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## The Reel Deal: The Stacked Benefits of a Reel Mower

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### Abstract

"Mow-lawning" is a colloquial term referred to actively cutting grass using a reel mower, typically at a faster than normal pace in order to maximize exercise benefit and minimize time, with the emphasis on the physical action of mowing and only secondarily on the resulting lawn care. While mow-lawning remains relatively uncommon in the United States, adoption of this practice by those healthy enough to engage in the level of exercise required can deliver a number of benefits that improve environmental, safety, and personal goals simultaneously. The stacking of so many benefits in one practice deserves more attention and promotion.

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### Conflict of Interest Statement

The authors have no potential conflicts of interest.

### Cover Page Footnote

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## **Introduction:**

Most American urban and suburban households include a typical grass lawn. While the environmental or aesthetic impacts of this practice in general are beyond the scope of this article, basic lawn cutting alone entails significant financial, environmental, and healthcare costs that are seldom tallied. Mow-lawning is a viable alternative lawn cutting practice that virtually reverses all of these costs and in many cases renders added benefits.

A reel mower is a fully man powered grass cutting machine consisting of several blades arranged in series that spin "vertically" against a cutting bar, creating a scissors-like action to cut blades of grass. Importantly this action only occurs while the machine is being pushed manually. Lawn aficionados tend to consider this cutting action more attractive and healthier for the grass, though often these are thought reserved only for small flat lawns because of the effort needed to push the machine and the often erratic cutting that can result when pushed rapidly over bumpy or uneven surfaces. Mow-lawning is a practice that embraces these machines as an exercise mechanism with the side effect that they perform basic lawn cutting, if not at the ideal, at least at acceptable levels even when used at higher speeds and over larger and uneven lawns. There are a surprising number of benefits to those physically able to adopt the practice. The purpose of this article is to outline these benefits, note areas where they intersect and multiply with one another, and advocate for more widespread adoption of this method. It should be understood from the beginning that prudence dictates the practitioner is assumed to be healthy enough to engage in vigorous-intensity aerobic activities as outlined by the American Heart Association and is comfortable with the safety of engaging in such a program over time.<sup>1</sup>

For the purposes of illustration only, when specific data are presented, it is taken from the actual measurements of the middle aged man mowing a lawn the lot size of 0.47 acres total supporting a 4 bedroom house and typical surrounding landscaping. It is also understood that the lawn is predominantly grass. While the cost, healthiness, and environmental benefits of a grass lawn are certainly worth discussion, grass lawns are the current default choice in America and this article accepts that reality. Given this situation it is also worth noting that the viable alternatives to the reel mower are almost always the employment of a personal gas or electric powered, push or self-propelled mower, a personal gas or electric powered riding lawnmower, or contracting with a lawn service that uses one of those alternatives. Some of these particular distinctions in contrast will be made below.

## **Environmental benefits:**

Reel mowers are made of steel, other base metals, and plastic. The components are not different than a comparable sized gas or electric mower. Utilizing only manpower, there is no need for rare earth metals, rubber tubing, copper wiring, or any number of other small component parts required by powered mowers. The reel mowers tend to be held together with typical bolts which are easily replaceable if they incur any damage. From a construction alone standpoint, there is little doubt that the overall environmental impact of producing these lawnmowers is favorable on an individual basis compared to motor powered lawnmowers.

Operating the reel mower itself generates no machine based waste products or emissions. This is in contradistinction to emissions directly from gas powered motors and indirectly from the power plants that ultimately power most electric mowers. Gasoline-powered lawn and garden equipment, of which lawnmowers logged the highest annual activity hours, emitted an astonishingly high 26.7 million tons (approximated) of pollutants in a 2011 study.<sup>2</sup> Previous studies have equated the emission of carbon monoxide, nitrogen oxide and volatile organic compounds from 30 minutes of conventional lawn mowing to that of driving a car for 275 km.<sup>3</sup>

#### **Maintenance benefits:**

Reel mowers require rinsing off and occasional application of oil to moving parts. The total amount of oil is a fraction of the oil needed to maintain a gas powered lawnmower machine. Recycled waste vegetable oil can be used for the reel mower, effectively reducing even this to a negligible concern.

#### **Environmental accidents:**

Reel lawnmowers have no gasoline or oil reservoir and thus are incapable of fuel spillage.

#### **Public health benefits:**

The proper operation of a reel mower even at relatively high speeds makes most mechanically generated injuries nearly impossible. The vertical spinning of the blades does not impart projectile motion to rocks or debris the way more traditional lawnmowers introduce risk.<sup>4</sup> In addition the blades contact the grass and cutting bar below the machine when in use. Because the blades stop as soon as one ceases pushing the machine, there is no practical way for the operator to accidentally insert a hand or foot underneath the machine while the blades are spinning. In addition, there is no possibility of burn or inhalation injury.

In distinction, grouped analysis of lawnmower related injuries in the United States reveals catastrophic numbers of injuries.<sup>4-9</sup> Retrospective analysis from 1990 - 2004, focusing only on children less than 20 years of age, estimated 140,700 lawnmower related injuries requiring treatment in hospital emergency rooms, consisting of lacerations (41.2%), soft tissue injury (21.4%), burns (15.5%), fractures (10.3%), amputations (5.1%), and foreign body injuries (3.3%).<sup>6</sup>

An equally concerning 8-year study of lawnmower related injuries from a representative emergency room database identified 14,878 injuries between 2006 and 2013, which translated into an estimate nationwide of 51,151 cases.<sup>9</sup> The authors concluded that the annual incidence of lawnmower related injuries per 100,000 person-years ranged between 1.3-1.8 over the time course, and the total emergency department and inpatient charges combined would be \$290 million.<sup>9</sup> A study that attempted to identify the type of lawnmowers involved in injury to children found the majority to be related to riding mowers, and of those mowers identified with injury, push type mowers accounted for only 4% (reel mowers as a separate type were not reported).<sup>8</sup> This author's experience, a basic understanding of the physics involved in the forces behind the different mower types, and common sense dictate that reel mowers are virtually

incapable of causing the vast majority of the injuries and damage attributed to the mechanics of powered mowers

### **Health benefits:**

Outside of contracting with a professional lawnmower, individuals who mow their lawns stand to gain some health benefits from pushing or moving. The extent of the benefit will vary greatly based upon the type of lawn mowing. The following assumes the person mowing is healthy enough to engage in the exercises at the levels below without ill effect.

The 2011 Compendium of Physical Activities list of activity associated metabolic equivalents (METs) is a reasonable standardized way of comparison between modalities.<sup>10</sup> One metabolic equivalent is defined as 1 kcal/kg/h, and is roughly equivalent to the energy cost of sitting quietly. The compendium lists lawn mowing using a riding lawnmower is rated at 2.5 METs. A vigorous effort using a hand mower (a mower pushed from behind) is rated up to 6.0 METs. By way of comparison, running at 4 mph is rated at 6 METs while running at 5 mph is rated at 8 METs.

There is no clear distinction in the 2011 Compendium of Physical Activities between reel mowers and other push mowers. We use the 6.0 METs for vigorous effort with a hand mower; this may underestimate the METs level for mow-lawning, but controlled studies would be needed to accurately quantify any gap. From a precautionary standpoint it is wise to consider mow-lawning a vigorous activity which may exceed the generic listed 6.0 METs for a hand mower.<sup>1,10-14</sup> Relatively speaking, the huge gain comes from the move off the passive riding mower to the push mower anyway, an increase in METs of (6 METs pushing -2.5 METs riding) = 3.5 METs at a minimum.

Current scientific guidelines put 6 METs at the intersection between moderate and vigorous intensity activity. The 2018 Physical Activity Guidelines Advisory Committee Scientific Report specifies mowing grass with a hand push mower is a vigorous intensity activity required 6 or greater METs.<sup>14</sup> That same report suggests the public health target range of 500-1000 MET-minutes of moderate to vigorous physical activity per week, or 150 to 300 minutes/week of moderate intensity physical activity. The calculation of METs-minutes is obtained by multiplying the activity METs value by the duration of the activity in minutes.<sup>10</sup> Assuming a push reel mower METs rank of at least 6, this would require 167 minutes of mowing per week to meet the 2018 Physical Activity Guidelines Advisory Committee METs-minutes recommendation - assuming no other physical activity is undertaken (6 METs x 167 total minutes mowing per week = 1002 METs-minutes per week).

Based upon one author's experience of push mowing a 0.47 acre grass lot (minus house and landscaping footprint) with a 21 inch bed reel mower, it takes between 60 and 75 minutes depending upon speed, which is largely dependent upon grass growth, which in turn depends largely upon frequency of mowing per week. Setting a reel mower to height of 2-1/2 to 3 inches to cut a minimal amount of grass per attempt tends to allow attainment of target heart rate within the 50-85% zone at a total speed of 2.5 to 3.0 mile per hour, effort dependent. When mowing at brisk speed, especially across this author's uneven lawn, the aesthetic results suffer as bouncing

causes some missed patches and the total length of grass clipped is minimal. To maintain grass at uniform height and prevent interval grass growth from causing very slow lawn mowing, which is the Achilles' heel of these types of machines, frequent mowing is in some sense desirable. Whether this is optimally healthy for the grass is unclear, but thrice weekly mowing to keep grass height at 2-1/2 to 3 inches is easily attainable from an exercise standpoint. This means that 100% of recommended exercise could be obtained from mow-lawning alone (60 minutes per mowing x 3 mowing episodes per week x 6 METS activity leads to 1,080 METS-minutes per week).

In addition, the act itself is relatively varied in action, consisting of periods of straightaway lawn mowing during which top speed can be pursued, alternating with turns and at times lifting of the weight of the machine. The particular brand one author uses is a 55 pound predominantly steel machine offering significant resistance during mowing. The entire experience occurs on soft ground at low impact to the joints. Every METS-minute per week mow-lawning could substitute for time spent in alternative forms of exercise and reduce or eliminate unwanted side effects associated with those. For example, running on asphalt roads has higher risk of joint impact injuries; either running or bicycle riding on public roads increases exposure to automobile injury and animal attacks. Further, the mow-lawning usually occurs at home which eliminates the need to transport to and from an exercise center such as a gymnasium and the pollution and cost associated with that.

Reel mowers also eliminate the noise pollution caused by powered mowers which is unpleasant for the neighborhood and is even capable of harming the hearing of the user as well as nearby children or adults not wearing ear protection.<sup>15</sup> The extent of this problem is hard to quantify though it is another harm which is totally eliminated by the quieter reel mower.

To be clear, at issue is not whether this is the optimal way to fulfill the above exercise recommendations; instead the compounding of all the other benefits requires only that the reader concede that it is a possible way to do so.

### **Financial benefits:**

Reel mowers reduce the costs associated with maintaining a grass lawn. For a direct comparison, the contrast against a gas powered push mower is the most useful as that is the most common alternative. The savings benefit would be even greater compared to a riding mower and comparable to an electric mower.

The cost of a very high quality reel mower is equivalent to similar sized gas mower. The lifespan of the reel mower should vastly outlast the powered mower given its design and construction, but that advantage can be reduced if the reel mower is used aggressively for exercise benefit, so the very conservative assumption is there is no advantage. However, the power mower will cost more to maintain, with the cost of spark plugs, motor oil and gasoline much more expensive than the occasional (and as noted potentially cost free) blade oil the reel mower needs. The exact cost depends upon mowing frequency. The time needed for a 0.47 acre lot would be similar per mow, but the frequency would be different. For this example we assume thrice weekly mowing with a reel mower for the exercise benefits previously outlined,

while once a week is assumed for a gas powered mower. At once weekly, current gas cost would be about \$35.00 a year versus \$0 for the reel mower. The user of the gas powered mower may be able to claim up to 60 minutes x 6 METS per week, but would need to augment this in order to match the exercise benefit gained by the user of the reel mower. Assuming a 6 month mowing season and \$50.00 per month gym membership and travel costs, the out of pocket expense for the equivalent mowing and exercise is \$335.00 per annum. A mow-lawner starting at age 20 and continuing through age 50 years old (a reasonable 30 year "career" in the author's opinion) would save \$10,050.00 in absolute dollars. This estimate can be assumed to be inflation protected as the cost of the alternatives should rise with inflation. In addition, though the absolute is unchanged, the relative savings to mow-lawning are higher if the alternatives are paid for in after-tax dollars. Merely for illustration purposes, if the annual savings were continuously invested and compounded at an 8% annual return, approximating the historical returns of the "prototypical" balanced mutual fund of a large investment company, the financial benefit alone would have compounded to over \$38,000.00.<sup>16</sup> A much higher expected value results if mow-lawning replaces both gym memberships and the employment of a lawn service; assuming \$25.00 per week to a lawn service for 26 weeks per year, the same 30 year commitment to mow-lawning (and same investment return rates) leads to a future value over \$108,000.00.

Of course, one could claim that a self-powered mower could also be used thrice weekly in order to eliminate the cost attributed to exercise, but this renders invalid the already conservative replacement and fuel costs above and would triple the externalities of pollution and health risk. Alternatively one could claim reduced or cost free exercise such as jogging to limit the financial advantage but again, not without incurring more health risk as outlined earlier. The point being that the reel mower approach can in some cases be extremely lucrative, but in virtually all cases the interplay of advantages will be financially advantageous.

### **Conclusion:**

For homeowners with grass lawns, the above analysis leads to the conclusion that the stacked advantages of using a reel mower approach are simply too efficient to ignore. Those who hold that physicians have a professional obligation to prescribe exercise would be well served to familiarize themselves with these advantages.<sup>17,18</sup> Recommending this approach, when medically appropriate, can lead to significant environmental, personal and public health, and financial improvements for individual patients.

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