the time spent by children in different locations but it is not specific regarding what children were actually doing.
- Has information on type of housing (detached homes, low-rise (< 5) and high-rise apartments (5+ stories).
- Has information on gardening activities.
- 2,254 subjects in BC (272 in low-rise; 102 in high-rise).
- No information regarding where the garden is located (proximity of the residence, neighbourhood garden, balcony/patio).

Canadian General Social Survey 2005 – population over 14 years

Group of activities	Average time spent in the activity (min) and 95% CI	Percentage of average time spent in the activity (min) and 95% CI
Inside at home not sleeping	490.7 (488.6 – 492.9)	34.1 (33.9 – 34.2)
Inside not at home	325.9 (323.4 – 328.3)	22.6 (22.5 – 22.8)
Outside not at home	29.9 (29.2 – 30.6)	2.1 (2.0 – 2.1)
Travel – including for work	62.9 (62.2 – 63.5)	4.4 (4.3 – 4.4)
Inside at home sleeping	505.3 (504.0 – 506.5)	35.1 (35.0 – 35.2)
Outside at home in garden	15.5 (15.0 – 16.0)	1.1 (1.0 – 1.1)
Outside at home not in garden	10.0 (9.6 – 10.3)	0.7 (0.7 – 0.7)

Canadian General Social Survey 2005 – population over 14 years

Place of activity	Dwelling type	Sex	Average time spent in the activity (min) and 95% CI	% of average time spent in the activity (min) and 95% CI
Outside at home garden	Single detached house (n=1472)	Male	25.4 (19.2 – 31.6)	1.8 (1.3 – 2.2)
		Female	17.9 (13.9 – 21.8)	1.2 (1.0 – 1.5)
	Low-rise apartment (n=278)	Male	0.8 (0.0 – 2.3)	0.1 (0.0 – 0.2)
		Female	2.3 (0.5 – 4.1)	0.2 (0.0 – 0.3)
	High-rise apartment (n=102)	Male	0.7 (0.0 – 2.1)	0.0 (0.0 – 0.1)
		Female	1.5 (0.0 – 4.5)	0.1 (0.0 -0.3)
	Other (n=385)	Male	9.5 (3.1 – 16)	0.7 (0.2 – 1.1)
		Female	5.3 (1.9 – 8.8)	0.4 (0.1 – 0.6)
	Not stated (n=15)	Male	5.0 (0.0 – 17.9)	0.3 (0.0 – 1.2)
		Female	0.0 (0.0 – 0.0)	0.0 (0.0 – 0.0)

Canadian General Social Survey 2005 – population over 14 years

Type of activity	Dwelling type	Distribution of time spent outdoor at home (min)							
		N	Mean	Std dev	Max	Min	5 th %	95 th %	99 th %
Outside at home in the garden	Single detached house	1472	21.4	70.3	830	0	0	150	360
	Low-rise apartment	278	1.7	10.9	90	0	0	0	75
	High-rise apartment	104	1.2	9.3	90	0	0	0	30
	Other types	385	7.1	33.5	390	0	0	60	150
	No response	15	2.0	7.7	30	0	0	30	30
Outside at home not in the garden	Single detached house	1472	12.0	50.1	595	0	0	70	240
	Low-rise apartment	278	5.4	29.6	330	0	0	30	180
	High-rise apartment	104	4.0	22.4	180	0	0	0	120
	Other types	385	7.4	32.4	360	0	0	55	150
	No response	15	0	0	0	0	0	0	0

Canadian General Social Survey 2005 – population over 14 years

Dwelling type	Age class	Distribution of time spent outdoor at home in the garden (min)							
		Subjects	Mean	Std dev	Max	Min	5 th %	95 th %	99 th %
Low-rise apartments (< 5 stories)	15 to 24	46	0.0	0.0	0	0	0	0	0
	25 to 34	44	0.0	0.0	0	0	0	0	0
	35 to 44	41	0.0	0.0	0	0	0	0	0
	45 to 54	30	0.0	0.0	0	0	0	0	0
	55 to 64	36	4.2	17.8	90	0	0	60	90
	65 to 74	30	3.7	12.5	60	0	0	30	60
	75 and over	51	4.4	18.1	90	0	0	60	90
High-rise apartments (5+ stories)	15 to 24	11	0.0	0.0	0	0	0	0	0
	25 to 34	24	0.0	0.0	0	0	0	0	0
	35 to 44	15	0.0	0.0	0	0	0	0	0
	45 to 54	12	0.0	0.0	0	0	0	0	0
	55 to 64	16	5.6	22.5	90	0	0	90	90
	65 to 74	10	3.0	9.5	30	0	0	30	30
	75 and over	16	0.0	0.0	0	0	0	0	0

Canadian General Social Survey 2005 – population over 14 years

Dwelling type	Age class	Distribution of time spent outdoor at home not in the garden (min)							
		Subjects	Mean	Std dev	Max	Min	5 th %	95 th %	99 th %
Low-rise apartments (< 5 stories)	15 to 24	46	0.7	4.4	30	0	0	0	30
	25 to 34	44	0.9	6.0	40	0	0	0	40
	35 to 44	41	7.1	40.8	260	0	0	0	260
	45 to 54	30	6.0	19.9	90	0	0	60	90
	55 to 64	36	14.4	61.8	330	0	0	180	330
	65 to 74	30	10.0	21.3	60	0	0	60	60
	75 and over	51	2.8	13.4	90	0	0	15	90
High-rise apartments (5+ stories)	15 to 24	11	0.0	0.0	0	0	0	0	0
	25 to 34	24	0.0	0.0	0	0	0	0	0
	35 to 44	15	20.0	54.0	180	0	0	180	180
	45 to 54	12	0.0	0.0	0	0	0	0	0
	55 to 64	16	3.8	15.0	60	0	0	60	60
	65 to 74	10	0.0	0.0	0	0	0	0	0
	75 and over	16	3.4	13.8	55	0	0	55	55

Canadian General Social Survey 2005 – population under 15 years

Dwelling type	Number of respondents with children under 15 years of age living in household				
	None	One child	Two children	Three or more children	Total
Single detached house	1113	150	142	67	1472
Low-rise apartment (<5 stories)	256	14	4	4	278
High-rise apartment (5+ stories)	91	9	1	3	104
Other	313	41	22	9	385
Not stated	12	3	0	0	15
Total	1785	217	169	83	2254

Canadian General Social Survey 2005 – population under 15 years

Dwelling type	Number of under 15 years of age living in household	
	Count	%
Single detached house	635	79.0
Low-rise apartment (<5 stories)	34	4.2
High-rise apartment (5+ stories)	20	2.5
Other	112	13.9
Not stated	3	0.4
Total	804	100

Canadian General Social Survey 2005 – population under 15 years

Dwelling type	Activity type	Distribution of time spent by dwelling and activity type by children under 14 years of age (min)							
		N	Mean	Min	Max	5 th %	25 th %	75 th %	95 th %
Single detached house	Inside at home not sleeping	365	229.6	5	855	30	80	311	625
	Inside not at home	142	183.8	10	1050	30	90	240	420
	Outside not at home	60	94.4	4	390	6	17.5	120	341.5
	Travel-including for work	205	57.8	3	525	10	20	75	160
	Outside at home - garden	9	86.1	30	195	30	30	120	195
	Outside at home – not garden	5	121.0	60	230	60	90	120	230
Low-rise apartments (< 5 stories)	Inside at home not sleeping	23	267.3	40	805	60	120	330	780
	Inside not at home	9	118.9	10	570	10	30	115	570
	Outside not at home	7	117.1	15	310	15	30	250	310
	Travel-including for work	14	38.1	10	110	10	20	45	110
	Outside at home - garden	0	.	.	.	.	.	.	.
	Outside at home – not garden	0	.	.	.	.	.	.	.

Canadian General Social Survey 2005 – population under 15 years

Dwelling type	Activity type	Distribution of time spent by dwelling and activity type by children under 14 years of age (min)							
		N	Mean	Min	Max	5 th %	25 th %	75 th %	95 th %
High-rise apartments (5+ stories)	Inside at home not sleeping	13	183.5	50	540	50	60	210	540
	Inside not at home	2	272.5	90	455	90	90	455	455
	Outside not at home	2	27.5	10	45	10	10	45	45
	Travel-including for work	7	105.7	10	255	10	20	210	255
	Outside at home - garden	0	.	.	.	.	.	.	.
	Outside at home – not garden	0	.	.	.	.	.	.	.
Other	Inside at home not sleeping	68	221.9	10	755	30	92.5	322.5	480
	Inside not at home	25	196	15	730	30	65	271	665
	Outside not at home	13	40.2	2	130	2	20	45	130
	Travel-including for work	38	56.2	10	185	10	20	70	175
	Outside at home - garden	0	.	.	.	.	.	.	.
	Outside at home – not garden	0	.	.	.	.	.	.	.

Canadian General Social Survey 2005

- Quite detailed; for BC, there is a non-zero time spent by adults in the garden and outside , in the proximity of the home, by subjects living in different dwelling types.
- Only children living in single detached homes appear to spend time outside, in the garden and courtyard.
- Unable to identify the location of the “home” garden.
- Not all dwelling types specified in the GSS questionnaire are actually available [single detached house]; [semi detached or double; garden home, town-house or row-house; duplex]=Other; [low-rise apartment]; [high-rise apartment]; [mobile home or trailer]=Other.

Canadian Human Activity Pattern Survey (CHAPS) and U.S. National Human Activity Pattern Survey (NHAPS)*

Location	Canada	U.S.	<i>p</i>
<i>A. Percent time spent in major locations (with 95% CI), all respondents</i>			
	n=2381	n=9386	
Indoor at home	65.94 (±0.83)	64.97 (±0.42)	0.0423
Outdoor at home	1.41 (±0.18)	2.50 (±0.13)	<0.0001
School/public building	4.21 (±0.40)	3.87 (±0.20)	0.1353
Indoors — other	7.95 (±0.59)	8.39 (±0.30)	0.1968
Bar/Restaurant	1.79 (±0.23)	1.91 (±0.12)	0.3622
Outdoors — other	4.60 (±0.41)	4.23 (±0.20)	0.1054
In vehicles	5.33 (±0.28)	5.74 (±0.12)	0.013
Near vehicles — outside	0.04 (±0.02)	0.19 (±0.04)	0.0002
Office/Factory	5.99 (±0.52)	5.90 (±0.27)	0.7634
Mall/Store	2.73 (±0.27)	2.30 (±0.13)	0.0033

*Leech et al. Journal of Exposure Analysis and Environmental Epidemiology (2002) 12, 427–432

Canadian Human Activity Pattern Survey (CHAPS) and U.S. National Human Activity Pattern Survey (NHAPS)*

Location	Canada	U.S.	<i>p</i>
<i>B. Time spent in major locations, age >17</i>			
	n=1747	n=7384	
Indoor at home	64.30 (±0.96)	64.40 (±0.48)	0.8619
Outdoor at home	1.16 (±0.20)	2.27 (±0.15)	<0.0001
School/Public building	2.96 (±0.40)	2.38 (±0.18)	0.0065
Indoors — other	8.14 (±0.68)	8.35 (±0.34)	0.5779
Bar/Restaurant	2.12 (±0.29)	2.22 (±0.14)	0.5532
Outdoors — other	4.30 (±0.47)	4.15 (±0.23)	0.5947
In vehicles	6.01 (±0.36)	6.16 (±0.17)	0.4456
Near vehicles — outside	0.05 (±0.003)	0.22 (±0.05)	0.0012
Office/Factory	7.83 (±0.67)	7.26 (±0.33)	0.1439
Mall/Store	3.13 (±0.35)	2.57 (±0.16)	0.0024

*Leech et al. Journal of Exposure Analysis and Environmental Epidemiology (2002) 12, 427–432

Canadian Human Activity Pattern Survey (CHAPS) and U.S. National Human Activity Pattern Survey (NHAPS)*

Location	Canada	U.S.	<i>p</i>
<i>C. Time spent in major locations, youths 11–17</i>			
	n=231	n=671	
Indoor at home	67.01 (±2.25)	61.02 (±1.52)	<0.0001
Outdoor at home	1.48 (±0.50)	2.31 (±0.42)	0.0352
School/Public building	12.12 (±1.86)	14.03 (±1.14)	0.0954
Indoor — other	6.12 (±1.67)	9.69 (±1.22)	0.0026
Bar/Restaurant	0.87 (±0.46)	0.93 (±0.23)	0.7959
Outdoor — other	8.00 (±1.65)	5.45 (±0.67)	0.0009
In vehicles	3.08 (±0.49)	4.87 (±0.49)	<0.0001
Near vehicles — outside	0.00 (±0.01)	0.14 (±0.09)	0.0840
Office/Factory	0.22 (±0.35)	0.18 (±0.14)	0.8096
Mall/Store	1.10 (±0.44)	1.37 (±0.30)	0.3795

*Leech et al. Journal of Exposure Analysis and Environmental Epidemiology (2002) 12, 427–432

Canadian Human Activity Pattern Survey (CHAPS) and U.S. National Human Activity Pattern Survey (NHAPS)*

Location	Canada	U.S.	<i>p</i>
<i>D. Time spent in major locations, children < 11</i>			
	n=324	n=1126	
Indoor at home	72.33 (±2.38)	70.52 (±1.17)	0.1521
Outdoor at home	2.69 (±0.66)	4.07 (±0.45)	0.0025
School/Public building	5.72 (±1.21)	7.83 (±0.75)	0.0066
Indoors — other	8.74 (±1.85)	8.15 (±0.91)	0.5533
Bar/Restaurant	0.66 (±0.20)	0.47 (±0.09)	0.0564
Outdoors	4.25 (±1.00)	4.17 (±0.54)	0.8950
In vehicles	3.66 (±0.53)	3.57 (±0.31)	0.7805
Near vehicles — outside	0.01 (±0.01)	0.05 (±0.03)	0.1481
Office/Factory	0.07 (±0.08)	0.12 (±0.09)	0.5973
Mall/Store	1.86 (±0.47)	1.05 (±0.18)	0.0001

*Leech et al. Journal of Exposure Analysis and Environmental Epidemiology (2002) 12, 427–432

Characteristics of BC housing inventory, 2001 Census

<u>Housing characteristic</u>	<u>Total</u>
Period of construction, before 1946	134,940
1946-1960	178,740
1961-1970	221,225
1971-1980	353,855
1981-1990	301,500
1991-1995	194,700
1996-2001	141,855
Type of dwellings	
Single-detached house	839,005
Semi-detached house	46,590
Row house	97,120
Apartment, detached duplex	97,265
Apartment, building that has five or more stories	101,595
Apartment, building that has fewer than five stories	302,760
Other single-attached house	3,510

Shortcomings in the time activity pattern data

- CHAD is not specific to BC, has no differentiation on type of multi-unit dwellings, does not refer to gardening activities. As a positive side, it has all age groups.
- GSS has very detailed activity data but has only 2 categories of multi-unit dwellings. Refers to gardening activities but is not clear where the gardens are located (balcony, outside of building, neighbourhood gardens). Only subjects over 15 years of age were surveyed but there is information on the age and number of children in the house as well as the time spent with the children and the location of the activity.

Rationale for survey

- The only difference between time activity patterns for people living in different housing types was the time spent outside in the garden (single detached house different than all others, which were similar).
- Need to identify the location of “the garden” and if possible, time children spend there.
- Lack of information on children’s activities at different locations.
- May not be necessary to investigate townhouses and other type of houses (besides multi-unit apartments).

Children Survey for Time Activity Patterns (Child STÆPs)

- The survey was approved by the UBC Ethics Board.
- <http://web.cher.ubc.ca/childsteps/>
- A pilot survey was already finalized
- Lessons learned and options for further approach

Survey format

- The appropriate sample size of the sample for a 5% margin of error and a 95% confidence interval is **378**. This means that if the survey shows that on average children play 10 minutes around the home per day then the 95% confidence interval for this average will lie between 9.5 and 10.5 minutes.
- Ministry of Health has provided a complete list with all licensed daycares in the province.
- A stratified random sampling proportional with the size of the city and day care maximum capacity was conducted.
- 80 daycares around B.C. were selected with a maximum capacity of 2000 children were contacted by mail to be invited in the survey.
- UBC Day Care system participated with 17 daycares in a pilot survey

Existing day cares

Day care maximum capacity	Frequency	Percent (%)
Missing	8	0.20
Under 10 children	1998	48.73
Between 10 and 15 children	313	7.63
Between 16 and 20 children	857	20.90
Between 21 and 25 children	275	6.71
Between 26 and 30 children	95	2.32
Between 31 and 35 children	69	1.68
Between 36 and 40 children	160	3.90
Over 40 children	325	7.93
Total	4100	100.00

Partial results – Pilot survey

Sampling distribution by housing type

House type	Children	Percent (%)	Cumulative frequency	Cumulative percent (%)
Single detached home	14	33.33	14	33.33
Semi detached/Double	1	2.38	15	35.71
Town-house or row-house	11	26.19	26	61.90
Duplex (one above the other)	1	2.38	27	64.29
Low-rise apartment (<5 stories)	12	28.57	39	92.86
High-rise apartment (>=5 stories)	3	7.14	42	100.00

Partial results – Pilot survey

Dwelling type	Activity type	Distribution of time spent by dwelling and activity type (min)							
		N	Mean	Min	Max	5 th %	25 th %	75 th %	95 th %
Single detached house	Missing info	1	15	15	15	15	15	15	15
	Inside at home not sleeping	14	357.5	180	555	180	270	490	555
	Inside at home sleeping	14	705.4	569	929	569	659	739	929
	Inside not at home	13	283.5	60	535	60	140	450	535
	Outside at home in garden	1	15	15	15	15	15	15	15
	Outside at home not garden	0	0	0	0	0	0	0	0
	Outside not at home	13	91.6	10	210	10	30	120	210
	Travel	10	36.5	0	75	0	25	60	75

Partial results – Pilot survey

Dwelling type	Activity type	Distribution of time spent by dwelling and activity type (min)							
		N	Mean	Min	Max	5 th %	25 th %	75 th %	95 th %
Town house or row-house	Missing info	1	15	15	15	145	300	15	15
	Inside at home not sleeping	11	424.5	145	660	540	599	565	660
	Inside at home sleeping	11	667.3	540	809	15	110	779	809
	Inside not at home	8	229.4	15	505	30	30	330	505
	Outside at home in garden	1	30.0	30	30	5	5	30	30
	Outside at home not garden	2	12.5	5	20	45	75	20	20
	Outside not at home	10	156.5	45	350	20	30	185	350
	Travel	6	58.3	20	120	60	60	75	120

Lessons learned

- Contact only bigger day cares, with at least 10 children enrolled (2,093 day cares available).
- If possible, establish direct, personal contact with the day cares.
- Use a higher sampling intensity, assuming a smaller response rate.
- Better instruct the day care personnel in distributing the invitation letters to the parents and raising awareness of the study.
- Have a back-up plan (conduct a telephone interview using a market research company -already done: eNRG, cost estimates available).

The new sample of day cares

City	Day cares	Children	City	Day cares	Children
Abbotsford	3	180	New Westminster	1	33
Burnaby	4	80	North Vancouver	5	88
Chilliwack	1	25	Port Coquitlam	1	36
Coquitlam	1	20	Richmond	4	61
Delta	2	99	Surrey	6	147
Duncan	1	20	Vancouver	44	1,452
Kamloops	5	198	Victoria	18	540
Langley	3	95	West Vancouver	2	40
Nanaimo	1	12	Total	104	3,186