Morgans IN ALLIANCE WITH CIMB

ResApp Health

What's in a cough

ADD

Current price:	A$0.31
Target price:	A$0.48
Previous target:	A$
Up/downside:	54.8%
Reuters:	RAP.AX
Bloomberg:	RAP AU
Market cap:	US$155.0m
	A$204.3m
Average daily turnover:	US$0.38m
	A$0.50m
Current shares o/s	659.0m
Free float:	90.2%

- RAP is a digital healthcare company with innovative technology diagnosing a range of respiratory conditions. RAP's solution provides a quantitative and objective diagnostic system which is both scalable and cost effective using only a smartphone with no additional hardware/accessories required.
- RAP are looking to form partnerships with the major Telehealth companies and we forecast this will generate revenue in FY18.
- There are a number of near-term catalysts including the top line results from a major respiratory study where 1,245 patients have been enrolled at three major hospitals in the US. The top line results are due in late July. Assuming the results are positive submissions will be made to the US and European regulators where clearances are expected in the next six months.
- We initiate on RAP with an Add recommendation and price target of A$0.48 noting an investment in RAP is appropriate for investors with a higher risk profile.

Source: Bloomberg

Price performance	1M	3M	12M
Absolute (%)	3.3	-15.1	6.9
Relative (%)	1.7	-13.4	-3.9

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Digital healthcare to diagnosis a range of respiratory conditions

RAP is a digital healthcare company involved in the R&D and commercialisation of medical technology to diagnose and monitor a range of respiratory diseases. RAP's growth strategy is premised on obtaining the necessary regulatory approvals and subsequent rollout and commercialisation of its platform. RAP has developed a series of algorithms which read and interpret these cough signals in order to diagnose a range of acute and chronic respiratory conditions. RAP's solution provides a quantitative and objective diagnostic system which is both scalable and cost effective.

Telehealth groups likely to provide first revenue

There are a number of revenue opportunities available to RAP including: Telehealth partnerships; use in a clinical setting either in the emergency department or at the GP; a lower cost offering in the developing world working through the non-governmental organisations (NGO); and a direct to consumer offering. We believe the Telehealth channel is the most obvious and near-term opportunity once the relevant regulatory clearances are achieved.

Catalysts are near term

There are a number of key catalysts expected over the next 6 months including top-line study results of the US based SMARTCOUGH-C trial and CE Mark and FDA clearances. To listen to a presentation from CEO Tony Keating click here.

Investment view – initiating with an Add and $0.48 price target

We initiate RAP on an Add recommendation and A$0.48 price target. Key strengths include: 1) clinical study results to date are positive, 2) the technology is cost effective and easily scalable, 3) large addressable markets can be accessed through Telehealth partnerships, and 4) near term catalysts will drive investor interest. Key risks to our price target relate to the success of the upcoming clinical trial which therefore determines the likelihood of securing the necessary FDA regulatory clearance.

Financial Summary	Jun-15A	Jun-16A	Jun-17F	Jun-18F	Jun-19F
Revenue (A$m)	0.15	0.00	0.00	1.00	7.50
Operating EBITDA (A$m)	(0.51)	(3.29)	(12.39)	(7.53)	(1.24)
Net Profit (A$m)	(0.51)	(3.33)	(12.67)	(7.63)	(1.36)
Normalised EPS (A$)	(0.002)	(0.005)	(0.019)	(0.011)	(0.002)
Normalised EPS Growth		119%	274%	(43%)	(82%)
FD Normalised P/E (x)	NA	NA	NA	NA	NA
DPS (A$)	-	-	-	-	-
Dividend Yield	0%	0%	0%	0%	0%
EV/EBITDA (x)	NA	NA	NA	NA	NA
P/FCFE (x)	NA	NA	NA	NA	NA
Net Gearing	(95%)	(86%)	(149%)	(105%)	(94%)
P/BV (x)	15.83	12.53	60.45	37.30	48.87
ROE	(24%)	(33%)	(130%)	(167%)	(27%)
% Change In Normalised EPS Estimates					
Normalised EPS/consensus EPS (x)					

SOURCE: MORGANS, COMPANY REPORTS

Figure 1: Financial summary

Income statement	FY15A	FY16A	FY17F	FY18F	FY19F	FY20F
Total revenue	**0.2**	**0.0**	**0.0**	**1.0**	**7.5**	**19.6**
EBITDA	**-0.5**	**-3.3**	**-12.4**	**-7.5**	**-1.2**	**10.5**
Associate income	0.0	0.0	0.0	0.0	0.0	0.0
Depreciation	0.0	0.0	0.0	0.0	0.0	0.0
EBITA	-0.5	-3.3	-12.4	-7.5	-1.2	10.5
Amortisation/impairment	0.0	0.0	0.0	0.0	0.0	0.0
EBIT	**-0.5**	**-3.3**	**-12.4**	**-7.5**	**-1.2**	**10.5**
Net interest expense	0.0	0.0	-0.3	-0.1	-0.1	-0.1
Pre-tax profit	-0.5	-3.3	-12.7	-7.6	-1.4	10.4
Income tax expense	0.0	0.0	0.0	0.0	0.0	0.0
After-tax profit	-0.5	-3.3	-12.7	-7.6	-1.4	10.4
Minority interests	0.0	0.0	0.0	0.0	0.0	0.0
NPAT	**-0.5**	**-3.3**	**-12.7**	**-7.6**	**-1.4**	**10.4**
Significant items	0.0	0.0	0.0	0.0	0.0	0.0
NPAT post abnormals	**-0.5**	**-3.3**	**-12.7**	**-7.6**	**-1.4**	**10.4**

Cash flow statement	FY15A	FY16A	FY17F	FY18F	FY19F	FY20F
EBITDA	-0.5	-3.3	-12.4	-7.5	-1.2	10.5
Change in working capital	0.1	0.9	4.0	-1.4	-0.5	-1.0
Net interest (pd)/rec	0.0	0.0	-0.3	-0.1	-0.1	-0.1
Taxes paid	0.0	0.0	0.0	0.0	0.0	0.0
Other oper cash items	0.0	0.0	0.0	0.0	0.0	0.0
Cash flow from ops (1)	**-0.4**	**-2.4**	**-8.7**	**-9.0**	**-1.9**	**9.5**
Capex (2)	0.0	0.0	0.0	0.0	0.0	0.0
Disposals/(acquisitions)	0.0	0.0	0.0	0.0	0.0	0.0
Other investing cash flow	-0.2	0.0	0.0	0.0	0.0	0.0
Cash flow from investing (3)	**-0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Incr/(decr) in equity	4.9	13.1	0.0	10.0	0.0	2.8
Incr/(decr) in debt	0.0	0.0	0.0	0.0	0.0	0.0
Ordinary dividend paid	0.0	0.0	0.0	0.0	0.0	0.0
Preferred dividends (4)	0.0	0.0	0.0	0.0	0.0	0.0
Other financing cash flow	-0.2	-1.1	0.0	0.0	0.0	0.0
Cash flow from fin (5)	**4.7**	**12.0**	**0.0**	**10.0**	**0.0**	**2.8**
Forex and disc ops (6)	0.0	0.0	0.0	0.0	0.0	0.0
Inc/(decr) cash (1+3+5+6)	**4.1**	**9.6**	**-8.7**	**1.0**	**-1.9**	**12.3**
Equity FCF (1+2+4)	-0.4	-2.4	-8.7	-9.0	-1.9	9.5

Balance sheet	FY15A	FY16A	FY17F	FY18F	FY19F	FY20F
Cash & deposits	4.1	13.7	5.0	6.0	4.2	16.4
Trade debtors	0.1	0.1	0.0	0.0	0.3	0.8
Inventory	0.0	0.0	0.0	0.1	0.4	1.0
Other current assets	0.6	0.0	0.0	0.0	0.0	0.0
Goodwill	0.0	0.0	0.0	0.0	0.0	0.0
Other intangible assets	0.0	2.4	2.4	2.4	2.4	2.4
Fixed assets	0.0	0.0	0.0	0.0	0.0	0.0
Investments	0.0	0.0	0.0	0.0	0.0	0.0
Other assets	0.0	0.0	0.0	0.0	0.0	0.0
Total assets	**4.8**	**16.3**	**7.5**	**8.6**	**7.3**	**20.6**
Short-term borrowings	0.0	0.0	0.0	0.0	0.0	0.0
Trade payables	0.5	0.2	4.1	2.8	2.9	3.0
Long-term borrowings	0.0	0.0	0.0	0.0	0.0	0.0
Other term liabilities	0.0	0.0	0.0	0.0	0.0	0.0
Other liabilities	0.0	0.0	0.0	0.0	0.0	0.0
Total liabilities	**0.5**	**0.2**	**4.1**	**2.8**	**2.9**	**3.0**
Share capital	0.0	4.0	21.5	21.5	31.5	31.5
Other reserves	0.0	0.0	1.3	1.3	1.3	1.3
Retained earnings	0.0	-3.5	-6.7	-19.4	-27.0	-28.4
Other equity	0.0	0.0	0.0	0.0	0.0	0.0
Total equity	0.0	0.5	16.0	3.4	5.8	4.4
Minority interest	0.0	0.0	0.0	0.0	0.0	0.0
Total shareholders' equity	**0.0**	**0.5**	**16.0**	**3.4**	**5.8**	**4.4**
Total liabilities & SE	**1.0**	**16.3**	**7.5**	**8.6**	**7.3**	**20.6**

Valuation metrics			
Share price	**$0.31**	**Target**	**$0.48**
DCF valuation inputs			
Rf	4.00%	10-year rate	4.00%
Rm-Rf	5.00%	Margin	2.0%
Beta	1.70	Kd	4.20%
CAPM (Rf+Beta(Rm-Rf))	12.5%	Ke	12.5%
		NPV cash flow (A$m)	392.3
Equity (E/EV)	100.0%	Minority interest (A$m)	0.0
Debt (D/EV)	0.0%	Net debt (A$m)	0.0
Interest rate	4.20%	Investments (A$m)	0.0
Tax rate (t)	30.0%	Equity market value (A$m)	392.3
WACC	12.5%	Diluted no. of shares (m)	814.1
		DCF valuation	**$0.48**

Multiples	FY15A	FY16A	FY17F	FY18F	FY19F	FY20F
Enterprise value (A$m)	256.5	266.1	257.4	258.4	256.5	268.8
EV/Sales (x)	1702.7	na	na	258.4	34.2	13.7
EV/EBITDA (x)	-500.8	-80.9	-20.8	-34.3	-206.7	25.5
EV/EBIT (x)	-500.8	-80.9	-20.8	-34.3	-206.7	25.5
PE (x)	**-132.2**	**-60.4**	**-16.1**	**-28.1**	**-157.7**	**24.2**
PEG x)	n.a.	-0.5	-0.1	-0.7	-1.9	0.0

Per share data	FY15A	FY16A	FY17F	FY18F	FY19F	FY20F
No. shares	219.3	648.8	659.0	659.0	692.4	692.4
EPS (cps)	-0.2	-0.5	-1.9	-1.1	-0.2	1.3
Dividend per share (c)	0.0	0.0	0.0	0.0	0.0	0.0
Dividend payout ratio (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dividend yield (%)	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Growth ratios	FY15A	FY16A	FY17F	FY18F	FY19F	FY20F
Sales growth	na	-100.0%	na	na	650.0%	161.3%
Operating cost growth	na	396.4%	276.6%	-31.2%	2.5%	3.8%
EBITDA growth	na	542.5%	276.6%	39.3%	83.5%	948.7%
EBITA growth	na	542.5%	276.6%	39.3%	83.5%	948.7%
EBIT growth	na	542.5%	276.6%	39.3%	83.5%	948.7%
NPAT growth	na	548.2%	280.2%	39.8%	82.1%	867.4%
Normalised EPS growth	n.a.	119.1%	274.3%	42.7%	82.1%	752.7%

Operating performance	FY15A	FY16A	FY17F	FY18F	FY19F	FY20F
Asset turnover (%)	1.6	0.0	0.0	3.1	23.6	35.1
EBITDA margin (%)	-340.0	na	na	-752.6	-16.5	53.7
EBIT margin (%)	-340.0	na	na	-752.6	-16.5	53.7
Net profit margin (%)	-341.3	na	na	-762.6	-18.2	53.3
Return on net assets (%)	-105.6	-20.5	-366.7		-105.6	-20.5
Net debt (A$m)	-4.1	-13.7	-5.0	-6.0	-4.2	-16.4
Net debt/equity (%)	-844.9	-85.6	-148.6	-104.9	-94.5	-93.0
Net interest/EBIT cover (x)						
Invested capital	-3.5	3.2	2.3	-1.6	-0.3	0.2
ROIC (%)	14.7	-103.6	-548.1	464.5	486.8	4321.4

Internal liquidity	FY15A	FY16A	FY17F	FY18F	FY19F	FY20F
Current ratio (x)	9.8	62.6	1.2	2.2	1.7	6.1
Receivables turnover (x)	4.6	0.0	0.0	48.7	42.9	35.2
Payables turnover (x)	2.7	9.3	5.8	2.5	3.1	3.1

SOURCE: MORGANS RESEARCH, COMPANY

What's in a cough

What do they do?

RAP is a medical technology company specialising in the development of diagnostic test and management tools for respiratory disease. RAP own the exclusive worldwide license to the machine learning technologies developed by Associate Professor Udantha Abeyratne at The University of Queensland. The technology requires no additional hardware and uses the in-built microphone in smartphones to read signatures in cough sounds and instantly diagnose an array of respiratory disease. The initial development was funded by The Gates Foundation and has patent applications filed in the US, Australia, Europe, China, Japan and South Korea.

Investment highlights

- **Objective, evidence based, non-invasive system** – to assist in the diagnosis and management a range of respiratory disease/infections.
- **Easily scalable and cost effective solution** – that can be delivered at low cost to a large population.
- **Repeatable, reliable test** with a high demonstrated diagnostic accuracy of >90%.
- **Large market size** – 700m+ p.a. doctor visits for respiratory disease globally (OECD estimates). 334m people have asthma (17.7m in US, 30m in Europe, 2.3m in Australia), 65m people have moderate to severe Chronic Obstructive Pulmonary Disease (COPD).
- **Multiple channels –** RAP is targeting four main market segments being telehealth, clinical use, developing world, and direct to consumer.
- **Clear regulatory pathway and commercialisation plans** – a FDA de novo submission is targeted for 3QCY17 after pivotal US clinical study "SMARTCOUGH-C" top-line results are received in July 2017. RAP aim a commercial launch by partnering with US telehealth players in the beginning of 2018 with a potential parallel rollout across European, Australian and Asian markets.
- **Strong patent portfolio** with US, European, Chinese, Australian, Japan, and Korean patent applications for its core method and apparatus for processing patient sounds.
- **News flow and catalysts pending to drive investor interest** – over the next 6 months there are a number of key catalysts; top line results from the SMARTCOUGH-C trial, CE mark and FDA clearance for its paediatric application.

Understanding RAP's technology

An excerpt from *"How it works"* - *ResApp*

RAP's technology is based on the premise that cough and breathing sounds carry vital information on the state of the respiratory tract. The tool is able to diagnose and measure the severity of a wide range of chronic and acute diseases such as pneumonia, asthma, bronchiolitis and COPD.

Typically, doctors use stethoscopes to listen to the lungs as the first indication of a respiratory problem. The information available from these sounds is compromised as the sound has to first pass through the chest musculature which muffles high-pitched components of respiratory sounds. In contrast, the lungs are directly connected to the atmosphere during respiratory events such as coughs. These audible sounds, used by the tool, contain significantly more information than the sounds picked up by a stethoscope. The approach is automated and removes the need for human interpretation of respiratory sounds.

RAP have taken a machine learning approach to develop highly-accurate algorithms which diagnose disease from cough and respiratory sounds. Machine learning is an artificial intelligence technique that constructs

algorithms with the ability to learn from data. In its approach, signatures that characterise the respiratory tract are extracted from cough and breathing sounds. The sample matches signatures in a large database of sound recordings with known clinical diagnoses. The machine learning tools then find the optimum combination of these signatures to create an accurate diagnostic test or severity measure.

The platform is based on sound alone and does not require physical contact with the patient. With modern smartphones integrating high quality microphones, the platform can be delivered without the need for additional hardware.

Targeting mutliple market segments/indications

It is intended that the technology will be used in a broad range of settings not just within the typical GP/Emergency Department situation including telehealth, developing world (aid agencies), and direct to consumer (B2C).

Clinical use: ED and GP clinics. Reduces time (few minutes vs >30 mins/few days) and costs (<$10 vs >$200 for x-ray). Revenue generated by a fee per test.

Telehealth: Online health providers (typically a video/telephone call). Use of these platforms continues to grow strongly (>50% growth rate and ~75m consults p.a. – *IHS 2014*). RAP is the only remote, clinically-accurate diagnostic tool which is essential for these types of consults. Revenue generated by a fee per test.

Developing world: Large unmet need for a low cost, accurate and fast diagnostic which is useable by non-medical personnel. RAP is aiming to partner with large international aid agencies. Revenue is expected to be generated by annual subscription fees. RAP is currently working with Médecins Sans Frontières (Doctors without Borders) to evaluate performance in low income settings.

Direct to consumer: Large global smartphone usage (2bn+) with mHealth app market expected to grow to $25bn in end of CY17. Consumers can download by app stores and use on a fee per test model.

The types of respiratory conditions that potentially will be analysed by the technology include:

- Pneumonia;
- URTI;
- Influenza;
- Bronchitis;
- Bronchiolitis;
- Pertussis;
- Croup;

Acute conditions

- Asthma;
- COPD;
- Cystic Fibrosis; and
- Bronchiectasis.

Chronic conditions

It is worth noting out that, after correct diagnosis, these conditions are all treated very differently. For example, asthma diagnosis is a chronic disease that is managed with steroids, while pneumonia is commonly treated with antibiotics, and URTI is normally treated with rest.

Results of studies done to date and upcoming efficacy studies

RAP has received strong validation supporting the technology through a number of preliminary clinical results, both of which continue to enrol patients

and analyse results. The below table outlines the two major Australian study results released to date. The preliminary data shows strong validation of the technology with ~90% accuracy in determining the disease/infection type. However it is important to highlight the lower (by comparison to other indications) pneumonia results. Usually in the case of children with pneumonia, there is typically the presence of other comorbidities (typically asthma) caused by the virus. This, and due to a lack of a gold standard diagnostic to confirm diagnosis results in the relative underperformance of this component of the study results.

Sensitivity is an ability to detect what is being looked for regardless of how little of the marker in question is presented. Specificity on the other hand, is the ability to only detect what is being assessed. This is generally considered the proportion of patients without the disease who receive a negative result. The FDA terminology of Positive Percent Agreement (PPA) and Negative Percent Agreement (NPA) are essentially the same, just different terminology.

Figure 2: Preliminary clinical results (enrolment and analysis continuing)

2015/16 Pediatric Study Preliminary Results (n = 976) - results as at Mar 16 Joondalup Health Campus and Princess Margaret Hospital	Sensitivity	Specificity	Accuracy
Pneumonia vs. no respiratory	100%	95%	97%
Asthma vs. no respiratory	97%	92%	95%
Bronchiolitis vs. no respiratory	100%	100%	100%
Croup vs. no respiratory	94%	100%	99%
URTI vs. no respiratory	100%	95%	96%
Pneumonia, croup or bronchioli's vs. URTI	89-100%	90-95%	89-98%
Differential diagnosis of pneumonia, croup, URTI and bronchiolitis	91-99%	89-98%	89-98%

Australian Adult Study Preliminary Results (2015/2016) (n = 772) - results as at Oct 16 Joondalup Health Campus and Wesley Hospital	Sensitivity	Specificity	Accuracy
COPD vs. no respiratory	100%	96-100%	98-100%
Asthma vs. no respiratory	91%	91-93%	91-92%
Pneumonia vs. no respiratory	97-100%	100%	98-100%
URTI vs. no respiratory	100%	100%	100%
Asthma or COPD vs. no respiratory	91-93%	91-93%	91-93%
Asthma vs. COPD	93%	96%	94%
Pneumonia vs. Asthma	92%	81%	88%
Pneumonia vs. COPD	92%	92%	92%

Positive Percent Agreement (PPA) & Negative Percent Agreement (NPA) method, as will be required by the US FDA. Results released 22 June 2017 Updated Australian paediatric study using SMARTCOUGH-C	Positive %	Negative %	Overall %
Primary Upper Respiratory Tract Infection (n = 53)			
- Cough alone	89%	84%	84%
- cough, age, gender and symptoms	**92%**	**89%**	**90%**
Croup (n = 57)			
- cough alone	97%	92%	93%
- cough, age, gender and symptoms	**100%**	**96%**	**97%**
Lower Respiratory Tract Involvement (n = 492)			
- cough alone	86%	85%	85%
- cough, age, gender and symptoms	**90%**	**92%**	**90%**
Asthma/Reactive Airways Disease (n = 234)			
- cough alone	80%	71%	75%
- cough, age, gender and symptoms	**92%**	**89%**	**90%**
Bronchiolitis (n = 101)			
- cough alone	94%	91%	91%
- cough, age, gender and symptoms	**95%**	**94%**	**94%**
Pneumonia (n = 123)			
- cough alone	80%	67%	70%
- cough, age, gender and symptoms	**89%**	**79%**	**81%**

SOURCES: MORGANS, COMPANY REPORTS

RAP has completed the recruitment of 1,245 patients (infants/children aged 29 days to 12 years old) in its pivotal SMARTCOUGH-C study at three major hospitals in the US. The hospitals participating include the Cleveland Clinic, Massachusetts General Hospital, and Texas Children's hospital which are highly prestigious academic teaching and research hospitals in the US. This study is a prospective, multi-site, double blinded study with the c-primary endpoint of diagnosis of childhood pneumonia compared to clinical and radiologic diagnosis. Secondary endpoints include the diagnosis of upper

respiratory tract infection (URTI), lower respiratory tract infection (LRTI), croup, bronchiolitis, and asthma/reactive airways disease. The study is currently in data verification phase with the remaining patients and final source data verification site visits being performed. **Top-line results are expected in late July 2017.**

Catalysts coming

Figure 3 sets out a number of key catalysts expected over the next 6 months. Assuming the top line SMARTCOUGH-C clinical results are positive, RAP intend to file a de novo FDA submission as a class II device for the paediatric application with labelling as an aid to diagnosis for clinicians. RAP has stated its intentions to commence commercialisation in FY18 through a partnership with a US telehealth provider. The company has also flagged potential European, Australian, and Asian market entries in parallel to the US launch.

Figure 3: Milestone Table

Timing	Milestone
3QCY17	Top-line data from SMARTCOUGH-C
3QCY17	File de novo premarket submission with FDA for lead pediatric product
4QCY17	File for CE Mark in Europe for lead pediatric product
4QCY17	Additional Australian adult study results
4QCY17	Start pivotal US adult clinical study
4QCY17	FDA clearance for lead pediatric product
4QCY17	Initial US commercialisation via telehealth partnership

SOURCES: MORGANS, COMPANY REPORTS

Market opportunity

The global market opportunity for a low cost and highly accurate respiratory disease diagnostic is very large. Current estimates state approximately >330m people worldwide suffer from asthma and a further 65m people have moderate to severe COPD. Within the US alone, the Centre for Disease Control (CDC) report 17.7m people have asthma which it estimates s $30bn p.a. economic burden.

In a recent study (n = 98,728) conducted by the University of Sydney on patient reasons for visiting their GP, they found that ~19% of patients presented due to respiratory concerns (*University of Sydney: General practice activity in Australia 2014-2015*). If we take the assumption that the Australian population is representative of most developed countries (developed world population of 1.2bn – *Population Reference Bureau, 2013)* and visit the GP on average 3.73 times per year (*Medicare Australia, 2008-2013*), we could assume ~850m GP consults p.a. just in the developed world due to patients presenting with respiratory concerns.

Another report published by the United States Census Bureau suggests similar rates in the US with the average American visiting the doctor 3.9 times per year while ~22% (excl asthma) of patients presented due to Upper Respiratory concerns (*Why Patients Visit Their Doctors, Mayo Clinic, 2013*).

In the developing world, acute respiratory illnesses are the leading cause of death in the infectious diseases (~5m p.a or 84.9 deaths per 100,000) (*WHO 2015*, *Population Reference Bureau 2013*). Most of the deaths are due to lower respiratory infections (pneumonia, influenza, bronchitis, and bronchiolitis) which traditional frontline methods can easily miss. Due to the nature of many of the populations, there is currently insufficient data in order to determine a reliable range for an addressable market but we note from numerous studies that respiratory illnesses are substantially more prevalent in the developing world due to circumstances such as low availability of healthcare and indoor cooking methods with solid fuel heating sources (*WHO, 2016*).

Intellectual Property

RAP has well protected intellectual property around the method for diagnosing respiratory illnesses. In addition to these applications, RAP has an exclusive license (including trade secrets) in the set of mathematical algorithms and

classifier technology used for the diagnosis and severity measurements for a number of respiratory diseases which were developed by the research team at University of Queensland.

Also RAP has a valuable proprietary database of over 2,500 patient cough sounds with associated clinical sign and symptoms, as well as diagnosis. This body of IP helps to create a significant barrier to entry for a regulatory approved diagnostic due to the time, money, and expertise required to generate these data points.

Figure 4: Intellectual property summary

Country	Application Number	Title
Australia	2013239327	A method and apparatus for processing patient sounds
Australia	2016903896	A Method and Apparatus for a Disease State Diagnosis
Australia	2017902184	Improvements to methods and apparatus
United States	14/389291	A method and apparatus for processing patient sounds
Europe	13768257.1	A method and apparatus for processing patient sounds
Japan	2015-502020	A method and apparatus for processing patient sounds
China	201380028268.X	A method and apparatus for processing patient sounds
Korea	10-2014-7030062	A method and apparatus for processing patient sounds

SOURCES: COMPANY REPORTS

Complementary/competing technologies

We highlight a number of competing technologies in Figure 5. We note the superior sensitivity, specificity, range of illnesses detected, time saving advantages, relative cost per test, and ability to diagnose via telehealth platforms of the ResAppDx® technology. We conclude that once the technology has received regulatory clearance it has excellent prospects of being commercialised.

Figure 5: Overview of complementary/competing technology

Technology	Description	Telehealth?	Sensitivity /PPA	Specificity /NPA	Time	Cost per test
ResAppDx®	Diagnosis of respiratory disease using cough sounds: pneumonia, bronchiolitis, croup, asthma/RAD, upper respiratory tract infection	Yes	~90% PPA	~90% NPA	Instant	~$5-10
CXR	Chest x-ray for pneumonia	No	~45-80%	~70-95%	30 mins – 24 hours dependant on setting (ED, inpatient, outpatient)	~$200-$400
LUS	Lung ultrasound for pneumonia, not in general use	No	~80-90%	~70-85%	Potentially bed-side	~$150
WHO clinical signs	Clinical diagnosis of pneumonia using combination of symptoms such as cough, respiratory rate and fever	Yes	~70-95%	~15-65%	Instant	$0
Respiratory Panel PCR	Identification of pathogens behind upper respiratory tract infections	No	N/A	N/A	1 hour	~$100-$150
Blood culture	Identification of bacterial infection	No	N/A	N/A	hours - days	~$50-$100
Sputum culture	Identification of bacterial infection in lower respiratory tract	No	N/A	N/A	hours - days	~$50-$100
Rapid strep test	Identification of streptococcal bacterial for sore throat	No	~65-90%	>95%	10 – 15 minutes	~$30-$50
Spirometry	Supporting COPD, asthma diagnosis, but not for young children	No	N/A	N/A	1 hour	~$100-$200
Aridol®	Bronchial provocation test for asthma using mannitol	No	~45-80%	~75-95%	1 hour	~$50-$100
NIOX VERO®/MINO®	Exhaled nitric oxide for asthma	No	~80-90%	~80-90%	< 2 minutes	~$25-$35

SOURCES: MORGANS, COMPANY REPORTS

Product segments and model assumptions

Product segments:

- **Telehealth:** Online health providers. Due to the nature of online examinations, no physical contact is possible to perform a stethoscope/x-ray/blood culture test. The relative time and potential accuracy makes the ResAppDX® a clear starting point for commercialisation for the technology. Upon regulatory approval, RAP expects to sign between two and five US telehealth providers in the first year, each performing between 2-4m consults p.a. We anticipate revenues of US$5-US$10 per test but model a base case of US$5, growing at 5% pa. over our forecast period.
    - Milestone: Requires regulatory approval (FDA/CE/TGA) – in late CY17 post SMARTCOUGH-C results.

  - Potential market size: We assume the necessary regulatory approvals are achieved in the US. Firstly in the paediatric (25% - approval anticipated by end CY17) of market, followed by adult 510k approval (75% - study commences end CY17 with approval in late CY18). Initially we forecast two telehealth providers are signed in FY18 with 2m consults pa. and this grows to ten over our forecast period. We also forecast 30% of Telehealth consults relate to a respiratory condition.

- **Clinical use:** Emergency departments and regular clinics. Large global market with 700m+ doctor visits pa. for respiratory disease.
  - Milestone: Requires regulatory approval (FDA/CE/TGA) – 4QCY17 post SMARTCOUGH-C and Australian study results.
  - Potential market size: Based on our research, we estimate that populations in developed countries visit a doctor on average 3.7 times per year. With a population of 321m people and taking a low approximation of 10% due to respiratory concerns (study found ~19% of patients who visit doctor complain of respiratory concerns), combined with an addressable market of initially 25% (considering only the paediatric FDA approval results anticipated at the end of 2017) – we estimate a potential market of approximately 150m potential tests p.a. in FY18. However, it remains unclear how quickly existing doctors may take-up use of the technology and how that will be managed at this stage (ie via insurers, reimbursements or user pays). We initially set our market share to zero but note significant upside if the uptake is strong.
- **Developing world:** Large international aid agency use. RAP has formed partnerships with a large NGO: MSF (Doctors without Borders). We would expect this to develop into commercial use of the diagnostic upon approval with other humanitarian aid providers to follow but have not forecast any revenues from this segment until there are some clearer indications of timing, fee methodology, and potential market.
- **Direct to Consumer:** Phone application for private use, downloadable from the App Store/Google Play/etc. We anticipate this segment to be the lowest priority for RAP due to focus on building the telehealth/developing world/clinical use segments but note significant upside potential in the space with ~2bn smartphones globally and a rapidly growing e-Health sector. At this stage, we forecast no revenues over our forecast period.

Revenue and cost assumptions:

Key revenue assumptions:

- The fee per test has been set out US$5 per test;
- Overall patient visit growth rate is set at 5% as a base case although note telehealth visits are currently estimated to be growing at >50% p.a.;
- 30% of patients present with a respiratory condition;
- Revenue is being generated from Telehealth partnerships and at this stage we have not included revenue from the three other opportunities of clinical use, developing countries and direct to consumer;
- The exchange rate is set 0.75 for USD/AUD; and
- A full summary is set out in Figure 6.

Key cost assumptions are:

- We forecast administration costs of A$1.4m in FY17 and A$3.4m in FY18 due to anticipated increase in staff numbers (sales, US head);
- A low single digit royalty is assumed to be paid to University of Queensland;
- R&D costs is estimated at A$5m pa across the forecast period; and
- Costs are forecast to increase at 2.5% pa.

Figure 6: Revenue estimates

	Patient visit	5%	5%	5%	5%
Assumptions	**2017F**	**2018F**	**2019F**	**2020F**	**2021F**
Clinical Revenue					
$ Fee / test		5.0	5.0	5.0	5.0
Patient visiits to ED/GP (m)		1,199	1,259	1,322	1,388
% present with respiratory		10%	10%	10%	10%
Children/Adult split		25%	25%	35%	45%
Total address market (m)		149.9	157.3	231.3	312.3
Market share		0.0%	0.0%	0.0%	0.0%
Revenue- Clinical (US$m)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Telehealth Revenue					
$ Fee / test		5.0	5.0	5.0	5.0
# Providers		2	5	7	10
Avg consults p.a. / provider (m)		2	3	4	5
Patients presenting with problem		30%	30%	30%	30%
Market addressable (childen/adults)		25%	25%	35%	45%
Total address market (m)		0.30	1.13	2.94	6.75
Weighting within FY (%)		50%	100%	100%	100%
Revenue- Telehealth (US$m)	**0.0**	**0.8**	**5.6**	**14.7**	**33.8**
Developing Revenue					
$ Fee / test		1.0	1.0	1.0	1.0
# NGO's		0	0	0	0
# Treatments per NGO (m)		1.0	1.0	1.0	1.0
Revenue- Developing (US$m)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Direct Consumer Revenue					
$ Fee / test		10.0	10.0	10.0	10.0
Patients presenting with respir problems		0	0	0	0
Total address market ($m)		0.00	0.00	0.00	0.00
Market share		0.0%	0.0%	0.0%	0.0%
Revenue- Direct (US$m)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total revenue - ResApp (US$m)	**0.0**	**0.8**	**5.6**	**14.7**	**33.8**
AUDUSD FX	0.8	0.75	0.75	0.75	0.75
Total revenue - ResApp (A$m)	**0.0**	**1.0**	**7.5**	**19.6**	**45.0**

SOURCES: COMPANY REPORTS

Valuation and Recommendation

Valuation:

We initiate coverage of RAP with a A$0.48 DCF valuation and an Add recommendation. We have set our price target at the same level. We have derived our DCF-based valuation using the following assumptions: WACC of 12.5%; risk-free rate of 4.0%; risk premium of 5.0%; beta of 1.7x; and long-term growth rate of 5.0%. We have pre-emptively assumed additional capital will need to be raised of A$10.0m in FY18 to fund additional clinical studies in adults and to roll out an expanded sales and marketing team. Therefore the fully diluted capital base (options, performance shares, new capital) is 829.1m shares. We note that 62m shares are being released from escrow on 14th July 2017.

Key Financials:

RAP posted a net loss of A$3.2m in FY16. For the 1HFY17 RAP posted a net loss of $7.5m on revenue $0.06m. The increased net loss was due to significant increases in administration and R&D expenses as the company ramps up to commercialisation, as well as A$4.0m in non-cash share based payments expense. Cash reserves stood at A$10.4m as at 31 March 2017.

Key risks

RAP has not yet secured the relevant regulatory clearance to enable its ResAppDX® system to be properly commercialised. There can be no certainty that these clearances and approvals will be obtained. This is the main risk to our valuation and price target. Therefore an investment in RAP is only suitable for investors with a higher risk profile.

Other risks that investors should consider include clinical risk, funding risk, and FX risks.

Sensitivity analysis:

Our model is most sensitive to an increase in market share assumptions and cost of fee per test. In Telehealth a 1% change in market share increase the valuation by A$0.01 and a US$1.00 change in fee per service increases the valuation A$0.09.

Management and Board

Figure 7: Management & Board

Management		
Role	**Name**	**About**
MD & CEO	Tony Keating, Ph.D	Tony has over 10 years' experience in commercialising technology. Tony created the initial business strategy for ResApp and has led the commercialization of ResApp's technology to date. Previously, Tony was Director, Commercial Engagement at UniQuest Pty Ltd, one of the global leaders in commercialisation of university technology. While at UniQuest, Tony held roles as interim Chief Executive Officer and Non-Executive Director for a number of privately-held, venture-capital funded start-up companies. Prior to joining UniQuest Tony held business development and engineering management roles at Exa Corporation, a US-based software company that is now listed on the NASDAQ.
ED & VP Corporate Affairs	Brian Leedman	Brian is a marketing and investor relations professional with over 10 years' experience in the biotechnology industry. Mr Leedman was co-founder of ResApp Diagnostics Pty Ltd which was acquired by Narhex Life Sciences Ltd to form ResApp Health. Prior to ResApp, Brian co-founded Oncosil Medical Limited and Biolife Science Limited (acquired by Imugene Limited). Brian previously served for 10 years as Vice President, Investor Relations for pSivida Corp which is listed on the ASX and NASDAQ. He is currently the WA chairman of AusBiotech, the association of biotechnology companies in Australia.
VP Development & Operations	Kay Taylor, Ph.D.	Kay is a life sciences commercialisation specialist with over 15 years experience in the life sciences sector. She joined ResApp Health from UniQuest Pty Ltd where she was most recently the Director of Startup and License Portfolio Asset Management. In this role she was responsible for driving the short and long term objectives for the life sciences portfolio of over 50 startups and 100 active licenses. Prior to UniQuest, Kay worked for two multinational life sciences companies in technical sales roles, providing support to customers across the Asia-Pacific region.
VP Software Engineering	Rob Keniger	Rob has over 20 years of experience in software design and development and has worked in iOS and Mac development for more than 10 years. Rob has worked in diverse business areas, he most recently built apps for some of the world's leading music labels, brands and companies and he was responsible for product design and development of a digital publishing platform that powers many of the top ranking magazines on the Apple App Store.
Board of Directors		
Role	**Name**	**About**
Chairman	Roger Aston, Ph.D.	Roger Aston, BSc (Hons) PhD is currently the Executive Chairman of OncoSil Medical. He has had extensive experience on boards of many pharmaceutical companies, and has been Chief Executive Officer of Pitney Pharmaceuticals Ltd, PSIMedica, pSiOncology Pte Ltd, Peptech and Cambridge Antibody Technology. In 2001, Dr Aston co-founded pSivida Limited. He served as the Chief Executive Officer of Mayne Pharma Group Limited until 15 February 2012. During his career, Dr Aston has been closely involved in start-up companies and major pharmaceutical companies. Aspects of his experience include FDA and EU product registration, clinical trials, global licensing agreements, fundraising through private placements, and a network of contacts within the pharmaceutical, banking and stock broking sectors.
NED	Chris Ntoumenopoulos	Chris Ntoumenopoulos is Managing Director at Twenty 1 Corporate, a boutique corporate advisory firm. He has worked in financial markets for the past 12 years, focusing on Capital Raisings, Portfolio Management and Corporate Advisory. Mr Ntoumenopoulos has advised and funded numerous ASX companies from early stage venture capital, through to IPO. He is director of various private and public companies which span across finance, technology and medical sectors.

SOURCES: MORGANS, COMPANY REPORTS

Substantial shareholders

Figure 8: Substantial shareholders

Name	Number of shares held	% Held
FIL Investment Management	51,872,000	7.9%
Freeman Road Pty Ltd.	44,000,000	6.7%
Brian Leedman	25,125,000	3.8%

SOURCES: COMPANY REPORTS

Queensland

Brisbane	+61 7 3334 4888
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Brisbane: Tynan Partners	+61 7 3152 0600
Brisbane: North Quay	+61 7 3245 5466
Bundaberg	+61 7 4153 1050
Cairns	+61 7 4222 0555
Caloundra	+61 7 5491 5422
Gladstone	+61 7 4972 8000
Gold Coast	+61 7 5581 5777
Ipswich/Springfield	+61 7 3202 3995
Kedron	+61 7 3350 9000
Mackay	+61 7 4957 3033
Milton	+61 7 3114 8600
Noosa	+61 7 5449 9511
Redcliffe	+61 7 3897 3999
Rockhampton	+61 7 4922 5855
Spring Hill	+61 7 3833 9333
Sunshine Coast	+61 7 5479 2757
Toowoomba	+61 7 4639 1277
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Gosford	+61 2 4325 0884
Hurstville	+61 2 9570 5755
Merimbula	+61 2 6495 2869
Neutral Bay	+61 2 8969 7500
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