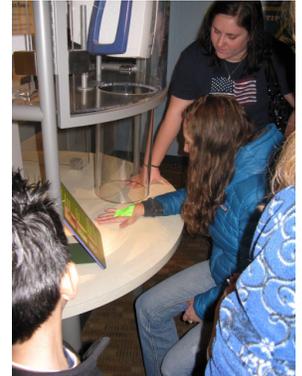


# *Expedition Health*



## **Summative Evaluation Report**

**Prepared for**  
**Denver Museum of Nature & Science**

**by**  
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*Your body is very cool you just can't see it.* 9-year-old girl

*Science is intrinsic to me and I love it, but there need to be places like this to enjoy it!* adult female



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## Executive Summary

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This report presents the findings from a summative evaluation of *Expedition Health*, a 10,000-square-foot permanent exhibition developed by the Denver Museum of Nature & Science (DMNS) that explores this central idea:

*Your body changes in ways you can see, measure, and optimize.*

Patricia A. McNamara, an independent evaluator, designed this study to document the exhibition's impact and effectiveness. This summary highlights the key findings. Readers are encouraged to consult the body of the report for a more fine-grained portrait of visitors' experiences in the exhibition.

This exhibition opened in April 2009; all data was collected between September and November 2009.

### Principle findings – tracking and timing

A total of 74 visitors (60 adults and 14 children) were unobtrusively observed as they toured the exhibition. Approximately 40 percent of all observations were made on weekends. Nearly all visitors were in the company of others as they toured the exhibition; the majority of adults were accompanied by one or more children. Twenty-five percent of those observed had visited *Expedition Health* before.

### Overall time spent and level of engagement

- ❖ Visitors spent a median of 38 minutes in the gallery. The shortest time spent by any visitor was 3 minutes; the longest was 2.25 hours.
- ❖ Visitors stopped at a median of 14 (47 percent) of the exhibition's 29 elements (both individual exhibits and specialized program areas).
- ❖ When visitors' overall use of *Expedition Health* is compared with that of visitors in similarly sized and themed exhibitions (Serrell 1998), it is clear that the Denver visitors' level of engagement was unusually high. Visitors to *Expedition Health* moved relatively slowly through the gallery (their average speed was 222 feet per minute) and nearly one-half of them stopped at more than 50 percent of all elements. These findings contrast markedly with Serrell's data from 33 "large nondiorama" exhibitions; visitors in those galleries typically moved faster (their average "sweep rate" was 400 square feet per minute) and used fewer components (in the average exhibition, only 23 percent of visitors used more than one-half of all elements).
- ❖ Because the exhibition has been open for a relatively short time, it is notable that approximately 25 percent of those observed were making a return visit. Although prior experience with the exhibition did not affect how long visitors remained in the gallery, those who had visited before stopped at significantly fewer exhibits and spent significantly more time at components where they did stop. These repeat visitors were also more likely to spend time in *Biology Base Camp* and see *BodyTrek Theater's* multimedia presentation.

### **Visitors' use of individual exhibits**

❖ Four exhibits (*Bio Ride*, *Size Up Your Stride*, *Measure Up*, and *Control Your Brain*) accounted for stops by more than one-half of all visitors and maintained visitors' attention for approximately 3 minutes or more. Four components engaged both adults and children for relatively long periods of time (*See Yourself Age*, *Food Is Fuel*, *Control Your Brain Waves*, and *Measure Up*).

❖ Five exhibits give visitors the opportunity for “full-body involvement” and use video or computer technology to interpret or enhance visitors' experiences (e.g., at *Bio Ride*, visitors pedal a stationary bike while they “virtually” navigate a mountain highway). At least 50 percent of visitors stopped at elements that shared these features. On the other hand, visitors were significantly less likely to stop at the five interactives where the sole opportunity for involvement was use of a touchscreen computer.

### **Visitors' use of specialized program areas**

*Expedition Health* includes four areas that offer visitors opportunities for more in-depth involvement. Two spaces (*BodyTrek Theater* and *Summit Stage*) feature regularly scheduled programs lasting from 10 to 15 minutes. *Tykes Peak* is a 400-square-foot semi-enclosed area with activities designed for use by young children and their caregivers, while *Biology Base Camp* (900 square feet) gives both adults and children a chance to conduct experiments in a simulated laboratory. The nature of these environments affected overall patterns of use. As a general rule, fewer visitors took part in these programs or activities, but those who did spent significant amounts of time in those spaces.

❖ Seventy percent of visitors either watched a program or took part in activities in at least one specialized program area, and visitors spent an average of 30 percent of their gallery time engaged in those activities. Visitors were most likely to watch a program at *Summit Stage* and least likely to spend time in *Biology Base Camp*.

### **Visitors' behavior at specific exhibit elements**

❖ Visitors were very likely to engage in physical interaction with exhibit elements. The average visitor stopped at 13 out of 21 interactive elements, and 67 percent of those stops included some degree of activity (i.e., visitors either used that component themselves, helped a child do so, or watched another visitor use the exhibit). Children were more likely to use interactives themselves, while adults were more likely to participate by watching others. Four exhibits both attracted visitor stops and promoted visitor interaction (*Bio Ride*, *Size Up Your Stride*, *Your Heart's Electricity*, and *Brain Challenge*).

❖ All but three visitors (two adults and one child) were observed to read text at exhibits at least once during their visit to the gallery, and an average of 41 percent of all visitors' stops at components included reading text. As is often the case, adults were observed to read text significantly more often than were children.

❖ Eleven exhibit components include displays of “plastinated” human organs or simulated body fluids or substances (e.g., urine, partially digested food). Seventy percent of all visitors examined at least one specimen in the exhibition (and 28 percent looked at four or more). Visitors seemed more likely to look at these when the specimen was an element’s central focus or mounted very near a related interactive component.

❖ One of *Expedition Health*’s key features is the Peak Pass, a card that both activates eight of the exhibition’s interactive devices and creates a record of those interactions that visitors can take home (and also access online via the *Expedition Health* website). Approximately 40 percent of visitors were observed to stop at a *sign-in station* and initialize a Peak Pass, but less than one-half of those visitors also used one of the *sign-out stations* to get a personalized printout.

### **Impact of gallery crowd levels on visitors’ behavior in Expedition Health**

Early in the design phase of this study, the DMNS team expressed concern about two situations created by the exhibition’s overall attractiveness (i.e., the gallery is very crowded at times) and the popularity of certain exhibit elements (i.e., long lines often formed at exhibits such as *Bio Ride* and *See Yourself Age*). The study findings indicate that these circumstances do affect visitors’ experiences.

❖ Seventy percent of visitors who were unobtrusively observed in *Expedition Health* toured the exhibition when it was judged to be at least moderately crowded. Not surprisingly, as the level of crowding increased, so did visitors’ likelihood of waiting in line before they could use exhibit components. Nearly 40 percent of all visitors were observed to wait in lines at three or more exhibits during their visit. Three exhibits were especially popular: 40 percent or more of visitors who stopped at *Measure Up*, *Size Up Your Stride*, and *See Yourself Age* waited for other visitors to leave the exhibit before they could use it themselves.

### **Principle findings – cued questionnaires**

A total of 144 questionnaires were completed by 89 adults and 55 children. Nearly all of these visitors were accompanied by others; approximately one-half of the adults were in groups that included at least one child. As was the case for the tracking-and-timing sample, approximately 25 percent had visited *Expedition Health* at least once before. Thirty-three percent of children were repeat visitors (compared with 18 percent of adults).

These visitors were “cued” – recruited as they entered the exhibit to fill out a survey after they exited. This procedure makes it possible to gauge an exhibition’s impact when visitors are motivated to use exhibit components more thoroughly and pay attention to exhibition messages. Visitors in the cued questionnaire sample did spend approximately 25 percent more time in the gallery than did those who were unobtrusively observed, and they were more likely to spend time in the generally underutilized *Biology Base Camp*.

The questionnaires included open-ended items that encouraged visitors to share their understanding of the exhibition’s overall “purpose” (i.e., what it was intended to “show people” or “make people do”), relate new ideas they encountered (e.g., “I never knew that ...”), and

recall anything that they were reminded of during their visit to the gallery. Minor wording changes were made to facilitate children's use of the questionnaires.

- ❖ When visitors discussed *Expedition Health* and their experiences in the exhibition, 70 percent of adults and children made references to elements of the exhibition's central idea and related messages (e.g., they discussed how the body changes or reacts in particular situations or in response to different stimulation).

- ❖ Visitors were also very likely to describe what they had learned or noticed about themselves (or what other people might learn about themselves), e.g., “[I didn't know that] my eyes would change when the light would change.” [8-year-old boy]

- ❖ Approximately 80 percent of all visitors' responses referred to one or more specific *Expedition Health* components. Children were most likely to mention something they had noticed or learned at *Bio Ride*, while adults were most likely to mention new ideas that they had encountered at either *Altitude Adjustment* or *Hydrate*. Approximately 25 percent of both adults and children who saw a *Summit Stage* program mentioned something new that they had learned there.

### **Visitor feedback about specialized program areas (BodyTrek Theater, Summit Stage and Biology Base Camp)**

- ❖ Adults were uniformly positive about their own experiences in those areas and often mentioned specific features of a program that they especially enjoyed. Although children were not asked to specifically rate their enjoyment of programs, at least one-half of those who participated in these programs also described specific features that captured their attention or were very “cool.”

- ❖ Adults' ratings of the activities' appropriateness for children varied across the three programs, possibly reflecting both differences among the activities themselves and the varying ages of accompanying children. Visitors who reported that particular programs were very engaging for their children often mentioned features that promoted children's engagement and enjoyment, e.g., “[Biology Base Camp] directions were step by step – the topic or main idea was clear to find in an investigative way.” [adult female]

### **Adults' recommendations to improve other visitors' experiences in Expedition Health**

- ❖ Approximately two-thirds of the adult questionnaires included suggested changes that might improve other visitors' experiences in *Expedition Health*. Forty-six percent of respondents specifically commented on how overall crowd levels and waiting in line to use components affected the quality of their experience, and a number of visitors suggested ways in which DMNS might mitigate the impact of overcrowding or exhibit popularity (e.g., limit the number of visitors in the gallery at one time or increase the number of stations at especially popular elements).

## Discussion and recommendations

- ❖ This study clearly demonstrates *Expedition Health's* success and effectiveness. Visitors used the exhibition very thoroughly and they learned about themselves and their own bodies. When asked to describe what the exhibition was “about,” the majority of adults and children addressed some aspect of the central idea that guided the exhibition’s development and character.
  
- ❖ Exhibits and programs varied with respect to their overall effectiveness, and a few were especially engaging and memorable. Seven components stood out in terms of their attractiveness, holding power, and communication potential (proportion of visitors mentioning related ideas in their questionnaire responses). Among those “top performers” were *Size Up Your Stride*, *Your Heart's Electricity*, and *Bio Ride*.
  
- ❖ This study does raise issues and questions for the *Expedition Health* development team. Areas identified for additional consideration and evaluation include the management of gallery crowding and wait time at components, visitors’ use of the *sign-in* and *sign-out stations*, the attractiveness and holding power of *demonstration-carts*, and the development of strategies that deepen and extend the experiences of the many adults and children who make repeated visits to *Expedition Health*.

## Introduction

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This report summarizes the summative evaluation of *Expedition Health*, a 10,000-square-foot exhibition developed by the Denver Museum of Nature & Science (DMNS). Patricia A. McNamara, an independent evaluation consultant, planned this study, designed the evaluation instruments, trained the on-site data collectors, analyzed the resulting data, and prepared this report.

*Expedition Health* is a cornerstone of the larger DMNS Health Science Initiative, the mission of which is to “broaden visitors’ knowledge of human biology, disease, and wellness and to inspire the application of these discoveries to their lives.”<sup>1</sup> This permanent exhibition opened at DMNS in spring 2009.

Working with Jeff Kennedy Associates, the DMNS exhibit team developed exhibition components to explore this central idea:

*Your body changes in ways you can see, measure, and optimize.*<sup>2</sup>

The team formulated three additional messages that expand on that central concept:

- *Your health is a combination of genetics, lifestyle, and environment.*
- *You can positively influence your body and optimize your health.*
- *You can participate in scientific inquiry and understand the scientific process.*

A variety of exhibition components were developed both to explore those concepts and to address core elements of the museum’s overall Health Science Initiative, i.e., that exhibits and programs should

- be firmly grounded in biological and health sciences;
- reflect current science and demonstrate its relevance to visitors’ own lives;
- include real artifacts and specimens that promote visitors’ curiosity about health science and how to maintain their own health;
- offer inquiry-based opportunities for practicing “authentic science”; and
- be set in the context of the larger natural world (in this case, an expedition up Mount Evans, one of Colorado’s most popular high-altitude destinations).

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<sup>1</sup> Denver Museum of Nature & Science. 2009. *Expedition Health Volunteer Training Manual*. unpublished manuscript.

<sup>2</sup> Ibid.

The exhibition's content, organization and components reflect these overall goals and guidelines. For example:

- As they enter *Expedition Health*, visitors use *sign-in stations* to provide basic demographic information about themselves and choose a virtual “buddy” who reappears at various points in the exhibition. This information is encoded on a personal Peak Pass card that visitors use to activate other interactive components scattered throughout the exhibition. At a corresponding *sign-out station*, visitors use their Peak Pass to generate individualized records of their interactions at various exhibition components (e.g., their heart rate measured at *Your Heart's Electricity*).
- Four specialized areas in the exhibition offer opportunities designed to appeal to specific target audiences or offer experiences that differ in duration or depth from the exhibition's freestanding displays. *Tykes Peak* is a 400-square-foot environment designed especially to encourage young visitors and their caregivers to use and learn about their own bodies. *Biology Base Camp* is a 900-square-foot laboratory where individuals and family groups can conduct their own lab experiments (e.g., view their own cheek cells under a microscope). In *BodyTrek Theater*, a 13-minute immersive and participatory multimedia experience makes it possible for visitors to accompany one of the virtual buddies as she completes an ascent of Mount Evans. At the *Summit Stage*, DMNS educators offer brief, regularly scheduled programs and specimen-focused demonstrations that explore health-related topics in an entertaining and engaging format.



- A variety of interactive components encourage both adults and children to learn about human biology and health by investigating how their own bodies function and respond (the photograph to the left shows a visitor group at *Bio Ride*).
- Three large wall-mounted video screens continuously display looping videos featuring dramatic images of various biological organs and processes thematically related to nearby exhibit components and activities.
- Plastinated specimens of actual human organs appear throughout the exhibition to remind visitors of the appearance and scale of their own internal organs.

See Figure 7 (page 14) for an exhibition floor plan. Photographs of specific components are included in the body of the report – see Appendix A for photographs of additional elements.

## Study Methodology

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Two evaluation strategies were used to document visitors' use of and reactions to *Expedition Health*: tracking-and-timing observations of adults and children in the exhibition and questionnaires administered to a separate sample of adults and children who had spent time touring the exhibition. Table 1 summarizes sample sizes by study component.

Table 1: Study components and corresponding sample sizes

Component	Adults	Children	Total
Tracking-and-timing observations	60	14	74
Cued questionnaires	89	55	144
Total	149	69	218

All observations and questionnaires were completed between September and November 2009.

### Tracking-and-timing observations

Unobtrusive observation of visitors' behavior in an exhibition can provide a good overview of the range of visitor behaviors prompted by exhibition components and the extent to which individual components capture and maintain visitor attention. Such data indicate whether casual visitors tend to spend enough time (or interact with a wide enough variety of components) to come in contact with the exhibition's key messages and ideas. Findings from these observations complement the insights about visitor experiences offered by more direct interaction with visitors (e.g., interviews or questionnaires).

Individual adults as well as children who appeared to be at least 8 years old were randomly selected for observation as they approached the exhibition entrance. An observation was initiated when a randomly selected visitor passed through the doorway at the exhibition entrance, and it was terminated when the target visitor crossed from the exhibition's *sign-out* area into an exterior hallway. For the purpose of this study, a "visitor stop" was recorded if the target visitor paused in front of a component and directed attention to it for at least 2 seconds.<sup>3</sup> If a visitor returned to a particular component, that subsequent interaction was not tabulated as a separate stop (but any additional activity or time spent was recorded and added to data for the original stop).<sup>4</sup>

A cadre of six trained observers used Noldus Observer XT loaded on small hand-held computers (PDAs) to record and time visitors' stops at individual exhibition components and note

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<sup>3</sup> Throughout this report, the term "component" is used to designate both "exhibits" (i.e., interactives or other displays) and "programs" (facilitated experiences offered in *BodyTrek Theater*, *Biology Base Camp*, or at *demonstration carts* or *Summit Stage*).

<sup>4</sup> If a target visitor left the exhibition and was clearly planning to return (e.g., she mentioned to companions that she was leaving to find a restroom, or she moved to the exterior hallway to use a cell phone), the observer paused the observation and resumed it when that visitor returned (or terminated it if the visitor did not reappear within a reasonable time).

occurrence of specific visitor behaviors at those stops.<sup>5</sup> These observations were “uncued,” i.e., visitors were not made aware of the observation in advance. As observed visitors exited the gallery, the observer did stop them briefly to ask whether they had seen *Expedition Health* before, but otherwise had no contact with the visitors they observed. Forty-two percent of all observations were conducted on weekend days (see Table 2).

*Table 2: Data collection schedule for tracking-and-timing observations*

<b>Day of week<sup>6</sup></b>	<b>Percent of all observations</b>
Monday	1%
Tuesday	31%
Thursday	5%
Friday	20%
Saturday	22%
Sunday	20%

### **Cued questionnaires**

A brief questionnaire prompted visitors to relate their own interpretation of *Expedition Health*'s main messages, recall any new ideas that they encountered in the gallery, share feelings and memories that their exhibition experiences evoked, and offer feedback about the programs they had participated in. Questionnaire respondents were “cued,” i.e., they were randomly recruited for participation as they approached the exhibition entrance. Those who agreed to participate in the study were asked to spend as much time in the exhibition as they wished and to return to complete the questionnaire when they were finished. The data collector recorded the amount of time that each target visitor spent in the exhibition but made no other observations of his or her behavior in the gallery. Visitors completed the questionnaire without any assistance from the data collector; minor wording changes were made to facilitate children’s use of the questionnaires. When the target visitor was a child, the accompanying adult was encouraged to remain to help the child understand the questions or reflect on the exhibit experience. The data collector did emphasize, however, that the child should write his or her own answers and that those answers should reflect only the child’s ideas and feelings. See Appendix C for copies of the questionnaires used at DMNS.

Approximately 85 percent of visitors recruited to complete questionnaires on weekend days were children; the adult sample was evenly divided between those completing questionnaires on weekdays and weekends (see Table 3).

<sup>5</sup> Noldus Observer XT is a commercially available software program developed to facilitate the recording of complex behavioral interactions. See Appendix B for additional information about the coding strategy and specific codes used.

<sup>6</sup> No tracking-and-timing observations were conducted on Wednesdays.

Table 3: Data collection schedule for questionnaires

Day of week	Adults (N=89)	Children (N=55)	All visitors (N=74)
Monday	18%	4%	12%
Tuesday	12%	13%	13%
Wednesday	18%	--	11%
Saturday	26%	60%	39%
Sunday	25%	24%	25%

## Principal Findings

### Tracking-and-timing observations

How did visitors spend their time in *Expedition Health*?

Visitors spent a median time of 38 minutes in the gallery, stopping at a median of 13.5 components (or 47 percent of the entire exhibition). They were very likely to use interactives, read text, examine specimens, and talk with each other about their experiences.

### Visitor characteristics

Sixty adults and 14 children were observed unobtrusively as they spent time in *Expedition Health*. Because these visitors were not interviewed, the observers estimated their ages and recorded the target visitors' apparent race and ethnicity, and how many other adults and children were accompanying them as they entered the exhibition.

Females accounted for 60 percent of observed adults<sup>7</sup>; nearly 40 percent of adults were estimated to be between 30 and 39 years old. Girls also outnumbered boys among the children who were observed, and approximately 50 percent were judged to be between 8 and 10 years of age. Nearly 90 percent of all targeted visitors appeared to be white, and only four of those appeared to be Latino (observers were unsure of the ethnicity of an additional 10 visitors).

Table 4: Demographic characteristics of observed visitors

Characteristics	N	%	
<b>Gender</b>	Female	45	61%
	Male	29	39%
<b>Estimated age</b>	8 – 10 years	8	11%
	11 – 13 years	5	7%
	14 – 17 years	1	1%
	18 – 29 years	16	22%
	30 – 39 years	23	31%

<sup>7</sup> Females are similarly overrepresented among DMNS visitors overall (Tinworth, 2008).

<b>Characteristics</b>	<b>N</b>	<b>%</b>
40 – 49 years	10	14%
50 – 59 years	3	4%
60 years or older	8	11%
<b>Race and ethnicity</b>		
Asian	1	1%
Black	2	3%
Latino	4	5%
White (not Latino or unsure)	65	88%
No information	2	3%

Because so few children were observed (relative to the size of the adult sample), the data from those two groups have generally been combined in this report.

Table 5 summarizes group composition for all observed visitors. Two adults were touring *Expedition Health* alone; all other visitors were accompanied in the exhibition by at least one other child or adult. Seventy-five percent of all adults were accompanied by at least one child (and 50 percent of all adults entered with children estimated to be younger than 8 years of age). One-half of the observed children were accompanied by one adult and two or more other children.

Table 5: Group composition – all visitors (N = 74)

<b>Number of children:</b>	<b>Number of adults:</b>			<b>Total</b>
	<b>One</b>	<b>Two</b>	<b>Three or more</b>	
None	3%	16%	5%	<b>24%</b>
One	12%	11%	4%	<b>27%</b>
Two	5%	11%	3%	<b>19%</b>
Three or more	12%	12%	5%	<b>30%</b>
<b>Total</b>	<b>32%</b>	<b>50%</b>	<b>17%</b>	<b>100%</b>

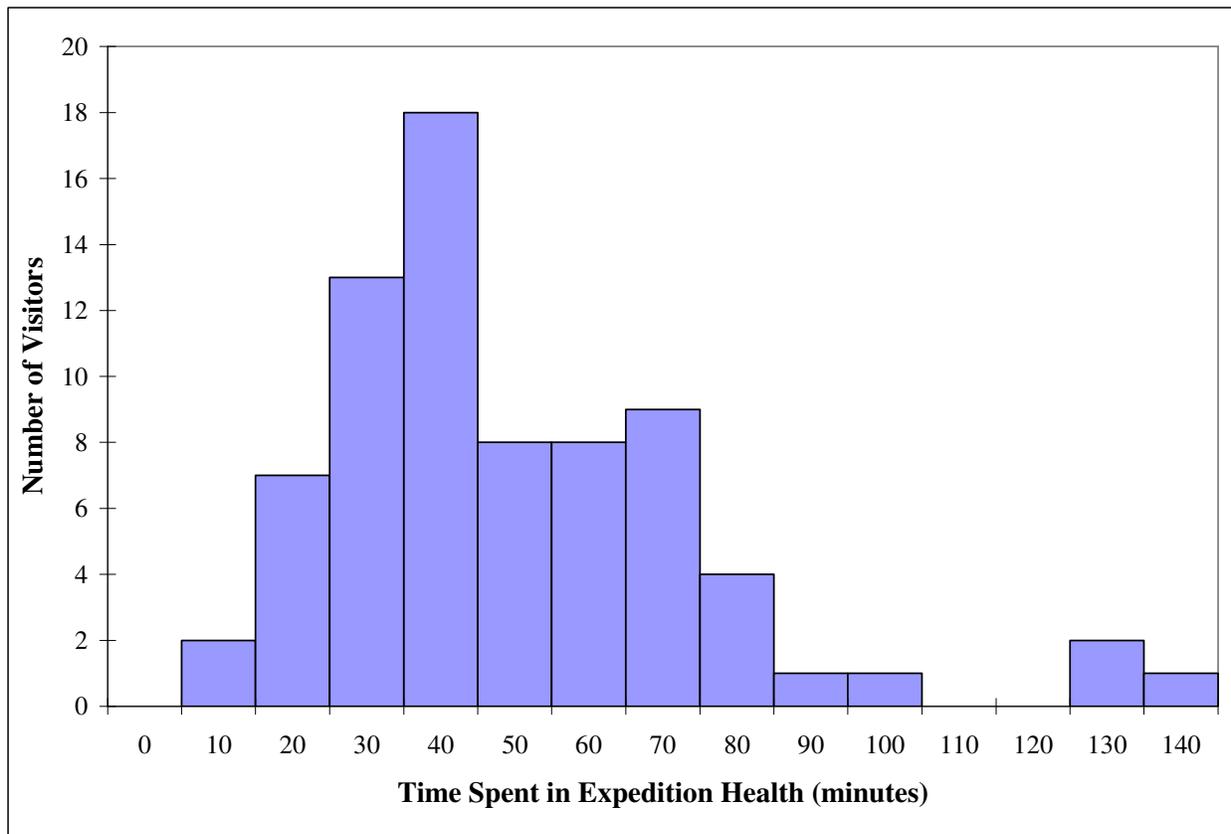
Seventy percent of all observed visitors reported that they were seeing *Expedition Health* for the first time.

### **How thoroughly did visitors use Expedition Health?**

The total time spent by visitors in *Expedition Health* ranged from 3 minutes to 135 minutes (2 hours and 15 minutes). As Figure 1 indicates, the distribution of visitor times was skewed to the right, that is, more visitors fall to the right side of the distribution's peak. Collecting tracking-and-timing data for more than 100 exhibitions of all kinds and sizes, Serrell (1998) found that this general distribution described the time spent by visitors in 50 percent of the exhibitions that she reviewed.<sup>8</sup>

<sup>8</sup> Serrell, Beverly. 1998. *Paying Attention: Visitors and Museum Exhibitions*. Washington, D.C.: American Association of Museums, Technical Information Service.

Figure 1: Total time spent by visitors in Expedition Health (N = 74)



In Serrell's data set, the relationship between exhibition size and time spent was roughly linear (as exhibition size increased, so too did the time spent by visitors). This equation expresses that relationship:

$$\text{Average time spent (minutes)} = 1.76 \times \text{exhibition size (thousands of square feet)} + 6.42^9$$

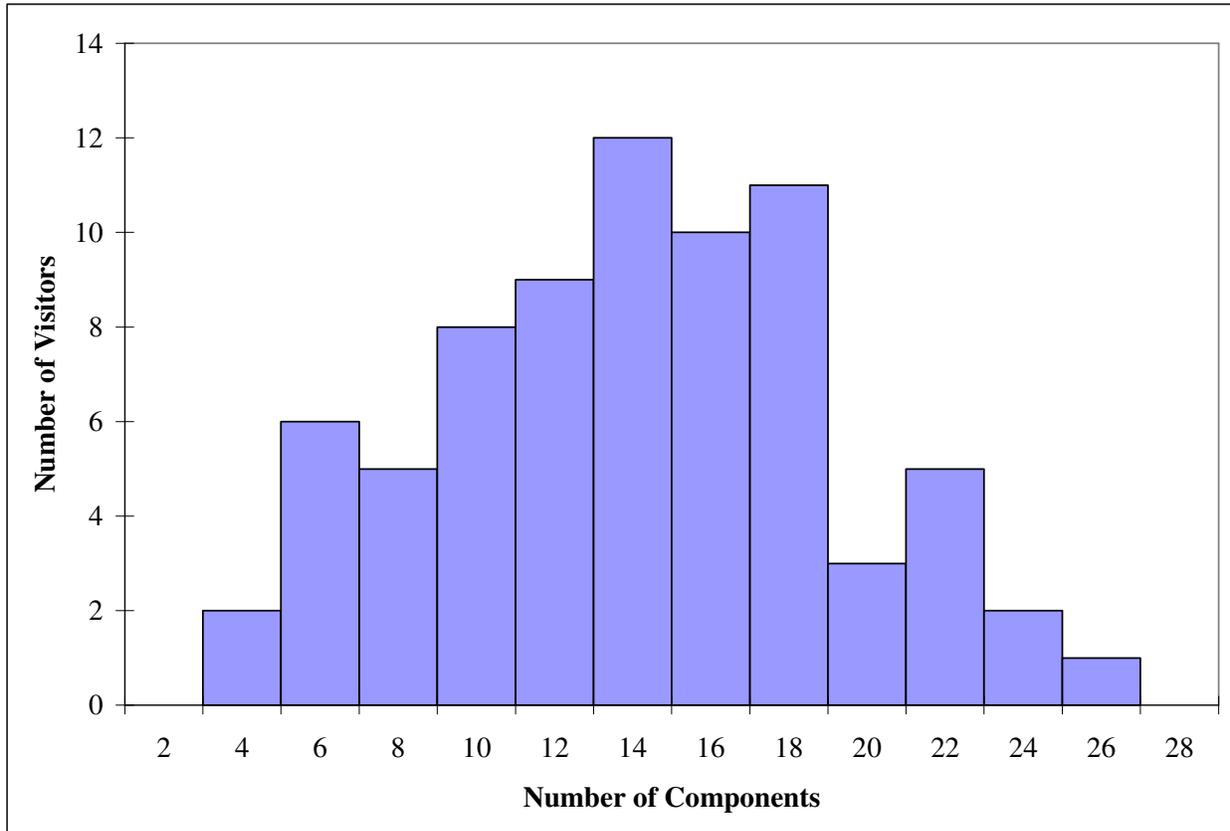
This equation predicts that visitors would spend an average of 24 minutes in *Expedition Health*. In fact, visitors' average time in the gallery was 45 minutes, or nearly double what Serrell's equation predicts.

Since relatively few visitors in exhibitions tend to spend the longest amounts of time, a more realistic measure of visitors' behavior is usually the median. Visitors to *Expedition Health* spent a median time of 38 minutes.

<sup>9</sup> Ibid., p. 22.

Visitors to *Expedition Health* stopped at a median of 14 (or 47 percent) of 29 possible elements.<sup>10</sup> Unlike the distribution of visitors' total time in the gallery, the histogram depicting total number of components used resembles a normal distribution and is more symmetrical (see Figure 2).<sup>11</sup>

Figure 2: Number of component stops made by visitors in Expedition Health (N = 74)



In her review of exhibitions, Serrell (1998) also proposed two global measures of visitors' behavior in exhibitions: the sweep rate index (SRI) and percent diligent visitors (%DV). When visitors' overall use of *Expedition Health* is compared with Serrell's sample of similarly sized and themed exhibitions, it is clear that visitors' level of engagement with *Expedition Health* is very high.

The SRI is computed by dividing the exhibition's total square footage (in this case, 10,000) by the average time spent there by individual visitors. As visitors spend more time (and move more slowly through an exhibition), the SRI drops correspondingly. The SRI computed for visitors observed in this study was 222, i.e., visitors moved through *Expedition Health* at the rate of 222

<sup>10</sup> The total number of elements includes individual exhibits and program spaces. *Demonstration carts* were not included, since their presence and location varied from one day to the next.

<sup>11</sup> This symmetrical pattern characterized approximately 30 percent of the exhibitions that Serrell surveyed. Right-skewed distributions of stops were much more common.

square feet per minute. These findings contrast markedly with Serrell’s data from “large nondiorama” and “science center” exhibitions, where visitors typically moved much more quickly (corresponding sweep rates were 360 and 400 square feet per minute, respectively).<sup>12</sup>

Percent diligent visitors (%DV) indicates how thoroughly visitors use an exhibition. It equals the percentage of visitors stopping at more than 50 percent of an exhibition’s components. Slightly less than one-half of the visitors observed in *Expedition Health* stopped at 15 or more components; the %DV was 46. Again, these visitors used this gallery more intensively than was the case for similar exhibitions included in Serrell’s data set. In the average large nondiorama exhibition, for example, only 23 percent of visitors met that criterion. Table 6 highlights the differences in SRI and %DV that are described here and includes corresponding data for *Prehistoric Journey*, a permanent DMNS exhibition that was included in Serrell’s data set.

*Table 6: Sweep rate index and percent diligent visitors – Expedition Health vs. comparable exhibitions*

	<b>SRI</b>	<b>%DV</b>
<b><i>Expedition Health</i></b>	<b>222</b>	<b>46</b>
Large nondiorama exhibitions	360	23
Science center exhibitions	400	13.5
<i>Prehistoric Journey</i>	326	37

Approximately 25 percent of the adults and children observed in *Expedition Health* were making a return visit to that exhibition, and some of these repeat visitors behaved differently in the gallery than visitors who were seeing the exhibition for the first time. Figures 3 and 4 contrast two aspects of these visitors’ behavior in *Expedition Health* – the total number of components where they stopped and the average time they spent at those elements.

<sup>12</sup> The 33 “large nondiorama exhibitions” in Serrell’s sample were those larger than 3,900 square feet.

Figure 3: Number of components where visitors stopped (repeat vs. first-time visitors)

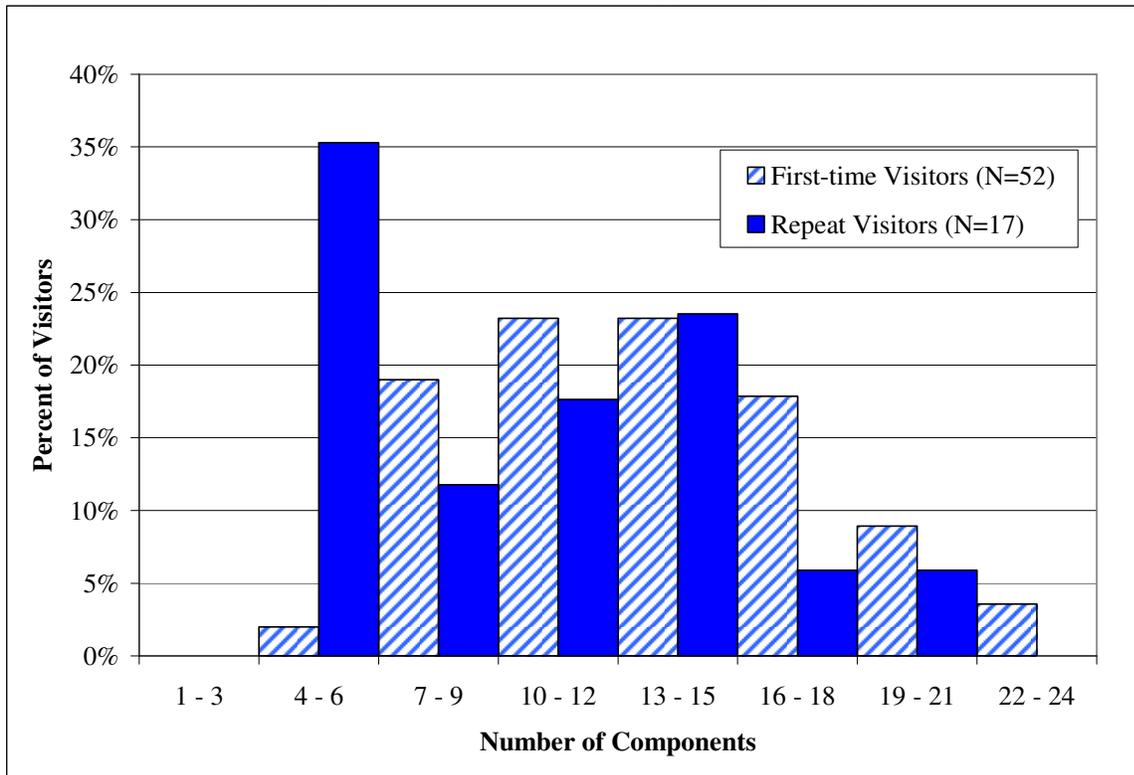
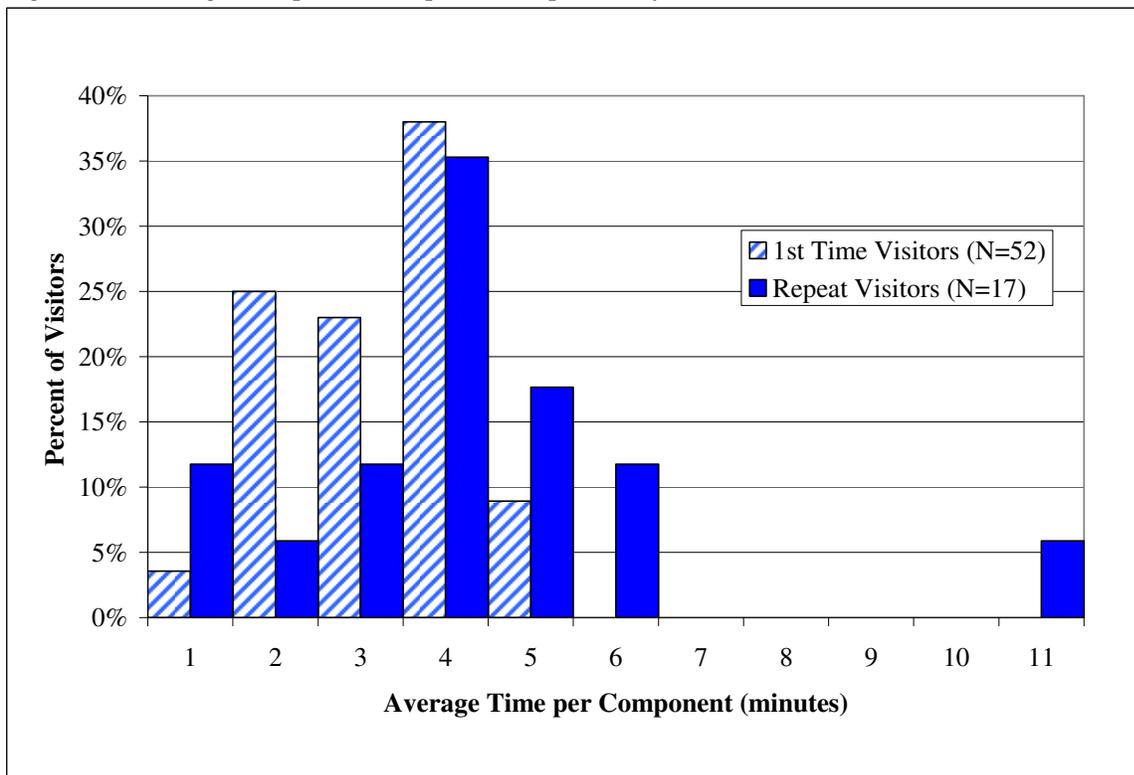


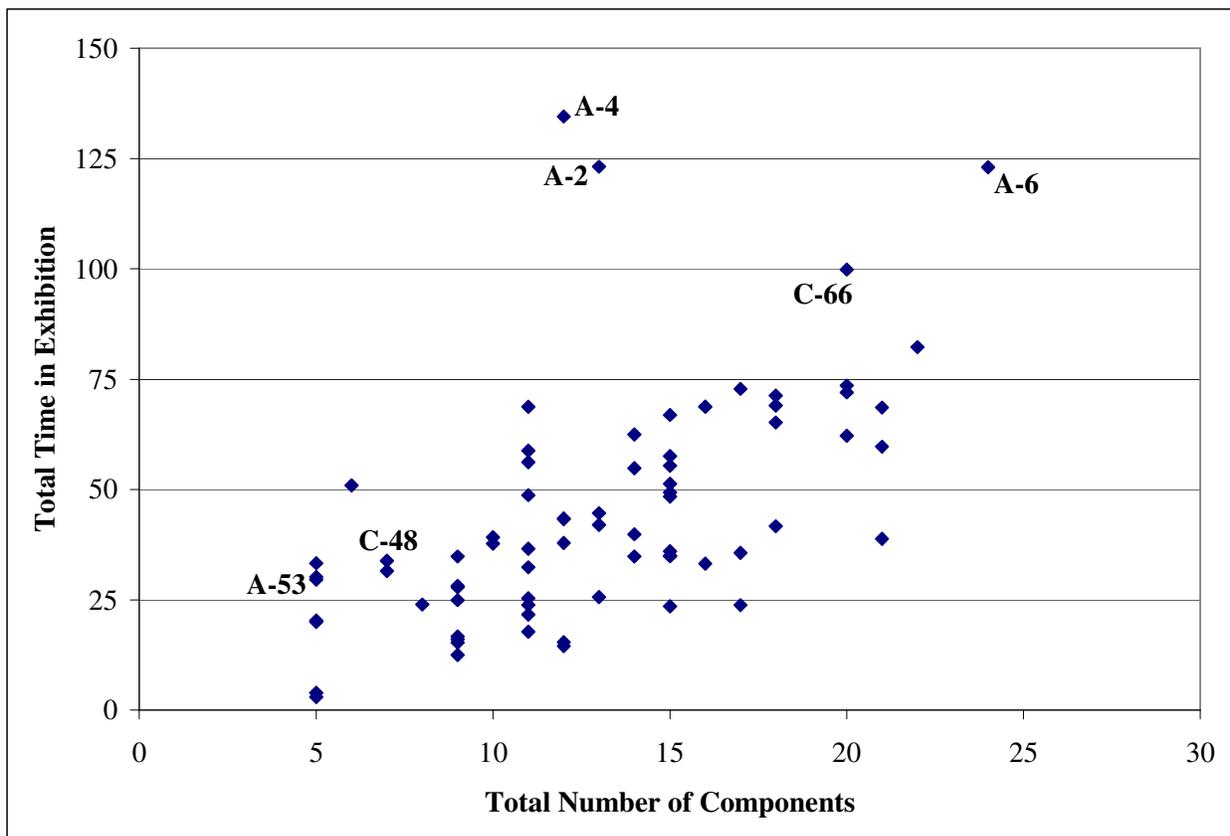
Figure 4: Average component stop time (repeat vs. first-time visitors)



Although the total time spent by repeat and first-time visitors did not differ, the repeat visitors (13 adults and four children) stopped at significantly fewer components than did the first-time visitors, and their component stops lasted significantly longer.<sup>13</sup> As Figures 3 and 4 indicate, however, these differences can be attributed to the unusual behavior of 35 percent of those repeat visitors: six adults who used six or fewer elements but spent an average of 5 minutes or more per component stop. These visitors were especially likely to take advantage of *Expedition Health* programs that demanded a greater time commitment (e.g., *Biology Base Camp*).

Figure 5 plots the number of component stops made by visitors against their total time in the *Expedition Health* gallery. In general, the number of components that visitors interacted with increased as they spent additional time in the exhibition. Two of the visitors who had seen *Expedition Health* before (labeled A-2 and A-4 in Figure 5) clearly departed from this trend and illustrate the pattern noted above: They interacted with far fewer elements than would have been expected, based on their total time in the gallery.

Figure 5: Total component stops plotted against total gallery time (all visitors)



<sup>13</sup> Repeat visitors stopped at an average of 9.8 components while first-time visitors' average number of component stops was 13.6 ( $p < .01$ , two-sample t-test assuming equal variances,  $df = 67$ ). Repeat visitors' average time per component stop lasted 3.7 minutes, compared with an average of 2.8 minutes for first-time visitors ( $p < .05$ , two-sample t-test assuming equal variances,  $df = 67$ ).

Even though a study like this one necessarily highlights typical patterns of interaction, Figure 5 testifies to the underlying variability in visitors' behavior. Four very different exhibition experiences are described here (represented on Figure 4 as points A-4, A-6, C-48, and C-66).

- A-4** *This **repeat** visitor was an adult female (30 – 39 years old) accompanied by one other adult and three children younger than 9 years of age (the observer made note of matching mother/daughter pigtails). This adult and her family spent a total of 2 hours and 15 minutes in Expedition Health on a Friday afternoon when the gallery was moderately crowded. During this visit she and her companions devoted nearly half of their time to programs. They viewed the BodyTrek Theater presentation, took part in three different Summit Stage shows (including one that they saw twice), and spent 17 minutes doing experiments in Biology Base Camp.*
- A-6** *This adult male (30 – 39 years old) visited Expedition Health by himself, spending approximately 2 hours on a Saturday afternoon when the exhibition was very crowded. This was his **first visit** to the gallery, and while he did see the BodyTrek Theater presentation, he spent most of his time at the exhibits. He interacted substantively at 22 different exhibits – reading labels, examining specimens, or manipulating interactives. Because it was very crowded, he did spend time waiting in line at seven exhibits, including a total of 45 minutes at See Yourself Age, possibly the gallery's most popular exhibit.*
- A-53** *This adult female (50 – 59 years old) was a **first-time visitor** to the gallery, and she was accompanied by another adult and one child younger than 6 years of age. The gallery was very crowded during their Thursday noontime visit. This woman spent approximately 30 minutes in the exhibition; her visit included one Summit Stage show, and she and the child spent 13 minutes in Tykes Peak. She stopped to interact with only one exhibit component (**sign-in station**) and looked briefly at Brain Challenge (but didn't try to "cross the stream").*
- C-66** *This boy (8 – 10 years old) was visiting Expedition Health for the **first time**. He was accompanied by one adult and three other children. He spent 1 hour and 40 minutes in the gallery and (as his position on the scatter gram indicates) he used the overall exhibition very thoroughly. He was in the gallery on a Tuesday afternoon after 3 p.m., when it was not very crowded. He saw the BodyTrek Theater presentation and played the role of "spinach" during a Summit Stage show. He used interactive devices, watched videos, read labels, or viewed specimens at 17 different exhibits; his average exhibition stop lasted nearly 2 minutes.*
- C-48** *This African-American girl (8 – 10 years old) was a **repeat visitor** to Expedition Health and was accompanied by five adults and two other children. The exhibition was moderately crowded on this Tuesday afternoon, and she spent 34 minutes in the gallery. She watched the multimedia show in BodyTrek Theater and spent nearly all of her remaining time engaged with exhibits. She stayed at Size Up Your Stride for nearly 5 minutes and spent 2 minutes or more at Full Body Viewer and Brain Challenge.*

### Visitor stops and time spent at individual components

Not surprisingly, individual elements differed with respect to their attractiveness (likelihood to prompt visitor stops) and their holding power (likelihood to promote extended engagement).

Figure 6 plots the percent of visitors stopping at each element against the median time that visitors spent engaged with each component.<sup>14</sup> Components in the scatter plot's upper-right quadrant were ones that attracted a high proportion of visitor stops and supported relatively long stop times, while the opposite was true of those in the scatter plot's lower-left quadrant.

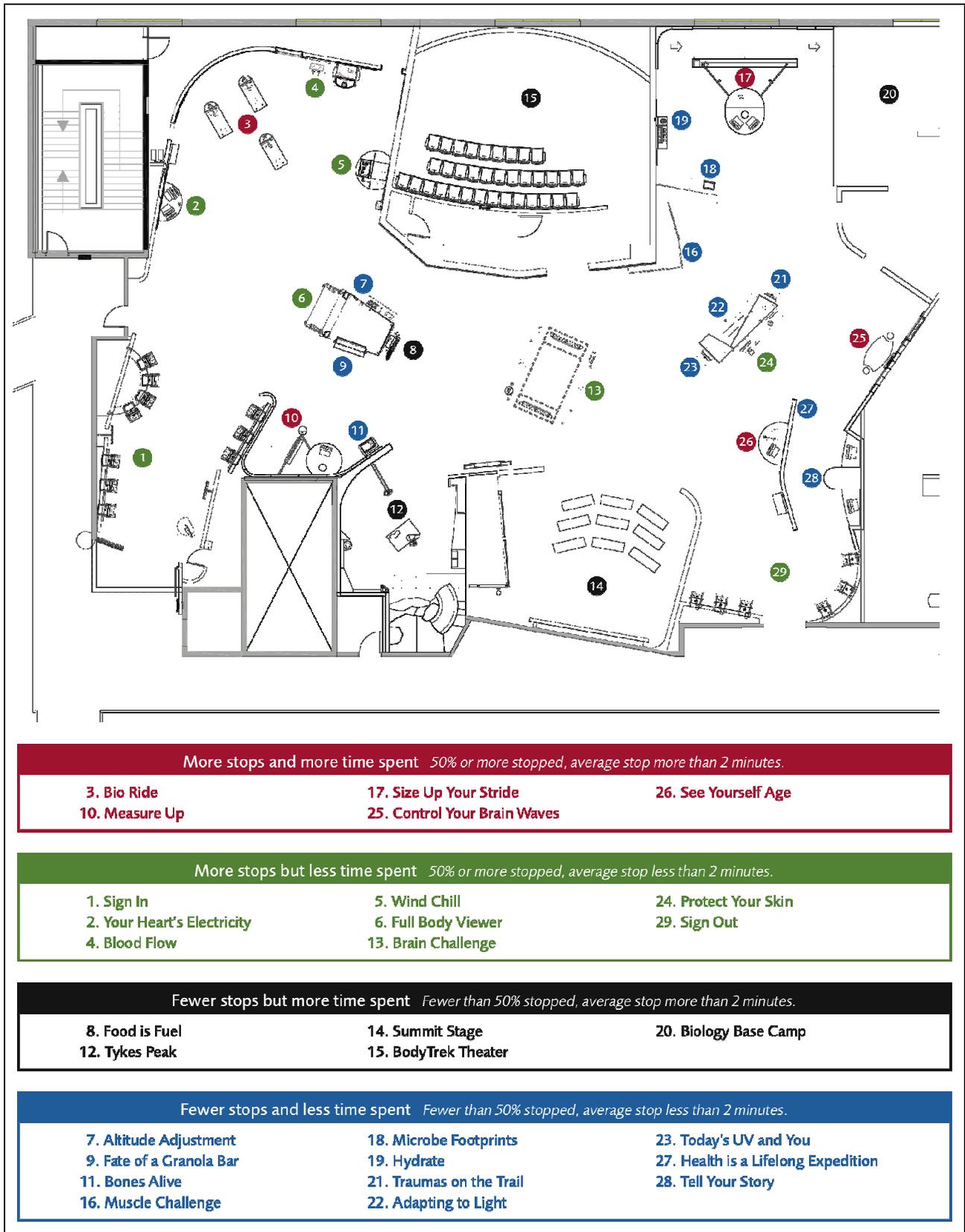
Figure 6: Components' relative attractiveness and holding power



As the exhibition's floor plan indicates (see Figure 7, next page), those components that attracted and held visitor attention most successfully were scattered throughout the exhibition. Those that were much less successful in that respect (highlighted in blue on the floor plan), seemed more likely to be located in the latter half of the area, where components were more tightly grouped. See Appendix D for a full listing of the proportion of visitors stopping at each component and the associated median stop times.

<sup>14</sup> Since the median time spent by visitors at *BodyTrek Theater* (14 minutes) was so much longer than the median time spent by visitors at any other component, that element is not included in this scatter plot.

Figure 7: Expedition Health floor plan



Thirteen exhibits prompted stops by 50 percent or more of all visitors: *sign-in*, *Brain Challenge*, *sign-out*, *Size Up Your Stride*, *Your Heart's Electricity*, *Bio Ride*, *Full Body Viewer*, *Protect Your Skin*, *Wind Chill*, *Measure Up*, *Control Your Brain Waves*, *Blood Flow*, and *See Yourself Age*. It is not surprising that *sign-in* attracted the highest proportion of visitor stops overall. As visitors entered the exhibition, a museum docent handed each of them a Peak Pass card and instructed them to use one of the nearby *sign-in stations* to enter information about themselves, select a virtual buddy and initialize their card. All but three visitors complied and stopped at least briefly at a *sign-in station* (although not all of them actually used one of the computers).

Five exhibits mentioned above (*Bio Ride*, *Size Up Your Stride*, *Measure Up*, *Full Body Viewer*, and *Brain Challenge*) give visitors the opportunity for “full-body involvement” and use video or computer technology to interpret or enhance visitors’ experiences (e.g., at *Bio Ride*, visitors pedal a stationary bike while they “virtually” navigate a mountain highway). Fifty percent or more of visitors stopped at elements that shared these features. On the other hand, visitors were significantly less likely to stop at the five interactives where the sole opportunity for involvement was use of a touchscreen computer (e.g., *Traumas on the Trail*, *Today's UV*).

As Figures 6 and 7 illustrate, exhibits that prompted visitors to stop were not necessarily those that held visitors’ attention the longest. Only five exhibits (*Bio Ride*, *Size Up Your Stride*, *Measure Up*, *Control Your Brain Waves*, and *See Yourself Age*) attracted stops by more than half of all visitors and maintained visitors’ attention for 2 minutes or more. Note that four components engaged both adults and children for relatively long periods of time: *See Yourself Age*, *Food Is Fuel*, *Control Your Brain Waves*, and *Measure Up*.

Two components were unusual in that they attracted relatively few visitor stops, but supported relatively long visitor engagement. For example, only 18 percent of all visitors stopped at *Food Is Fuel*, but those who did spent a median time of 3.2 minutes. Similarly, only 26 percent of visitors stopped to interact with *Tell Your Story*, but their median time at that element was 1.8 minutes. While only 18 percent of visitors (four adults and four children) stopped at a *demonstration cart* when one of those portable elements was available in the gallery, they spent a median time of 2.1 minutes.<sup>15</sup>

The exhibits clustered in the scatter plot’s lower-left quadrant (and identified by blue dots on the floor plan) were ones at which fewer visitors stopped (and those who did spent relatively little time). These included *Muscle Challenge* (a small-scale climbing wall designed for use by children), *Altitude Adjustment*, *Fate of a Granola Bar*, *Microbe Footprint*, *Bones Alive*, *Hydrate*, *Traumas on the Trail*, and *Today's UV and You*. With the exception of *Muscle Challenge*, these were all smaller elements featuring specimens or touchscreen computers. *Health Is a Lifelong Expedition* (a graphic panel near the exhibition’s exit) was the only element that attracted no visitor stops.<sup>16</sup>

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<sup>15</sup> Overall, approximately 60 percent of visitors were in the gallery when at least one *demonstration cart* was available (these gallery-based carts are in addition to those featured in a *Summit Stage* program).

<sup>16</sup> Since this panel featured large images and relatively little text, visitors might have glanced at it (and noted its messages) as they walked by.

### Visitors' use of specialized program areas

The nature of *Expedition Health's* specialized program areas (*BodyTrek Theater*, *Tykes Peak*, *Biology Base Camp*, and *Summit Stage*) does make comparison with the exhibition's freestanding exhibits somewhat difficult. For that reason, visitors' use of these areas is discussed separately here. Seventy percent of the adults and children who were observed in *Expedition Health* did take part in activities in at least one of these areas during their visit, and they spent an average of 30 percent of their gallery time in those areas. As Table 7 indicates, visitors were most likely to watch a program at *Summit Stage*.

Table 7: Proportion of visitors who participated in specific programs (N = 74)

Component	
<i>Summit Stage</i>	34%
<i>Tykes Peak</i>	28%
<i>BodyTrek Theater</i>	26%
<i>Biology Base Camp</i>	12%

**BodyTrek Theater** is a 35-seat enclosed theater in which an innovative multimedia program takes viewers on an expedition to the top of 14,000-foot Mount Evans. Once visitors enter the theater, they typically stay for the entire 13-minute program (and indeed, visitors' median time in this area was 14 minutes). Note that four of the 23 visitors who initially stopped and waited in line at the theater did not actually enter to watch the program.



**Tykes Peak** (see photograph to the left) is a partially enclosed 400-square-foot space specifically designed for small children and their caregivers. Prominent signage discourages use by those who do not meet that criterion. Even so, 46 percent of observed adults and children did stop outside this area to watch activity there or entered that space to take part in activities themselves. Twenty-one of the 34 visitors who stopped spent less than 3 minutes and had probably paused to find out what was happening there or to interact with an activity at the area's entrance. The median time spent by the remaining visitors (who were probably accompanied

by small children and actually used the area as intended) was approximately 7 minutes (much longer than the median time spent by all visitors who stopped).

**Biology Base Camp**, a 900-square-foot laboratory-themed environment, attracted considerable visitor interest – 38 percent of all adults and 64 percent of all children stopped to at least watch what other visitors were doing in that activity space or read accompanying signage. Since this area accommodates only five visitor groups at a time (and those who use this space may



spend considerable time there), many visitors decide not to wait for an opening or choose not to commit the time required. Only 12 percent of visitors (six adults and three children) actually donned lab coats and performed experiments in *Biology Base Camp*. Those nine visitors, however, spent an average of 22 minutes in that area.

**Summit Stage** (see photographs below) is a 700-square-foot space where DMNS educators offer short (and entertaining) theatrical presentations that explore health-related topics (e.g., *Pirates of the Human Being*) or conduct specimen-based demonstrations (e.g., dissection of a human lung). This semi-enclosed area is open to the general exhibition space and the audience may sit on benches within the theater space itself or stand nearby. Indeed, many of those who were waiting in line to use *See Yourself Age* (an exhibit that attracts considerable visitor interest) were often observed to simultaneously watch ongoing *Summit Stage* presentations if they had that opportunity. Thirty-three visitors (25 adults and eight children) watched a *Summit Stage* presentation at least briefly; 15 of those who stopped spent less than 90 seconds, suggesting that they paused briefly to see what was happening in the area but decided not to watch a full presentation. The median time spent by those who stayed longer was 10 minutes (one adult spent 53 minutes in this area and watched a total of four presentations).



### **Visitor activity at individual components**

*Visitors to Expedition Health were actively involved with exhibit components – they typically engaged in physical interaction, read text, studied specimens, and talked with each other about their experiences.*

In addition to recording and timing component stops, the observers noted occurrences of these specific component-related behaviors (unless otherwise specified, observers recorded these only when exhibited by the target visitor):

<b>Behavior Code</b>	<b>Description</b>
<i>Interp</i>	Talks with a DMNS docent about a demonstration, program, or exhibit
<i>Look only</i>	Looks at component but doesn't engage in relevant activity

<b>Behavior Code</b>	<b>Description</b>
<i>Pix</i>	Anyone in target visitor's group takes a photograph at component
<i>Prob</i>	Target visitor or companion encounters difficulty in using component
<i>Read</i>	Looks at text panel or computer screen displaying text for at least 2 seconds
<i>ROL</i>	Reads text aloud to companion
<i>Spec</i>	Looks closely at specimen
<i>Talk</i>	Talks with companion about component or related topic
<i>Use-Ch</i>	Target visitor helps accompanying child use interactive appropriately
<i>Use-S</i>	Target visitor uses interactive appropriately him/herself
<i>Video</i>	Looks at video
<i>Wait</i>	Waits to use component
<i>Watch</i>	Watches someone else use interactive
<i>Watch Show</i>	Watches program at <i>Summit Stage</i> or <i>BodyTrek Theater</i>

As Table 8 indicates, 80 percent of all visitor stops at exhibits included relevant activity (e.g., reading labels, using interactives, talking with companions about the exhibit).<sup>17</sup>

*Table 8: Incidence of selected activities during visitor stops at exhibit components*

<b>Activity</b>	<b>Visitor stops that included specific activity</b>	
	<b>Average</b>	<b>Range</b>
Looked only	19%	0 – 53%
Read text	41%	0 – 82%
Physically interacted (or watched another person interact)	67%	0 – 100%
<i>Used interactive oneself</i>	47%	0 – 100%
<i>Helped a child use an interactive (adults only)</i>	29%	0 – 100%
<i>Watched another</i>	63%	0 – 93%
Talked with another about component	15%	0 – 60%
Waited to use interactive	19%	0 – 58%

<sup>17</sup> See Appendix B for more detailed descriptions of components, including notes about activities that were appropriate for each.

Visitors were very likely to engage in physical interaction with exhibit elements. The average visitor stopped at 13 out of 21 elements where such interaction was appropriate and 67 percent of those stops included some degree of interaction (i.e., visitors either used a component themselves, helped a child to do so, or watched another visitor use the exhibit). Children were more likely to use interactives themselves, while adults were more likely to participate by watching others.

Four exhibits both attracted visitor stops and promoted visitor interaction (these are highlighted in Table 9). For example, *Brain Challenge* (see photograph to the right) was well placed to attract visitor stops, and both adults and children could interact with it easily and quickly. As a result, nearly all visitors stopped there, and 74 percent of them actually crossed the simulated stream themselves (an additional 9 percent watched someone else do that). On the other hand, relatively few visitors stopped at *Food Is Fuel* and *Tell Your Story* (two of the exhibition’s touchscreen computer interactives), but 80 percent or more of those who did use those computers as intended.



Table 9: Visitor stops that included any interaction, by component (N = 74)

Element #	Component	Visitor stops that included interaction	Visitors stopping
8	Food Is Fuel	100%	18%
10	Measure Up	95%	57%
3	<b>Bio Ride</b>	<b>92%</b>	<b>66%</b>
17	<b>Size Up Your Stride</b>	<b>91%</b>	<b>72%</b>
24	Protect Your Skin	88%	57%
6	Full Body Viewer	86%	59%
4	Blood Flow	85%	54%
2	<b>Your Heart’s Electricity</b>	<b>85%</b>	<b>70%</b>
13	<b>Brain Challenge</b>	<b>83%</b>	<b>89%</b>
25	Control Your Brain Waves	80%	55%
28	Tell Your Story	79%	26%
5	Wind Chill	76%	57%
22	Adapting to Light	74%	36%
26	See Yourself Age	70%	54%
23	Today’s UV	69%	22%
18	Bones Alive	65%	35%
21	Traumas on the Trail	65%	23%
16	Muscle Challenge	60%	41%
1	Sign-in	44%	96%

Element #	Component	Visitor stops that included interaction	Visitors stopping
29	Sign-out	34%	80%
19	Hydrate	12%	35%

All but three visitors (two adults and one child) were observed to read exhibit text at least once during their visit, and an average of 41 percent of all visitors' component stops included such reading. As is often the case, adults were observed to read text significantly more often than were children.<sup>18</sup>

Visitors' engagement with the exhibition was also reflected by their likelihood to talk with their companions about related topics during their exhibit stops. All but four children and 16 adults were observed to engage in exhibit-related conversation at least once during the time they spent in *Expedition Health*, and those visitors who did so engaged in exhibit-related conversations at approximately 20 percent of their component stops. Visitors were especially likely to talk with each other at *Food Is Fuel* (38 percent of visitors who used that computer spoke with companions about it), *Control Your Brain Waves* (34 percent), *Bio Ride* (33 percent), *Protect Your Skin* (31 percent), and *Altitude Adjustment* (29 percent).

Fourteen adults and four children also spoke with at least one DMNS docent during their visit to *Expedition Health*. These conversations were most likely to occur in program areas where activities were docent-facilitated. Thirteen percent of visitors who stopped at *Biology Base Camp* interacted with a docent there; 9 percent had similar interactions at *Summit Stage*. Only eight visitors stopped at a *demonstration cart* in the gallery, but six of those visitors spoke with the docent interpreter.

Eleven exhibit components include plastinated specimens of human organs, such as an entire human digestive tract (*Fate of a Granola Bar*). "Specimens" also include simulated fluids or substances (such as containers filled with liquid representing the volumes of urine produced at different elevations). Seventy percent of all visitors examined at least one specimen in the exhibition (and 28 percent looked at four or more). Visitors seemed more likely to look at these when the specimen was an element's central focus, as was the case at *Bones Alive* or *Altitude Adjustment*. Six components include both an interactive device and a related specimen mounted in a separate display. In those situations, visitors tended to be more interested in using the interactive and less likely to notice the nearby specimen. For example, three-quarters of visitors who stopped at *Adapting to Light* used (or watched someone else use) that interactive, but only 19 percent looked at the eyeball and optic nerve mounted just to the left of the interactive. At *Your Heart's Electricity*, a plastinated human heart attracted the attention of only four of the 44 visitors who stopped in that area (who typically clustered around the popular interactive, with their backs to the specimen display).

<sup>18</sup> Adults read text at an average of 45 percent of components where they stopped; children read text at an average of only 28 percent of their component stops ( $p < .01$ , two-sample t-test assuming equal variances,  $df=72$ )

Three components include related videos.<sup>19</sup> Visitors were most likely to watch the video segment at *Altitude Adjustment* (see photograph to the right), where the video screen and program are prominently featured in a panel that includes graphics, text, and containers displaying simulated urine (see photograph to the right). One-third of the adults who stopped at *Altitude Adjustment* watched that video for at least 2 seconds. In contrast, the video screens at *Bio Ride* and *Control Your Brain Waves* are farther from the focus of visitor interaction and 5 percent or fewer of the adults who stopped at those components were observed to watch material playing on those screens.



Seventy percent of visitors who were unobtrusively observed in *Expedition Health* toured the exhibition when it was judged to be at least moderately crowded. As the level of crowding increased, so did visitors' likelihood of spending time waiting in line before they could use exhibit components. Nearly 40 percent of all visitors were observed to wait in such lines at three or more exhibits during their visit. Three exhibits were especially popular: 55 percent or more of visitors who stopped at *See Yourself Age*, *Measure Up*, and *Size Up Your Stride* waited for other visitors to leave the exhibits before they could use them.

Long lines were especially evident at *See Yourself Age*, where software allows visitors to see how factors such as smoking, UV damage and obesity could affect their facial appearance as they get older. Seventy percent of those who stopped at that interactive waited in line before they could use it themselves, and it is likely that the long lines common at that component limited the number of visitors who were able to actually interact with it. To learn more about visitors' experiences at *See Yourself Age*, a small number of additional observations were conducted of uncued adults who approached and waited in line at that component. Thirty-three adults were observed at *See Yourself Age*; Table 10 summarizes the information recorded about those visitor stops. These observations confirmed that visitors can spend considerable amounts of time in line at that exhibit, especially when the gallery is crowded.

Table 10: Observations of adults at See Yourself Age

	High crowd level (N = 10)	Medium crowd level (N = 5)	Low crowd level (N = 18)
Average wait time	14.2 minutes	9.0 minutes	9.6 minutes
Longest time spent	59.0 minutes	35.0 minutes	18.3 minutes
Visitors who actually used computer themselves	20%	40%	61%

<sup>19</sup> A fourth screen (adjacent to *Tykes Peak*) displays videotaped material that is generally related to the gallery's overall theme but not connected to any specific component. Only one visitor was observed to obviously pay attention to it.

Although approximately 70 percent of the observed adults spent less than 10 minutes in line, 10 percent were willing to wait 30 minutes or more (and one visitor waited for approximately 1 hour). Visitors who were observed when the gallery was very crowded were the least likely to wait in a long line: 80 percent of them left the line before they had a chance to use the computer. Yet visitors' time in line was not entirely unproductive: 88 percent of those waiting were observed to spend some time watching the outcomes of other visitors' interactions on the large overhead monitor (and 35 percent spent some time watching an ongoing presentation at the nearby *Summit Stage* when one of those programs was underway).

Observers noted that 11 adults and five children experienced problems at least once during their interactions at *Expedition Health* components.<sup>20</sup> Eight visitors had problems using their Peak Pass cards to activate an exhibit component (seven had to insert their cards more than once; one adult couldn't find his pass and borrowed one from a companion). Six visitors had problems at *Bio Ride*, either with the card reader (three visitors) or trying to use a bicycle that was too small. Overall, visitor difficulties were more likely to involve "interface" issues (e.g., understanding how to use a component) rather than component malfunctions (see Appendix E for descriptions of all problems noted by observers).

### **Visitors' use of sign-in and sign-out stations and the Peak Pass card**



One of *Expedition Health*'s most important features is the Peak Pass, a card that both activates eight of the exhibition's interactive devices and creates a record of those interactions that visitors can take home (and also access online via the *Expedition Health* website). As visitors entered the gallery, a docent handed each of them a Peak Pass and directed them to one of the *sign-in stations*, where they could use a computer to initialize their card, input basic demographic information about themselves (such as gender and age) and select a "virtual buddy" who would accompany them on their "expedition." Visitors' use of their Peak Pass at subsequent interactives made it possible to personalize their experience (at computer-mediated interactives, their virtual buddy might reappear to guide them through that activity) or record information about their own body and its reactions (e.g., their EKG and resting heart rate at *Your Heart's Electricity* or their stride length and energy score at *Size Up Your Stride*).

As visitors exited the exhibition, they passed the *sign-out stations*, where signage directed them to insert their Peak Pass cards and print out a personalized record of their interactions with card-activated components (the printout also includes a code that visitors can use later to enter the *Expedition Health* website).

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<sup>20</sup> These reports were based on observer judgments, and the likelihood to note visitor problems varied from one observer to another.

Nearly 40 percent of all visitors were observed to stop at a *sign-in station* and initialize a Peak Pass. Unfortunately, fewer than half of those visitors also used one of the *sign-out stations* to get a printout (see Table 11). Approximately 40 percent stopped at both components but didn't actually use either computer themselves.<sup>21</sup>

Table 11: Visitors' behavior at *sign-in* and *sign-out*

Behavior	Percent
Visitor used both <i>sign-in</i> and <i>sign-out</i>	19%
Visitor used <i>sign-in</i> , but not <i>sign-out</i>	20%
Visitor used <i>sign-out</i> , but not <i>sign-in</i>	3%
Visitor stopped at both components but didn't use either computer	41%
Visitor stopped and looked at one component, but didn't stop at the other	12%
Other <sup>22</sup>	6%

Visitors' use of Peak Pass-activated interactives suggests that some of those who did not obtain a card for themselves probably used one belonging to a companion. This especially seemed to be the case at *Size Up Your Stride*, where 57 percent of visitors used that interactive themselves, even though only 39 percent of visitors had actually initialized their own Peak Pass card at *sign-in*.<sup>23</sup>

### Impact of crowding on visitors' behavior in Expedition Health

When *Expedition Health* first opened, DMNS issued timed tickets to limit overcrowding. That ticketing system was no longer in place during data collection for this study, and the gallery was very crowded at times. Observers were asked to judge the relative crowd size as they began each observation using these criteria:

<b>Low crowd level</b>	Many components are not in use and very few visitors are waiting in line at any component.
<b>Medium crowd level</b>	Approximately one-half of components are in use, but there are no significant lines at any of them. Most visitors can use many interactives without having to wait in line, but may have to wait to use very popular ones.

<sup>21</sup> Although visitors did seem slightly less likely to use a *sign-in station* when the gallery was very crowded, that difference was not significant. Approximately 50 percent of visitors did not use one of those stations even when relatively few visitors were in the gallery overall.

<sup>22</sup> Two adults didn't use *sign-in* but helped an accompanying child use *sign-out*. Two visitors did not stop at either component.

<sup>23</sup> Although the datasets are difficult to compare directly, these findings are somewhat corroborated by the museum's records of overall Peak Pass use during the period of the study. Between September 25 and November 6, 2009, approximately 38,700 Peak Pass cards were initialized at a *sign-in* station, while approximately 29,800 cards were subsequently used at *sign-out* (a decrease of 23 percent, compared with the 35 percent decrease observed in this study). Similarly, the total number of interactions recorded at *Size Up Your Stride* (45,660) was 17 percent greater than the total number of Peak Pass cards initialized at *sign-in*.

**High crowd level** There are visitors at nearly all components, and lines exist at many interactives. Most visitors will have to wait in line at least briefly before they can use the majority of interactives.

As Table 12 indicates, 70 percent of all visitors were observed in *Expedition Health* when the gallery was judged to be at least moderately crowded.

Table 12: *Estimated crowd levels during visitor observations*

Crowd level	All visitors
Low	30%
Medium	39%
High	31%

Four aspects of visitors’ behavior in the exhibition were compared across crowd levels: the total time that they spent in *Expedition Health*, the total number of components they stopped at (including programs), their likelihood to use interactives themselves, and the proportion of component stops where they waited in line (see Table 13).

Table 13: *The effect of crowd level on visitor behavior in Expedition Health (N = 74)*

Crowd level	Median time in gallery	Total stops	% stops where visitor interacted	% stops where visitor waited in line
Low	44 minutes	16	45%	14%
Medium	45 minutes	15	42%	20%
High	46 minutes	13	39%	23%

Overall, crowd level seemed to have negligible effects on these four measures of visitors’ behavior. Where crowding did have an impact was on the likelihood that visitors would have to wait in line at components, and that effect did approach statistical significance.

## Cued questionnaires

What did visitors say about their experiences in *Expedition Health*?

*As they described the exhibition’s purpose and what they had learned from their experiences in the gallery, both adults and children clearly addressed the exhibition’s key messages, and they often related those messages in very personal terms (e.g., what they had learned about themselves). Their interactions with individual components were also very memorable: More than 80 percent mentioned content related to one or more specific exhibits or programs.*

Visitors were asked to participate in this phase of the study before they entered the exhibition. Study participants spent as much time as they wanted in *Expedition Health* and then returned to answer questions about their experiences in the gallery. This “cuing” procedure was used to test the exhibition’s communication effectiveness in a situation where visitors would be motivated to

use exhibition components and pay attention to their messages. A total of 144 questionnaires were completed by 89 adults and 55 children.

Of 231 adults and children approached by a data collector, 38 percent (five children, 14 teenagers, and 68 adults) either refused outright or initially agreed to participate in the study but did not actually return to complete the questionnaire. As was the case for the observation and questionnaire samples, females outnumbered males among those who chose not to participate in the study, especially among adults. Crowds may have discouraged visitors from remaining in the gallery for extended periods of time: 75 percent of all refusals occurred on weekend days (including 23 visitors who refused on Sunday, Oct. 4 – a free day). Several visitors who initially agreed to complete questionnaires on that day left the exhibition before they had intended, explaining to the data collector that the gallery was too crowded.

Both adult and child versions of the questionnaire included open-ended items prompting respondents to describe the exhibition’s purpose and relate new ideas that they encountered as they interacted with components. Adults were also asked to rate various aspects of three programs (*BodyTrek Theater*, *Summit Stage*, and *Biology Base Camp*) and comment on their experiences in those areas. Children were asked to provide unstructured feedback about those programs. Copies of both questionnaires are included in Appendix C.

### Visitor characteristics

Table 14 summarizes demographic and other characteristics of the adults and children who completed questionnaires. Again, females dominated both samples (57 percent of the adults and 60 percent of the children). Adults were well educated: 65 percent had earned college or advanced degrees. Forty-four percent of adults described themselves as having a special interest, knowledge, or training in medicine, biology, or physiology. These included 20 medical/health professionals (e.g., doctors, nurses, laboratory technicians) and 14 visitors who had completed specialized training, college coursework, or a college degree in biology or other relevant disciplines (e.g., B.S. in biochemistry, wilderness first-aid training).

Approximately 25 percent were first-time visitors to DMNS, and 70 percent were visiting *Expedition Health* for the first time. Approximately 33 percent of children were repeat visitors (compared with only 18 percent of adults). Additional information about these visitors is tabulated below.

Table 14: Characteristics of adults and children who completed cued questionnaires<sup>24</sup>

Characteristics		Number	Percent
Estimated age	6 – 8 years	7	5%
	9 – 11 years	19	13%
	12 – 14 years	19	13%
	15 – 19 years	14	10%
	18 – 29 years	32	22%
	30 – 39 years	20	14%

<sup>24</sup> Accompanying adults were asked to provide this information for children.

<b>Characteristics</b>	<b>Number</b>	<b>Percent</b>
	40 – 49 years	23 16%
	50 – 59 years	4 3%
	60 years or older	4 3%
<b>Race and ethnicity</b>	Asian	3 2%
	Black	1 1%
	Latino	16 11%
	White (not Latino or unsure)	114 79%
	No information	7 5%
<b>Language spoken at home</b>	English	128 89%
	Spanish	6 4%
	English and Spanish	2 1%
	English and other language	2 1%
	Other language	2 1%
<b>Household income</b>	Less than \$15,000	4 3%
	\$15,000 – 24,999	8 6%
	\$25,000 – 34,999	19 13%
	\$35,000 – 49,999	9 6%
	\$50,000 – 74,999	21 15%
	\$75,000 – 99,999	18 13%
	\$100,000 – 150,000	22 15%
	\$150,000 – 199,999	10 7%
	\$250,000 or more	4 3%
	No response	29 20%

Tables 15 and 16 summarize group composition for the cued questionnaire samples. As was the case for the tracking-and-timing sample, only a small number of adults toured the exhibition by themselves; all other visitors were accompanied by at least one child or adult. Approximately one-half of the adults who completed questionnaires were visiting with one or more children. Nearly all of the children arrived at *Expedition Health* accompanied by at least one adult; 80 percent of them were part of a group that included two or fewer children (including the child who completed the questionnaire).

Table 15: Group composition – adults returning questionnaires (N = 89)

<i>Number of children:</i>	<i>Number of adults:</i>				<b>Total</b>
	<b>One</b>	<b>Two</b>	<b>Three or more</b>	<b>Unknown</b>	
None	6%	36%	7%		<b>48%</b>
One	14%	10%	1%		<b>25%</b>
Two	3%	11%	--		<b>15%</b>
Three or more	2%	7%	2%		<b>11%</b>
Unknown	--	--	--	1%	<b>1%</b>
<b>Total</b>	<b>25%</b>	<b>64%</b>	<b>10%</b>	<b>1%</b>	<b>100%</b>

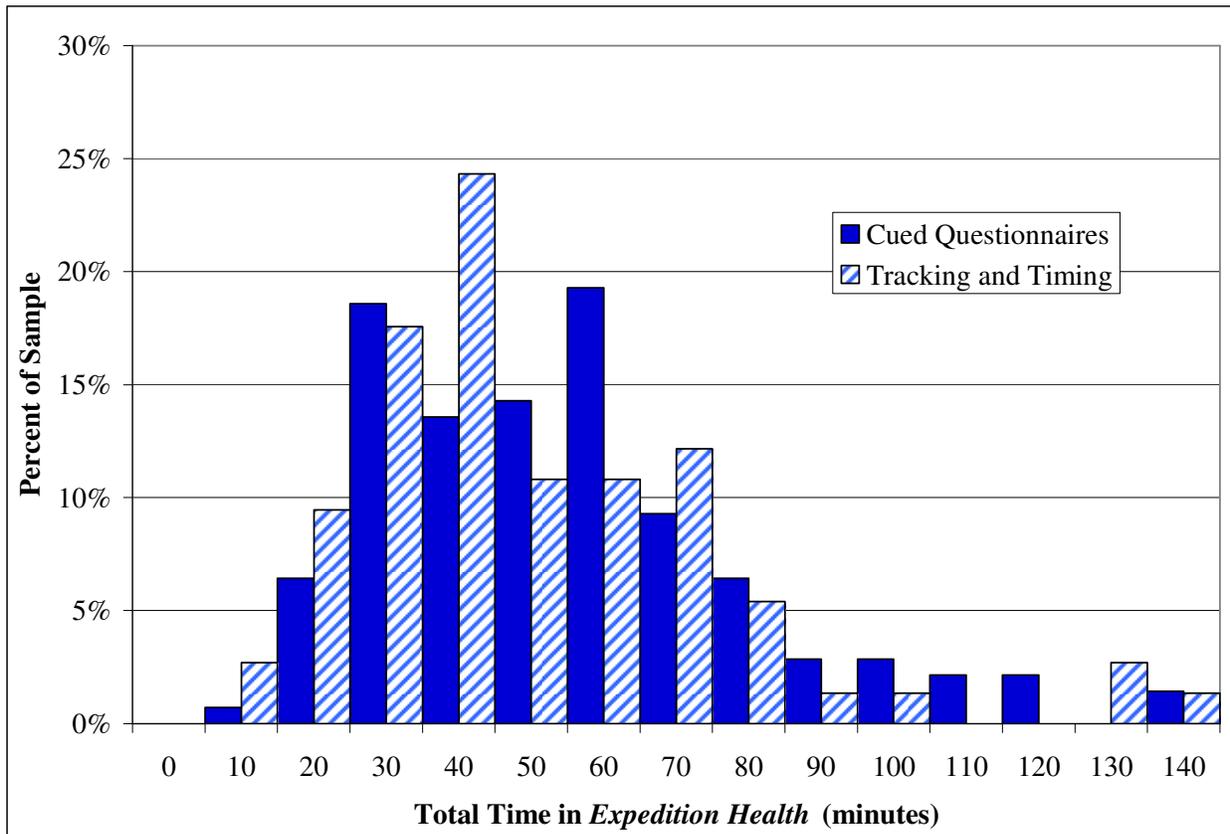
Table 16: Group composition – children returning questionnaires (N = 55)

<i>Number of children:</i>	<i>Number of adults:</i>				<b>Unknown</b>	<b>Total</b>
	<b>None</b>	<b>One</b>	<b>Two</b>	<b>Three or more</b>		
One	--	18%	9%	2%	--	<b>29%</b>
Two	3%	23%	22%	2%	--	<b>51%</b>
Three or more	2%	4%	13%	--	--	<b>18%</b>
Unknown	--	--	--	--	<b>2%</b>	<b>2%</b>
<b>Total</b>	<b>5%</b>	<b>45%</b>	<b>44%</b>	<b>4%</b>	<b>2%</b>	<b>100%</b>

### **Cued visitors' behavior in Expedition Health**

Figure 8 (next page) compares the time spent in *Expedition Health* by those completing questionnaires with time spent by visitors in the tracking-and-timing sample. The cuing procedure increased visitors' median time by approximately 24 percent when compared to the time spent by their uncued counterparts in the observation sample. Even so, the distributions of time spent by these two groups were very similar.

Figure 8: Total amount of time spent in Expedition Health by adults and children completing questionnaires



Both adults and children were asked whether they had taken part in activities in three of the gallery’s specialized program areas (*BodyTrek Theater*, *Summit Stage*, and *Biology Base Camp*). Approximately 60 percent of cued visitors recalled having taken part in at least one of those programs; 10 percent of adults and 15 percent of children participated in two programs. Only three adults recalled taking in all three.

As Table 17 indicates, adults were more likely to have seen *BodyTrek Theater’s* multimedia presentation, while children were most likely to recall seeing a program at *Summit Stage*. While the cuing procedure did not seem to increase visitors’ likelihood of watching programs at *BodyTrek Theater* and *Summit Stage*, visitors asked to complete the questionnaires were nearly twice as likely to spend time in *Biology Base Camp* than were their counterparts in the tracking-and-timing sample.

Table 17: Visitors' participation in Expedition Health programs <sup>25</sup>

<b>Program</b>	<b>Adults (N=89)</b>	<b>Children (N=55)</b>	<b>All visitors</b>
Biology Base Camp	22%	20%	22%
BodyTrek Theater	30%	24%	28%
Summit Stage	21%	28%	24%
No programs	42%	43%	42%

### Visitors' reflections on their experiences in Expedition Health

Visitors described what they thought the exhibition was “about” and what they recalled about it by completing four open-ended statements:

*Questions posed to adults:*

What would you say is the main purpose of the displays in *Expedition Health*?

- To show people ...
- To make people ...
- I didn't know or never realized that ...
- It reminded me that ...

*Questions posed to children:*

If you were going to tell a friend what *Expedition Health* is all about, what would you say?

- The museum made these exhibits to show people ...
- The museum made these exhibits to make people ...
- I didn't know that ...
- It reminded me that ...

Because many responses included more than one discrete idea, those were isolated and grouped by similar concepts.

When they considered what the exhibition's overall “purpose” might be (i.e., what it was intended to “show people” or “make people do”), both adults and children typically mentioned something about the human body, health, or how complex and amazing the body is (Table 18).

Table 18: Visitor descriptions of the exhibition's purpose (N = 144)

<b>Idea mentioned</b>	<b>All visitors</b>	<b>Example</b>
It's about the human body.	31%	[To show] <i>How your body works.</i> [To make people] <i>Think about the changes your body undergoes in various situations. [adult]</i> [To show] <i>How their body works.</i> [To make people] <i>Have fun and learn about themselves. [12-year-old girl]</i>
It's about health.	19%	[To show] <i>The main purpose is to show the public how important Health is &amp; why you should take care of yourself. [adult female]</i> [To make people] <i>Think about how they live and how they treat their body most of all. But mainly how your health is part of your daily life. [16-year-old boy]</i>
It's about the body and health.	42%	[To show] <i>How your body works &amp; the effects of certain aging factors. [To make people] Think about their lives &amp; make people consider healthier options/lifestyles. [adult male]</i> [To show] <i>How your body works, nutrition, and helps with exercise [sic]. It helps kids to stay healthy. [10-year-old girl]</i>

<sup>25</sup> Since visitors may have seen more than one of these programs, the total percentage reported exceeds 100 percent.

Idea mentioned	All visitors	Example
It's about body/health and how amazing the body is.	7%	<p>[To show] <i>Overall functions of the human body.</i> [To make people] <i>Appreciate all the amazing processes that go on in our bodies.</i> [adult female]</p> <p>[To show] <i>How your body works, what is in it, and the miracle of life.</i> [To make people] <i>Amazed at what their bodies can do.</i> [11-year-old girl]</p>

Five adults and one child specifically identified children as the exhibition's primary target audience, e.g.,

[To show] *People (mostly kids) basic principles of how the body functions & how outside elements affect it.* [adult female]

Additional items prompted visitors to relate new ideas that they encountered (e.g., "I never knew that ...") and recall anything that they were reminded of during their visit to the gallery. When visitors discussed *Expedition Health's* overall purpose and their experiences in the exhibition, both adults' and children's statements frequently made reference to elements of the exhibition's central idea and related messages that had been defined by the exhibit team. Nearly 70 percent of all visitors addressed these general ideas in one or more of their questionnaire responses.

- **How the body changes or reacts in particular situations or in response to different stimuli** (41 percent of all visitors)

[Didn't know] *Bodies work so differently at different altitudes.* [adult female]

[Didn't know] *When you exercise your heart rait [sic] gets higher.* [9-year-old girl]

[Didn't know] *How you got bellyaches. I didn't know how bacteria grows.* [8-year-old, gender unknown]

- **What people can see or measure about their bodies** (27 percent of all visitors)

[Reminded me] *I need to be conscious of the signs my body shows me in regards to health.* [adult male]

[Didn't know] *Technology had come so far in it's [sic] ability to measure & view the body.* [adult female]

[Didn't know] *My heart rate was 77 beats per min.* [12-year-old girl]

[Didn't know that when] *I walked that my stride was 2.7 feet.* [11-year-old boy]

- **Specific actions that people can take to improve their own health** (36 percent of all visitors)

[Reminded me] *Exercise improves lung function.* [adult female]

[Reminded me] *I should eat healthy, put sunscreen on & exercise regularly.* [adult female]

[Reminded me] *I'm a little bit chubby and need to eat and exercise better.* [13-year-old boy]

- **You can participate in scientific inquiry and understand the scientific process** (1 adult)

[To show] *To show and expose people to scientific method. Inform them of natural wonder.* [adult female]

Again, visitors were also reminded of how amazing their bodies are: Four adults and four children made comments like these:

[Reminded me] *Your body is very cool you just can't see it.* [9-year-old girl]

[Reminded me] *The human body has some amazing abilities.* [adult female]

As several of these comments indicate, the exhibit team's efforts to personalize exhibit messages clearly resonated with visitors. Approximately 50 percent of both adults and children described either what they had learned or noticed about themselves, or what they could (or should) change about themselves to be healthier.

[Didn't know] *When I got scared my pulse jumped so much.* [adult female]

[Reminded me] *I should work out more often, and to relax more.* [adult male]

[Didn't know] *My heart can feel like the most powerful part of my body, yet sometimes I don't even realize that it's there.* [adult female]

[Reminded me] *How fast I go, how my heart beat so fast.* [9-year-old boy]

[Didn't know] *My eyes would change when the light would change.* [8-year-old boy]

[Didn't know that ...] *When I'm walking in my medical boot it lowered my energy when walking.* [14-year-old girl]

[Reminded me] *To wash my hands! To ride bikes a lot to make my heart pump.* [8-year-old]

Even more striking was visitors' likelihood to mention content clearly related to their experiences with specific exhibition components. Eighty-two percent of all visitors' responses referred to one or more specific *Expedition Health* exhibits or programs; 28 percent mentioned content related to two or more elements. Children were most likely to mention something they had noticed or learned at *Bio Ride*, while adults were most likely to mention new ideas that they had encountered at either *Altitude Adjustment* or *Hydrate*. Approximately 25 percent of both adults and children who saw a *Summit Stage* program mentioned something new that they had learned there. A selection of component mentions are included below; see Appendix F for a compilation of all component-related comments from visitors' questionnaires.

- ***Altitude Adjustment – Hydrate – BodyTrek Theater*** (17 percent of adults; one child)

[Didn't know] *We lose so much fluids because of the altitude.* [Reminded me] *I need to hydrate more.* [adult female]

[Didn't know] *Effect of altitude on urine output...* [adult female]

- ***Bio Ride*** (8 percent of adults; 25 percent of children)

[To show people] *I would say I could not finish the bike and they should come! ☺* [Didn't know] *I could not bike that well.* [Reminded me] *I need to bike more.* [12-year-old girl]

[Didn't know] *If you reach your target heart rate your heart will work harder.* [16-year-old girl]

[Didn't know] *There is such thing as too much exercise. That there is a level of exercise that is perfect.* [Reminded me] *Exercise can be harder at high altitudes.* [14-year-old girl]

[Didn't know] *The changes in heart rate w/ very little exercise.* [adult male]

- **Protect Your Skin – Today’s UV and You** (16 percent of adults; 18 percent of children)

[Didn't know] ... *We need to use MORE sunscreen.* [Reminded me] *To use MORE sunscreen.* ... [adult female]

[Didn't know] *Under a black light screen if you put sun block on your hand it turns black.* [Reminded me] *Suns [sic] harmful ray could really damage our cells.* [adult male]

[Didn't know] *That sunscreen is so important when you go out in the sun.* [12-year-old girl]

[Didn't know] *30 SPF sunscreen really does help sunburn by looking through a camra [sic].* [9-year-old boy]

- **See Yourself Age** (7 percent of adults; 13 percent of children)

[Didn't know] *That if you don't wear sunscreen you get lots of wrinckles [sic]. (lots more)* [10-year-old girl]

[Didn't know] *If you don't use sunscreen when you are young, you will get more moles & warts. I didn't know what I would look like at 70.* [10-year-old girl]

[Didn't know] *You can see how old you can be in the future.* [adult female]

[Didn't know] *The sun was so bad for your skin.* [adult male]

- **Summit Stage** (27 percent of those who recalled seeing a program there)

[Didn't know] *The heart felt squishy.* [12-year-old boy]

[Reminded me] *Bacteria [sic] can grow even if you wash with cleaners.* [10-year-old girl]

[Didn't know] *You can grow new alveoli in response to exercise.* [Reminded me] *Exercise improves lung function.* [adult female]

- **BodyTrek Theater** (20 percent of those seeing program)

[Didn't know] ... *No muscle in fingertip.* [8-year-old boy]

[Didn't know] *Blood oxygen levels are very similar between people but pulse rates can really vary.*  
[Reminded me] *The heart & lungs work together to keep your body at homeostasis.* [adult female]

- **Biology Base Camp** (17% of those who reported spending time there)

[Didn't know] *Caffeine made Daphnia's heart rate increase just like ours.* [10-year-old girl]

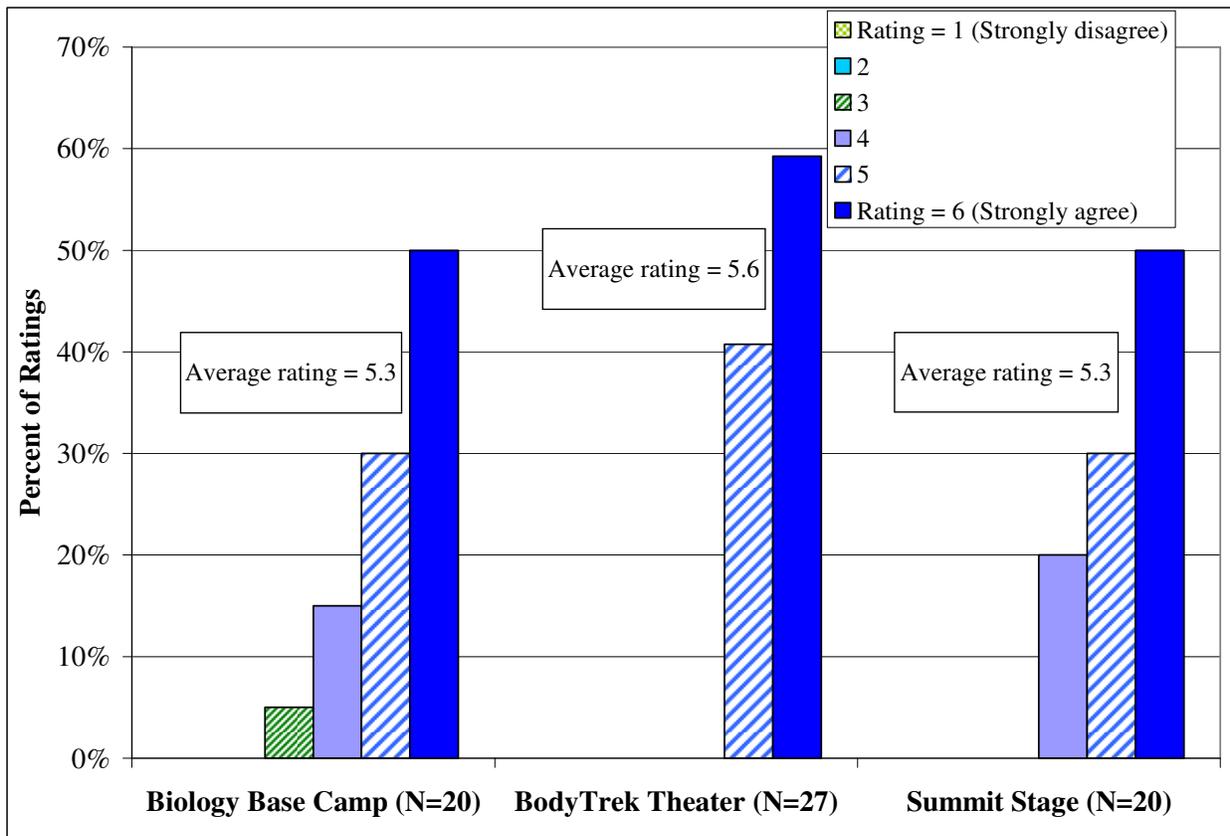
[Didn't know] *So much sugar in breakfast cereals!* [adult male]

### **Visitors' feedback about the specialized program areas**

Adults who recalled participating in a particular program were asked to rate their enjoyment of that program and its suitability for any accompanying children. Children were simply asked to offer unstructured feedback about the programs they reported seeing.

Adults were uniformly positive about their experience in those areas and especially enjoyed *BodyTrek Theater's* multimedia experience (see Figure 9).

Figure 9: Adults' level of agreement with the statement, "We really enjoyed this program."



Adults often mentioned specific program features that they enjoyed. Although children were not asked to rate their enjoyment of programs, at least half of those who participated in those programs also described specific program features that captured their attention or were very “cool.”

- **BodyTrek Theater**

*The environmental synthesizers (i.e. UV light & wind machine) were engaging & made the material more interesting.* [adult female, rating = 5]

*Interesting; good facts; LOVED the pulse-ox [oxygen] and SNOW!* [adult female, rating = 6]

*I think it was cool to see your heart rate and pulse on the monitor.* [10-year-old girl]

- **Summit Stage**

*Loved the heart dissection - Loved the Super Food Hero – Antioxidine [sic].* [adult female, rating = 6]

*I thought it was cool and that I like how they dress up.* [10-year-old girl]

*It was interesting, I learned facts about lungs, and got to see inside lungs.* [11-year-old boy]

- **Biology Base Camp**

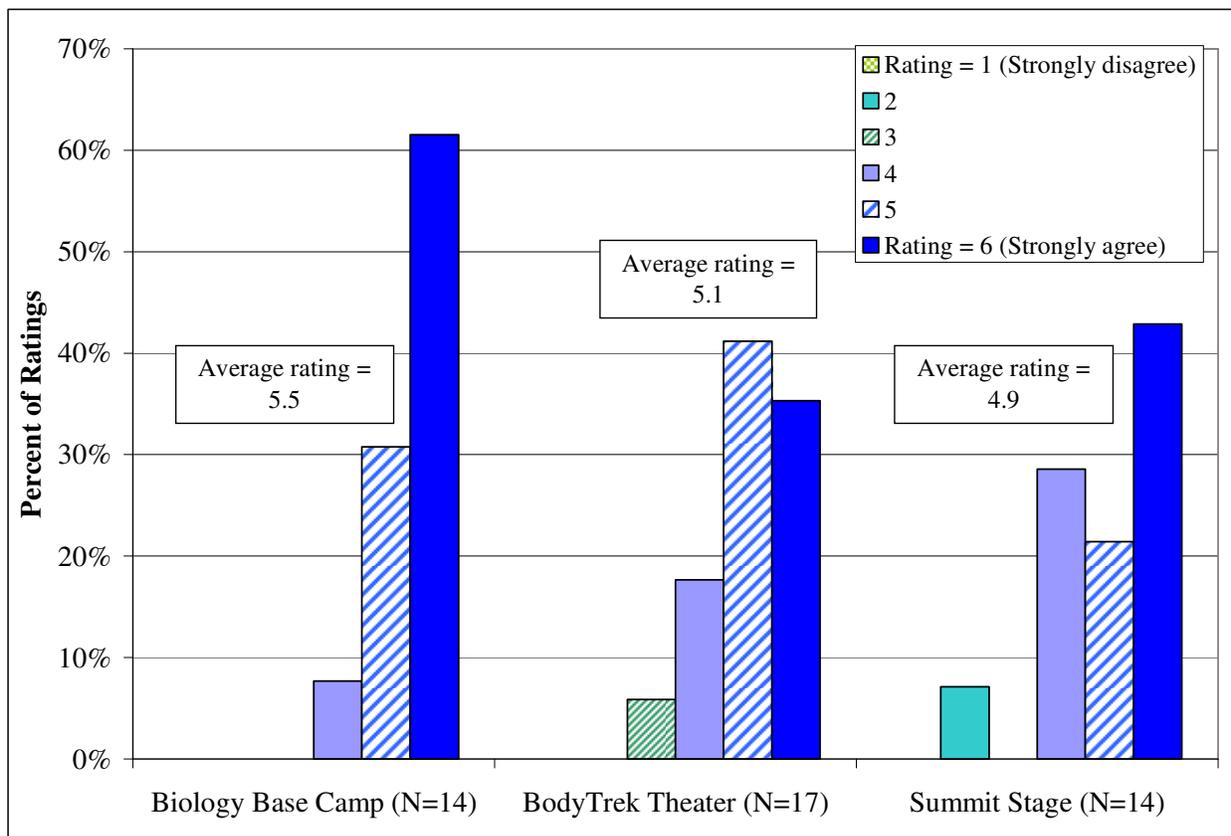
*Cool experiments! Wonderful helpers and educators.* [adult male, rating = 6]

*Wow. I did "See your own cells" and it was incredible ... how often can you do that?* [11-year-old boy]

*I loved it!! Think it's cool to do experaments [sic] with a lab coat and evrything [sic].* [10-year-old girl]

As Figure 10 illustrates, adults' ratings of activities' appropriateness for children varied across the three presentations, possibly reflecting differences among both the activities themselves and the varying ages of accompanying children.

Figure 10: Adults' rating of their agreement that "These activities were very appropriate for children in my group."



Adults who judged that programs were not at the right level for their children typically commented that their children were too young to participate in them or understand what they were seeing. Those who agreed that a program was very suitable often mentioned specific features that promoted their children's engagement and enjoyment, e.g.,

*Came w/ 6 yr. old daughter. [BodyTrek Theater was] understandable & not "dumbed down."* [adult female, rating = 5]

*[BodyTrek Theater] The interactive piece and length – kids want to keep moving. The surprise – test to pulse helped keep my kid interested.* [adult female, rating = 5]

[Biology Base Camp] *Directions were step by step – the topic or main idea was clear to find in an investigative way.* [adult female, rating = 6]

A small number of adults and teenagers described the *Summit Stage* theater pieces as being more suitable for children than adults, i.e.,

*The presentation was interactive with little kids but kind of little kiddish and boring.* [14-year-old girl]

*It was for younger kids then [sic] me.* [13-year-old boy]

*The kid's [sic] seemed to like it more than I did. Lot's [sic] of "Wow - cool!!!"* [adult male, rating = 2]

### **Adults' recommendations for exhibition improvements**

When prompted to suggest changes that would improve other visitor's experiences in *Expedition Health*, approximately one-third of visitors either did not respond or made comments like these:

*Good Expedition.* [adult female]

*Nothing everything is very good.* [adult male]

*It's a great resource for knowledge and over all health I believe the Expedition of Health is great the way it is.* [adult male]

Forty-six percent of respondents specifically commented on how overall crowd levels and waiting in line to use components affected the quality of their experience in the gallery (the photograph to the right shows visitors waiting in line to use *See Yourself Age*). A number of visitors suggested ways in which DMNS might mitigate the impact of overcrowding or exhibit popularity (e.g., limit the number of visitors in the gallery at one time or increase the number of stations at especially popular elements).



*More kiosks of the same experiment would be nice. I spent much of my time waiting in line for a few popular exhibits & even skipped some due to the line. More numbered steps would also be helpful & potentially ease backups.* [adult female]

*Shorter lines at the AGING station - maybe have MORE to read or a place to wait and hear something while we waited in line.* [adult female]

*Limit the amount of people so the lines are not as long (make groups sign up for shifts) or make more stations available.* [adult female]

*Have certain number of people allowed in at a time. Lines were very long, especially visiting at the same time as schools. Children would cut in and make lines longer.* [adult male]

*There were too many school groups to participate in a lot of the activities. Maybe only allow so many in at a time. I was in the exhibit with my 2 yr. old daughter.* [adult male]

Twenty-five percent of adults suggested a variety of other changes (or noted specific problems that they encountered in the gallery). Four visitors reported technical problems with either the

card readers (three visitors) or the height sensor at *Measure Up* (one visitor). Six visitors requested additional activities to enhance existing programs or exhibits, e.g.,

*Ways to improve health, expand a little on the nutrition station.* [adult male]

*More "buddies" to choose from in the card registry. ...* [adult female]

*Add some auditory portions about hearing & affects [sic] of loud music & of course --> Dental Health & how it relates to whole-body health.* [adult female]

Four visitors requested additional docents or wayfinding assistance:

*Make more of a road map. It can be confusing!* [adult female]

*Guide for first timers.* [adult female]

*More people around to assist / explain the exhibits.* [adult female]

*Have more helpers showing you what to do. ...* [adult female]

And finally, three visitors would have appreciated sanitizing stations, e.g.,

*With flu season upon us, hand sanitizers and wipes for the equipment should be provided. It gave me the creeps to touch some of the equipment after all the runny nose kids.* [adult female]

## Discussion and Recommendations

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**This study demonstrates Expedition Health's success and effectiveness on a variety of levels.**

**Visitors used the exhibition very thoroughly.**

The visitors who were unobtrusively observed in *Expedition Health* spent a median time of 38 minutes (and more than one-third spent 60 minutes or longer). These visitors spent nearly as much time as adults and children who were asked to visit the exhibition and answer questions about it, suggesting that (on its own) *Expedition Health* promotes considerable engagement and exploration. Indeed, visitors in the tracking-and-timing sample did spend 80 percent of their time using exhibits or taking part in programs, and 46 percent of them stopped to interact with more than one-half of the exhibition's 29 elements. Although these visitors spent the majority of their time interacting with exhibit components, 70 percent did take part in activities in at least one of the gallery's specialized program areas (e.g., *BodyTrek Theater*).

**Both adults and children learned about themselves and their bodies.**

The DMNS team that developed *Expedition Health* hoped that adults and children would not only learn more about how the human body functions and reacts under different circumstances, but that they would also learn something about themselves and notice new things about their own bodies. Exhibition experiences were specifically designed to convey this central idea:

*Your body changes in ways you can see, measure, and optimize.*

This study provides compelling evidence that *Expedition Health* communicates that message very effectively, especially when visitors are specifically motivated to spend time in the exhibition and interact with a variety of elements. When cued visitors were asked to describe what *Expedition Health* was “about” in their own words and reflect on their experiences, 70 percent of them addressed some aspect of the central idea that guided the exhibition’s development and character.

*I would say [Expedition Health is] generally about health and keeping fit. It had things that measure your pulse oxygen level in your blood, height, arm span, and how you age. I didn't know that your pace and step length effected [sic] how efficient you walk. [The exhibits reminded me that] UV rays and obeicity [sic] can seriously effect [sic] how you look as you age. [14-year-old boy]*

[DMNS made these exhibits to show] *1) What is inside our body. 2) How our body systems work. 3) An appreciation for this marvelous machine. [These exhibits make people] Appreciate the beauty & complexity of the human body -- & to care for it. [I didn't know that] My brain waves are more tense than everyone else's ☺. [adult female]*

The exhibit team’s efforts to personalize exhibit messages clearly resonated with visitors. Approximately 50 percent of both adults and children described either what they had learned about themselves or actions that they could take to promote their own health and well-being.

[The exhibits reminded me] *To wash my hands! To ride bikes a lot to make my heart pump. [8-year-old child]*

**Exhibits and programs did vary with respect to their overall effectiveness, and a few were especially engaging and memorable.**

Only one component (*Health Is a Lifelong Expedition*) failed to prompt even one visitor stop. That graphics panel was opposite *Tell Your Story*, and visitors passed it as they approached the *sign-out stations* and the exhibition exit. Unlike other gallery elements, it does not include any specimens, interactive devices, or videos that might have prompted visitors to stop.

Seven exhibits stand out in terms of their attractiveness (more than 50 percent of observed visitors stopped to interact), holding power (those who stopped spent longer than 1 minute), and communication potential (nine or more of those who completed questionnaires mentioned related ideas).

Table 19: Top-performing exhibit components

Exhibit	Percent stopping	Median time spent	Visitors mentioning related ideas
<i>Size Up Your Stride</i>	72%	2.8 minutes	17 (12%)
<i>Your Heart's Electricity</i>	70%	1.7 minutes	9 (6%)
<i>Bio Ride</i>	66%	3.3 minutes	22 (15%)
<i>Measure Up</i>	57%	3.0 minutes	9 (6%)
<i>Protect Your Skin</i>	57%	1.3 minutes	24 (17%)

<b>Exhibit</b>	<b>Percent stopping</b>	<b>Median time spent</b>	<b>Visitors mentioning related ideas</b>
<i>Control Your Brain Waves</i>	55%	3.9 minutes	10 (7%)
<i>See Yourself Age</i>	51%	2.2 minutes	11 (8%)

A number of different (and sometimes overlapping) factors probably account for these components' effectiveness. All of these "top performers" are among those components that used technology in innovative ways to enhance and interpret visitors' experiences. In many cases, visitors had a chance to see or measure something about themselves that they are typically unaware of or rarely observe directly (e.g., a real-time EKG of their own beating heart, their walking silhouette projected on a large screen). These technologies and striking images attracted visitor attention in the gallery and were often mentioned on visitors' questionnaires, e.g.,

[Didn't know] *My heart can feel like the most powerful part of my body, yet sometimes I don't even realize that it's there.* [adult female]

As these excerpts indicate, a few adult visitors were impressed by the technology itself:

[Didn't know] *Technology had come so far in it's [sic] ability to measure & view the body.* [adult female]

[Didn't know] *The vein viewer was really cool – I never realized instant imaging technology like that existed.* [adult female]

*Size Up Your Stride*, *Bio Ride*, and *Measure Up* are among those that offered an opportunity for "full-body" interaction – a design feature that seemed to invite visitor interaction and attract the attention of others who possibly stopped to watch and then interact themselves.

Six of the elements highlighted in Table 19 were also among those activated by visitors' Peak Pass cards. This feature did not seem to increase visitors' likelihood to interact with or spend time at individual components. (Because some components can only be operated with a Peak Pass, this feature may have actually limited the extent to which visitors used such exhibits themselves.) Data from visitors' interactions with these exhibits were included on personalized printouts, however, so visitors could retrieve their information if they used a *sign-out* computer. Even though visitors in the questionnaire sample were not asked whether or not they had printed such a record for themselves, it seems very possible that having those printouts could have prompted them to mention that information as they completed the questionnaires.

The DMNS exhibit developers often used more than one element to reinforce concepts, and this strategy worked especially well to communicate three specific ideas.

- Three components (*Protect Your Skin*, *See Yourself Age*, and *Today's UV and You*) use different approaches and technologies to explore how UV exposure damages skin and why it is important to use sunscreen. Eighteen percent of adults and 25 percent of children mentioned these ideas on their questionnaires, making this concept perhaps the most memorable one that visitors encountered in *Expedition Health*.

- Three elements (*Altitude Adjustment*, *Hydrate*, and *BodyTrek Theater*) explore how dramatically altitude affects the body's use and loss of water. Sixteen percent of adults in the questionnaire sample were surprised to learn about this relationship (and often vowed to “drink more water” as a result).
- Two exhibits (*Your Heart's Electricity* and *Bio Ride*) encourage visitors to focus on their own hearts – how this muscle beats and how the heart responds to exercise. Two programs (*BodyTrek Theater* and a *Summit Stage* demonstration) also reinforce these concepts. Children especially were captivated by these ideas and experiences – nearly 30 percent of their questionnaires mentioned what they had learned or noticed about their hearts (e.g., how fast they beat, how hard their hearts work when they exercise, or how the heart is a muscle).

**Expedition Health obviously supports return visits – approximately 25 percent of all visitors included in this study had seen the exhibition at least once before in the six months since its opening.**

Although the exhibits themselves are certainly engaging, the gallery developers included additional elements that seem to encourage repeat visits. Slightly more than one-third of returning visitors were drawn to specialized program areas, such as *Biology Base Camp* (where the time commitment required may have discouraged stops from first-time visitors) or *Tykes Peak* (where visitors with small children know that they can find age-appropriate activities in a more protected space).

**This study also raises issues and questions for the Expedition Health development team.**

**The number of people in the gallery (and resulting lines at popular components) does affect the quality of visitors' experiences in the exhibition.**

Early in the design phase of this study, the DMNS team expressed concern about two situations created by the exhibition's overall attractiveness (i.e., the gallery is very crowded at times) and the popularity of certain exhibit elements (i.e., long lines often formed at exhibits such as *Bio Ride* and *See Yourself Age*). The study findings indicate that these circumstances do affect visitors' experiences.

*This was our 3rd time to the exhibit & our best experience because it wasn't crowded & we were able to try everything we wanted to try. [adult female]*

Seventy percent of visitors who were unobtrusively observed in *Expedition Health* toured the exhibition when it was judged to be at least moderately crowded. Not surprisingly, as the level of crowding increased, so did visitors' likelihood of spending time waiting in line before they could use exhibit components. Nearly 40 percent of all visitors were observed to wait in such lines at three or more exhibits during their visit. Three exhibits were especially popular – 40 percent or more of visitors who stopped at *Measure Up*, *Size Up Your Stride*, and *See Yourself Age* waited for other visitors to leave the exhibit before they could use it themselves. Visitors' wait time was not entirely unproductive – those who were in line often watched others' interactions with components as they waited or watched a *Summit Stage* program from the line at *See Yourself*

*Age*. Nevertheless, nearly 50 percent of the adults who returned questionnaires specifically commented on how overall crowd levels and waiting in line to use components affected the quality of their experience in the gallery.

A number of visitors suggested ways in which DMNS might mitigate the impact of overcrowding or exhibit popularity. The most easily implemented of these would be to reinstitute ticketed entry on an as-needed basis. The museum's flexible ticketing system and movable ticketing kiosks would seem to make it easy to temporarily issue timed tickets when the gallery is likely to be especially crowded (including any weekdays when large school groups are also visiting the exhibition). The museum could also consider using signage (or docents) at the exhibition entrance to alert casual visitors when the gallery is crowded with students (giving them the option to return later when they might enjoy greater access to exhibits and programs).

Even under the best of circumstances, however, visitors often waited to use popular exhibit components. This was most likely to be the case at *See Yourself Age*, where lines persisted despite the museum's attempts to discourage them (signs alerted visitors to "estimated wait times" and informed users that the software worked best for those within a certain age range). At the same time, the cued questionnaire findings document that visitors' interactions with this element (whether they used the computer themselves or watched others "aging" on the large overhead screen) were not only very memorable but also communicated very relevant messages. More casual observations of visitor interactions at *See Yourself Age* suggest that additional actions might be helpful. For example, when the gallery is likely to be crowded, a docent assigned to that specific component could help visitors use the device properly (so that they can complete their interaction more quickly) and summon a technician quickly if the software malfunctions. That docent could also discourage visitors from cycling through the program more than once (which was more likely to happen with children) or talk with waiting visitors about what they were seeing on the overhead monitor.

The lesson for future exhibition projects – other than the unlikely option of developing less-engaging components – is to seriously determine how visitor wait times can be managed and minimized as much as possible. Interactions should be streamlined, especially when a single component includes interactions at multiple stations (e.g., *Measure Up* and *Size Up Your Stride*). At both of those components, visitors could complete the initial activity relatively quickly, but then they were forced to wait as other visitors used the second, more involved, computer station. When interactions are inherently time-consuming, designs that create satisfying and engaging experiences for those who are watching (as well as for those who are participating directly) are likely to be successful. In *Expedition Health*, that seemed often to be the case at *Control Your Brain Waves*, where pairs of visitors would use the interactive while their companions (and total strangers) would gather around them to follow participants' brainwaves on a large monitor, watch the small ball go back and forth between them, and cheer on the "winner" (or encourage the "loser" to "relax!").

**Relatively few visitors in the tracking-and-timing sample actually used both the sign-in and sign-out stations.**

The study's tracking-and-timing findings indicate that less than one-half of visitors used the *sign-in stations* to initialize a Peak Pass for themselves and that only one-half of those visitors used that card at a *sign-out station* to generate a personalized record of their experiences in *Expedition Health*. Unfortunately, this situation limited the extent to which visitors could use card-activated interactives (although some visitors apparently did borrow a card from a companion when they needed to) or take advantage of the exhibition's companion website ([www.dmns.org/peakpass](http://www.dmns.org/peakpass)), which can be accessed only with a code number on the Peak Pass printout.

The current study does not have data to explain these findings. Although it is possible that visitors might be less likely to use a *sign-in station* when the exhibition is very crowded, the proportion of visitors who were observed to use the *sign-in stations* did not increase when the gallery was less crowded. A more targeted evaluation could certainly be designed to document visitors' use of those stations across different gallery conditions and identify the factors that promote (or discourage) interaction with those stations (and use of the Peak Pass card itself). With more information, educators and exhibit staff could prototype various strategies to encourage broader use of the Peak Pass cards.

**The demonstration carts seem to be an underutilized resource.**

At various times throughout the day, DMNS docents bring wheeled carts into the gallery to give visitors the opportunity to explore gallery-related topics in more depth. Cart themes typically reinforce specific exhibit content (e.g., "The Brain," "Bones Alive") and often include specimens that visitors can handle. The cart schedule varies from day to day, but approximately 60 percent of visitors in the tracking-and-timing sample were in the gallery when at least one cart was available. Only 18 percent of those visitors were observed to actually stop and engage a docent in conversation or look at anything on one of the carts. Even though it is unrealistic to expect that a majority of visitors would encounter or stop at a *demonstration cart*, it is possible that additional docent training, monitoring, and feedback would increase the proportion of gallery visitors who take advantage of this resource.

**What opportunities are there to enhance and extend visitors' experiences in Expedition Health?**

Given the backgrounds of *Expedition Health* visitors (40 percent are trained in related disciplines or work in health/medical professions) and visitors' overall likelihood to make repeated visits to the gallery, DMNS educators might consider ways in which these visitors could be encouraged to continue regular visitation and get even more out of their experiences in the gallery. For example, since returning adults and children seem more likely to spend time in *Biology Base Camp*, letting them know that new experiments are available in that area could prompt them to return to the gallery even more often than they might otherwise. Visitors to the *Expedition Health* website could be invited to sign up for occasional e-mail updates alerting them when new

programs and activities are available (including new *Summit Stage* offerings or even related special programming that might appeal to these visitors).

***These findings suggest questions that could be addressed by additional and more targeted evaluation studies.***

As described above, visitors' experiences in *Expedition Health* (and the exhibition's overall impact) might benefit most from additional examination of adults' and children's use of the *sign-in* and *sign-out stations* and the testing of strategies designed to increase visitors' likelihood to initialize their own Peak Pass cards and print a record of their interactions in the gallery as they exit.

Other small-scale studies could be undertaken in *Expedition Health* to inform the development of future DMNS exhibitions or yield data that could enhance visitors' experiences in other galleries as well. For example, tracking of visitors' use of the *Expedition Health* website would demonstrate the extent to which adults and children actually take advantage of such resources. Since visitors who obtain a printout at a *sign-out station* are assigned unique code numbers, it might even be possible to track repeated visits by specific (albeit anonymous) individuals and compare usage by visitor age and gender. Similarly, a separate study could concentrate on visitors' interactions with *demonstration carts* and how docent training and approaches to visitors might increase visitors' engagement with this resource.

Finally, this study's original plan underestimated the amount of time that typical visitors would spend in the gallery. As a result, data collection ended before a large enough sample of children could be assembled to document how children use the exhibition and the extent to which their behavior differs from that of adults. Additional tracking-and-timing observations following this study's protocol could add to this sample of children and address such questions.

## Acknowledgements

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Several DMNS staff members contributed to the successful completion of this study. Chief among them is Kathleen Tinworth, director of visitor research and program evaluation, who facilitated my contacts with other DMNS staffers, generously shared her office space and computer with me, recruited and managed the data collectors, reviewed the study design – and also introduced me to arguably the best breakfast spot in Denver. A team of seven indefatigable DMNS research assistants (Anabel Adler, Adey Dimalanta, Kristie Kelley, Mary Livaudais, Maggie Miller, Lisa Roll, and Fred Staab) quickly mastered a new and challenging data collection technology, tested and improved the study protocols and instruments, and made it possible for me to collect a large amount of data in a relatively short time. The *Expedition Health* development team (Bridget Coughlin, Frances Kruger, Bryce Snellgrove, and Nancy Walsh) shared their vision for the exhibition, offered valuable feedback about the study plan and instruments, and patiently answered all of my questions.

I am also grateful to Beverly Serrell, a Chicago colleague and fellow evaluator, who reviewed (and improved upon) early report drafts, always asking the insightful questions that helped me communicate study findings more clearly.

## **Appendices**

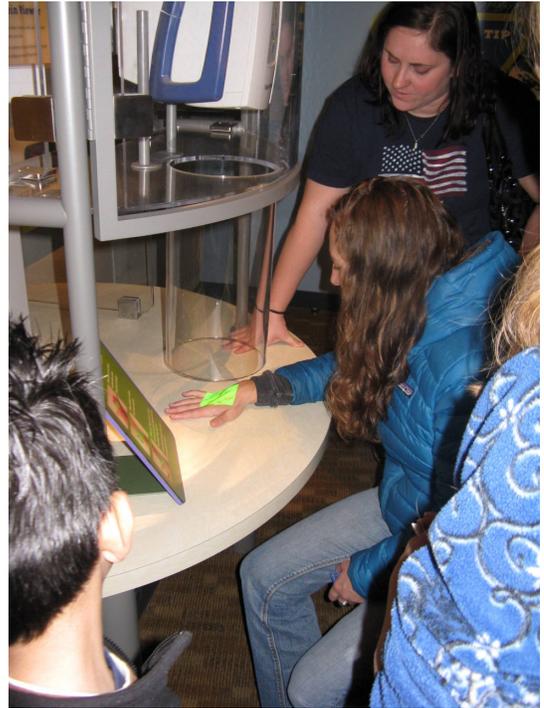
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- A. Photographs of selected *Expedition Health* components**
- B. Tracking-and-timing guidelines and codes**
- C. Copies of cued questionnaires**
- D. Percent of visitors stopping at all components and median stop times**
- E. Visitor problems described by observers during tracking and timing**
- F. Visitor references to specific components**

**Appendix A: Photographs of selected Expedition Health components**



**22. Adapting to Light**



**4. Blood Flow**



**25. Control Your Brain Waves (interactive)**



**25. Control Your Brain Waves (specimen)**



**9. Fate of a Granola Bar**



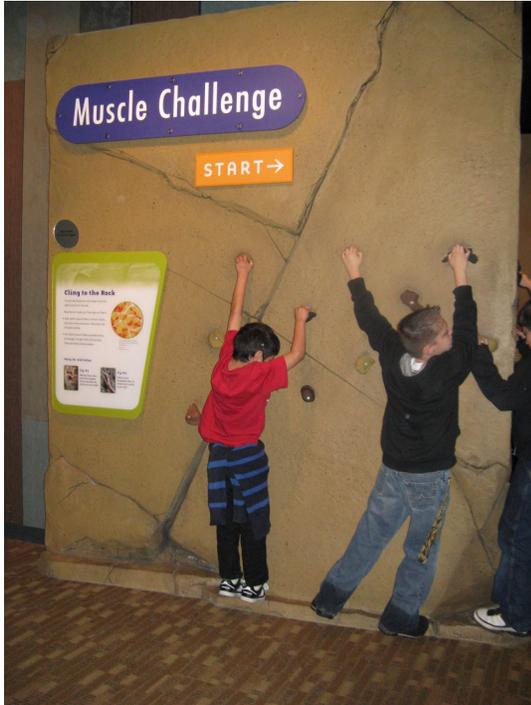
**8. Food Is Fuel**



**6. Full Body Viewer**



**10. Measure Up**



**16. Muscle Challenge**



**24. Protect Your Skin**



**28. Tell Your Story**



**2. Your Heart's Electricity**

## Appendix B: Tracking-and-timing guidelines and codes

## Appendix B: Tracking-and-timing guidelines and codes

Codes	Component Name	Includes Text Panels	USE	VIDEO	SPEC	PROB
<i>Exhibit Group</i>						
<b>Sign In</b>	Sign In		Interact with computer			<b>card</b> - Visitor inserts card more than once or reader doesn't seem to be working.
<b>MOBILE</b>	[moving between components or not paying attention to any specific component]					
<b>Adapt Light</b>	Adapting to Light	Light and Sight	Watch pupil change		X	
<b>Altitude Adj</b>	Altitude Adjustment		n/a	X	Urine Urinary tract	
<b>Bio Ride</b>	Bio Ride	Target a Healthy Heart, Exped Tip	Ride bike, interact w/ computer	X		<b>card</b> - See above.
<b>Blood Flo</b>	Blood Flow	See Your Blood Vessels, Vein Viewer	Hand in viewer			
<b>Blood Vessel</b>	Blood Vessel Network		n/a		missing	
<b>Bones Alive</b>	Bones Alive	Growing Bone	Use magnifiers			
<b>Brain Wave</b>	Brain Waves	Most Relaxed Person Wins	n/a		X	
<b>BT Theater</b>	BodyTrek Theater		n/a			
<b>Cart</b>	Demonstration cart		Engage with cart activities (e.g., handle specimens)			
<b>Cntrl Brain</b>	Control Your Brain Waves	Altering Normal Aging	Play game	X		<b>card</b> - See above.
<b>Cross Stream</b>	Cross the Stream	Balance Is a Brain Challenge	Walk log			
<b>Damage Lung</b>	Damaged Lungs and Arteries	Altering Normal Aging	n/a		X	
<b>Exped Health</b>	Expedition Health (entry text panel)					
<b>Eyeballs</b>	Eyeballs and Optic Nerve	Light and Sight	n/a		X	
<b>Fate Granola</b>	Fate of a Granola Bar		n/a		Digestive sys or Jars	
<b>Food Fuel</b>	Food Is Fuel		Interact with computer			<b>card</b> - See above.
<b>Full Body</b>	Full Body Viewer		Move body, watch image			<b>gndr</b> - changing gender <b>sys</b> - changing system <b>move</b> - making skeleton match their movement
<b>Heart Anat</b>	Heart Anatomy	See Your EKG	n/a	??	X	
<b>Heart Elec</b>	Your Heart's Electricity	Authentic Specimens	Grasp bar, watch			<b>card</b> - See above. <b>no rate</b> - visitor grasps bar, but

## Appendix B: Tracking-and-timing guidelines and codes

Codes	Component Name	Includes Text Panels	USE	VIDEO	SPEC	PROB
			pulse			heart rate line doesn't change
<b>Hydrate</b>	Hydrate / How Much Do You Lose?	Why You Need Water, Exped Tip	Use flips		X	
<b>Lifelong Exped Meas Up 1</b>	Health Is a Lifelong Expedition Measure Up – Step 1		n/a Measure height, span			<b>card</b> - See above. <b>height</b> - Visitor remarks that height is wrong.
<b>Meas Up 2</b>	Measure Up – Step 2		Use computer			<b>card</b> - See above.
<b>Microbe FP</b>	Microbe Footprints	Got Stinky Feet?	n/a		Footprint	
<b>Muscle Chal</b>	Muscle Challenge		Walk the ledge			
<b>Protect Skin</b>	Protect Your Skin	Exped Tip	Put on sunscreen, watch image			
<b>Resp Cold</b>	Responding to the Cold		n/a			
<b>See Age</b>	See Yourself Age		Use computer			<b>card</b> – See above.
<b>Sign Out</b>	Sign Out		Use computer, take printout			
<b>Size Up 1</b>	Size Up Your Stride – Step 1		Walk across			<b>card</b> – See above.
<b>Size Up 2</b>	Size Up Your Stride – Step 2		Use computer			<b>card</b> – See above.
<b>Skin UV</b>	How Your Skin Responds to UV		Use magnifiers			
<b>Summit Cart</b>	Summit Theater – cart activity		Participate in activities (e.g., handle specimens)	X		
<b>Summit Theater</b>	Summit Theater – presentation		n/a			
<b>Tell Story</b>	Tell Your Story		Use computer			
<b>Today UV</b>	Today's UV and You		Use computer			
<b>Traumas</b>	Traumas on the Trail		Use computer			
<b>Tykes Peak</b>	Tykes Peak		n/a			
<b>Video TP</b>	Video to left of Tykes Peak		n/a			
<b>Wind Chill</b>	Wind Chill		Hand in box			<b>card</b> – See above.
<b>Activity Group</b>						
<b>INTERP</b>	Talks with interpreter					
<b>LOOK only</b>	Looks at component, no other activity					
<b>PIX</b>	Takes picture (anyone in group)					
<b>PROB</b>	Visitor/group has problem (describe under remarks)					

## Appendix B: Tracking-and-timing guidelines and codes

Codes	Component Name	Includes Text Panels	USE	VIDEO	SPEC	PROB
<b>READ</b>	Looks at text panel for at least 2 sec					
<b>ROL</b>	Reads out loud to someone else					
<b>SPEC</b>	Looks at specimen					
<b>TALK</b>	Talks with companions about exhibit or related topic					
<b>USE-Ch</b>	Observed visitor helps child use interactive appropriately					
<b>USE-S</b>	Observed visitor uses interactive appropriately					
<b>VIDEO</b>	Looks at video					
<b>WAIT</b>	Waits, attends to component					
<b>WATCH</b>	Watches someone else use interactive					
<b><i>Independent Variables</i></b>						
<b>Gender</b>	Male, Female, Not sure					
<b>Age</b>	By age group (e.g., 20 – 29 yrs)					
<b>Race</b>	White, Black, Asian, NatAm, Other, Not sure					
<b>Ethnicity</b>	Latino, Not Latino, Not sure					
<b>N Adults</b>	Number of individuals over 18 in your target’s group. <b>Include target visitor in this number.</b>					
<b>Age 5 or younger, etc.</b>	Number of children with target visitor (by age group). Estimate age as best you can.					
<b>EH before?</b>	Has target visitor seen EH before?					
<b>Crowd Size</b>	<b>Low</b> (many components are open, few visitors are waiting in line to use anything) <b>Medium</b> (approximately half of components are in use, but there are no significant lines – i.e., most visitors can use at least					

**Appendix B: Tracking-and-timing guidelines and codes**

Codes	Component Name	Includes Text Panels	USE	VIDEO	SPEC	PROB
	some interactives without having to wait in line, but might have to wait for popular ones)					
	<b>High</b> (nearly all components are in use and there are lines at many components – i.e., most visitors will have to wait in line before they can use an interactive)					

## Appendix C: Copies of cued questionnaires

**Adults**

**Children**

**Adult Questionnaire**

Date: \_\_\_\_\_

Time Started: \_\_\_\_\_

Time Finished: \_\_\_\_\_

Date Collector: \_\_\_\_\_

Log #: \_\_\_\_\_

Gender: M F

# Group: Adult only - # \_\_\_\_\_

OR \_\_\_\_\_ A + \_\_\_\_\_ K

a. Is this your first visit to DMNS?  Yes  
 No → Is this your first visit to EH?  Yes  No

b. Do you have any special interest, knowledge or training in medicine, biology or physiology?  
 No  Yes – please describe: \_\_\_\_\_



1. What would you say is the main purpose of the displays in **Expedition Health**?

To show: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

To make people: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. What new ideas are you taking away with you from your experiences in **Expedition Health**?

I didn't know or never realized that: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

It reminded me that: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Please turn over →**

3. Did you see the 12-minute film shown in the BodyTrek Theater?  Yes  
 No (*skip to # 6*)  
 Not sure (*skip to #6*)

**IF YES**, please circle the number that indicates your agreement with these statements:

	<b>Strongly Disagree</b>		<b>Strongly Agree</b>
4. I (We) really enjoyed this program.	1	2	3
Why do you say that?	4	5	6

5. The presentation's level was very appropriate for the children in my group.	1	2	3	4	5	6	Not applicable
Why do you say that?							

6. Did you see any presentation at the Summit Stage (across from the BodyTrek Theater)? (e.g., Pirates of the Human Being, SuperFood Heroes, Heart Dissection, Lung Dissection)
- Yes       No (*skip to # 9*)  
 Not sure (*skip to # 9*)

**IF YES**, please circle the number that indicates your agreement with these statements:

	<b>Strongly Disagree</b>		<b>Strongly Agree</b>
7. I (We) really enjoyed this program.	1	2	3
Why do you say that?	4	5	6

8. The presentation's level was very appropriate for the children in my group.	1	2	3	4	5	6	Not applicable
Why do you say that?							

**Please turn over →**



**Child Questionnaire**

Date: \_\_\_\_\_ Time Recruited: \_\_\_\_\_ Time Exiting exhibit: \_\_\_\_\_

Date Collector: \_\_\_\_\_ Log #: \_\_\_\_\_

Gender: M F Age: \_\_\_\_\_ # Group: \_\_\_\_\_ A + \_\_\_\_\_ K

- a. Is this your first visit to DMNS?  Yes  
 No → Is this your first visit to EH?  Yes  No



1. If you were going to tell a friend what **Expedition Health** is all about, what would you say?

*The museum made these exhibits to show people:* \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

*The museum made these exhibits to make people:* \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

2. What new ideas are you taking away with you from **Expedition Health**?

*I didn't know that:* \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

*It reminded me that:* \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**Please turn over →**

*Your answers to these questions will help us compare your child's responses to those of other children whom we are talking to. All information will be kept anonymous and confidential.*

3. How old are you? \_\_\_\_\_

4. I am a (*check one*):       Girl       Boy

5. Please describe your racial and ethnic background: \_\_\_\_\_

5. What language do you speak at home most often? \_\_\_\_\_

6. What is your Zip code? \_\_\_\_\_

8. What is your family's total household income?

- less than \$15,000
- \$15,000 – \$24,999
- \$25,000 – \$34, 999
- \$35,000 – \$49,999
- \$50,000 – \$74,999
- \$75,000 – \$99,999
- \$100,000 – \$149,999
- \$150,000 – \$199,999
- \$200,000 or more
- I'd rather not say

**Thank you!**

## Appendix D: Percent of visitors stopping at all components and median stop times

Component #	Component	Percent of all visitors stopping	Median stop time (minutes)
22	Adapting to Light	36%	1.9
7	Altitude Adjustment	38%	0.5
20	Biology Base Camp	43%	2.0
3	Bio Ride	66%	3.3
4	Blood Flow	54%	1.1
15	BodyTrek Theater	31%	14.1
18	Bones Alive	35%	0.3
13	Brain Challenge	89%	0.6
25	Control Your Brain Waves	55%	3.9
30	Demonstration cart	18%	2.1
9	Fate of a Granola Bar	28%	0.3
8	Food Is Fuel	18%	3.2
6	Full Body Viewer	59%	0.9
27	Health Is a Lifelong Expedition	0%	-
19	Hydrate	35%	0.5
10	Measure Up	57%	3.0
18	Microbe Footprints	30%	0.4
16	Muscle Challenge	41%	0.4
24	Protect Your Skin	57%	1.3
26	See Yourself Age	51%	2.2
1	Sign In	96%	1.3
29	Sign Out	80%	0.9
17	Size Up Your Stride	72%	2.8
14	Summit Theater	45%	2.5
28	Tell Your Story	26%	1.8
23	Today's UV and You	22%	0.8
21	Traumas on the Trail	23%	0.5
12	Tykes Peak	46%	4.3
5	Wind Chill	57%	1.5
2	Your Heart's Electricity	70%	1.7

**Appendix E: Visitor problems described by observers during tracking and timing.**

<b>Component</b>	<b>Description of problem</b>
<i>Biology Base Camp</i>	<ul style="list-style-type: none"> <li>• Told by docent that lab was full.</li> </ul>
<i>Bio Ride</i>	<ul style="list-style-type: none"> <li>• Card reader (three instances)</li> <li>• Adult too big for bike.</li> <li>• Child too small for bike.</li> <li>• Told by friend she was going too fast.</li> </ul>
<i>Food Is Fuel</i>	<ul style="list-style-type: none"> <li>• Card reader</li> </ul>
<i>Full Body Viewer</i>	<ul style="list-style-type: none"> <li>• Problem switching between genders.</li> <li>• Looking for directions.</li> </ul>
<i>Measure Up</i>	<ul style="list-style-type: none"> <li>• Card reader</li> <li>• Measured height twice, problem with first reading.</li> <li>• Incorrect height measurement.</li> <li>• Started at second station (three instances).</li> </ul>
<i>Protect Your Skin</i>	<ul style="list-style-type: none"> <li>• Trouble using sunscreen dispenser.</li> </ul>
<i>Sign In</i>	<ul style="list-style-type: none"> <li>• Not sure what to do at computer so didn't get Peak Pass.</li> </ul>
<i>Size Up Your Stride</i>	<ul style="list-style-type: none"> <li>• Card reader – didn't know to pull card out.</li> <li>• Didn't get it at first.</li> </ul>
<i>Tell Your Story</i>	<ul style="list-style-type: none"> <li>• Card reader</li> <li>• Moved to second camera (first not working?).</li> </ul>
<i>Your Heart's Electricity</i>	<ul style="list-style-type: none"> <li>• EKG not showing up on screen.</li> </ul>
<i>Brain Challenge</i>	<ul style="list-style-type: none"> <li>• Child afraid to go across at first.</li> </ul>
<i>Wind Chill</i>	<ul style="list-style-type: none"> <li>• Didn't have card, borrowed from companion.</li> </ul>
<i>Other</i>	<ul style="list-style-type: none"> <li>• Went back to <i>sign-in</i> to get new cards.</li> </ul>

## Appendix F: Visitor references to specific components

<b>Adapting to Light</b>
[Didn't know] <i>What optic nerves look like.</i> [ID# 61 adult male]
[Didn't know] <i>My eyes would change when the light would change.</i> [ID# 21, 8-year-old boy]
[Didn't know] <i>Your pupils change size.</i> [ID# 34, 9-year-old girl]
[Reminded me] <i>Your pupils get wider (dialate) [sic] or smaller, depending on the amount of light...</i> [ID# 47, 13-year-old girl]

<b>Altitude Adjustment - BodyTrek Theater</b>
[Didn't know] <i>Bodies work so differently at different altitudes.</i> [ID# 5 adult female]
[Didn't know] <i>Effect of altitude on urine output...</i> [ID# 8 adult female]
[Didn't know] <i>Your body makes more urine in higher elevations. ...</i> [Reminded me] <i>I need to drink more water.</i> [ID# 36 adult female]
[Didn't know] <i>I urinated so much when hiking at elevation.</i> [ID# 60 adult female]
[Didn't know] <i>How altitude affects body.</i> [Reminded me] <i>Keep hydrated.</i> [ID# 74 adult female]
[Reminded me] <i>Altitude has a major effect on the body.</i> [ID# 80 adult female]
[Didn't know] <i>We urinate more at high altitude.</i> [Reminded me] <i>I need to drink more water.</i> [ID# 83, gender unknown]
[Didn't know] <i>We lose so much fluids because of the altitude.</i> [Reminded me] <i>I need to hydrate more.</i> [ID# 89 adult female]
[Didn't know] <i>You produce more urine at higher elevation.</i> [ID# 42, 12-year-old boy]

<b>Altitude Adjustment / Hydrate</b>
[Reminded me] <i>I need to drink more water.</i> [ID# 39 adult female]
[Didn't know] <i>How much water I lost per day in Denver.</i> [Reminded me] <i>I need to drink more water.</i> [ID# 41, gender unknown]
[Reminded me] <i>We need a lot of water ...</i> [ID# 64 adult female]
[Reminded me] <i>Altitude has a major effect on the body.</i> [ID# 80 adult female]

<b>Biology Base Camp</b>
[Didn't know] <i>So much sugar in breakfast cereals!</i> [ID# 67 adult male]
[Didn't know] <i>Daphnias had such a hard life.</i> [ID# 69 adult male]
[Didn't know] <i>The bleach cleaned better then other cleaneres [sic].</i> [ID# 7, 10-year-old boy]
[Didn't know] <i>Caffiene [sic] made Daphnia's heart rate increase just like ours.</i> [ID# 19, 10-year-old girl]

<b>Bio Ride</b>
[Didn't know] <i>... target heart rate easily reached.</i> [Reminded me] <i>I need to exercise more!</i> [ID# 8 adult female]
[Reminded me] <i>I need to exercise more.</i> [ID# 19 adult male]
[Reminded me] <i>Get more exercise!</i> [ID# 21 adult female]
[Reminded me] <i>I should work out more often ...</i> [ID# 31 adult male]
[Didn't know] <i>Target heart rate.</i> [ID# 34 adult male]
[Didn't know] <i>The changes in heart rate w/ very little exercise.</i> [ID# 54 adult male]
[Didn't know] <i>Pedaling a bike is hard when out of shape.</i> [ID# 73, adult, gender unknown]
[To show people] <i>I would say I could not finish the bike and they should come! ☺</i> [Didn't know] <i>I could not bike that well.</i> [Reminded me] <i>I need to bike more.</i> [ID# 11, 12-year-old girl]
[Didn't know] <i>There is such thing as too much exercise. That there is a level of exercise that is perfect.</i> [Reminded me] <i>Exercise can be harder at high altitudes.</i> [ID# 12, 14-year-old girl]
[Reminded me] <i>I have a faster heart beat when I exerisise [sic].</i> [ID# 17, 9-year-old boy]

### **Bio Ride**

[Reminded me] *How fast I go, how my heart beat so fast.* [ID# 22, 9-year-old boy]

[Didn't know] *Your body should work a lot harder than we work them.* [ID# 27, 14-year-old boy]

[Didn't know] *My heart rate increased with exercise.* [ID# 31, 6-year-old girl]

[Didn't know] *Faster you work faster is your heart rate.* [ID# 32, 8-year-old girl]

[Didn't know] *If you reach your target heart rate your heart will work harder.* [ID# 35, 16-year-old girl]

[Reminded me] *It is hard to ride a bike uphill.* [ID# 36, 11-year-old boy]

[Reminded me] *... To ride bikes a lot to make my heart pump.* [ID# 40, 8-year-old]

[Didn't know] *When you exercise your heart rait [sic] gets higher.* [ID# 41, 9-year-old girl]

[Didn't know] *I can't reach my target heart rate on the bike.* [Reminded me] *I am out of shape.* [ID# 44, 16-year-old girl]

[Reminded me] *I should work out more.* [ID# 51, 12-year-old boy]

[Didn't know] *The heart was a muscle which is really neat.* [Reminded me] *All hearts can contract.* [ID# 52, 11-year-old girl]

### **Blood Flow**

[Didn't know] *The vein viewer was really cool – I never realized instant imaging technology like that existed.* [ID# 81 adult female]

[Didn't know] *My veins in my arm were limit [sic] to such a small number.* [ID# 45, 12-year-old boy]

### **BodyTrek Theater**

[Didn't know] *When I got scared my pulse jumped so much.* [ID# 1 adult female]

[Didn't know] *I might be able to climb Mt. Evans! ...* [ID# 21 adult female]

[Didn't know] *That body works with electricity.* [ID# 22 adult female]

[Didn't know] *Blood oxygen levels are very similar between people but pulse rates can really vary.*

[Reminded me] *The heart & lungs work together to keep your body at homeostasis.* [ID# 56 adult female]

[Didn't know] *It's cold up in the mountains.* [ID# 1, 13-year-old boy]

[Didn't know] *Muscle \_\_ [illegible]. No muscle in fingertip.* [ID# 23, 8-year-old boy]

[Didn't know] *Hiking could be so hard.* [ID# 51, 12-year-old boy]

[Didn't know] *... I don't have muscles in my fingers.* [ID# 55, 11-year-old boy]

### **Bones Alive**

[Didn't know] *... Ice cream can make strong bones.* [ID# 36 adult female]

[Didn't know] *Bone function & aging.* [ID# 78 adult male]

### **Brain Challenge**

[Didn't know] *Your primary sense that the body "prioritizes" or believes the most is sight.* [ID# 47, 13-year-old girl]

### **Control Your Brain Waves**

[Didn't know] *The brain waves could be harnessed to move a ball.* [ID# 18 adult male]

[Didn't know] *My brain waves are more tense than everyone else's ☹.* [ID# 25 adult female]

[Reminded me] *... to relax more.* [ID# 31 adult male]

[Didn't know] *I could be so relaxed.* [ID# 48 adult, gender unknown]

[Didn't know] *The jedi powers are deep in my brainwaves.* [ID# 66 adult female]

[Didn't know] *I can move a ball with my brain calming down. I beat my partner 4 times.* [ID# 68 adult male]

[Didn't know] *Brain waves make electrical waves with alpha and theta waves. ...* [ID# 14, 14-year-old boy]

[Didn't know] *Brain waves can move things.* [ID# 15, 11-year-old girl]

### Control Your Brain Waves

[Didn't know] *Your brain when given more things to think about chooses something to focus on which may result in.* [ID# 24, 14-year-old girl]

[Didn't know] ... *you could move a ball with our mind ...* [ID# 55, 11-year-old boy]

### Demonstration Cart

[Didn't know] *The size of your brains is same than two hand tie together.* [ID# 40 adult, gender unknown]

### Fate of a Granola Bar

[Didn't know] *Your intestines analyze the amount of liquid you need.* [ID# 39 adult female]

[Reminded me] *I don't want any more granola.* [ID# 53 adult male]

[Didn't know] *The digestive process was so interesting.* [ID# 77 adult female]

[Reminded me] *Those times on the toilet.* [ID# 82 adult male]

[Didn't know] *Process of the food from eating to waste was so complex.* [ID# 84 adult female]

### Food Is Fuel - Summit Stage

[Reminded me] *I don't eat right.* [ID# 14 adult male]

[Reminded me] *I need to eat better.* [ID# 26 adult male]

[Reminded me] *I need to eat well.* [ID# 38 adult female]

[Reminded me] *I do not eat right.* [ID# 73 adult, gender unknown]

[Reminded me] *You should eat healthy ...* [ID# 34, 9-year-old girl]

[Reminded me] ... *how to eat a balanced meal.* [ID# 45, 12-year-old boy]

[Reminded me] *I need to eat enough of all the right foods a day.* [ID# 53, 17-year-old girl]

### Hydrate

[Didn't know] *So little water is lost with respiration here – so many people are so active it would seem greater.* [ID# 16 adult female]

[Didn't know] *Kidney stones were that large.* [Reminded me] *I need to drink more water.* [ID# 42 adult, gender unknown]

[Didn't know] *The amount of H2O expired in different activities ...* [Reminded me] *Needed to drink more H2O.* [ID# 52 adult female]

### Measure Up

[Didn't know] ... *My arm span is almost equal to my height.* [ID# 43 adult, gender unknown]

[Didn't know] *My arm span & height were the same.* [ID# 44 adult female]

[Didn't know] *Arm span & height were close to the same.* [ID# 46 adult female]

[Didn't know] *That I am that tall.* [ID# 53 adult male]

[Didn't know] *I was the height I am.* [ID# 87 adult female]

[Didn't know] *Your arm span is similar to your height.* [ID# 5, 15-year-old girl]

[Didn't know] *How tall I was.* [ID# 22, 9-year-old boy]

[Didn't know] *My arm length was equal to my height [sic].* [Reminded me] *I am the tallest one in my family.* [ID# 49, 17-year-old boy]

### Protect Your Skin – Today's UV and You

[Reminded me] *To use sunscreen more often.* [ID# 1 adult female]

[Didn't know] *The extent UV damage can have on your skin.* [Reminded me] *UV protection is important.* [ID# 3 adult male]

[Reminded me] *I need to wear sunscreen.* [ID# 7 adult male]

[Didn't know] *Sun screen worked so well.* [ID# 19 adult male]

## Protect Your Skin – Today's UV and You

[Didn't know] ... <i>We need to use MORE sunscreen.</i> [Reminded me] <i>To use MORE sunscreen.</i> ... [ID# 21 adult female]
[Didn't know] <i>That I might have some ... UV Radiation problems.</i> [ID# 23 adult male]
[Didn't know] <i>The sun was so bad for your skin.</i> [ID# 26 adult male]
[Didn't know] <i>Sunblock was so effective.</i> [Reminded me] <i>UV is very strong at altitude.</i> [ID# 29 adult male]
[Didn't know] <i>The effect of UV and aging.</i> [ID# 35 adult female]
[Reminded me] <i>Sunscreen is important.</i> [ID# 45 adult male]
[Didn't know] <i>Sun exposure was so prominent, even to someone who protects "well."</i> [ID# 59 adult female]
[Reminded me] <i>I should ... put sunscreen on.</i> ... [ID# 65 adult female]
[Didn't know] <i>Under a black light screen if you put sun block on your hand it turns black.</i> [Reminded me] <i>Suns harmful ray could really damage our cells.</i> [ID# 71 adult male]
[Reminded me] <i>Sunscreen matters!</i> [ID# 81 adult female]
[Reminded me] <i>I need to wear more sunscreen...</i> [ID# 84 adult female]
[Didn't know] <i>Sunscreen made such a difference.</i> [Reminded me] <i>[Sunscreen] is very important.</i> [ID# 88 adult female]
[Reminded me] <i>I need to put on sunscreen!</i> [ID# 10, 12-year-old girl]
[Didn't know] <i>30 SPF sunscreen really does help sunburn by looking through a camra [sic].</i> [ID# 17, 9-year-old boy]
[Reminded me] <i>I should wear sunscreen.</i> [ID# 31, 6-year-old girl]
[Reminded me] <i>You should ... always wear sunscreen.</i> [ID# 34, 9-year-old girl]
[Reminded me] <i>Lotion is a soothing substance for skin.</i> [Didn't know] <i>When you have different chemicals on your skin it shows the dryness &amp; wetness.</i> [ID# 37, 12-year-old girl]
[Reminded me] <i>About ... UV protection ...</i> [ID# 43, 16-year-old girl]
[Didn't know] <i>Sunscreen looked black in ultra-violet rays.</i> [ID# 46, 16-year-old girl]
[Reminded me] <i>... you sunburn easily at a high elevation.</i> [ID# 47, 13-year-old girl]
[Reminded me] <i>Sun screen does protect your skin.</i> [ID# 48, 17-year-old girl]
[Didn't know] <i>That sunscreen is so important when you go out in the sun.</i> [ID# 54, 12-year-old girl]

## See Yourself Age

[Didn't know] <i>You can see how old you can be in the future.</i> [ID# 47 adult female]
[Reminded me] <i>I need to quit smoking.</i> [ID# 50 adult, gender unknown]
[To show people] ... <i>it shows you what you look like when your [sic] older.</i> [Didn't know] <i>To much sunlight can give you a lot of wrinkles.</i> [ID# 2, 9-year-old girl]
[Didn't know] ... <i>how I would age.</i> [ID# 4, 11-year-old boy]
[Didn't know] <i>That if you don't wear sunscreen you get lots of wrinckles [sic]. (lots more)</i> [ID# 9, 10-year-old girl]
[Didn't know] <i>UV Rays can dramatically change your face as you age.</i> [ID# 13, 12-year-old boy]
[Reminded me] <i>UV rays and obeicity [sic] can seriously effect [sic] how you look as you age.</i> ... [ID# 14, 14-year-old boy]
[Didn't know] <i>I would look funny when I was older.</i> [Reminded me] <i>I am aging.</i> [ID# 29, 11-year-old boy]
[Didn't know] <i>If you don't use sunscreen when you are young, you will get more moles &amp; warts. I didn't know what I would look like at 70.</i> [ID# 30, 10-year-old girl]

## Size Up Your Stride

[Didn't know] <i>Stride length.</i> [ID# 7 adult male]
[Didn't know] <i>How much your stride can tell about you &amp; how important the simple/little things are.</i> [ID# 30 adult male]
[Didn't know] <i>I walk efficiently.</i> [ID# 38 adult female]
[Didn't know] <i>I look terrible (posture) when walking!</i> ... [Reminded me] <i>I should be more aware of my posture!</i>

## Size Up Your Stride

[ID# 43 adult, gender unknown]

[Didn't know] *I walk so stiffly.* [ID# 51 adult female]

[Didn't know] ... *also learned stride/energy level.* [ID# 52 adult female]

[Didn't know] *Walking could create so much energy.* [ID# 55 adult male]

[Didn't know] *I walked so slowly!* [ID# 64 adult female]

[Didn't know] *I have very poor posture when I walk.* [ID# 85 adult male]

[Didn't know] *When I'm walking in my medical boot it lowered my energy when walking.* [ID# 8, 14-year-old girl]

[Didn't know] ... *I didn't know that your pace and step length effected [sic] how efficient you walk.* [ID# 14-year-old- boy]

[Didn't know] *People have different strides when they walk.* [Reminded me] *Some people walk faster then [sic] others.* [ID# 26, 12-year-old girl]

[Didn't know] *If you walk low to the ground you use more energy.* [ID# 33, 13-year-old boy]

[Didn't know] *I walked that my stride was 2.7 feet.* [ID# 36, 11-year-old boy]

[Didn't know] *How fast I walk.* [ID# 39, 9-year-old girl]

[Didn't know] *How fast I walk.* [ID# 48, 17-year-old girl]

[Didn't know] *I can run 7.6 mph.* [ID# 50, 11-year-old girl]

## Summit Stage

[Didn't know] *Learned about different bacteria. The Pirate is excellent!!* [ID# 2 adult female]

[Didn't know] *You can grow new alveoli in response to exercise.* [Reminded me] *Exercise improves lung function.* [ID# 15 adult female]

[Didn't know] *Lung dissection could be so fun! ☺* [ID# 33 adult female]

[Didn't know] *New technologies – especially heart valves & stents [?? hard to read] etc.* [ID# 70 adult female]

[Didn't know] *How bacteria is flushed out of the body.* [ID# 82 adult male]

[Didn't know] *The heart felt squishy.* [ID# 16, 12-year-old boy]

[Reminded me] *Bacteria [sic] can grow even if you wash with cleaners.* [ID# 25, 10-year-old girl]

[Didn't know] *How you got belly aches[sic]. I didn't know how bacteria grows.* [Reminded me] *To wash my hands!* [ID# 40, 8-year-old]

[Didn't know] *409 & hand sanitizer doesn't call [sic] all bactirea [sic]...* [ID# 55, 11-year-old boy]

## Wind Chill

[Didn't know] *Goosebumps conserved heat and that is why our body reacts to cold with goose bumps.* [ID# 28 adult female]

[Reminded me] *You can be cold when it's windy.* [ID# 1, 13-year-old boy]

## Your Heart's Electricity

[Didn't know] *That I might have some heart ... problems.* [ID# 23 adult male]

[Didn't know] *My heart rate is really slow. But I'm glad I got info on it and can research it in the future.* [ID# 49 adult female]

[Reminded me] *Heart rate/EKG changes when you hold your breath.* [ID# 51 adult female]

[To show people] *It tells you what your heart rate is ...* [ID# 2, 9-year-old girl]

[Didn't know] *My heart rate resting was 58 bpm and that a lot of people suffer from heart problems.* [ID# 3, 16-year-old boy]

[Didn't know] *My resting heart rate was at 65 bpm ...* [ID# 4, 11-year-old boy]

[Didn't know] *My heart rate was 77 beats per min.* [ID# 10, 12-year-old girl]

[To show people] *Your heart will beat. It's fun.* [adult wrote for child] [ID# 23, 8-year-old boy]

[To show people] ... *when your heart rate is higher it can affect how you are.* [ID# 51, 12-year-old boy]

**Multiple mentions**

[To show people] ... *It had things that measure your pulse oxygen level in your blood, height, arm span, and how you age.* [ID# 14, 14-year-old, gender unknown]

[To show people] *How your heart beats, how tall you are, how fast you age.* [ID# 22, 9-year-old boy]

[To show people] ... *It measures size, speed etc.* [ID# 37, 12-year-old girl]

[To show people] *About ... body temp. and heart beat.* [ID# 39, 9-year-old girl]

[To show people] *This exhibit shows your height, heart rate, experiments to see cheek cells, and how to have a healthy meal.* [ID# 43, 16-year-old girl]

**Not Sure**

[Didn't know] *The brain had such a huge impact on our physical state of health.* [ID# 4 adult male]

[Didn't know] *How the body's energy works.* [ID# 76 adult male]