Medical Hypotheses 133 (2019) 109398

Contents lists available at ScienceDirect

Medical Hypotheses

journal homepage: www.elsevier.com/locate/mehy

Predicted economic damage from a quick, simple Alzheimer's disease cure

Leslie C. Norins

Alzheimer's Germ Quest, Inc., 4301 Gulfshore Blvd, Suite 1404, Naples, FL 34103, USA

A B S T R A C T

The estimated 5.8 million Alzheimer's disease patients in the U.S. require an enormous share of national healthcare expenditures. Other nations face similar economic burdens. There have been great efforts, thus far unsuccessful, to discover an effective therapeutic, with 1081 Alzheimer's disease drug trials completed as of May 2019. The pessimism thus engendered has forestalled contingency planning for the potential major economic repercussions of a simple, quick cure. Yet, promising new research spotlighting the possible "trigger" role of infectious agents might allow some or all cases of Alzheimer's disease to be halted, reversed, or prevented with an antibiotic or antiviral compound, possibly even one already approved by drug regulators for other uses. The sudden advent of such an unexpected therapy would theoretically have dramatic impacts, both detrimental and beneficial, on the American economy. The damages would include a $414 billion shrinkage of Medicaid, Medicare and other revenues to all six sectors comprising the healthcare provider category. Nursing homes and skilled nursing facilities are projected to suffer the greatest loss of annual revenue: $51 billion and $16 billion, respectively. This would cause the loss of an estimated 654,000 jobs. Facility mortgage and commercial loan repayments could stop. Other adverse consequences would include detrimental effects on reserves for Social Security and pensions, cutbacks in dementia research funding, and reduced donations to Alzheimer's disease advocacy groups. Insurance company reserves for fixed payment annuities already sold could be jeopardized. However, an Alzheimer's disease cure would also create economic beneficiaries. Medicare and Medicaid would save up to a projected $195 billion annually. Life insurance companies and unpaid caregivers would also benefit financially. By identifying the healthcare sectors likely to be detrimentally impacted by a simple, quick Alzheimer's disease cure, contingency plans can be made in the U.S. and other countries to assist the foreseeable painful transitions for staff and facilities.

Introduction

An estimated 5.7 million Americans were living with Alzheimer's disease (AD) as of 2018 [1]. It is the sixth-leading cause of death, with 121,528 people dying from this devastating illness in 2017 alone. AD also accounts for major healthcare expenditures, with medical and nursing outlays estimated at $290 billion [1]. This is greater than the annual budget of California ($261 billion), or New York and Texas combined ($268 billion) [2]. It consumes a formidable eight percent of the total U.S. healthcare expenditures of $3.5 trillion [3]. Worldwide, the estimated cost of AD and other dementias is $605 billion, or one percent of the global gross domestic product [4].

There has yet to be an effective curative therapy or preventive for AD, despite the urgent need for one and enormous efforts by researchers and pharmaceutical companies. Principal attention and significant monies have been invested in developing pharmaceuticals targeting brain amyloid-β [5]. Research funding has reached an all-time high; the 2019 fiscal year National Institutes of Health (NIH) budget for AD studies was estimated at $2.3 billion [6]. As of May 2019, 1081 AD trials of various therapeutics were marked as "completed", but there have been no reports of breakthroughs [7]. Yet the search is still on; as of May 2019, another 405 clinical trials were recruiting volunteers [8].

However, the prevailing frustration, and even pessimism, that permeates the quest for an effective AD therapy or preventive has postponed consideration of a quite different possibility—the sudden discovery of a simple, quick cure or preventive for AD. Likely this would be regarded as a medical miracle, especially by patients, their families, and the millions aging into the decades of life in which AD prevalence escalates.

Despite previous failures, the potential for producing a curative for AD is not unwarranted. For example, increased attention is now being paid to infectious agents as possible triggers or promoters of AD. Suggestive evidence is accumulating, with both preclinical and clinical studies implicating viruses [9–12], bacteria [10,13–15], parasitic one-celled eukaryotes [16], fungi [17], and prions [18] in AD. If one or more microorganisms is proven to be directly causative or to play a necessary role in AD, the path opens to a simple blood test for diagnosis, and repurposing or developing a curative anti-infective drug or preventive vaccine. Or perhaps a different causation mechanism will be revealed, leading to a simple, quick cure tailored to it.

But there has been little or no attention to the economic side effects of the unpredicted sudden arrival of an AD curative or preventive. U.S. data permit an instructive analysis. Much or all of the $290 billion currently received for AD-related matters in the U.S. would stop flowing to the behemoth medical infrastructure that supports the diagnosis and long-term care of this illness. The hypothesis presented here is that the

E-mail address: leslie.norins@alzgerm.org.

https://doi.org/10.1016/j.mehy.2019.109398
Received 26 July 2019; Received in revised form 10 September 2019; Accepted 13 September 2019

outright elimination of AD resulting from a simple, quick cure would be challenging, if not devastating, to certain now-comfortable sectors of healthcare which have become accustomed to providing care to millions of AD patients, in such settings as nursing homes, skilled nursing facilities, etc. These providers would suffer dramatic losses of revenue, which in turn would force drastic reductions in their staffs. The detrimental and beneficial ramifications to these and other economic sectors will be considered in this analysis.

Those sanguine about the proximity of a cure for AD will feel the type of economic calculations presented here are imperative, so that societal preparations can be made. Those more pessimistic about prospects for a therapeutic hopefully will view this theoretical analysis as at least a useful academic exercise in the applied economics of curing a chronic, ultimately fatal disease which is prevalent among millions of seniors.

Methodology used in evaluating hypothesis

For convenience in estimating the macroeconomic effects, two assumptions were made. The first is that the remedy is easy and convenient to administer, such as a bottle of pills or one injection in the doctor's office. The other assumption is that it works quickly to halt or reverse AD, on an outpatient basis. Another consideration is that some current AD patients will have already suffered extensive loss of cognition and functionality and may not benefit significantly from the new medication, potentially requiring a lifetime of long-term care. But this cohort is assumed to be relatively small, with no new patients entering this stage, and thus it is not considered further in this study. Finally, "cure" includes preventives as well.

The statistics presented on AD cases are only estimates, and projections from estimates, as there are several factors that are intrinsically difficult to define. For example, published source data often combined AD and "other dementias" (OD) into a single compilation "AD/OD" (Alzheimer's disease and other dementias). However, in this study, only a single, overall "AD" label was applied to all compilations and estimates, and it thus includes some unknown percentage of OD cases. These would likely not be helped by the new drug, which will lessen the cure's economic effect to some extent. However, AD has been estimated to comprise a significant portion (50–70 percent) of all dementias [19]. The imprecision introduced by the foregoing simplifications and other decisions made for this analysis is believed to be relatively small in comparison to the very large economic effects foreseeable. Finally, only the United States economic and healthcare systems, and statistics applicable to them, were considered. However, the general trends and challenges revealed will likely apply in varying degrees to many other countries as well.

Predicted detrimental economic consequences

Revenues slashed at healthcare facilities

In the event of a novel, simple, and fast-acting AD curative entering the market, there would be an expected significant loss in revenues for healthcare facilities and other providers. All six categories of providers (nursing homes, hospitals, skilled nursing facilities, medical providers, home healthcare, and hospice) are projected to suffer a loss of Medicare revenue. (Table 1) Of course, there would still remain other disorders/diseases to be treated as seniors age, so no category would shrink to zero.

Annually, each AD/OD patient requires $35632 more in Medicare payments than a non-AD patient, $44,633 versus $9001 [1]. As there are estimated to be 5.8 million patients with Alzheimer's and other dementias, in 2018 dollars the predicted total shrinkage of AD/OD-related payments via Medicare beneficiaries to the healthcare provider sector of the economy would be approximately $35,632 × 5.8 million, or an estimated $207 billion reduction [1]. (Table 1) Further, since Medicare is about 50% of total expenditures for AD/OD [1], we can double the Medicare number to estimate the total reduction from all revenue sources to healthcare providers and project an astounding $414 billion reduction.

Nursing home revenue will be hit hard

The potentially hardest hit of the long-term care (LTC) provider categories would be nursing homes. The Henry J. Kaiser Family Foundation estimates the number of residents in such facilities at about 1.35 million [2]. Centers for Disease Control and Prevention (CDC) statistics indicate about 50 percent of such patients carry the diagnosis of AD [20], and thus an AD cure would remove about 675,000 patients from nursing homes (we ignore those presently too far into cognitive decline to exit, but once they die they would not be replaced).

What revenue would be lost by nursing home operators if these presently occupied beds become empty within a short period, possibly a year or two—which we will consider as "overnight"—and there are no more AD patients arriving to replace them? There is no single number to assign to this contemplated lost per bed revenue, as much depends on the payor, and there is some geographic variation.

Medicaid is the principal payor, supplying 62–66 percent of their revenue [21]. The remainder comes from Medicare, insurance, private pay, and other sources. The national average Medicaid reimbursement per nursing home patient is $210 per day, which amounts to $76,000 of revenue annually [21]. A non-Medicaid patient, paying an average of $263 per day, provides $96,000 annually [21]. A conservative estimate of the loss of nursing home revenue following an AD cure was calculated by assuming the average Medicaid rate of about $76,000 annually is being paid for each of the 675,000 patients that may be removed from revenues. Multiplying these two numbers yields about $51 billion of annual revenue which would potentially be removed from the nursing home industry. (This is likely underestimating the monetary shrinkage, as about 45 percent of the estimated AD patients are paid from non-Medicaid sources, at a higher annual revenue each [21].)

This $51 billion decrease approximates the entire annual budget of Michigan ($56 billion) [22]. The total revenue estimated for all nursing homes in the U.S. in 2019 is projected to be $140 billion [23]. The projected disappearance of $51 billion is approximately 36 percent of that total. It is ten times the $5 billion 2018 revenue of the largest U.S. nursing home chain, Genesis Healthcare [24,25]. Thus, the predicted impact would be enormous.

Assisted living revenues will decrease

The expected disappearance of AD-affected residents would also have a sizable impact on residential care facilities, sometimes known as "assisted living." According to the CDC, 2016 data indicate residential care communities house 811,500 individuals, 340,830 of whom (42 percent) have AD [26]. Genworth Financial estimates the average 2018 cost of residing at an assisted living facility at $48,000 [27]. Multiplying this per-resident cost by the number of AD residents—whose beds will become unused—yields a projected annual revenue loss to the assisted living industry of an alarming $16.3 billion. This is more than triple the annual revenues posted in 2018 by Brookdale Senior Living ($4.53 billion), which operates more than 1100 senior living facilities nationwide, and is the largest senior living facility operator in the U.S. [28].

Hospitals will potentially lose the extra increment of annual revenue ($7654) they collect from an AD patient as compared to a non-AD senior [1]. However, hospital admissions are usually short-stay, and for most of these facilities, AD patients are not a major part of the hospital inpatient mix. Therefore, hospitals were not further considered.

Table 1
Projected U.S. annual payment shrinkage per provider category.[a]

Provider Type	Average Per-Person Annual Medicare Payment – AD/OD ($)	Average Per Person Annual Medicare Payment- Without AD/OD ($)	Additional Cost to Medicare per AD/OD Patient ($)	Total Annual Medicare Payments – U.S. AD/OD Patients ($ Billions) [c]	Total Annual Payment Shrinkage – U.S. AD/OD Patients-all Payors ($ Billions)[d]
Nursing Home	15,984	774	15,210	88	176
Hospital Inpatient	11,306	3652	7654	44	88
Skilled Nursing Facility	6977	477	6500	38	76
Medical Provider [b]	5728	3568	2160	13	26
Home Health Care	2578	374	2204	13	26
Hospice	2060	156	1904	11	22
Total	44,633	9001	35,632	207	414

[a] Data derived from 2019 Alzheimer's Facts and Figures, Alzheimer's Association. Medicare annual payments per patient 65+ years by types of providers (in 2018 dollars) [1].
[b] "Medical provider" includes physician, other medical provider and laboratory services, and medical equipment and supplies.
[c] Assumes 5.8 million Americans with AD/OD.
[d] Medicare is about 50% of total expenditures for Alzheimer's and other dementias, thus total reduction can be estimated by doubling the total annual Medicare payments.

Deleterious impact on healthcare employment

An AD curative which empties LTC beds would also adversely impact the employees of those facilities. Assuming that present staff-to-patient ratios are maintained, a significant number of jobs would be lost. To estimate these, we first identified the number of individuals employed by such entities, using the most currently available CDC data [20]. As shown in Table 2, there are an estimated 1.45 million "patient care" jobs, distributed among the five types of providers which comprise the LTC healthcare sector. Nursing homes and residential care facilities together account for the vast majority (85 percent) of these, the former for 66 percent and the latter for 19 percent. The other categories (adult day care, home health agency, and hospice) provide the rest.

With a significant number of AD patients residing in LTC facilities (as high as 48.5% in nursing homes), an AD cure would significantly impact employment at these facilities. The percentage of patients/residents diagnosed with AD/OD in each provider category is shown (Table 2). Again assuming that the staff-to-patient ratio remains unchanged, an AD cure would reduce employment in each category by that percentage. Thus, the number of employee layoffs can be predicted. An estimated 654,000 jobs will be lost across all five LTC options. The largest employee shrinkages would likely occur in nursing homes (461,700 jobs eliminated) and residential care communities (110,300 jobs lost).

Which categories of workers would theoretically be hit the hardest? The LTC patient care job universe of 1.45 million full-time-equivalent nursing employees is sub-divided into four classifications: registered nurses (RN), licensed practical nurses (LPN), licensed vocational nurses /LVN), and nursing aides (NA). Across all five categories of providers of LTC, approximately 105,000 RN jobs are projected to be lost, as would approximately 130,000 LPN/LVN jobs, assuming these workers are not transferred to other positions. (Table 3) But the biggest impact would be on NA jobs, as about 419, 000 positions would be eliminated.

Table 2
Projected patient care job losses in U.S. long-term care industry due to AD cure.[a]

Provider Category	Number of LTC Employees (0 0 0)	Patients/Residents Diagnosed with AD/OD (percent)	Employee Layoffs Predicted (0 0 0)
Nursing Home	952.1	48.5	461.7
Residential Care	278.6	39.6	110.3
Hospice	57.8	44.3	25.6
Home Health	143.6	34.7	49.8
Adult Day Care	20.7	31.9	6.6
Total	1452.8		654

[a] Data adapted from National Center for Health Statistics, 2013 [20].

Loss of spending power

With the predicted loss in jobs in the LTC sector due to an AD cure, there would be an accompanying loss in spending power, which may also impact the economy. The average annual pay for an RN in 2017 was $73, 550 and for an LPN/LVN, $45,710 [29]. The median salary for a nursing aide was $27, 520 [30]. Multiplying those wages by the projected loss of jobs in each AD care provider niche yields a potential reduction in spending power of $7.7 billion for RNs, $5.9 billion for LPNs/LVNs, and $11.5 billion for NAs, for a total of $25.1 billion. However, this theoretical shortfall in annual wages paid may not be fully realized as many workers will find new employment within a few months, and others will be eligible for unemployment compensation.

Other negative effects on the economy

Social security, pension, and annuity payouts extended

Although the beneficial health effects of an AD curative would be concentrated in the over-65 age group, overall the population would likely live longer. Therefore, actuarial tables of life expectancy would have to be extended. In financial terms, the per-person expected durations of Social Security payments and pension payments would have to be lengthened. This increased liability may add to recent concerns over underfunded pension funds and Social Security reserves.

There may also be problems for the companies which sold fixed payment annuities. Longer lives for seniors would extend the average number of payout years beyond those initially forecast. This could put pressure on the earnings and assets of such firms.

Research funding

Research activities would also be expected to undergo significant rearrangements. The 2019 NIH budget for AD is estimated at $2.3 billion [6]. Unless significant aspects of AD, such as the cause and mechanisms of damage, remain unsolved after the cure is found, these funds would be redirected to other illnesses or they would be otherwise available for medical research. It is likely that many scientists and facilities now working on AD would be able to refocus their talents, experience, techniques, and tools on alleviating other dementias and neurodegenerative diseases.

Advocacy groups

If AD is removed as a major threat, public interest, family activism,

Table 3
Predicted U.S. nursing layoffs due to Alzheimer's disease cure.[a]

Provider Category	Predicted Total Nursing Layoffs (0 0 0)	No. of RNs (0 0 0) (Percent)[b]	No. of LPNs/LVNs (0 0 0) (Percent)[b]	No. of Nursing Aides (0 0 0) (Percent)[b]
Nursing Home	461.7	54.0 (12)	105.7 (23)	301.2 (65)
Residential Care	110.3	8.4 (8)	11.3 (10)	90.6 (82)
Hospice	25.6	14.0 (55)	2.5 (10)	9.1 (36)
Home Health	49.8	27.1 (54)	9.5 (19)	13.2 (27)
Adult Day Care	6.6	1.3 (19)	0.7 (11)	4.6 (69)
Total	654.0	104.8	129.7	418.7

[a] Data adapted from CDC/NCHS, National Study of Long-Term Care Providers. Data from 2012 [20] (Appendix B).
[b] Percentages are relative to three presented providers (RN, LPN/LVN, Nurse's Aides). May not sum to 100 due to rounding.

and contributions for the disease would be expected to wane. The polio story is instructive. At one point in time, the National Foundation for Infantile Paralysis, and its "March of Dimes" fundraising had immense public recognition and played a crucial role in the research efforts to develop a polio vaccine. But after the vaccine essentially eliminated polio in the U.S., donations shrank, and the Foundation had to refocus for survival. Another example is the National Tuberculosis Association, so named in 1918. After the advent of antibiotics for the disease reduced U.S. cases, and eliminated the need for lengthy hospitalizations, public support dwindled. The group broadened its mission, and in 1973 changed its name to the American Lung Association. Similarly, perhaps, current AD advocacy groups could remain active by refocusing on other dementias and neurodegenerative diseases.

Predicted economic beneficiaries

Healthcare outlays reduced, benefiting government and patients

While eradicating AD will theoretically give rise to economic hardship for certain healthcare providers and employees, its elimination should also offer economic benefits by potentially removing staggering AD patient care expenditures from budgets. Such outlays continue to soar: 2019 total costs for caring for patients afflicted with AD and other forms of dementia are estimated to be at a record $290 billion [1]. An AD cure could save the government the combined $195 billion paid out annually by Medicare ($146 billion) and Medicaid ($49 billion) for patients with AD or OD [1]. Out-of-pocket spending of $63 billion related to AD would also be eliminated, as would $32 billion spent by other sources including private insurance carriers, health maintenance organizations, and other managed care organizations [1].

The preceding calculations do not include prescription medications. Presently, annual Medicare payments for prescription medicines are $498 higher for an Alzheimer's patient, $3503, than for a non-Alzheimer's patient, $3005 [1]. However, it is difficult to predict what the annual cost of an AD curative might be. It could be relatively high-priced, which would raise Medicare expenditures for this category. Yet, the pharmaceutical manufacturers might, with some justification, argue that the pill's high cost is reasonable when viewed against its benefits, as it would eliminate present outlays of $197 billion for other Medicare services related to AD [1].

Insurance industry

Life insurance companies would potentially benefit greatly if an AD cure is introduced. The life expectancies of seniors would increase, thus delaying the time when life insurance benefits must be paid to survivors. Companies offering LTC policies would find the projected AD payouts deferred or eliminated, because of the AD admissions to LTC avoided. These changes would allow more time for company investments to earn money. Those increased earnings may be allotted to profit, reserves, or be passed through to policyholders and potential customers in the form of lower annual premiums.

Unpaid caregivers would benefit

Caregiving and financial AD burdens would be lifted from families. Before AD patients enter nursing homes or memory care/assisted living, and sometimes until their final days or death, many are cared for at home for months or years by spouses and other family members. Though unpaid, these efforts take a toll on the caregivers' time, strength, and possibly physical and mental health. The Alzheimer's Association estimated this annual uncompensated care in 2019 at 18.5 billion hours, and its value at $234 billion [1]. Caregivers and patients would also benefit from the elimination of the out-of-pocket expenses and insurance co-pays incurred before admission to a residential care facility.

Conquest of AD would also allow a return to the workforce of any of the estimated 16 million uncompensated caregivers who need or desire to do so, thus increasing the number of Americans seeking employment. At the same time, those already employed may be able to work more productively, freed from the time, effort, and mental burdens of caregiving. Overall, family discretionary incomes may rise.

Discussion

There have been so many expensive failures of clinical trials of putative treatments for AD that pessimism about finding a cure is becoming widespread. It is sometimes forgotten that rare events, "Black Swans", can indeed occur, despite their low probability [31]. The history of medicine offers many instances of unlikely breakthroughs, and even lone investigators can unexpectedly discover causes and cures for diseases.

With the enormous ongoing effort by the pharmaceutical industry and other researchers in the AD space, it is possible that a quick, simple cure for AD could be found sooner than commonly supposed, through brilliant research insights or even serendipity. For example, the building scientific evidence for infectious agents playing a role in AD is very promising, and a rapid, simple cure effective against one of these microbes may be discovered. Other possibilities for a therapy are also being investigated.

The financial adjustments which follow a quick, simple cure for AD will likely be major. However, this possibility has received no prior consideration in AD circles, as far as could be determined. Yet, several important healthcare sectors have come to depend upon revenues from AD care for significant portions of their income. Their financial well-being would be threatened if the envisioned cure suddenly arrives.

Importantly, there are historical precedents for this economic impact theory. Medical history reveals that such remedies for major diseases can occasionally appear unexpectedly or with only brief advance notice. Within the last century we have experienced the unpredicted mass introduction of rapid cures for illnesses; all have dramatically impacted the healthcare system at their advent. Three notable ones involved infectious diseases that were widespread. For example, during the 18th and 19th centuries, tuberculosis "treatment" consisted of lengthy hospitalization or prolonged quasi-quarantine in sanatoria. Surgery to collapse infected lungs, to "rest" them, also became popular

[32]. But with the introduction of antibiotics — streptomycin in 1945 and later, isoniazid — long-term medical care and thoracic surgery were eliminated, emptying out full sanatoria and hospital wards filled with tuberculosis patients.

Also, during the 1940s, treatment of syphilis changed dramatically. What was once considered "rapid treatment" — prolonged intravenous therapy — at 3000 locations, using arsenic compounds which had dangerous side effects, was replaced by simple penicillin injections [33].

Polio provides another example. Beginning in 1955, the widespread use of the Salk vaccine to prevent the disease dried up the formerly-significant and frightening seasonal flow of paralyzed patients into hospitals and physical therapy centers [34]. Iron-lung machines became surplus and paralysis rehabilitation facilities closed or switched focus to problems other than polio.

Likewise, it is predicted here that an AD simple cure would detrimentally slash healthcare revenues to providers, while saving monies for payors. All six major categories of healthcare providers would be impacted, with an astounding $414 billion potential reduction of Medicare and other payments. Nursing homes and skilled nursing facilities would likely face the greatest economic damage. In addition to the financial impact on these businesses, employee jobs would be sliced, with a projected 654,000 potential layoffs across all LTC constituents. The expected loss of jobs would generate major national concerns, especially as many of these jobs provide employment for groups on lower rungs of the economic ladder. Detrimental ripples in other sectors would include unanticipated extended payouts for reserves of Social Security and pensions, shifts in research funding to other areas, and a loss of jobs within advocacy groups.

There would, however, be economic beneficiaries from this transition. Medicare and Medicaid would see huge reductions in outlays, saving the government a combined $195 billion paid out annually by them. Patients would save $63 billion in out-of-pocket expenses. Along with this, unpaid caregivers, who provided annual uncompensated care in 2019 valued at $234 billion, would benefit from having an opportunity to increase their participation in the workforce or enjoy more unstressed leisure time with loved ones. An estimated 16 million uncompensated caregivers would potentially return to the workforce. An additional $32 billion spent by other sources such as health maintenance organizations and private insurance carriers would be cut. Payouts from LTC policies would be deferred or eliminated due to fewer AD patients, benefiting the insurers.

The assumptions and calculations made in this presentation were necessarily inexact. Available source data was predominantly AD/OD rather than just AD. Another consideration is that there is a lack of consensus by specialists on guidelines for detection and confirmation of the earliest signs of AD, and therefore the number of relevant cases may be inexact [35]. Also, in general, for many AD patients the accuracy of office diagnosis is not aided by highly informative positron-emission tomography (PET) imaging, but is based on cognitive loss and/or memory testing. Even if a PET scan is done, interpretations may vary among experts [36,37]. However, the big-picture trends and data presented here are believed sufficiently useful to aid in constructive planning for the advent of an AD cure.

The applicability of these projections to other countries will also depend on how exactly their systems for dementia healthcare resemble those in the U.S. But hopefully the calculations herein will provide at least an alert to them that significant economic effects will likely follow an AD cure.

The U.S. economy has been challenged before by major upheavals in the economy due to job loss/gain and has coped well in some cases, and not in others. For example, coal mining jobs were reported to drop 191,000 from September 2014 to May 2016 [38]. The domestic steel industry likewise declined from 100,894 jobs in 2008 to 81, 063 jobs in 2017, with displaced workers mostly being absorbed into the economy [39].

Demobilization of World War II troops flooded the job market with discharged soldiers, bringing 10.5 million adults back into the job market and peacetime economy. Plans for demobilization were being considered as early as 1942 — three years before the end of the war—when nothing was certain [40]. Yet, there was an expectation, or at least hope, for victory, and a plan for that future was deemed warranted. The result, to at least some extent aided by that planning, was the successful transition of millions of veterans into various civilian sector jobs when the war ended.

Similarly, it would be prudent to begin contingency planning for the possible, though far from certain, eventuality that a fast-acting, simple cure for AD is found. Its widespread introduction would have enormous detrimental effects throughout the LTC economic complex, with whole sectors and groups losing patients and revenues. Facilities, to lessen or avoid economic damage, would need to fill the gaps with patients, residents, or services in other categories beyond AD/dementia. Possibilities include creation or expansion of assisted living and senior life communities.

The expected impending job loss may be cushioned, at least somewhat, with a successful transition to new employment for nurses, nursing aides, and other staff who are currently devoted in whole or in part to AD patients. The general increase in the aging population will bring a concomitant rise in geriatric ills, which may provide alternative work possibilities. Newer phenomena, such as the "aging in place" movement, may raise demand for workers in home health services.

Finally, it appears to be time for a taskforce of government officials, business executives, healthcare economists, and other stakeholders to produce a plan, even if theoretical, to cope with predictable economic effects of a quick and easy cure for AD. This medical miracle could arrive sooner than anyone expects.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

My thanks to Dana Barberio, MS, Scientific/Medical writer, for her assistance in editing and writing.

References

[1] Alzheimer's Association (2019). Alzheimer's Disease Facts and Figures. Alzheimer's Dement 2019;15(3):321–87.
[2] Henry J Kaiser Family Foundation, State Health Facts: Total State Expenditures (in Millions) 2017 [updated January 5, 2017]. Available from: https://www.kff.org/other/state-indicator/total-state-spending/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D.
[3] Centers for Medicare and Medicaid Services, NHE Fact Sheet 2019 [updated April 26, 2019]. Available from: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NHE-Fact-Sheet.html.
[4] Alzheimer's.Net: 2017 Alzheimer's Statistics 2018. Available from: https://www.alzheimers.net/resources/alzheimers-statistics/.
[5] Cummings J, Lee G, Ritter A, Zhong K. Alzheimer's disease drug development pipeline: 2018. Alzheimer's Dement (NY) 2018;4:195–214.
[6] NIH, Research Portfolio Online Reporting Tools: Estimates of Funding for Various Research, Condition, and Disease Categories (RCDC) [updated April 19, 2019]. Available from: https://report.nih.gov/categorical_spending.aspx.
[7] ClinicalTrials.gov, Completed Studies: Alzheimer's Disease 2019 [updated May 12, 2019]. Available from: https://clinicaltrials.gov/ct2/results?cond=Alzheimer+Disease&Search=Apply&recrs=e&age_v=&gndr=&type=&rslt=.
[8] ClinicalTrials.gov, Recruiting Studies: Alzheimer's Disease 2019 [updated May 12, 2019]. Available from: https://clinicaltrials.gov/ct2/results?cond=Alzheimer+Disease&Search=Apply&recrs=a&age_v=&gndr=&type=&rslt=.
[9] Fulop T, Itzhaki RF, Balin BJ, Miklossy J, Barron AE. Role of microbes in the development of Alzheimer's disease: state of the art – an international symposium presented at the 2017 IAGG congress in San Francisco. Front Genet 2018;9:362.
[10] Harris SA, Harris EA. Herpes simplex virus type 1 and other pathogens are key causative factors in sporadic Alzheimer's disease. J Alzheimers Dis

2015;48(2):319–53.
[11] Readhead B, Haure-Mirande JV, Funk CC, et al. Multiscale analysis of independent Alzheimer's cohorts finds disruption of molecular, genetic, and clinical networks by human herpesvirus. Neuron 2018;99(1). 64–82 e7.
[12] Itzhaki RF. Corroboration of a major role for herpes simplex virus type 1 in Alzheimer's disease. Front Aging Neurosci 2018;10:324.
[13] Miklossy J. Historic evidence to support a causal relationship between spirochetal infections and Alzheimer's disease. Front Aging Neurosci 2015;7:46.
[14] Balin BJ, Hammond CJ, Little CS, et al. Chlamydia pneumoniae: an etiologic agent for late-onset dementia. Front Aging Neurosci 2018;10:302.
[15] Singhrao SK, Harding A, Poole S, Kesavalu L, Crean S. Porphyromonas gingivalis periodontal infection and its putative links with Alzheimer's disease. Mediat Inflamm 2015;2015:137357–8.
[16] Mahmoudvand H, Sheibani V, Shojaee S, et al. Toxoplasma gondii infection potentiates cognitive impairments of Alzheimer's disease in the BALB/c mice. J Parasitol 2016;102(6):629–35.
[17] Alonso R, Pisa D, Aguado B, Carrasco L. Identification of fungal species in brain tissue from Alzheimer's disease by next-generation sequencing. J Alzheimers Dis 2017;58(1):55–67.
[18] Watts JC, Prusiner SB. β-Amyloid prions and the pathobiology of Alzheimer's disease. Cold Spring Harb Perspect Med 2018;8(5):a023507.
[19] Plassman BL, Langa KM, Fisher GG, et al. Prevalence of dementia in the United States: the aging, demographics, and memory study. Neuroepidemiology 2007;29(1–2):125–32.
[20] Harris-Kojetin L, Sengupta M, Park-Lee E, et al. Long-Term Care Providers and services users in the United States: data from the National Study of Long-Term Care Providers, 2013-2014. Vital Health Stat 2016;3(38):1–105.
[21] National Investment Center for Seniors Housing & Care (NIC), Skilled Nursing Data Report: Key Occupancy and Revenue Trends 2019. Available from: https://info.nic.org/hubfs/Skilled%20Nursing/NIC_Skilled_Nursing_Report_4Q2018.pdf.
[22] Senate Fiscal Agency, FY 2017-18 Appropriations Report Part II – Initial Appropriations 2017. Available from: www.senate.michigan.gov/SFA/Publications/Approps/Initial2018.pdf.
[23] IBIS World, Nursing Care Facilities Industry in the US: Industry Market Research Report 2019 [updated February 2019]. Available from: https://www.ibisworld.com/industry-trends/market-research-reports/healthcare-social-assistance/nursing-residential-care-facilities/nursing-care-facilities.html.
[24] Genesis, Earnings Release 2018 [updated March 18, 2019]. Available from: http://www.genesishcc.com/investor-relations/earnings-release/ctl/readgenesis/mid/3761/articleid/234.
[25] Stempniak M. (2018) Genesis Leads in New Analysis of Nursing Home Chains 2018 [updated October 26, 2018]. Available from: https://www.mcknights.com/news/genesis-leads-in-new-analysis-of-nursing-home-operators/.
[26] Caffrey C, Sengupta M. Variation in residential care community resident characteristics, by size of community: United States, 2016. NCHS Data Brief 2018(299):1–8.
[27] Genworth, Cost of Care Survey 2018. 2019. Available from: https://www.genworth.com/aging-and-you/finances/cost-of-care.html.
[28] Brookdale Senior Living, Brookdale Makes Further Progress on Turnaround Strategy Announced in Early 2018; Announces Fourth Quarter and Full Year 2018 Results 2019. Available from: https://brookdaleseniorlivinginc.gcs-web.com/static-files/5957c26d-3572-4dbd-9159-863368e2e3f9.
[29] U.S. News. Registered Nurse Salary 2019. Available from: https://money.usnews.com/careers/best-jobs/registered-nurse/salary.
[30] U.S. News and World Reports. Nursing Aide Salary. 2019. Available from: https://money.usnews.com/careers/best-jobs/nursing-aide/salary.
[31] Taleb N. The Black swan: the impact of the highly improbable. New York, NY, US: Random House; 2007.
[32] Frith J. History of Tuberculosis. Part 2 – the Sanatoria and the Discoveries of the Tubercle Bacillus. J Mil Veterans Health 2014;22(2):36–41.
[33] Tampa M, Sarbu I, Matei C, Benea V, Georgescu SR. Brief history of syphilis. J Med Life 2014;7(1):4–10.
[34] Baicus A. History of polio vaccination. World J Virol 2012;1(4):108–14.
[35] Vos SJ, Verhey F, Frolich L, et al. Prevalence and prognosis of Alzheimer's disease at the mild cognitive impairment stage. Brain 2015;138(Pt 5):1327–38.
[36] Salvado G, Molinuevo JL, Brugulat-Serrat A, et al. Centiloid cut-off values for optimal agreement between PET and CSF core AD biomarkers. Alzheimers Res Ther 2019;11(1):27.
[37] Morris E, Chalkidou A, Hammers A, Peacock J, Summers J, Keevil S. Diagnostic accuracy of (18)F amyloid PET tracers for the diagnosis of Alzheimer's disease: a systematic review and meta-analysis. Eur J Nucl Med Mol Imaging 2016;43(2):374–85.
[38] Jeffrey TP. CNSNews.com. U.S. Has Lost 191,000 Mining Industry Jobs Since September 2014 [updated May 6 2016]. Available from: https://www.cnsnews.com/news/article/terence-p-jeffrey/us-has-lost-191000-mining-jobs-september-2014.
[39] Bureau of Labor Statistics. Quarterly Census of Employment and Wages 2019 [updated May 13, 2019]. Available from: https://data.bls.gov/timeseries/ENUUS0001053311.
[40] Internet Archive. United States. National resources planning board. National resources development report for 1943 [updated November 26, 2008] Available from: https://archive.org/details/unitedstatesnatires1943rich.