

ORIGINAL ARTICLE

Promoting physical activity in upper elementary children using multi-theory model (MTM) of health behavior change

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Keywords

Schools • Exercise • Child • Behavior

Summary

Background. Physical activity and exercise offer numerous benefits to children and Centers for Disease Control and Prevention guidelines require that school children engage in at least 60 minutes of moderate to vigorous physical activity every day. Unfortunately, up to 30% elementary students do not meet these requirements and 79% elementary schools do not provide students with physical education classes every day. The transition from elementary to secondary school is particularly deleterious for levels of physical activity. Therefore, there is a need to develop educational interventions for upper elementary school children to promote physical activity. A new theory multi-theory model (MTM) of health behavior change can be utilized to develop such interventions.

Objectives. The purpose of this article was to develop and introduce an instrument based on MTM for physical activity change in upper elementary school children and propose an approach for changing this behavior among sedentary students.

Methods. A review of literature in MEDLINE, CINAHL, Google Scholar, and ERIC databases was conducted for physical activity in upper elementary children and multi-theory model of health behavior change to prepare this article.

Results. An instrument with Flesch-Kincaid Grade level of 5.4 and the Flesch Reading Ease of 68 making it suitable for administration with upper elementary school children was developed. An approach utilizing the constructs of participatory dialogue, behavioral confidence and changes in physical environment to initiate physical activity and reifying the constructs of emotional transformation, practice for change and changes in social environment to sustain physical activity in upper elementary school children is presented.

Conclusions. MTM offers potential to augment current educational efforts to promote physical activity in upper elementary school children.

Background

Regular physical activity and exercise performed by children helps in improving their academic performance [1], managing weight, and fostering cardiovascular and musculoskeletal health thereby reducing the chances of developing chronic diseases as adults [2]. Schools provide opportunities for children to be physically active that can contribute to their meeting the 60 minutes/day moderate-to-vigorous physical activity guideline [3]. Unfortunately, many schools are not providing adequate opportunities to children for becoming physically active. A nationally representative survey of 1,831 elementary schools in United States from 2009–2012 found that only about 21% provided students with physical education classes every day [4]. A meta-analysis found that elementary children do not meet CDC guidelines for physical activity lesson time in schools [5]. Furthermore, 2009–2010 National Health and Nutrition Examination Survey in the United States based on proxy reports found that 30% children in the ages 6 to 11 years did not meet CDC recommended levels of physical activity [6].

Transition from elementary to secondary school is particularly deleterious for levels of physical activity [7]. A study with upper elementary school children revealed that total physical activity and particularly moderate to vigorous physical activity significantly declined from fifth to sixth grades [8]. There is an ardent need to develop educational interventions for upper elementary school students to enhance their physical activity levels. In recent years various educational interventions have been tried in elementary school children to promote physical activity such as utilization of classroom instruction [9], curricular changes [10], health promotion programs consisting of educational and policy changes [11], peer-led programs [12], use of computer games [13], training of physical education teachers [14] and others. These interventions have had mixed results and many of these do not use any behavioral theory thus not aiding in evidence-based practice. The interventions in health education have progressed in four generations from knowledge-based to skill-based to theory-based to now multiple theory-based, precision interventions [15]. One such approach of utilizing multiple theories is the multi-theory model [MTM] of health behavior change [15, 16].

MTM divides the process of health behavior change into initiation and sustenance. The model advocates the constructs of participatory dialogue in which advantages of behavior change outweigh the disadvantages of making the proposed change; behavioral confidence that can come from any internal or external sources and is futuristic; and changes in physical environment that provide resources and opportunities for behavior change are instrumental in initiating the behavior change. In order to sustain the behavior change the constructs of emotional transformation in which one directs one's feelings toward behavior change; practice for change in which one actively reflects on changing one's behavior and devises ways of overcoming barriers; and changes in social environment in which one recruits support from family, friends, health professionals and others are reified. The purpose of this article was twofold. First objective was to develop an instrument based on multi-theory model (MTM) of health behavior change that can gauge changes in physical activity among upper elementary school children. Second objective was to propose an approach for promoting physical activity in upper elementary school children based on MTM.

Methods

In order to prepare this article a review of literature in MEDLINE, CINAHL, Google Scholar, and ERIC databases was conducted for physical activity in upper elementary children and multi-theory model of health behavior change. Based on this review of literature, informal discussion with a group of upper elementary children in Mississippi, and a previous validated instrument with college students [15, 17] the instrument for this article was prepared by the authors (see Appendix 1).

Results

The instrument developed by the authors is presented in Appendix 1. The Flesch-Kincaid Grade level of this instrument was found to be 5.4 thus making it suitable for administration with upper elementary school children and the Flesch Reading Ease of this instrument was found to be 68 once again making it readily comprehensible in this age group. The construct of participatory dialogue is derived from a subtractive score of advantages minus disadvantages of being physically active for 60 minutes daily. Both advantages and disadvantages are measured on a scale of never (0), almost never (1), sometimes (2), fairly often (3), and very often (4). Some of the advantages that the instrument taps into include being healthy, being relaxed, getting sick less often, having more energy, and enjoying life more. Some of the disadvantages included in the instrument are getting tired, not having enough time for school or other activities, not having enough time for friends and getting injuries. The construct of behavioral confidence is based on a response to five items on a scale of not

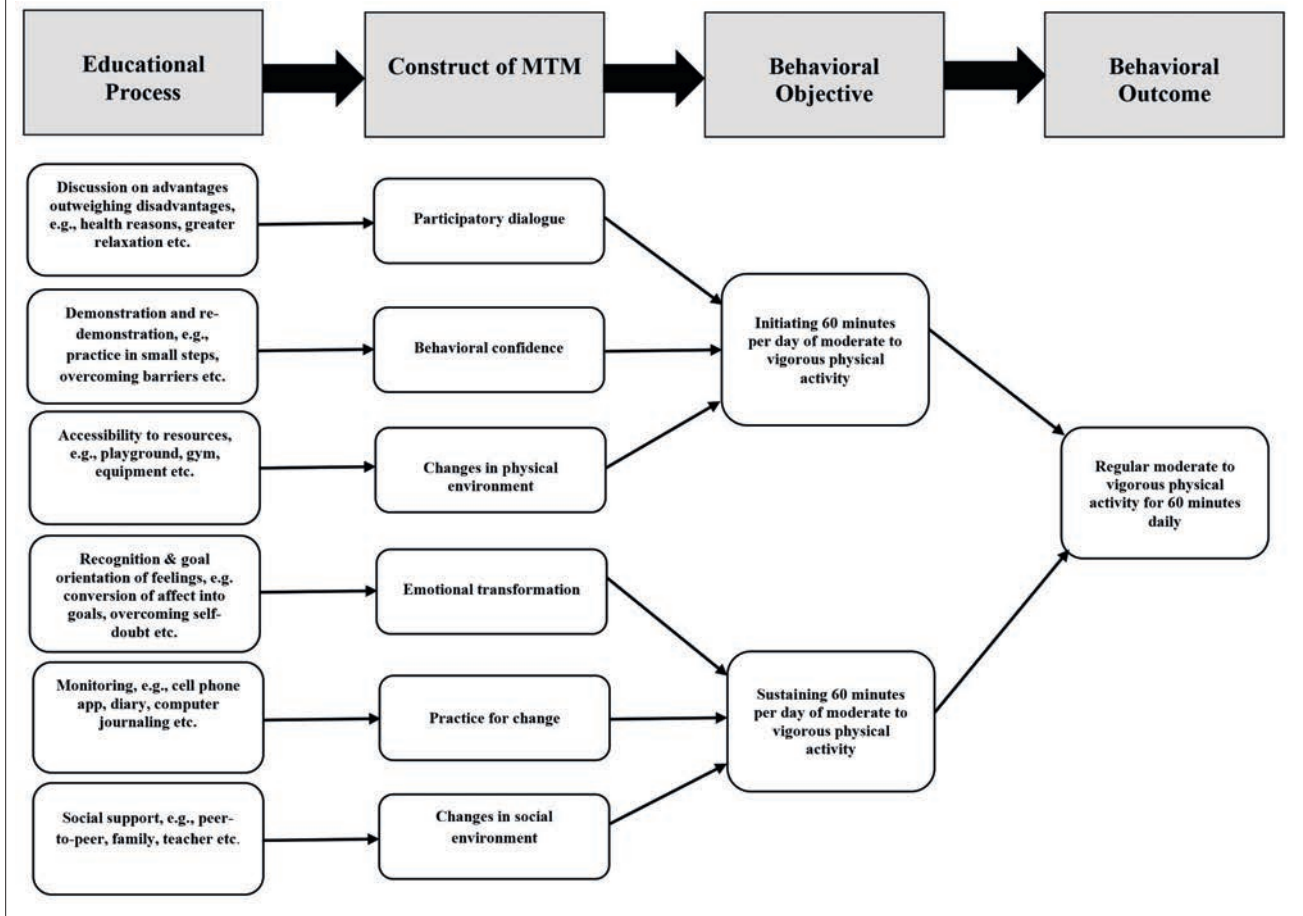
at all sure (0), slightly sure (1), moderately sure (2), very sure (3), and completely sure (4). The behavioral confidence entails being physically active despite having school work, despite finding time for rest, without getting tired and without sustaining any injuries. The construct of changes in physical environment is also measured on a scale of not at all sure (0), slightly sure (1), moderately sure (2), very sure (3), completely sure (4) and taps into having a place for being physically active, being able to afford it and be able to use tools to exercise. The construct of emotional transformation also uses the same scale of not at all sure (0), slightly sure (1), moderately sure (2), very sure (3), completely sure (4) and gauges surety about directing feelings toward the goal of physical activity, inspiring oneself toward the goal and defying self-doubt. The construct of practice for change also utilizes the same scale of surety and measures ability to monitor, being active despite barriers and changing plans when faced with difficulties. The construct of changes in social environment also uses the same scale of surety and asks about getting help from a family member, friend or health worker. Finally, the intention to initiate and sustain physical activity are measured on scales of not at all likely (0), somewhat likely (1), moderately likely (2), very likely (3), and completely likely (4).

Discussion

The purpose of this article was to develop and introduce an instrument based on multi-theory model (MTM) for physical activity change in upper elementary school children and propose an approach for changing this behavior among sedentary students. The instrument that has been presented can be validated for face and content validity by a panel of experts that include a mix of experts on this theory, upper elementary school children and instrumentation. The instrument can further be subjected to construct validation by administering it to a sample of upper elementary school children and doing confirmatory factor analysis on the subscales using structure equation modeling or an extension of exploratory factor analysis (Sharma & Petosa, 2014). Internal consistency reliability of subscales can be established by computing Cronbach's alpha and test retest reliability assessment can also be done [18].

The proposed approach for promoting physical activity in upper elementary school children based on MTM is depicted in a logic diagram in Figure 1. While MTM has not been tested with school-aged children it has been tested with college students and found to be useful [17]. In order to facilitate participatory dialogue it is important to have personalized discussion with the kids about advantages and disadvantages of at least 60 minutes per day of physical activity and exercise. For building behavioral confidence demonstration and re-demonstration of skills by students will be helpful. This can also be complemented with a discussion on sources of behavioral confidence for being physically

Fig. 1. Using Multi-theory model (MTM) of health behavior change to promote physical activity in upper elementary children.



active and how to build it. Regarding changes in physical environment the educators must ensure that children have access to playgrounds in the premises of the school and that they utilize these. For bringing about emotional transformation interactive affective exercises (such as role play, psychodrama or simulation) can be deployed to explore feelings in children and how to direct them toward goals for being physically active. In order to foster practice for change cell phone apps or computer journaling should be encouraged for the students to monitor their daily physical activity. A growing number of upper elementary children are having access to these gadgets and spending greater time on these [19]. There is a potential to employ these measures in educational interventions to promote physical activity. Finally for building changes in social environment peer-to-peer social support is indispensable and must be utilized. Previous interventions have also found this approach to be beneficial [12] (Fig. 1). In summary, it can be appreciated that MTM offers potential to augment current educational efforts to promote physical activity in upper elementary school children. MTM based interventions have an advantage of being brief and precise in fostering behavior change thus making them replicable. Careful and concerted operationalization of this model to this target group has the potential

to help sedentary school children become more physically active.

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Conflict of interest statement

None declared.

Authors' contributions

Manuscript conceptualization: MS and VKN; Manuscript writing (First Draft): MS; Manuscript writing (Final Draft); Instrument development: MS.

References

- [1] Käll LB, Nilsson M, Lindén T. The impact of a physical activity intervention program on academic achievement in a Swedish

- elementary school setting. *J Sch Health* 2014;84(8):473-80. doi: 10.1111/josh.12179.
- [2] US Department of Health and Human Services. 2008 Physical Activity Guidelines for Americans. Available at: <http://www.health.gov/paguidelines/pdf/paguide.pdf>.
 - [3] Centers for Disease Control and Prevention. School health guidelines to promote healthy eating and physical activity. *Morb Mortal Wkly Rep* 2011;60:1-71.
 - [4] Turner L, Johnson TG, Slater SJ, Chaloupka FJ. Physical activity practices in elementary schools and associations with physical education staffing and training. *Res Q Exerc Sport* 2014;85(4):488-501. doi: 10.1080/02701367.2014.961053.
 - [5] Hollis JL, Williams AJ, Sutherland R, Campbell E, Nathan N, Wolfenden L, Morgan PJ, Lubans DR, Wiggers J. A systematic review and meta-analysis of moderate-to-vigorous physical activity levels in elementary school physical education lessons. *Prev Med* 2016;86:34-54. doi: 10.1016/j.ypmed.2015.11.018.
 - [6] Fakhouri TH, Hughes JP, Brody DJ, Kit BK, Ogden CL. Physical activity and screen-time viewing among elementary school-aged children in the United States from 2009 to 2010. *JAMA Pediatr* 2013;167(3):223-9. doi: 10.1001/2013.jamapediatrics.122.
 - [7] Rutten C, Boen F, Seghers J. Changes in physical activity and sedentary behavior during the transition from elementary to secondary school. *J Phys Act Health* 2014;11(8):1607-13. doi: 10.1123/jpah.2012-0465.
 - [8] Lau EY, Dowda M, McIver KL, Pate RR. Changes in physical activity in the school, afterschool, and evening periods during the transition from elementary to middle school. *J Sch Health* 2017;87(7):531-537. doi: 10.1111/josh.12523.
 - [9] Sirota D, Meyer D, Nieto A, Zamula A, Stockwell M, Berger-Jenkins E. In-classroom physical activity and its impact on physical activity outside of school in a Hispanic community. *J Phys Act Health* 2014;11(7):1350-3. doi: 10.1123/jpah.2012-0318.
 - [10] Donnelly JE, Greene JL, Gibson CA, Smith BK, Washburn RA, Sullivan DK, DuBose K, Mayo MS, Schmelzle KH, Ryan JJ, Jacobsen DJ, Williams SL. Physical Activity Across the Curriculum (PAAC): a randomized controlled trial to promote physical activity and diminish overweight and obesity in elementary school children. *Prev Med* 2009;49(4):336-41. doi: 10.1016/j.ypmed.2009.07.022.
 - [11] King KM, Ling J. Results of a 3-year, nutrition and physical activity intervention for children in rural, low-socioeconomic status elementary schools. *Health Educ Res* 2015;30(4):647-59. doi: 10.1093/her/cyv029.
 - [12] Santos RG, Durksen A, Rabbanni R, Chanoine JP, Lamboo Miln A, Mayer T, McGavock JM. Effectiveness of peer-based healthy living lesson plans on anthropometric measures and physical activity in elementary school students: a cluster randomized trial. *JAMA Pediatr* 2014;168(4):330-7. doi: 10.1001/jamapediatrics.2013.3688.
 - [13] Sharma SV, Shegog R, Chow J, Finley C, Pomeroy M, Smith C, Hoelscher DM. Effects of the quest to lava mountain computer game on dietary and physical activity behaviors of elementary school children: a pilot group-randomized controlled trial. *J Acad Nutr Diet* 2015;115(8):1260-71. doi: 10.1016/j.jand.2015.02.022.
 - [14] Carson RL, Castelli DM, Pulling Kuhn AC, Moore JB, Beets MW, Beighle A, Aija R, Calvert HG, Glowacki EM. Impact of trained champions of comprehensive school physical activity programs on school physical activity offerings, youth physical activity and sedentary behaviors. *Prev Med* 2014;69 Suppl 1:S12-9. doi: 10.1016/j.ypmed.2014.08.025.
 - [15] Sharma M. Theoretical foundations of health education and health promotion. (3rd ed.) Burlington, MA: Jones and Bartlett 2017, pp. 250-262.
 - [16] Sharma M. Multi-theory model (MTM) for health behavior change. *WebmedCentral Behaviour*. 2015;6(9): WMC004982. Available from http://www.webmedcentral.com/article_view/4982
 - [17] Nahar VK, Sharma M, Catalano HP, Ickes M, Johnson P, Ford MA. Testing multi-theory model (MTM) in predicting initiation and sustenance of physical activity behavior among college students. *Health Promot Perspect* 2016;6(2):58-65. doi: 10.15171/hpp.2016.11.
 - [18] Sharma M, Petosa RL. Measurement and evaluation for health educators. Burlington, MA: Jones and Bartlett 2014.
 - [19] Kaiser Family Foundation, 2017. Generation M2: media in the lives of 8- to 18-year-olds. Available from <http://www.kff.org/other/event/generation-m2-media-in-the-lives-of/>

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APPENDIX 1
MEASURING CHANGE IN PHYSICAL ACTIVITY IN UPPER ELEMENTARY CHILDREN

Directions: This survey is voluntary, which means you may choose not to complete it or not to answer some questions. There is no direct benefit of this survey to you. All data from this survey will be kept secret and not used for grading. Your responses will help in making good physical education programs. Please put an X mark by the response or fill the response that correctly describes your position. Thank you for your help!

1. During the past seven days, how many minutes did you participate in any physical activities or exercises such as running, playing ball, sports, or walking for exercise?

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
_____ min.	_____ min.	_____ min.	_____ min.	_____ min.	_____ min.	_____ min.

Please add the total minutes up: _____ minutes/week

If your total is over 420 minutes, then you can stop taking this questionnaire. Thank you for your time.

2. Do you suffer from any medical condition including any physical disability that prevents you from being physically active?

- No
 Yes

If you answered Yes you may stop this questionnaire and thank you for your time.

3. What is your gender?

- Boy
 Girl
 Other, _____

4. How old are you today? _____ years

5. What is your class?

- 5th grade
 6th grade

6. Have you been taught about being physically active in school?

- No
 Yes, one class lesson
 Yes, two class lessons
 Yes, three or more class lessons

7. Do you participate in a physical education class at school?

- No
 Yes

8. How many times does your physical education class meet per week? _____ (write a number)

9. How many minutes is your physical education class? _____ (minutes)

Never Almost
Never Sometimes Fairly
Often Very
Often

**If you do more than 60 minutes
of physical activity every day you will...**

10. ... be healthy.

11. ... be relaxed.

12. ... get sick less often.

13. ... have more energy.

14. ... enjoy life more.

Never Almost
Never Sometimes Fairly
Often Very
Often

**If you do more than 60 minutes
of physical activity every day you will...**

15. ... be tired.

16. ... not have enough time for school.

17. ... not have enough time for other things.

18. ... not have time for friends.

19. ... get injuries.

	Not At All Sure	Slightly Sure	Moderately Sure	Very Sure	Completely Sure
How sure are you that you will be physically active for 60 minutes ...					
20. ... from tomorrow?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. ... this week while finishing all school work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. ... this week while finding time for rest?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. ... this week without getting tired?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. ... this week without getting injured?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Not At All Sure	Slightly Sure	Moderately Sure	Very Sure	Completely Sure
How sure are you that you will...					
25. ... have a place to be physically active for 60 minutes per day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. ... be able to afford a place to be physically active for 60 minutes per day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. ... be able to use tools to be physically active for 60 minutes per day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How sure are you that you can...					
28. ... direct your feelings to the goal of being physically active for 60 minutes every day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. ... inspire yourself to be physically active for 60 minutes every day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Not At All Sure Slightly Sure Moderately Sure Very Sure Completely Sure

How sure are you that you can...

30. ... defy self-doubt in meeting the goal of being physically active for 60 minutes every day?

How sure are you that you can...

31. ... keep a self-diary to monitor total time of your physical activity every day?

32. ... be physically active for 60 minutes every day even if you come across barriers?

33. ... change your plan for being physically active for 60 minutes every day if you face difficulties?

Not At All Sure Slightly Sure Moderately Sure Very Sure Completely Sure

How sure are you that you can get the help of a...

34. ... family member to be physically active for 60 minutes every day?

35. ... friend to be physically active for 60 minutes every day?

36. ... health worker to be physically active for 60 minutes every day?

Not At Somewhat Moderately Very Completely
 All Likely Likely Likely Likely Likely

How likely is it that you will...

37. ...increase your physical activity to
 60 minutes from tomorrow.

How likely is it that you will...

38. ... Increase your aerobic physical activity to
 60 minutes every day from now on.

SCORING

Construct of advantages: Scale: Never (0), Almost never (1), Sometimes (2), Fairly often (3), Very often (4). Summative score of Items 10-14. Possible range: 0- 20. High score associated with likelihood of initiation of behavior change.

Construct of disadvantages: Scale: Never (0), Almost never (1), Sometimes (2), Fairly often (3), Very often (4). Summative score of Items 15-19. Possible range: 0- 20. Low score associated with likelihood of initiation of behavior change.

Construct of participatory dialogue: Subtract disadvantages score from advantages score to calculate participatory dialogue construct score. Positive score will be indicative of behavior change.

Construct of behavioral confidence: Scale: Not at all sure (0), slightly sure (1), moderately sure (2), very sure (3), completely sure (4). Summative score of Items 20-24. Possible range 0-20. High score associated with likelihood of initiation of behavior change.

Construct of changes in physical environment: Scale: Not at all sure (0), slightly sure (1), moderately sure (2), very sure (3), completely sure (4). Summative score of Items 25-27. Possible range 0-12. High score associated with likelihood of initiation of behavior change.

Construct of emotional transformation: Scale: Not at all sure (0), slightly sure (1), moderately sure (2), very sure (3), completely sure (4). Summative score of Items 28-30. Possible range 0-12. High score associated with likelihood of sustenance of behavior change.

Construct of practice for change: Scale: Not at all sure (0), slightly sure (1), moderately sure (2), very sure (3), completely sure (4). Summative score of Items 31-33. Possible range 0-12. High score associated with likelihood of sustenance of behavior change.

Construct of changes in social environment: Scale: Not at all sure (0), slightly sure (1), moderately sure (2), very sure (3), completely sure (4). Summative score of Items 34-36. Possible range 0-12. High score associated with likelihood of sustenance of behavior change.

For modeling initiation dependent variable can be Item 37: not at all likely (0), somewhat likely (1), moderately likely (2), very likely (3), and completely likely (4) and multiple regression can be used. For modeling sustenance dependent variable can be Item 38: not at all likely (0), somewhat likely (1), moderately likely (2), very likely (3), and completely likely (4) and multiple regression can be used.

Flesch-Kincaid Grade level: 5.4

Flesch Reading Ease: 68