

Measuring and Increasing the “Dose” of Community Health Interventions

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What is Dose?

Community health prevention initiatives, such as those focused on obesity, often seek to improve policies, programs, and the neighborhood environment. **Dose is an estimate of the impact of those community interventions on an average resident’s behavior.** The dose measure is a combination of: (1) the number of people reached by the intervention, and (2) the strength of the intervention to change the behavior of those reached. Dose focuses on an “average resident” to capture the impact across the *entire* community, i.e., those people exposed to an intervention as well as those who are *not* exposed. It is an *estimate* of the impact because we often have incomplete and/or subjective information about the reach and strength of interventions.

Why is Dose important?

Dose gives us a way of comparing very diverse intervention strategies using a common yardstick – for example, comparing high reach, but low intensity, environmental changes (e.g., building more sidewalks to increase walkability) to low reach, but high intensity programs (e.g., a walking group that meets every day). It lets us add up the impact of different interventions targeting the same outcomes and populations. And it gives us a way of talking about how to increase the impact of our strategies – increasing the number of people reached and/or finding ways to make them stronger.

How is Dose calculated?

Dose is calculated by multiplying together two elements:

Reach = The percentage of people from your target population who are touched by (exposed to) an intervention strategy (*number of people exposed divided by number in the entire target population*).

Strength = The degree to which people exposed to an intervention strategy change their behavior to make healthier choices as a result of being exposed (*the “effect size” or average percent change in behavior for each person exposed*).

The dose calculation is important because it takes into consideration those who don’t change at all, and therefore provides a picture of impact across the entire community. It approximates the percent change for an “average resident”, including, those exposed and those not exposed.

For example, suppose that half (500) the people in a community of 1000 people live near a new walking trail, and the people living nearby increase the number of minutes they walk by an average of 5% each day.

Reach = % of the community exposed to the walking trail = **50%**
(500 divided by 1000)

Strength = average % change in behavior for exposed people = **5%**
(the increase in average minutes walked each day by those reached)

Dose = reach times strength = 50% (reach) times 5% (strength) = **2.5%**.
(The actual calculation is: $.50 \times .05 = .025$)

Another way to think about it: Half of the people in the community live too far away to be exposed to the trail and don’t change their behavior, and the other half changed 5% (added an average of 5% more minutes of walking per day) so the average change across everyone in the targeted community is 2.5%.

What does “exposed” mean in the reach definition?

People are exposed to programs if they participate in them (e.g., go to an exercise class). It’s harder to define exposure to environmental and policy changes, but it generally means that people encounter the improved environment on a regular basis and are assumed to be influenced by it. Some examples of environmental exposure include:

- Number of residents living near a newly renovated park or playground
- Number of people with access to vending machines that now include only healthier items
- Number of shoppers at a grocery store that now offers a greater variety of fresh produce

How do we know how “strong” interventions are?

Ideally, we would get estimates of strength (often called “effect sizes”) from either an actual evaluation of the health intervention or from published research studies of the same health intervention with a comparable population that systematically captured the degree of behavior change.

Evaluation example: We evaluate a cooking class and find that before the class people were eating an average of 4 servings per day of fruits and vegetables, and at the completion of the class they’re eating 6 servings a day. So the effect size of the class on fruit and vegetable consumption is 0.5 or 50%, calculated as 2 servings (the increase in average servings per day, or 6 minus 4) divided by 4 servings (the baseline number of servings per day before taking the class).

Research example: A researcher conducts a study of a new school physical education (PE) curriculum and finds that students in the PE class increased their minutes of physical activity by an average of 20%. So if a community implements that PE program we might expect their participants to also see a 20% increase in minutes, assuming that the program is implemented in a comparable way in a similar population.

But often we don’t have estimates of effect sizes through actual evaluations or published studies, so we must make judgments about strength based on:

- **Frequency of exposure** – whether the environment or program is regularly encountered or is more infrequent; e.g., a daily PE class vs. a monthly walk-to-school promotion.
- **Intensity of exposure** – the magnitude of environmental changes. For example, a store that makes many major changes in the healthy food available vs. another store that makes only minor changes.
- **Degree to which the healthy choice is the *only* choice** – For example, removing all unhealthy snacks from a closed-campus school vs. adding a few healthy snacks but leaving the unhealthy ones in place.
- **Supporting promotional and educational strategies** – For example, a farmers market that also includes a booth to teach how to cook some of the foods that are being sold.

What is the process for estimating strength?

We use a two-step approach to estimate strength when we don’t know actual effect sizes:

Step 1. Assign the strategy to one of three potential strength categories based on what we know about how the intervention works—the likelihood that the intervention will change behavior. The categories are low, medium and high (see **Table 1**).

Low strength interventions include media campaigns or other interventions that have a light touch. These programs might provide important support for other intervention efforts, but are unlikely to create behavior change on their own.

High strength interventions include programs where everyone reached is a participant and there is enough frequency/intensity to expect larger effect sizes.

Medium strength interventions fall somewhere in between and include many environmental interventions – grocery store changes, Safe Routes to Schools, and school cafeteria changes. They are more intensive than media campaigns, but fewer people are likely to change their behavior as a result of their exposure to the intervention.

Step 2. Use information about the implementation of an intervention to make a more informed actual strength estimate. This involves reviewing the characteristics of the way the intervention is implemented as chronicled in progress reporting and observation/measurement. See **Table 2** for intervention features that make for stronger strategies, by type of strategy. For example, a media campaign using ongoing coordinated messages across a number of media (print, radio, social media) has a greater impact than a single radio spot.

Table 1. Potential Strength Categories

	<i>Low strength</i>	<i>Medium Strength</i>	<i>High Strength</i>
Types of interventions	Low intensity interventions or the literature indicates they are ineffective when implemented on their own	Environmental changes with lower intensity/frequency of exposure (though may have broad reach)	Programmatic interventions with greater intensity/frequency of exposure
Examples	<ul style="list-style-type: none"> • Passive media/social marketing strategies • Less intensive educational programs 	<ul style="list-style-type: none"> • Built environment changes – sidewalks, trails, parks • Safe Routes to School (SRTS) • Changes in institutional food and beverage offerings where foods are served and sold– e.g., government agencies • Worksite and other institutional changes (e.g., faith-based, apartments) • Changes to retail food environments (e.g. grocery stores, limiting fast food outlets) 	<ul style="list-style-type: none"> • School Physical Education (PE) curriculum changes (e.g. time spent in MVPA) • Breastfeeding programs, BMI counseling, screening for over consumption sugary beverage consumption, physical inactivity • Community-based physical activity programs • Physical activity minute requirements in schools, licensed child care centers, after school programs • Changes in institutional food and beverage offerings where food and beverages are provided (e.g. schools, prisons, hospitals)
Rationale	<ul style="list-style-type: none"> • Information only through media unlikely to change behavior on its own 	<ul style="list-style-type: none"> • More passive exposure - many of those exposed will not alter their behavior 	<ul style="list-style-type: none"> • More active exposure –All participants are engaged to some degree

How can we increase dose?

We have described how dose is measured, but even more important is increasing dose – finding ways of increasing the reach and strength of the interventions. Reach can be increased by spreading changes to more people or organizations – for example increasing the number of schools or stores making healthy changes. Table 2 suggests ways of increasing the strength of different kinds of interventions; for example, one could implement more coordinated messaging across multiple media outlets to increase the strength of media campaigns or remove all unhealthy items from school vending machines. The higher strength characteristics outlined below come from the literature of evidence-based practices.

Table 2. Factors Influencing Actual Strength Ratings, by Strategy Category

Category	Strategy	Higher strength characteristics:
Low	Passive media/social marketing <ul style="list-style-type: none"> • Radio, newspaper, TV, billboard spots 	<ul style="list-style-type: none"> • Coordinated messaging • Multiple media platforms – e.g., print, radio, social media • Sustained campaigns
Low	Less intensive educational curricula/programs <ul style="list-style-type: none"> • Bike safety programs • Nutrition education 	<ul style="list-style-type: none"> • Frequency/duration – offered several times/week, number of minutes per session • Evidence-based programs
Medium	Built environment <ul style="list-style-type: none"> • Sidewalks/Trails • Park infrastructure • General plan 	<ul style="list-style-type: none"> • Length of sidewalk and trail networks • Connection of trails/sidewalks to desirable destinations • Park amenities designed to promote PA, well-promoted, visible • General plan changes significantly improve walk/bikeability
Medium	Restaurants <ul style="list-style-type: none"> • Menu labeling • Healthier entrees 	<ul style="list-style-type: none"> • Quality of labeling/promotion • Number of healthier entrees offered, unhealthy ones removed • Only healthy options for children’s meals
Medium	Healthy food retail <ul style="list-style-type: none"> • Corner store conversions • New supermarkets 	<ul style="list-style-type: none"> • Number of healthier foods offered, unhealthy ones removed • Supporting promotion, outreach and marketing efforts • WIC/EBT certification • Zoning strategies to encourage healthy food
Medium	Cafeteria changes <ul style="list-style-type: none"> • Schools • Worksites 	<ul style="list-style-type: none"> • Few options for eating apart from the cafeteria (e.g., closed-campus schools, more isolated worksites) • Entrees changed or salad bars added • Standards aligned with current guidance on optimal nutrition • Unhealthy options largely removed, replaced with healthier ones • Availability of water
Medium	Vending machines/concessions in schools, worksites, community centers	<ul style="list-style-type: none"> • Pricing and placement strategies to encourage healthier items • All unhealthy options removed and replaced with healthier ones • Restricting marketing on vending machines
Medium	Foods and beverages served and sold through government agencies environment	<ul style="list-style-type: none"> • Standards aligned with Dietary Guidelines for Americans • Standards apply to all government-owned and/or operated buildings, worksites, locations • Pricing strategies to encourage healthier options
Medium	Healthy snacks/rewards/fundraisers	<ul style="list-style-type: none"> • Candy/sweets no longer offered, replaced with healthier options
Medium	Farmers markets	<ul style="list-style-type: none"> • Operating weekly or more frequently • Large selection of produce vendors • Healthy menus, nutrition or cooking education • Offering WIC/EBT
Medium	Gardens	<ul style="list-style-type: none"> • Educational programs provided
Medium	Worksite wellness programs <ul style="list-style-type: none"> • Environmental changes • Programs 	<ul style="list-style-type: none"> • Environmental changes (e.g., exercise cubicles, stairwell promotions) support healthier choices • Intensity of programs (e.g., wellness challenges)
Medium	Institutionally-based programs <ul style="list-style-type: none"> • Faith-based institutions • Apartment complexes 	<ul style="list-style-type: none"> • Environmental changes (e.g., changes in event food offerings) support healthier choices • Intensity of programs (e.g., wellness challenges)
Medium	Intensive educational programs <ul style="list-style-type: none"> • Ongoing classes • Promotoras/Community health workers 	<ul style="list-style-type: none"> • Literature supporting effectiveness of approach • More frequent/ongoing, tied to activities (e.g., garden education, cooking classes)
Medium	Safe Routes to School (SRTS)	<ul style="list-style-type: none"> • Significant infrastructure changes • Ongoing activities (e.g., Walking School Bus, weekly challenges)

Category	Strategy	Higher strength characteristics:
High	Breastfeeding promotion <ul style="list-style-type: none"> Lactation consultants Education 	<ul style="list-style-type: none"> Lactation consultants available for intensive support, consultation Infrastructure changes (e.g. lactation rooms) that facilitate breastfeeding Policy changes at medical facilities (e.g. Baby-Friendly Hospital Initiative)
High	Physical activity in schools: <ul style="list-style-type: none"> PE curriculum Active recess Classroom exercise 	<ul style="list-style-type: none"> Evidence-based curriculum, well-implemented (e.g., teacher training) Frequency/duration/intensity of classroom exercise – number of times/week, minutes per occasion, time spent in MVPA.
High	Physical activity– community-based, after-school programs, child care providers	<ul style="list-style-type: none"> Frequency/duration/intensity – offered several times/week, number of minutes per session, time spent in MVPA Provide opportunity to build social networks for support
High	Healthy food programs <ul style="list-style-type: none"> CSA boxes 	<ul style="list-style-type: none"> Frequent deliveries, at least weekly Quantity/diversity of produce included
High	Screening programs, BMI counseling, weight-loss programs	<ul style="list-style-type: none"> High proportion of obese patients screened/referred Effective or evidence-based interventions
High	Pricing strategies (e.g. taxes)	<ul style="list-style-type: none"> Revenues dedicated to obesity prevention

The dose of a particular intervention can also be increased by implementing complementary strategies that all target the same defined population. Building on Table 2 above and using sugar-sweetened beverages as an example, Table 3 provides an example of how low and medium strength strategies can be coordinated to increase the overall dose of the intervention.

Table 3: Increasing dose by using complementary strategies

Desired Outcome: Reduce consumption of sugar-sweetened beverages among youth		
Strength category	Strategy	Example
Low	Passive media/social marketing	<ul style="list-style-type: none"> Social marketing campaign on consumption of sugar-sweetened beverages targeting youth
Low	Less intensive educational curricula/programs	<ul style="list-style-type: none"> Education on sugar-sweetened beverages included as a component of nutrition education in school
Medium	Intensive educational programs	<ul style="list-style-type: none"> Promotoras provide education on overconsumption of sugary beverages to parents of school aged children
Medium	Vending machines in schools	<ul style="list-style-type: none"> Sugar-sweetened beverages removed from vending machines, school stores
Medium	Cafeteria changes	<ul style="list-style-type: none"> Sugar-sweetened beverages removed from school meal program
Medium	Restaurants	<ul style="list-style-type: none"> Eliminate sale of sugar-sweetened beverages in child restaurant meals