PATHWEIGH Tool for Chronic Weight Management Built into EPIC Electronic Medical Record: Methods, Pilot Results and Future Directions

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Abstract

Objective: Despite the overwhelming prevalence and health implications of obesity, it is rarely addressed in a health care setting. Providers and patients alike cite innumerable barriers as to the reasons why. The current study provides a framework to systematically address and deconstruct these barriers.

Methods: A pilot study was conducted to evaluate the feasibility of the PATHWEIGH weight loss intervention in primary care. The intervention consisted of staff team training, workflow system management and data capture from the electronic medical record (EPIC). Two family medicine clinics in the same health care system were compared in their approach to weight management: PATHWEIGH method vs. Standard of Care (SOC); matched for provider expertise. Statistical analyses examined patient demographics, weight-related comorbidities, baseline weight and weight loss over 18 months.

Results: Patients in the PATHWEIGH group (N = 109) vs. SOC (N = 338) were younger (45 vs. 54 years old, p < 0.001), more likely to be female (89% vs. 65%, p < 0.01) and be commercially insured (93% vs. 52%, p < 0.001). The groups were comparable with respect to the numbers of weight-related comorbidities (p = 0.57). Baseline weight was not different between the groups (103.8 vs. 101.5 kg, p = 0.32), but weight lost was significantly greater in the PATHWEIGH group (7.9 kg / 7.2% body weight vs. 2.4 kg / 2.1% body weight SOC, p < 0.001 for both) despite a similar number of patients receiving bariatric surgery (10% for both groups, p = 0.99). Anti-obesity medication was more commonly prescribed in PATHWEIGH vs. SOC (79.8 vs. 20.7%, p < 0.001).

Conclusion: These preliminary data demonstrate the feasibility and suggest superiority of using PATHWEIGH for weight loss in a primary care setting.

Keywords

PATHWEIGH, Weight management tool in EPIC, Electronic medical record

Abbreviations

SOC: Standard of Care; CDC: Centers for Disease Control and Prevention;
BMI:  Body Mass Index; U.S.: United States; EMR: Electronic Medical Record; MA: Medical Assistant; TSH: Thyroid Stimulating Hormone; ALT: Alanine Transaminase; AST: Aspartate Aminotransferase; HDL: High-Density Lipid; IBT: Intensive Behavioral Therapy; CME: Continuing Medical Education

Introduction

As of 2016, the Centers for Disease Control and Prevention (CDC) estimated that 72% of United States (U.S.) adults have overweight (i.e. body mass index (BMI) ≥ 25 kg/m²) and 40% have obesity (e.g. BMI ≥ 30 kg/m²) with no sign of abatement [1]. Obesity is a well-established risk factor for innumerable diseases, collectively costing the U.S. $1.7 trillion in 2018 [2]. Importantly, however, obesity is being increasingly recognized not only as a risk factor for disease but also as a disease itself. Despite this fact, only ~ 50% of people with a BMI of 50 kg/m² have a diagnosis of obesity [3] and < 1% of people with any degree of overweight or obesity are offered anything other than lifestyle advice [4].

Reasons behind the lack of weight management prioritization are extensive and complex. Eighty-two percent of people with obesity believe they are responsible for their weight; a number highly corroborated by health care providers [5]. Health care providers cite lack of time and competing issues as the leading causes of why obesity is not prioritized [5], but poor reimbursement for care and lack of effective tools are also widely cited [5]. Employers providing commercial insurance to employees cite yet a different reason for why anti-obesity medication is rarely covered: lack of data on effectiveness, cost effectiveness, long-term benefits and safety [5]. While these are only a handful of the many reasons why weight management is rarely pursued in a clinical setting, suffice it to say, stigma and bias against obesity exist on every level [6].

To address these barriers and facilitate the practice of obesity medicine, PATHWEIGH was developed: a workflow and disease state prioritization tool for chronic weight management in primary care. The purpose of PATHWEIGH was to design a scalable, iterative clinical tool that effectively helps patients to lose weight and maintain weight loss. This paper describes data from the pilot analysis and discusses future directions.

Materials and Method

Participants

Participants in this pilot study were adults (age ≥ 18 years) with BMI ≥ 25 kg/m² seen in one of two primary care clinics in the Denver, Colorado metro area (~ 20 miles apart) between January 1, 2018 and June 15, 2019. Two providers at one site used the PATHWEIGH weight management method vs. two providers at the other site used standard of care (SOC) for weight management (i.e. discretionary advice for diet, exercise, behavior change, use of anti-obesity medication and/or referral to bariatric surgery) [7]. Providers were purposefully selected to be matched on sex, type of training and specialty. Specifically, each clinic had one female endocrinologist and one male primary care physician of similar ages all of whom had been working in their respective clinic for 5-7 years. No additional training was given to the providers outside of their board-certified area and no differences existed with respect to the potential to refer to behavioral health, dieticians, bariatric, etc. Patients seen by the providers using the PATHWEIGH method (see below) were demarcated on a specific patient list (collected in a pre-specified fashion prior to the deployment of PATHWEIGH into the electronic medical record (EMR), specifically EPIC (EPIC; Verona, WI) whereas patients at the SOC clinic were extracted from the EMR based on a primary diagnosis of obesity, weight management or any obesity and/or weight-related ICD-10 codes (E66-E66.9; Z76.89). All data were de-identified and devoid of personal health information on extraction using a proprietary process developed by the COMPASS Data Warehouse Aurora, CO. The Colorado Multiple Institutional Review Board has deemed studies using this process exempt from informed consent and protocol review.

Interventions

PATHWEIGH

PATHWEIGH incorporates two general features that make it unique from other EMR systems that capture data around body weight: the workflow and the tool built into EPIC.

Workflow: There are two possible workflow scenarios. First, if the patient was known to be coming to the clinic for weight management, a message was sent to the medical assistant (MA) before the visit alerting him/her to use the PATHWEIGH flow sheet. The MA acquired vital signs, including height and weight (EPIC then calculates BMI), listed obesity or weight management as the diagnosis, chief complaint and reason for visit, and took a brief weight history in pre-determined fields. The process took approximately 10 minutes. Second, if the patient was not known to be coming to the clinic for weight management, but weight management became the priority during the visit, the provider transitioned their note into the PATHWEIGH flow sheet. The use of the PATHWEIGH method was 100% optional and conventional note formats were always available. In the initial scenario above (preferred), conventional workflow was optimized because 1: the diagnosis of overweight or obesity is automated, 2: linkage to the weight-related comorbidities (ICD-10 codes E66-E66.9; Z76.89) was automated to optimize reimbursement, 3: key historical information captured prior to the clinician entering the room left maximal time for the clinician-patient conversation.

The tool itself: PATHWEIGH was built to capture a broad array of weight-related data in discrete fields. The flow sheet prompts the medical assistant and/or clinician to ask about history of weight gain and loss, goals and impact of weight on their health and quality of life. Specific questions for the initial and follow-up visits are outlined in table 1. Labs of interest (i.e. A1c, liver function tests, lipids and thyroid stimulating hormone (TSH)) within the past year automatically import

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Current standards of care recommend lifestyle counseling for patients with a BMI > 25 kg/m² focusing on increasing physical activity, caloric restriction and the avoidance of trans and saturated fats. Instruction on behavioral modification to achieve these goals is an essential, highly personalized aspect of weight management. Anti-obesity medication may be considered for those with a BMI > 30 kg/m² or > 27 kg/m² with weight related comorbidities. Bariatric surgery may be considered for those with a BMI > 40 kg/m² or > 35 kg/m² with weight related comorbidities.

**Outcomes**

The primary outcomes of interest for the pilot analyses were 1: weight loss, defined by the change in weight from the first (baseline) encounter of the patient to the last encounter of the patient during the study period, and 2: percent of patients losing > 5% weight loss, > 10% weight loss or > 15% weight loss (not mutually exclusive groups). Examination of the > 15% weight loss was exploratory as compared to > 5% and > 10% which are conventional for the approval of anti-obesity pharmacotherapy.

The secondary outcomes of interest were absolute and percent change in BMI, which used similar processes as the weight loss outcomes. Baseline values are defined as the first encounter for the patient during the data extraction period (January 1, 2018 through June 15, 2019).

Additionally, differences in baseline data were compared between groups including weight-related comorbidities (0 comorbidities, 1-2 comorbidities, 3-4 comorbidities, and ≥ 5 comorbidities; as well as specific comorbidities); labs of interest (hemoglobin A1c, alanine transaminase (ALT), aspartate aminotransferase (AST), high-density lipid (HDL) cholesterol, triglycerides, and thyroid stimulating hormone (TSH)); and percent using anti-obesity medication (full list of medication included in Supplementary table 2) or referred to bariatric surgery.

Because of the relatively short duration of the pilot, change in labs, comorbidities, medication use for comorbidities, quality of life, weight loss goals achieved or success with respect to weight loss maintenance were not analyzed.

**Statistical analysis**

**Statistics**

Following extraction from EPIC, data were managed in SAS 9.4 (Cary, NC). Descriptive statistics were used to compare baseline demographics, weight-related comorbidities, labs of interest, weight and BMI for the PATHWEIGH and SOC groups. T-tests and chi-square analyses were used to compare baseline demographics, weight-related comorbidities, 1-2 comorbidities, 3-4 comorbidities, and ≥ 5 comorbidities; as well as specific comorbidities; labs of interest (hemoglobin A1c, alanine transaminase (ALT), aspartate aminotransferase (AST), high-density lipid (HDL) cholesterol, triglycerides, and thyroid stimulating hormone (TSH)); and percent using anti-obesity medication (full list of medication included in Supplementary table 2) or referred to bariatric surgery.

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**Results**

A total of 471 patients (110 PATHWEIGH and 361 SOC) were included in the pilot study; however, 24 patients were removed due to only having one encounter during the specified study period. Hence, a total of 447 total patients were included in this analysis (109 PATHWEIGH and 338 SOC).

Approximately 10% of eligible patients (i.e. BMI > 25 kg/m²) had their weight prioritized at the time of their visits and this was not different between the PATHWEIGH and SOC clinics. The baseline demographic data are shown in table 2. Patients in the PATHWEIGH group were younger, more likely to be female and be commercially insured compared to the SOC group. There were no differences between the groups with respect to self-reported race or ethnicity. The groups were also comparable with respect to the number of self-reported...
weight-related comorbidities with the majority of patients in both groups diagnosed with 1-2 weight-related comorbidities (67% vs. 64%, PATHWEIGH vs. SOC, p = 0.57). Some differences were seen in the type of weight-related comorbidity reported (Table 3). Baseline A1c levels were statistically higher in the SOC vs. PATHWEIGH groups (Table 4) with no such differences observed for lipids, liver function tests, or TSH. The most common weight-related comorbidities reported at initiation of weight loss (Table 3) and differences in baseline demographics (Table 2) were comparable, but weight loss 8.0 ± 10.5 kg (7.3%) vs. 2.5 ± 10.7 kg (2.3%) was significantly greater in PATHWEIGH vs. SOC, respectively (p < 0.001). The percentage of patients losing > 5% (53 vs. 28%, p < 0.001), > 10% (32 vs. 16%, p < 0.001) or > 15% (18 vs. 6%, p < 0.001) body weight were greater in the PATHWEIGH patients vs. SOC patients (Figure 1). After adjusting for the patients’ age, sex, number of weight-prioritized clinic visits and insurance type at baseline, the difference in absolute and percent weight loss remained

Figure 1: Average weight loss (A) and percent losing >5%, >10% and >15% of baseline body weight (B) over an average follow-up of one year.
significantly different (and not materially changed) between the PATHWEIGH and SOC groups (p < 0.01 for both analyses). Anti-obesity medication was used in 79.8% of PATHWEIGH and 20.7% of SOC patients (p < 0.001; types queried shown in table 6), whereas the number of patients receiving a bariatric procedure (~ 10% for both, p = 0.99), was similar between groups. The use of anti-obesity medication or bariatric surgery was solely at the discretion of the clinician without prompting. The average length of follow-up was 352 days in the PATHWEIGH group and 363 days in the SOC group, during which time the average number of visits was 6.7 in the PATHWEIGH group and 2.9 in the SOC group.

**Discussion**

Findings from the current preliminary pilot study demonstrate the feasibility, and illustrate the potential utility, of approaches like PATHWEIGH; a workflow and disease state prioritization tool for chronic weight management in primary care. A highly time-efficient, no additional cost, integrated data capture tool was associated with 7.2% vs. 2.1% total body weight loss in clinics matched for provider expertise and patient demographics, as much as possible.

Though a high prevalence of obesity is seen in primary care, it remains undertreated and underdiagnosed [3]. To address these needs, PATHWEIGH was developed and tested the hypothesis that a simple flow sheet that prompts the clinician through a prioritized visit for weight management results in greater patient weight loss. Indeed, results support this hypothesis but likely relate to the higher use of anti-obesity medication in combination with lifestyle counseling rather than lifestyle counseling (or bariatric surgery) alone. Results are consistent with a systematic review that found physician counseling alone was unlikely to result in clinically meaningful weight loss without the addition of pharmacotherapy [8]. Importantly, patient contact was far more frequent in the PATHWEIGH group (6.7 vs. 2.9 visits over 1 year), which

### Table 4: Baseline labs of interest.

| Test                  | PATHWEIGH Mean (SD) | SOC Mean (SD) | p-value |
|-----------------------|---------------------|---------------|---------|
| Triglycerides (mg/dL) | 159.7 (101.1)       | 172.0 (100.9) | 0.40    |
| sample size           | 71                  | 147           |         |
| A1c (%)               | 5.8 (0.9)           | 7.0 (1.7)     | < 0.001 |
| sample size           | 62                  | 201           |         |
| HDL Cholesterol (mg/dL) | 45.5 (10.0)   | 45.0 (13.0)   | 0.78    |
| sample size           | 71                  | 147           |         |
| TSH (mIU/L)           | 3.0 (5.2)           | 2.6 (2.5)     | 0.42    |
| sample size           | 75                  | 168           |         |
| ALT (U/L)             | 21.9 (12.2)         | 24.0 (13.0)   | 0.57    |
| sample size           | 16                  | 48            |         |
| AST (U/L)             | 20.4 (7.5)          | 25.5 (13.7)   | 0.16    |
| sample size           | 16                  | 48            |         |

SOC = Standard of Care

### Table 5: Most common weight-related comorbidities reported with ICD-10 codes.

| Pulmonology                  | Obstructive sleep apnea- G47.33 |
|------------------------------|---------------------------------|
| Hypoventilation syndrome- R06.89 |
| Asthma- J45                  |
| Restrictive obstructive pulmonary disease- Z87.09 |

| Gastroenterology             | NAFLD- K76.0 |
|------------------------------|--------------|
| Steatosis- E76.0             |
| Steatohepatitis (NASH)- K75.81 |
| Cirrhosis- K74.60            |
| Cholelithiasis- K80          |
| Cholecystitis- K81           |
| GERD- K21                    |
| Hernias- K40, K41, K42, K43, K44, K45, K46 |
| Pancreatitis- K85            |
| Constipation- K59            |

| Gynecology and Urology       | Amenorrhea- N91 |
|------------------------------|-----------------|
| Infertility- N46, N97        |
| PCOS- E28.2                  |
| Stress Urinary incontinence- N39 |
| Gestational Diabetes- Q24   |
| Hirsutism- L68               |
| Erectile dysfunction- N52    |
| Pelvic prolapse- N81- cystocele, rectocele, uterine prolapse, vault prolapse |

| Renal                        | Proteinuria- R80 |
|------------------------------|-----------------|
| CKD- N18                     |

| Neurology and Musculoskeletal | Meralgia Paresthetica- G57 |
|-------------------------------|----------------------------|
| Carpal Tunnel Syndrome- G56   |
| Osteoarthritis- M17, M18, M19, M47 |
| Gout- M10                     |
| Immobility- Z74.09            |
| Low back pain- M54            |
| Pes planus- M21               |
| Knock knee deformity- M21     |
| Migraines- G43                |

| Skin                         | Striae Distensae- L90.6 |
|------------------------------|-------------------------|
| Cellulitis- L02, L03, H60, N61, K12 |
| Intertrigo- L30              |
| Carbuncles- L02.93           |
| Furunculosis- L02            |
| Hidradenitis suppurrative- L73.2 |
was at the discretion of the providers and underscores the importance of consistent follow-up. Future analyses will utilize the data from PATHWEIGH to derive probability estimates as to which patients are more likely to respond to which anti-obesity medication, increasingly guiding its users to provide personalized weight management in the primary care setting. Unlike most other prescription medications, however, utilization of anti-obesity medication must be accompanied by lifestyle changes for their positive benefits to be seen. Increasing evidence supports the feasibility of performing intensive behavioral therapy (IBT) in primary care [9-11]. Behavioral health providers integrated into primary care clinics are ideally positioned to support patients with overweight or obesity in making behavioral modifications that are necessary for sustained weight loss [12] and are an integral part of the PATHWEIGH program. Psychosocial factors that impact weight gain are often complex and multifaceted [12]. Behavioral health providers working alongside primary care providers can help in uncovering idiographic mechanisms that led to or have maintained overweight or obesity for patients [12], as well as tailor individualized health behavior goals to support lifestyle changes. Behavioral health is also equipped to manage comorbid conditions which can impact the success of traditional weight loss treatments, including: insomnia, depression, anxiety, binge eating, chronic pain, attention deficit hyperactivity disorder (ADHD) or other serious mental illnesses (e.g. bipolar, post-traumatic stress disorder) [12]. Inclusion of these comorbid conditions was integrated midway through this pilot analysis and will be carefully examined for their impact on weight in the evolution of PATHWEIGH (see mental health diagnoses table 3).

The results of the pilot analyses are promising in that patients were able to lose weight during the early test phase of PATHWEIGH. The most unique aspect of PATHWEIGH is the ability to have a data capture system that will increasingly guide care, making obesity management viable for time-constrained clinicians. EPIC is a widely utilized EMR in the U.S., thus the PATHWEIGH tool has great potential for easy dissemination to other medical practices that use EPIC could have great potential for dissemination. Further study is warranted to confirm the tool’s efficacy in a larger sample of practices with diverse patient and provider characteristics. Additionally, understanding how PATHWEIGH could be disseminated and implemented into different clinical and community contexts is needed. Nevertheless, PATHWEIGH was designed to be scalable and it overcomes the most basic barriers to weight management including documenting obesity as a disease, linking it to its comorbidities to address billing issues, utilizing medical assistant time to conserve clinician time and asking specific questions whose answers direct the weight management strategy. Future iterations of PATHWEIGH will include learning modules for clinic staff to understand the workflow and continuing medical education (CME)-accredited modules for clinicians to learn how to practice comprehensive obesity medicine. EPIC will be optimized to prompt clinicians and offer suggestions as to what may work for which patients, as well as include animations and video content relevant to specific patients and their barriers. Collectively, the approach will iterate to address the current barriers that exist.

Several limitations of the current work should be noted. First, this was a pilot study conducted in a single health care system in the Denver metro area. Therefore, the patients and providers may not necessarily represent patients and providers elsewhere. Second, the two clinics were matched for

Table 6: Anti-obesity medications queried.

| Obesity Medications       | Potential Trade Names |
|---------------------------|-----------------------|
| Phentermine               | Lomaira, Adipex, Fastin |
| Topiramate                | Topamax               |
| Orlistat                  | Xenical, Alli         |
| Phentermine/topiramate    | Qsymia                |
| Lorcaserin                | Belviq                |
| Buproprion/naltrexone     | Contrave              |
| Buproprion                | Wellbutrin IR/SR/XR   |
| Naltrexone                | Narcan                |
| Liraglutide 3.0           | Saxenda               |

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provider characteristics rendering some differences in patient characteristics, such as insurance status which could have led to healthy user bias. It should be noted however, ~ 80% of commercial insurance does not cover anti-obesity medication [4]. Sample size differed between groups (which could have been due to differences in patient volume between the clinics, total patients with BMI > 25 kg/m², weight prioritization or other) and patients at each site could have been at very different stages of their weight management. Comprehensive data on socioeconomic status was not collected. Additionally, baseline laboratory tests were not completed on everyone; however, the proportions of labs for each group (PATHWEIGH and SOC) were similar suggesting non-differential missingness (data not shown). Nevertheless, lack of patient randomization may have led to systematic differences affecting the results. Lastly, providers delivering the PATHWEIGH program may not be representative of like providers at large. Collectively, these limitations have led us to not over-interpret the current results, but rather view them as hypothesis-generating. A pilot study conducted in a different patient population may have led to entirely different results. Future studies will address these limitations to ensure generalizability of the results.

Conclusion

In conclusion, results from the current study support the notion that weight management can be done efficiently and effectively in primary care. Patients in the current study lost > 5% more body weight in PATHWEIGH vs. SOC with roughly half of the PATHWEIGH patients losing > 5% body weight, one-third losing > 10% body weight and nearly one-fifth losing > 15% body weight. Most importantly, the same flow sheet that leads clinicians through a patient visit for weight management captures data that will guide improvement in this process. Further, future analyses will examine predictors of weight loss maintenance, resolution of obesity-related complications and cost effectiveness, in addition to further validating the approach.

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